# ENVIRONMENTAL IMPACT ASSESSMENT REPORT:

## Specialist vegetation study on the potential impacts of the proposed COZA Iron Ore Mine project near Postmasburg, Northern Cape

Prepared for:

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On behalf of:

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## SUMMARY

The proposed COZA iron ore project will be a greenfields mining project located on Farm Driehoekspan 435 (Remaining Extent) and Doornpan 445 (Portion 1) within the Tsantsabane Local Municipality in the Northern Cape Province, approximately 12 km north of the town of Postmasburg The mining method is opencast mining by means of truck and shovel from two separate opencast pits on these farms, and the overburden will be placed in waste rock dumps located near to the pits. At full development the project is expected to produce 2 million tonnes of ore per annum. It is estimated that the pits will reach a depth of 80-100 m below surface. The Doornpan ore body is planned to be mined first.

This draft report provides details of the findings of the environmental impact assessment phase of the EIA. This phase included an analysis and verification of the data collected during two field surveys, mapping areas of ecological sensitivity and localities of species of special concern, an assessment of the potential impacts of mining activities on the vegetation, and providing management actions, recommendations and mitigation measures to avoid or reduce impacts on the vegetation, sensitive habitats and species of special concern.

There are two major vegetation types present in the development footprint area, Kuruman Thornveld and Kuruman Mountain Bushveld, and both are considered to be Least Threatened and have a wide distribution and extent. The vegetation types therefore do not have a high conservation status. Most of the area appears to be in a natural condition with little transformation. Parts of the study area have a higher ecological sensitivity, such as the dry watercourses and a few habitats with populations of species of special concern. The sensitivity analysis indicated that the watercourse on Driehoekspan is considered an area of high sensitivity, and sections of the hills on Driehoekspan are of medium-high sensitivity. One habitat on Doornpan, a small calcrete pan, is ranked as a habitat of medium-high sensitivity. Seventeen species of special concern listed and recorded for the area are tabled in this report, and ten species were recorded as present. These include two protected trees (under the National Forests Act), one declining species (*Boophone disticha*), and seven species protected under the NCNCA (2009). Another seven protected species have a medium to high probability of occurrence. On Doornpan, two protected trees and one protected species are present, while on Driehoekspan two protected trees, one declining species and six protected species occur. The species diversity based on the number of species recorded is moderate to high, with a total of 118 species listed for the quarter degree square in which the study area is located.

The potential impacts on the ecology of the area are impacts on biodiversity, impacts on sensitive habitats, impacts on ecosystem function, secondary (indirect) and cumulative impacts on the ecology, and impacts on the economic use of the vegetation. Activities considered that could potentially impact on the ecology and vegetation were - clearing of land for construction, the construction of access roads, operation of construction camps, haulage and stockpiling/dumping, the placement of powerlines and pipelines, water management, storage of chemicals and materials required for construction and operation of machinery/vehicles and dewatering.

The main potential impacts that can be expected to affect the vegetation on the two sites as a result of mining include loss of natural vegetation, habitat fragmentation, impacts on species of special concern, dust impacts and establishment of declared weeds and alien invasive plants.

The overall potential impacts of this proposed project are predicted to be of medium significance. With all avoidance and mitigation measures implemented, it should be possible to reduce most negative impacts to a medium or low significance, and only if the medium-high to high sensitivity areas are avoided or impacts on these are minimal, and all areas impacted on by mining activities are properly rehabilitated on closure.

The proposed development, when viewed in isolation, will not significantly affect the conservation status of species of special concern on a regional scale. However, it will add to the cumulative impacts on these species. The cumulative impact of numerous similar developments in the immediate area and on a regional scale, is however significant and increasing, and a strategic environmental assessment of the mining corridor from Postmasburg and Danielskuil in the south to Hotazel and Moshaweng in the north is now urgently required.

Permits for the removal or destruction of protected species and protected tree species will be required from the Department of Environment and Nature Conservation in Kimberley and the Sub-directorate Forestry of the Department of Agriculture, Forestry and Fisheries before any vegetation is cleared.

It is important to note that no detailed mine layout plan was provided for the proposed Driehoekspan mining site. As a result a review by an ecologist or vegetation specialist is needed when the mine layout plan is available before any clearing for mining starts. The positioning of infrastructure may need to be revised based on the areas of ecological sensitivity, and recommendations, mitigating measures and/or management actions revised to ensure that potential impacts are kept to a minimum. The EMP would also need to be revised. Groundwater depth will be required to assess the potential impacts of dewatering during mining activities on any protected trees that are dependent on a possible shallow aquifer.

Recommendations and actions for mitigation and management are provided in Table 10.

**GLOSSARY AND ABBREVIATIONS**

CBA - Critical Biodiversity Areas - areas required to be maintained in a natural state to meet targets for biodiversity pattern (features) or ecological processes.

DEAT – Department of Environmental Affairs and Tourism.

ECO – Environmental Control Officer

EIA – Environmental Impact Assessment

EMP – Environmental Management Plan

ESA - Ecological Support Areas - areas required to be maintained in an ecologically functional state to support Critical Biodiversity Areas.

NFA – National Forests Act

NCNCA – Northern Cape Nature Conservation Act

SANBI – South African National Biodiversity Institute

POSA – Plants of South Africa, SANBI web database based on the PRECIS database

PRECIS – National Herbarium Pretoria (PRE) Computerised Information System.

QDS – Quarter Degree Square.

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# 1. INTRODUCTION

## 1.1 Regulations and specialist details

The EIA regulations promulgated under the *National Environmental Management Act* No. 107 of 1998, list the required information to be provided by specialists and in specialist reports. According to Regulation 385 section 33 (2), a specialist report or report on a specialized process must contain: (a) Details of the person who prepared the report and the expertise of that person to carry out the specialist study/process; (b) Declaration that the person is independent in a form as may be specified by the competent authority; (c) Indication of the scope of, and the purpose for which, the report was prepared; (d) Description of the methodology adopted in preparing the report; (e) Description of any assumptions made and any uncertainties or gaps in knowledge; (f) Description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment; (g) Recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority; (h) Description of any consultation process that was undertaken during the study; (i) Summary and copies of any comments that were received during consultation; and (j) Any other information requested by the competent authority.

Tania Anderson was commissioned by Synergistics Environmental Services to provide a specialist vegetation study for the Environmental Impact Assessment for the proposed COZA iron ore mine project near Postmasburg in the Northern Cape.

### *Summary of expertise*

Tania Anderson has:

- BSc. Honours (1987), UP. MSc. Masters in Environmental Management, UFS (2005).
- 24 years of experience working as Botanist at the McGregor Museum (Jan 1989 - Jan 2013).
- Published four refereed scientific papers, three technical scientific reports, more than 60 popular articles, four booklets and contributed to and edited a field guide. Contributor to the Red Data list of SA Plants 1996.
- Presented at numerous conferences.
- 17 years of experience in specialist studies for EIAs, and has completed at least 66 specialist reports.
- Reviewed many EIAs and EMPs for projects in the Northern Cape for NGOs.

The specialist's contact details are provided on the front page of this report.

***Statement of Independence***

Tania Anderson has no connection, financial or legal, to the proponent and remuneration for services for this study is not linked to approval by the responsible decision-making authorities. She is an independent consultant and has no business, financial or personal interest in the application other than fair remuneration for work performed for the application. There are no circumstances that compromise the objectivity of this specialist performing such work.

## 1.2 Approach and Terms of Reference

Synergistics Environmental Services were appointed by ArcelorMittal South Africa (AMSA) to undertake an application for environmental authorisation through an Environmental Impact Assessment (EIA) and to submit a mining right application for the proposed COZA iron ore project. The COZA iron ore project will be a greenfields mining project located on Farm Driehoekspan 435 (Remaining Extent) and Doornpan 445 (Portion 1) in the Tsantsabane Local Municipality, Postmasburg area, Northern Cape Province.

The overall approach for the project includes:

- A description of the regional and local vegetation of the site,
- A field survey(s) to search for sensitive habitats and species of special concern,
- Mapping of the sensitive habitats,
- Assessing the potential impacts on the vegetation, and
- Providing recommendations on possible mitigation measures and rehabilitation procedures/ management guidelines.

The terms of reference for the environmental impact assessment phase included:

- A follow up field survey in early summer.
- The verification of the vegetation units of the study area and the plant species list.
- Recording the presence of species of special concern as well as estimating their population sizes. Sensitive habitats containing populations of these species to be geo-referenced and mapped. A final sensitivity map must be produced indicating the different scales of sensitivity of the vegetation types and any critical biodiversity areas, biodiversity support areas, ecological corridors and other sensitive habitats.
- An assessment of the nature, extent, duration, intensity/magnitude, probability and significance of the potential impacts and the level of confidence. The impacts of the project on terrestrial and aquatic ecosystems, including impacts of dust on vegetation, and the potential for proliferation of alien invasive species.
- Suggesting where possible alternatives for site locations where sensitive ecosystems are likely to be affected as a result of the infrastructure footprint.
- Management actions, recommendations and mitigation measures to avoid or reduce impacts on the vegetation, sensitive habitats and species of special concern.
- Monitoring programmes where necessary for inclusion in the EMP.

This report provides details of the findings of the environmental impact assessment phase of the EIA. This phase includes an analysis and verification of the data collected during two field surveys, mapping areas of ecological sensitivity and localities of species of special concern, an assessment of the potential impacts of mining activities on the vegetation, and providing management actions, recommendations and mitigation measures to avoid or reduce impacts on the vegetation, sensitive habitats and species of special concern.

## 1.3 Project description

The proposed COZA iron ore project will involve opencast mining by means of truck and shovel. Topsoil will be stripped and stockpiled and the overburden will be placed in waste rock dumps located near to the pits. Ore will be placed at a run-of-mine (ROM) stockpile, possibly blended and then loaded for transport. At full development the project is expected to produce 2 million tonnes of ore per annum, with a lifespan of 5-10 years. Mining will be from two separate opencast pits on the farms Doornpan and Farm Driehoekspan. It is estimated that that the pits will reach a depth of 80–100 m below surface. No processing, other than blending of material, will take place at the proposed sites. Any blending will take place at the ROM stockpile adjacent to the pit. Initially it is planned that the mined ore will be transported by truck to existing surrounding mines for processing and onward transport. The infrastructure that will be developed includes access roads and entrance controls, mine fencing, water management infrastructure (pollution control dams and water

supply dams), power supply, a small office, change house and workshops, packaged sewage treatment facility and temporary accommodation for the construction phase. The Doornpan ore body will be mined first.

## 1.4 Study area

The two the farms Driehoekspan 435 (Remaining Extent) and Doornpan 445 (Portion 1) lie approximately 19 km and 11 km north of Postmasburg respectively. The total mine footprint area for the project will be approximately 150 ha. The total area to be disturbed by the project on the farm Doornpan (2837 ha in extent) is estimated to be approximately 25 ha; 5.6 ha will be the pit, 5.6 ha the waste rock dump, 2.6 ha the ROM stockpile and the balance for access roads and support infrastructure. The total area of the farm Driehoekspan is 1983 ha with approximately 80 ha that will be disturbed, of which 26.5 ha will be the pit, 26.5 ha the waste rock dump, 13 ha the ROM stockpile and the balance for access roads and support infrastructure. These figures are not final and the final mine footprint will be determined when the layout plan has been completed.**Note that no detailed mine layout plan was provided for the Driehoekspan mining site.** The vegetation study focussed on the mining footprint areas (Figure 1 and Figure 2).

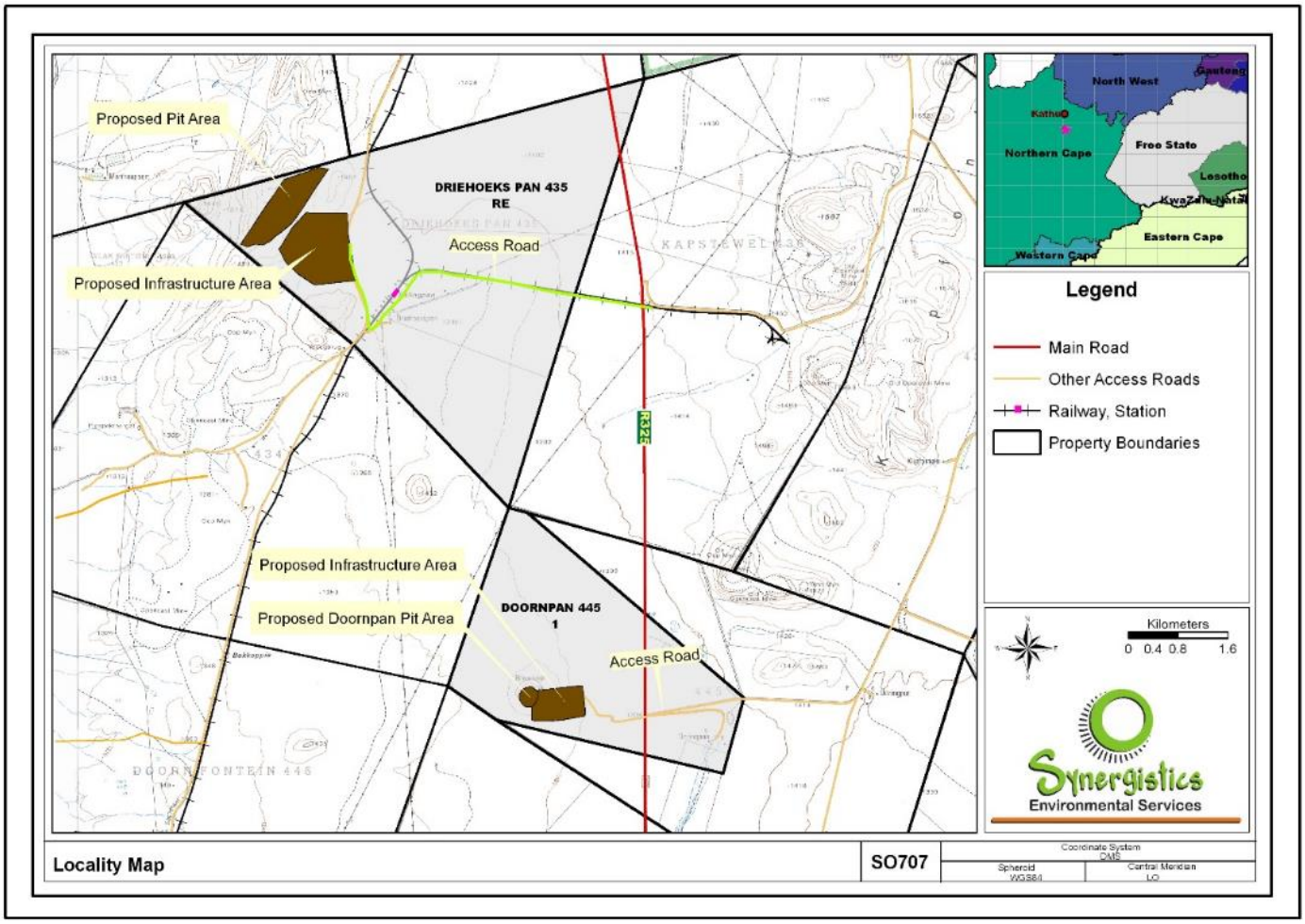


*Figure 1. The farms and preliminary footprints of the proposed mining activities of the COZA iron ore project (supplied by Synergistics).*

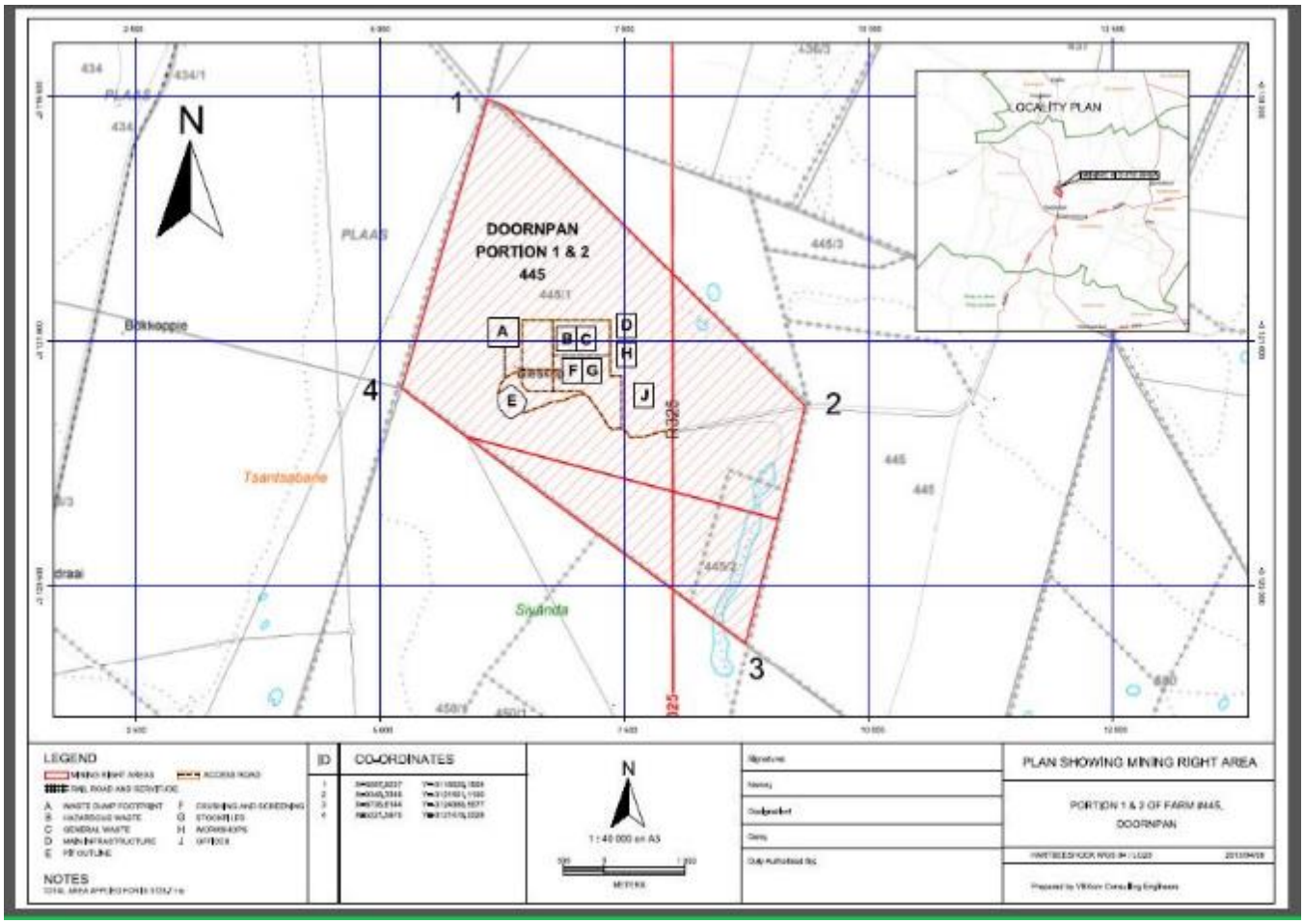


*Figure 2. The proposed mine layout plan for the Doornpan ore body (supplied by Synergistics).*

## 2. REGULATORY FRAMEWORK AND PERMIT REQUIREMENTS

The applicable legal considerations for this project are summarised below.

The ***National Environmental Management Act*** (NEMA) sets out a number of principles (chapter 1, sect. 2) to give guidance to developers, private land owners, members of public and authorities. Principle number three determines that a development must be socially, environmentally and economically sustainable. Number 4(a) states that all relevant factors must be considered, *inter alia* i) that the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied; ii) that pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied; vi) that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised; and viii) that negative impacts on the environment and on peoples' environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.

***The Environment Conservation Act No. 73 of 1989 Amendment notice R1183 of 1997*** states that - development must be environmentally, socially and economically sustainable. Sustainable development requires the consideration of the following main factors: a) that pollution and degradation of the

environment is avoided, or where they cannot altogether be avoided, are minimised or remedied; b) that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource; c) that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised, and d) that negative impacts on the environment and on peoples' environmental rights be anticipated and prevented, and where they cannot altogether be prevented are minimised and remedied.

The ***National Environmental Management: Biodiversity Act*** (NEMBA 2004) provides for: the management and conservation of South Africa's biodiversity within the framework of the NEMA, the protection of species and ecosystems that warrant national protection, and the use of indigenous biological resources in a sustainable manner, amongst other provisions. Furthermore, NEMBA states that the loss of biodiversity through habitat loss, degradation or fragmentation must be avoided, minimised or remedied. The loss of biodiversity includes *inter alia* the loss of threatened or protected species. Biodiversity offsets are a means of compensating for the loss of biodiversity after all measures to avoid, reduce or remedy biodiversity loss have been taken, but residual impacts still remain and these are predicted to be medium to high.

***National Environmental Management: Biodiversity Act, 2004: Threatened and Protected Species Regulations*** Chapter 4, Part 2 of NEMA Biodiversity Act, 2004 (Act No. 10, 2004) provides for listing of species that are threatened or in need of protection to ensure their survival in the wild, while regulating the activities, including trade, which may involve such listed threatened or protected species and activities which may have a potential impact on their long-term survival. In February 2007 the Minister of Environmental Affairs and Tourism published a list of CR, EN, VU and Protected Species (PS), according to Section 56(1) of the Act. The Act states that a person may not, without a permit, carry out a restricted activity involving a specimen of a listed threatened or protected species. This implies that any negative impacts on habitats in which populations of protected species occur or are dependent upon would be restricted according to this Act. Restricted activities for flora include cutting, collecting, gathering, destroying, damaging and translocating plants or parts thereof.

The Act provides for listing of species as threatened or protected, under one of the following categories:
• **Critically Endangered:** any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
• **Endangered:** any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
• **Vulnerable:** any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
• **Protected species:** any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Certain activities, known as Restricted Activities, are regulated by a set of permit regulations published under this Act. These activities may not proceed without environmental authorization. They are:
1) Under the **Environmental Impact Assessment Regulations Listing Notice 1 of 2010** (No. R.544) the following activities are likely to be triggered:
*Activity 11* (Xi): The construction of infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.
2) Under **Environmental Impact Assessment Regulations Listing Notice 3 of 2010** (*R.546): Activity 14.* The clearing of an area of 5 hectares or more of vegetation where 75% or more of the vegetation cover constitutes indigenous vegetation.

Chapter 5, sections 73–75) regulates activities involving invasive species, and lists duty of care as follows:

- the land owner/land user must take steps to control and eradicate the invasive species and prevent their spread, which includes targeting offspring, propagating material and regrowth, in order to prevent the production of offspring, formation of seed, regeneration or re-establishment,
- take all required steps to prevent or minimise harm to biodiversity, and
- ensure that actions taken to control/eradicate invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment.

The NEMBA Regulations on Alien and Invasive Species are being developed and draft lists are available on the website www.invasive.species.sanbi.org.

The ***National Forests Act*** (Act 84 of 1998) provides for the protection of certain tree species, and protected trees that occur in this region are *Acacia erioloba*, *Acacia haematoxylon* and *Boscia albitrunca*. According to section 1 (5) 1 of the Act, a license is required to remove, cut, disturb, damage or destroy the listed protected trees. The Department of Agriculture, Fisheries and Forestry: Branch Forestry issues the required permits.

The ***Conservation of Agricultural Resources Act*** (CARA 1983) states that no land user shall utilise the vegetation of wetlands (a watercourse, pans) in a manner that will cause its deterioration or damage. This includes cultivation, overgrazing, diverting water run-off and other developments that damage the water resource. CARA (1983) includes regulations on alien invasive plants. According to the amended regulations (No. R280) of March 2001 of CARA (1983), declared weeds and invader plants are divided into three categories:

- *Category 1* may not be grown and must be eradicated and controlled,
- *Category 2* may only be grown in an area demarcated for commercial cultivation purposes and for which a permit has been issued, and must be controlled, and
- *Category 3* plants may no longer be planted and existing plants may remain as long as their spread is prevented, except within the flood line of watercourses and wetlands. It is the legal duty of the land user or land owner to control invasive alien plants occurring on the land under their control.

The ***National Spatial Biodiversity Assessment (NSBA)*** was completed in 2004 and its main focus was on mainstreaming biodiversity priorities throughout the economy, and making links between biodiversity and socio–economic development. It is the first ever comprehensive spatial assessment of biodiversity throughout the country. The NSBA used systematic biodiversity planning, which is based on three key principles:

• The need to conserve a representative sample of biodiversity pattern, such as species and habitats (the principle of representation).

• The need to conserve the ecological and evolutionary processes that allow biodiversity to persist over time (the principle of persistence).

• The need to set quantitative biodiversity targets that tell us how much of each biodiversity feature should be conserved in order to maintain functioning landscapes and seascapes.

Five main strategic objectives have been identified in the ***National Biodiversity Strategy Action Plan (NBSAP) by DEAT 2005***, namely:

• *Strategic Objective 1*: An enabling policy and legislative framework integrates biodiversity management objectives into the economy.

• *Strategic Objective 2:* Enhanced institutional effectiveness and efficiency ensures good governance in the biodiversity sector.
• *Strategic Objective 3:* Integrated terrestrial and aquatic management across the country minimizes the impacts of threatening processes on biodiversity, enhances ecosystem services and improves social and economic security.
• *Strategic Objective 4:* Human development and well-being is enhanced through sustainable use of biological resources and equitable sharing of the benefits.
• *Strategic Objective 5*: A network of protected areas conserves a representative sample of biodiversity and maintains key ecological processes across the landscape and seascape.

The ***Northern Cape Nature Conservation Act of 2009*** was developed to consolidate and amend the laws relating to nature and environmental conservation, and to provide for matters incidental thereto. It is divided to cover nature reserves, protection of wild animals other than fish, protection of rhinos, protection of fish in inland waters and the protection of flora. According to this Ordinance, no person without a valid permit from the Northern Cape Department of Environment and Nature Conservation may pick, buy, sell, donate, import or export any specially protected and protected plant species. “Pick” includes destroying or removing plants or parts thereof from their habitat. In terms of the fauna, "No person shall without a permit hunt, import, export, transport, keep, possess, breed or trade in a specimen of a (specially) protected animal ". The Act does not imply that habitat for these species should be regarded as sensitive and appears to be primarily concerned with protecting individual animals from hunting or trading.

## 3. METHODOLOGY

### 3.1 General approach

The general approach adopted for this type of study is to identify any critical biodiversity issues and focus on red flags or potential fatal flaws that would prevent the project from taking place. Biodiversity issues are assessed by determining whether any important biodiversity features occur on the site, with the focus on the vegetation. These include species, ecosystems or ecosystem processes. At the species level, the presence of plant species of special concern (threatened, rare, protected and declining species) and protected trees are determined. For ecosystems, threatened ecosystems, protected ecosystems, critical biodiversity areas, areas of high diversity, biodiversity support areas and centres of endemism are investigated. Ecosystem processes include wetlands, rivers and drainage lines/watercourses, corridors and important topographical features.

The assessment was undertaken in two phases, a scoping phase and EIA phase. The objective of the scoping phase was to review the vegetation and flora patterns to identify any highly sensitive areas to be avoided during development, and to identify issues that need further investigation during the EIA phase. The EIA phase included a follow up field survey in early summer, additions to the plant species list, and recording, geo-referencing and estimating population sizes of species of special concern in the field. Based on this information, an analysis and mapping of vegetation sensitivity and an assessment of the potential impacts of mining activities on the vegetation was completed.

The methodology used included a literature review as part of desktop study for information on the ecology of the region. Plant species records were obtained from the Plants of South Africa (POSA PRECIS) database of the South African National Biodiversity Institute (SANBI) and KMG Herbarium, McGregor Museum, Kimberley. The Red Data List of Plants (SANBI 2010) was used to list the potential presence of species of special concern, and the list of protected trees of the National Forests Act for protected trees. The BiodiversityGIS databases were used to determine ecosystem status and presence of protected areas. SANBI’s BGIS online mapping was used to map the vegetation types of the study area.

Guidelines for specialists provided by the South African National Biodiversity Institute (SANBI 2011) with regards to Red Data List plants were followed. One of the guidelines state that specialist surveys are to be conducted during the appropriate season, and preferably during their flowering time due to the temporal element of species identification. South Africa's highly diverse flora is characterized by many plant groups of which the species within a genus look vegetatively very similar and can only be told apart if flowering or fruiting. Most species of conservation concern are from such groups. There are also a number of species that are ephemeral and may appear only after a certain environmental event. Given this temporal element to species identification, it is vital that specialist surveys are conducted during the appropriate season (SANBI 2011), in this case from October to April.

The first field survey was undertaken from 9-10 April 2013 and the second survey was completed from 18-21 November 2013. During the site visits, the different biodiversity features and ecological units present at the site were identified and roughly mapped in the field. Walk-through surveys were conducted within the different habitats and all species observed were recorded. The presence of sensitive habitats such as wetlands were searched for.

Species of special concern were searched for and the locations of their populations were geo-referenced using a GPS. For each species, the likelihood that it occurs at the site was rated according to the following scale:
**Low:** The available habitat does not appear to be suitable for the species and it is unlikely that the species occurs at the site.
**Medium:** The habitat is broadly suitable or marginal and the species may occur at the site.
**High:** There is suitable habitat and micro-habitats at the site and it is highly probable that the species occurs there.
**Definite:** Species that were directly observed at the site.

*Determining ecological sensitivity*
In general, the ecological sensitivity of any piece of land is based on its inherent ecosystem service and overall preservation of biodiversity. It therefore relates to:
• Species diversity, endemism (unique species or unique processes) and the high occurrence of species of special concern or ecosystems protected by legislation –*conservation importance*;
• The degree of ecological connectivity between systems within a landscape matrix. Thus, systems with a high degree of landscape connectivity amongst one another are perceived to be more sensitive – *ecological function*.

Sensitive habitats are known to occur in the region. Areas with untransformed natural vegetation, high diversity and complexity, species of special concern and systems vital to sustaining ecological function are potentially sensitive. Examples of sensitive habitats include wetlands, seasonal pans, perennial and non-perennial rivers and streams (watercourses) and ecological corridors with high connectivity to other ecosystems. Highly sensitive habitats often contain larger and/or healthier populations of species of special concern, or a higher species diversity of these particular species, and are considered to be of higher conservation value and more sensitive than areas with fewer or sparsely distributed species of special concern.

The sensitivity of habitats within the study areas were assessed during the EIA phase using the criteria below:

***Table 1. Sensitivity ratings and factors used to classify sensitivity (adapted from Hoare 2011).***

| Sensitivity | Factors contributing to sensitivity | Example of qualifying features |
|---|---|---|
| Very High | Indigenous areas that are highly positive for any of the following:<br>o Presence of threatened species (CE, E, V) and/or habitat critical for the survival of populations of threatened species.<br>o High conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk).<br>o Protected habitats (areas protected under national/provincial legislation, e.g. National Forests Act, draft ecosystem list of NEM:BA inter alia).<br>And may also be positive for the following:<br>- High intrinsic biodiversity value (high species richness and or turnover, unique ecosystems).<br>- High value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value).<br>- Low ability to respond to disturbance (low resilience, dominant species very old). | - Remaining areas of vegetation type listed in draft ecosystem list of NEM:BA as Critically Endangered, Endangered or Vulnerable.<br>- Protected forest patches.<br>- Confirmed presence of populations of threatened species. |
| High | Indigenous natural areas that are positive for any of the following factors:<br>o High intrinsic biodiversity value (moderate/high species richness and or turnover).<br>o Presence of highly suitable habitat for threatened species (CE, E & V species).<br>o Moderate ability to respond to disturbance (moderate resilience, dominant species of intermediate age).<br>o Moderate conservation status (moderately intact, moderately fragmented, habitat for species at risk).<br>o Moderate to high value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value).<br>o May contain Protected habitats (areas protected under national/provincial legislation). | o Habitat with exceptionally high diversity (richness or turnover).<br>o Habitat where a threatened species could occur (habitat suitable but no confirmed records).<br>o Confirmed habitat for species of lower threat status (NT, rare).<br>o Confirmed habitat for large densities of protected trees.<br>o Habitat with individuals of extreme age.<br>o Habitat with low ability to recover from disturbance.<br>o Habitat with a unique species composition and narrow distribution.<br>o Ecosystem providing high value ecosystem goods & services. |
| Medium-high | Indigenous natural areas that are positive for one/two of the factors listed above, but not a combination of factors. | - Habitat with high diversity (richness or turnover).<br>- Habitat where a species of lower threat status (NT, rare) could occur (habitat suitable but no confirmed records).<br>- Habitat with scattered individuals of protected trees. |
| Medium | Other indigenous natural areas in which factors listed above are of no concern. May also include natural buffers around ecologically sensitive areas and natural links or corridors with ecologically functional natural habitats. | |
| Medium-low | Degraded or disturbed indigenous natural vegetation. | |
| Low | No natural habitat remaining. | |

### 3.2 Limitations and assumptions

The draft report is based on a desk-top study and two field surveys as well as limited datasets. The assumption is made that the databases provide information that is accurate and reliable. There is a paucity of information on and collections of Red Data List species, and being rare these species are very difficult to locate. There is therefore a chance that species not known or expected to occur in the area could have been overlooked.

The major potential limitation associated with the survey approach is the narrow temporal window for recording species presence. Ideally, a site should be visited several times during different seasons to ensure that the full complement of plant species present are captured. However, this is rarely possible due to time and cost constraints and therefore, the representivity of the species recorded at the time of the site visits should be critically evaluated. It is however likely that most of the species were recorded during the two site visits. The ecological patterns at the site were clear, and although additional species might be recorded at different times of the year, this is highly unlikely to alter the overall pattern which has been formed by the land-use history of the site. Rainfall in the periods preceding the site visits was below average and the vegetation at the time of the survey was fairly dry, but the majority of grasses, forbs and shrubs could be identified. This represents a sufficiently conservative and cautious approach which takes account of the study limitations. It is likely that most species of special concern were recorded during the two surveys, however some later summer to autumn flowering plants which were possibly dormant due to the timing and amount of rainfall may have been missed.

The mapping of the sensitive habitats is not an accurate account of the boundaries of each unit, as it is based on satellite imagery and ground-truthing to within approximately 50 m. Estimates of population sizes of species of special concern and the number of protected trees were based on a rough count and will be refined during the EIA phase.

## 4. DESCRIPTION OF THE STUDY AREA ENVIRONMENT

### 4.1 Climate, geology, soils and land capability

The climate and geology of this semi-arid region (generally known as the Kalahari) have a profound effect on the vegetation and distribution of plant communities. The study area experiences summer and autumn rainfall with most rain falling from November to April. Rainfall is highly unpredictable and the mean annual precipitation varies from 300 – 450 mm. This rain usually falls as a result of thunderstorms when tropical thunderstorm activity extends southwards over the Kalahari. Summer temperatures can reach 40ºC (range 20 – 40ºC) and the dry winters are mild to cold. Winter daytime temperatures can reach 25ºC, but at night frost can occur and temperatures can average below 0ºC (Mucina & Rutherford 2006).

The land cover is mostly dominated by natural habitats with a well- developed open to closed shrub and open tree layer on the flat, rocky plains. There are hills with gentle to moderate slopes, covered with an open to closed shrubveld with a well-developed grass layer. The suitability of the sites for agriculture is highly limited and restricted to grazing and wildlife. The sites are considered to have a low land capability.

The geology of the general area comprises red aeolian sand (Gordonia Formation, Kalahari Group) that forms part of the Kalahari and what is now considered to be a fossil desert. The red sands of the Kalahari are often underlain by calcrete of Tertiary to Recent age which in turn overlies andesitic or basaltic lava of the Ventersdorp Group (Visser, 2006). Some Campbell Group dolomite is present. Localised linear, rocky pavements are formed in places. The Kuruman and Asbestos Hills consist of banded iron formation, with jaspilite, chert and riebecktite-asbestos of the Griqualand West Supergroup (Vaalian). Soils are shallow sandy soils, of the Hutton form (Mucina & Rutherford 2006).

## 4.2 Broad vegetation description of the region

The study area falls within the Eastern Kalahari Bushveld Bioregion of the Savanna Biome (Mucina & Rutherford 2006). The vegetation of the southern Kalahari in general is relatively species-poor and less than 2.5% of the total species list of the southern Kalahari is regarded as endemic, while less than 6% of the plant species is regarded as near-endemic species (Van Rooyen & Van Rooyen 1998). A total of 47 plant species have been listed as endemic and/or near-endemic to the southern Kalahari.

Previous vegetation studies have been undertaken in the Kathu region. A detailed study of the vegetation of the Kalahari was carried out by Smit (2000). More recent studies include a botanical study of the farms owned by Sishen Iron Ore Mine (SIOM) for the EMP (Anderson 2003), which provides detailed descriptions of the vegetation units as well as a checklist of the more than 200 plant species recorded for that area. Seymour *et al* (2006) undertook a study of the ecological impacts of the Gamagara River sinkhole for SIOM. A specialist study for a railway link between Postmasburg and Olifantshoek described the vegetation to the west of the two sites (Anderson 2007). More recently specialist studies for expansions and new developments at SIOM were undertaken by Anderson (2009a, b, c & d, 2010c). The most recent vegetation study was for the SIOM complex EIA (Anderson 2011). Botanical studies in areas close to the two sites proposed for the COZA mine include studies for mining right applications on the farms Lomoteng and Helpebietjie (Anderson 2010a & b). These studies provide descriptions of the vegetation in the region.

No bioregional planning has yet been completed for the Tsantsabane Local Municipality or the Siyanda District. An Environmental Management Framework for the Siyanda District Municipality was completed in 2008, but the planning was done at the vegetation type scale with no fine scale planning, which would include mapping critical biodiversity areas, biodiversity support areas, etc. Conservation strategies focussed on the Lower Gariep Alluvial Vegetation of the Orange River (EnviroNomics 2008). The Northern Cape Department of Environment and Nature Conservation (DENC, J. Koen *pers. comm.*) has indicated that the only bioregional planning so far completed is for the Namakwa District, and the Provincial Biodiversity Plan will only be available in 2013. There is therefore no fine scale mapping for the area that indicates any Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs). The only CBAs in the region as identified in the provincial maps on the SANBI website (www.bgis.sanbi.org) are wetlands and rivers. The study area is also not included in any protected area or in a planned protected area as mapped for the National Protected Areas Expansion Strategy (NPAES 2008).

The study area falls within the Griqualand West Centre of Endemism (described in van Wyk & Smith 2001, Figure 3). Centres of endemism are extremely vulnerable; relatively small disturbances in a centre of endemism may easily pose a serious threat to its many range-restricted species (Van Wyk & Smith 2001). The Griqualand West Centre (GWC) is one of the 84 African centres of endemism and one of 14 centres in southern Africa, and these centres are of global conservation significance. The GWC is considered a priority area for conservation in the Northern Cape, as the number of threats to the area is increasing rapidly and it has been little researched and is poorly understood. Furthermore, this centre of endemism is extremely poorly conserved, and is a national conservation priority. A significant amount of mining is taking place in this region and this is a cause for concern.

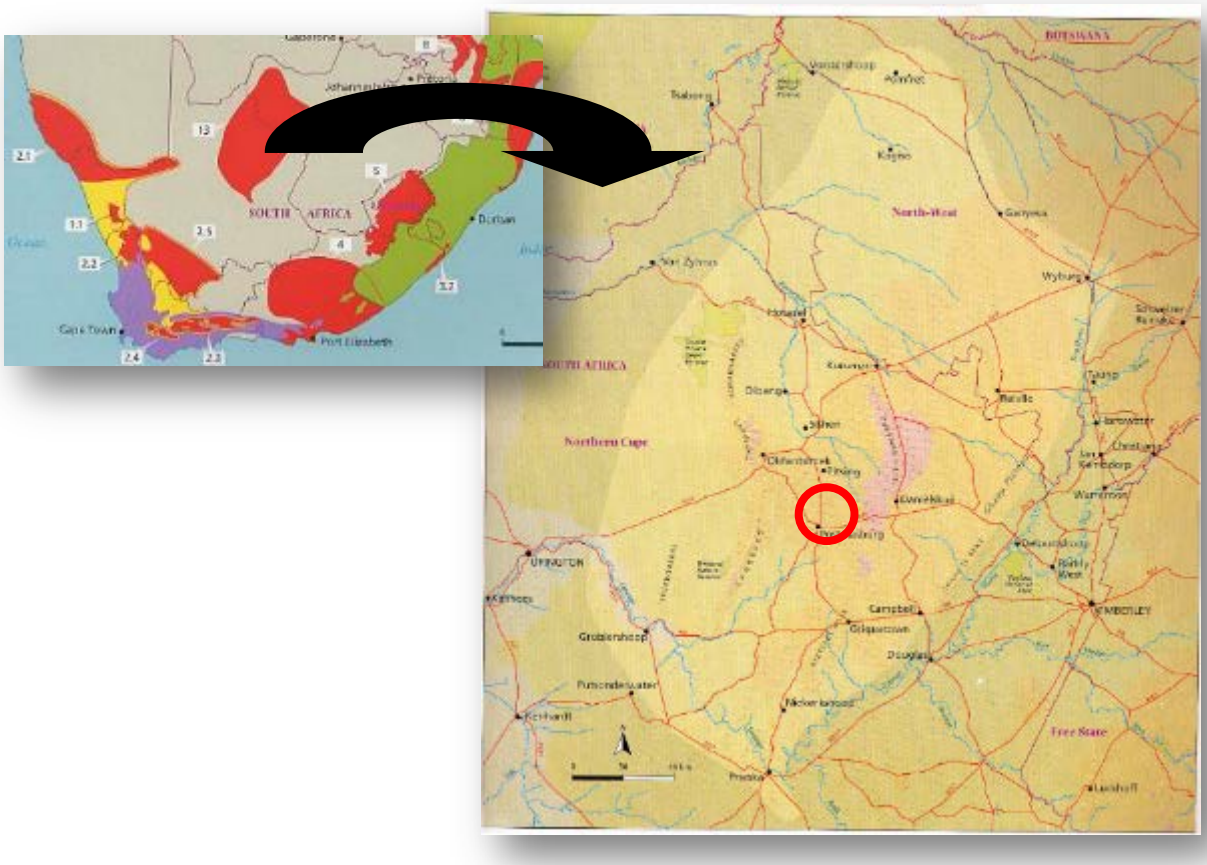


*Figure 3. The Postmasburg area is close to the centre of the Griqualand West Centre of Endemism indicated in this map from Van Wyk & Smith (2001).*

According to the vegetation classification of South Africa by Mucina & Rutherford (2006, BiodiversityGIS vegetation map), there are two vegetation types present in the study areas – Kuruman Thornveld and Kuruman Mountain Bushveld. The vegetation types are mapped in Figure 3 and the two vegetation types are described in more detail below.

The **Kuruman Thornveld** occurs on flats from the vicinity of Postmasburg and Danielskuil (west of the Kuruman Hills) in the south extending via Kuruman to Tsineng and Dewar in the north (Mucina & Rutherford 2006). Its features are usually flat rocky plains and some sloping hills with a very well developed, closed shrub layer and well developed open tree stratum consisting of camel thorn *Acacia erioloba*. Smaller trees in this vegetation unit include *Acacia mellifera* subsp. *detinens* and *Boscia albitrunca*. Taller shrubs are *Grewia flava, Lycium hirsutum, Tarchonanthus camphoratus* and *Gymnosporia buxifolia*. Small shrubs present are *Gnidia polycephala, Helichrysum* species, *Hermannia* species and *Plinthus sericeus*. Common grasses are *Aristida meridionalis, A. stipitata* and *Eragrostis lehmanniana*.

The **Kuruman Mountain Bushveld** covers the hills with generally gentle to moderate slopes and hill pediment areas, with an open to closed shrubveld. The grass layer is fairly well developed. Common large shrubs include black thorn *Acacia mellifera* ssp. *detinens,* common guarri *Euclea undulata*, bloubos *Diospyros lycioides*, *Searsia tridactyla*, *Rhigozum obovatum* and vaalbos *Tarchonanthus camphoratus* and *T. obovatus*. Shepherd's trees *Boscia albitrunca* are occasional. Several rock figs *Ficus cordata* grow on the peaks of the hills where large boulders or sheer rock outcrops are a feature. Common grasses include *Heteropogon contortus*, *Enneapogon* sp.*, Eragrostis* sp., *Aristida diffusa* and *Cenchrus ciliaris.* Dwarf shrubs and herbaceous species include *Hermannia* species, *Eriocephalus* sp., *Helichrysum* species and a variety of small legume species such as *Indigofera* sp.

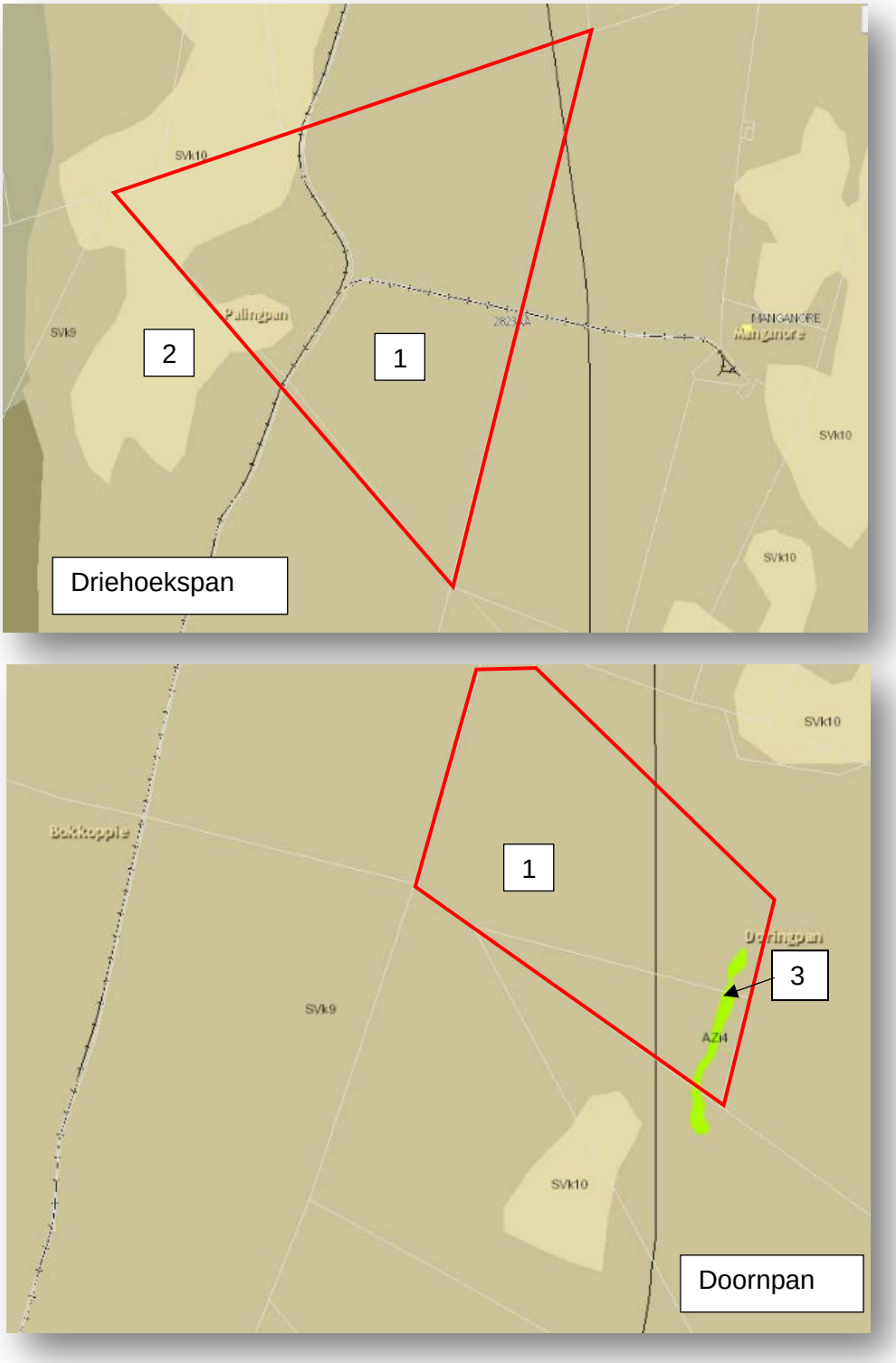


*Figure 4. Vegetation map of the vegetation types in the study areas outlined in red. 1 = Kuruman Thornveld, 2 = Kuruman Mountain Bushveld and 3 = Southern Kalahari Salt Pan (acknowledgments to SANBI BGIS online mapping).*

## 4.3 Fine scale ecological patterns

### *4.3.1 Doornpan*

The majority of this study site comprises of Kuruman Thornveld (Figure 5), with a small portion on the top of the hill more characteristic of the Kuruman Mountain Bushveld ecological unit (Figure 6). The plant species diversity of both these ecological units is lower than that of Driehoekspan and less species of special concern are present on this farm. There are no watercourses within the proposed mining area on Doornpan. The proposed open pit area will remove the hill which will impact on the Kuruman Mountain Bushveld and the waste rock dump and infrastructure will impact on the Kuruman Thornveld. The Kuruman Thornveld occurs on very shallow, rocky soils overlying dolomite outcrops, and is dominated by black thorn *Acacia mellifera* subsp *detinens* which forms a dense, closed shrubland. Prospecting activities on the hill of Doornpan have transformed patches of the natural vegetation and several weeds are colonising the drilling sites and access roads to these sites.

*Figure 5. Kuruman Thornveld on the plains of the farm Doornpan.*

*Figure 6. Kuruman Mountain Bushveld on the top of the hill on Doornpan.*

There are two pans on Doornpan. The one in the south-eastern corner of the property across the R325 (classified as a Southern Kalahari Salt Pan) was not investigated as the area could not be accessed besides being outside of the mine footprint area. The other small pan, with a calcareous floor, is located in the south-western corner. It covers approximately 2.3 ha of the study area (Figure 7). The calcrete floor of this pan is considered to have formed due to the seasonal saturation of the soil profile. Under current conditions it is unlikely that the entire pan can become inundated following heavy rain, though the presence of the calcrete does prevent rainfall from infiltrating into the soil and small puddles are likely to form across the pan floor. It supports one highly specialised protected species, a dwarf succulent *Prepodesma orpenii*. This species has a very restricted range and specific habitat requirements.

As the pan has no defined outflow and no link to any adjacent or downslope water resources, the pan cannot perform any significant function in terms flood attenuation, water quality enhancement, erosion control or sediment trapping, functions which are typically attributed to wetland areas. The main function of the pans is considered to be biodiversity support through 1) the extended presence of surface water; 2) supports aquatic invertebrates; 3) habitat for waterfowl moving through the area when the pan is inundated; 4) support of vegetation differing in species composition and structure from the surrounding landscape; 5) drinking water for game; and 6) provision of a range of microhabitats leading to an increase in diversity.

Generally the condition of the vegetation on Doornpan is not very good as it has been overgrazed.

Transformed areas on Doornpan (± 2 ha) include the access road, roads cleared for the prospecting and drilling activities and areas cleared at prospecting and drilling sites, mostly on the hill containing the ore body.

*Figure 7. Small pan in South-western corner of Doornpan, habitat of the protected dwarf succulent* Prepodesma orpenii*.*

### *4.3.2 Driehoekspan*

The major ecological unit in the study area is the Kuruman Thornveld on the flat plains (Figure 8). The hills are covered with Kuruman Mountain Bushveld (Figure 9), the second ecological unit, which has a higher diversity of species and contains a different species composition on areas where this unit occurs on quartzites. The dry watercourse in the valley between the hills is the third ecological unit with a number of large, scattered camel thorn trees. The open pit is proposed for the hills and will impact on the Kuruman Mountain Bushveld, whilst the waste rock dump and infrastructure will impact on the Kuruman Thornveld and possibly the watercourse. The Kuruman Thornveld within the proposed infrastructure area occurs on shallow soils overlying calcrete, and is dominated by camphor bush *Tarchonanthus camphoratus*, with scattered sweet thorn *Acacia karroo* trees.

Due to past disturbances, several alien invasive plants have been introduced. These include the mesquite *Prosopis* cf. *glandulosa* and *Opuntia ficus-indica* mainly growing along the access road and railway line.

Prospecting activities in the surveyed areas on the hills and rocky ridges of Driehoekspan have transformed patches of the natural vegetation and several weeds are colonising the drilling sites and access roads to these sites (Figure 10). It is estimated that 18 ha within the mine footprint has been cleared or disturbed and is probably permanently transformed.

*Figure 8. Kuruman Thornveld on the plains areas of Driehoekspan.*

*Figure 9. Kuruman Mountain Bushveld on the Driehoekspan quartzite topped hills with a higher diversity of plants.*

*Figure 6. Transformed patches due to prospecting activities on Driehoekspan.*

# 5. CONSERVATION STATUS AND SENSITIVE HABITATS

## 5.1 Ecosystem status

Table 2 provides detail on the ecosystem and conservation status of the vegetation types (after Rouget et al. 2005). Ecosystem status is based on the percentage of original area remaining untransformed (by croplands, mining, urban development & roads) in relation to the biodiversity target and a threshold for ecosystem functioning. Biodiversity target refers to the percentage of the original areas required to capture 75% of the species occurring in each vegetation type. The targets are aimed only at species conservation, and ecological processes are not considered. No significant disruption of ecosystem functioning is assumed in *least threatened* vegetation units, which still have more than 80% of their original extent untransformed.

***Table 2. The ecosystem status, biodiversity target and protection level of the vegetation types.***

| Vegetation type | Extent (sq. km) | % area remaining | Biodiversity target (%) | Ecosystem status | Protection level |
|---|---|---|---|---|---|
| Kuruman Mountain Bushveld | 4360.52 | 99 | 16 | Least Threatened | Not protected (0%) |
| Kuruman Thornveld | 5794.38 | 98 | 16 | Least Threatened | Not protected (0%) |

Note that at a macro-scale (i.e. the entire vegetation unit extent) the level of transformation for this vegetation types is 1-2%. However, this ranking is based on land cover data of 1996 and at the local level especially on the iron and manganese ore hills and outcrops between Kathu and Postmasburg there is significant transformation pressure on the vegetation.

## 5.2 Species of special concern

Threatened and protected species are subject to NEMA (1998), NEMBA (2004) and the Northern Cape Nature and Environmental Conservation bill of 2009. Threatened plant species (i.e. critically endangered, endangered and vulnerable species) are listed in the Red Data List of South African Plants (TSP 2009, SANBI 2010), and protected species in the NEMBA ToPS list (February 2007) and the Northern Cape Nature Conservation Act (2009). Endemic species (range-restricted species) are sometimes also considered to be species of special concern, as their distribution may be very localised and they could be threatened by developments. Definitions of the various categories of species of special concern are provided in Table 3 below.

The PRECIS database (POSA 2011) and KMG Herbarium records were used to compile the plant species checklist of the 55 species that may be present in the study area (Appendix 1). Another 63 species were recorded during the field surveys and added to the species checklist, which comes to a total of 118 species. The Red Data list (TSP 2010) was consulted to determine the status of the species of special concern. Field knowledge of certain species' habitat requirements and the potential of suitable habitats for these species being present were also considered.

***Table 3. Definitions of the various categories of species of special concern (IUCN 2001 Red List categories, Victor & Keith 2004 orange list categories for SA).***

| IUCN category | Definition | Class |
|---|---|---|
| EX | A taxon is **Extinct** when there is no reasonable doubt that the last individual has died. | Extinct |
| CR | A taxon is **Critically Endangered** when it is facing an extremely high risk of extinction in the wild. | Red List |
| EN | A taxon is **Endangered** when the best available evidence indicates that it meets any of the five IUCN criteria for Endangered and is therefore facing a very high risk of extinction in the wild. | Red List |
| VU | A taxon is **Vulnerable** when it is facing a high risk of extinction in the wild. | Red List |
| NT | A taxon is **Near Threatened** when available evidence indicates that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future. | Orange List |
| Declining | A taxon is **Declining** when it does not qualify for the categories Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline in the population. | Orange List |
| Critically Rare | A taxon is **Critically Rare** when it is known to only occur at a single site, but is not exposed to any direct or plausible potential threat. | Orange List |
| Rare | A taxon is **Rare** when it meets any of the four SA criteria for rarity, but is not exposed to any direct or plausible potential threat. | Orange List |
| DDD | **Data Deficient** – A taxon is DDD when there is inadequate information to make an assessment of its risk of extinction. Future research could show that a threatened classification is appropriate. | Orange List |
| DDT | A taxon is DDT when taxonomical problems hinder its distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible. | Data Deficient |
| Thr* | Taxa that have been identified as likely to be threatened, but their status has not yet been finalized. | Data Deficient |
| LC | A taxon is **Least Concern** when it has been evaluated against the five IUCN criteria and does not qualify for the categories CR, EN, VU and NT, or Critically Rare, Rare or Declining. | |

Certain trees are protected by the National Forests Act (NFA 1998), and three protected tree species are found in this region. The protected camel thorn tree *Acacia erioloba* occurs in dry woodland along watercourses in arid areas where underground water is present as well as on deep Kalahari sands. The protected grey camel thorn *Acacia haematoxylon* occurs on deep Kalahari sand between dunes or along dry watercourses, and protected shepherd's tree *Boscia albitrunca* is common on sandy to loamy soils and calcrete soils (Seymour & Milton 2003).

A list of the species of special concern that could potentially be present and recorded in the study areas is provided in Table 4. There are not many species of special concern listed for the region; this is probably due to limited floristic research and plant collecting in the area, and the flora of the region is therefore poorly represented in herbaria and databases.

***Table 4. Plant species of special concern potentially present and recorded in the study area.***

| Species | | Conservation Status | Probability of Occurrence | Local Distribution |
|---|---|---|---|---|
| *Acacia erioloba* | Camel thorn | Declining and Protected tree | Definite | Along watercourses and on deep red sands. |
| *Acacia haematoxylon* | Grey camel thorn | Protected tree | Low | Sandy areas, dunes. |
| *Asclepias fruticosa* | Milk bush | Protected | High, listed for this QDS | Disturbed areas. |
| *Boophone disticha* | Bushman's poison | Declining | Definite | Rocky areas, coarse sands. |
| *Boscia albitrunca* | Shepherd's tree | Protected tree | Definite | Sandy & rocky areas. |
| *Cotyledon orbiculata* | | Protected | Definite | Hills. |
| *Crassula capitella subsp nodulosa* | | Protected | Medium, listed for this QDS | Hills. |
| *Euphorbia mauritanica* | | Protected | Medium, listed for this QDS | Hills. |
| *Gymnosporia buxifolia* | | Protected | Definite | Widespread. |
| *Hereroa wilmaniae* | | DDT, Protected | Medium, listed for this QDS | Flat rocky outcrops. |
| *Kalanchoe rotundifolia* | | Protected | Medium, listed for this QDS | Rocky areas. |
| *Mestoklema sp.* | Donkievygie | Protected | Medium | Sandy & rocky areas. |
| *Olea europaea* subsp *africana* | Wild olive | Protected | Definite | Rocky areas. |
| *Pachypodium succulentum* | | Protected | Definite | Rocky areas. |
| *Pergularia daemia* subsp *daemia* | | Protected | Medium, listed for this QDS | Sandy areas. |
| *Prepodesma orpenii* | | Protected | Definite | Calcrete pans and calcrete bedrock |
| *Ruschia griquensis* | | Protected | Definite | Hills. |
| *Sarcostemma viminale* | Melktou | Protected | Definite | Hills. |
| *Searsia ciliata (ex tridactyla)* | | Endemic | Definite | Hills. |
| *Tarchonanthus obovatus* | Olienvaalbos | Near Endemic | Definite | Hills. |

Two protected trees (under the National Forests Act) are present and one declining species (*Boophone disticha*) is present (Table 4). Seven species protected under the NCNCA (2009) were recorded in the study area, and another seven protected species have a medium to high probability of occurrence. On Doornpan, two protected trees and one protected species are present, while on Driehoekspan two protected trees, one declining species and six protected species occur. The estimated number of protected trees and protected species population sizes are provided in Table 5 below.

***Table 5. Population estimates of species of special concern for permit applications.***

| Species | Estimated number of trees/ population size in mine footprint area | |
|---|---|---|
| | **Doornpan** | **Driehoekspan** |
| *Acacia erioloba* Camel thorn | 5 large trees > 2m in height.<br>No < 2m trees observed. | ± 115 > 2m in height.<br>± 50 < 2m in height. |
| *Boscia albitrunca* Shepherd's tree | ± 20 tall trees > 2m in height, stem diameter < 40cm.<br>± 200 shrubby trees < 2m height. | ± 45 >2m in height, stem diameter < 40cm.<br>No < 2m trees observed. |
| *Olea europaea* subsp *africana* Wild Olive | None observed. | ± 100 trees > 2m in height |
| *Boophone disticha* Bushmans' poison | None observed. | ± 500 |
| *Cotyledon orbiculata* | None observed. | ± 1000 |
| *Gymnosporia buxifolia* | None observed. | < 100 |
| *Pachypodium succulentum* | None observed. | ± 5000 |
| *Prepodesma orpenii* | ± 500 | None. |
| *Ruschia griquensis* vygie | None observed. | > 5000 |
| *Sarcostemma viminale* melktou | None observed. | > 100 |

The localities of the protected tree clusters and other protected species populations are mapped in Figure 9 & 10 (as green trees) and their GPS coordinates are provided in Annexure 3.

## 5.3 Permit requirements

The protected trees listed in Tables 4 & 5 are protected under the National Forests Act (1998) and amendments. These trees are also protected as Specially Protected Species (schedule 1) in the NCNCA of 2009. The other protected species listed in Tables 4 & 5 are protected as Protected Species (schedule 2) under the NCNCA of 2009.

A permit to remove the two protected tree species (camel thorn and shepherd's tree) will be required from both the Forestry sub-directorate of Department Agriculture, Forestry and Fisheries (Ms J. Mans) as well as from the Department of Nature and Environmental Conservation (DENC), Northern Cape (Ms M Smit or L Hanser) before any vegetation clearing commences. A permit to remove the rest of the protected species listed in Tables 4 & 5 will also be needed from the DENC before any vegetation clearing commences. This also includes the protected species that were not definitely recorded as present but have a medium to high probability of occurrence in the study area. It is also a requirement of the DENC that a report be submitted on all the species that were destroyed as well as estimates of numbers.

## 5.4 Sensitivity assessment

In general, the ecological sensitivity of any piece of land is based on its inherent ecosystem service and overall preservation of biodiversity. It therefore relates to:

• Species diversity, endemism (unique species or unique processes) and the high occurrence of species of special concern or ecosystems protected by legislation –*conservation importance*;

• The degree of ecological connectivity between systems within a landscape matrix. Thus, systems with a high degree of landscape connectivity amongst one another are perceived to be more sensitive – *ecological function*.

Sensitive habitats are known to occur in the region. Areas with untransformed natural vegetation, high diversity and complexity, species of special concern and systems vital to sustaining ecological function are potentially sensitive. Examples of sensitive habitats include wetlands, seasonal pans, perennial and non-perennial rivers and streams (watercourses) and ecological corridors with high connectivity to other ecosystems. Highly sensitive habitats often contain larger and/or healthier populations of species of special concern, or a higher species diversity of these particular species, and are considered to be of higher conservation value and more sensitive than areas with fewer or sparsely distributed species of special concern.

Results of the field surveys revealed that there are no permanent wetlands within the mining footprint areas. The sensitivity maps were produced to guide the optimal positioning of infrastructure to ensure that sensitive habitats are avoided.  Figure 9 and 10 indicate the various levels of sensitivity of natural features of the sites.

The analysis of the vegetation on Doornpan indicates that the vast majority of the proposed mine footprint (75 ha) comprises of vegetation of a medium sensitivity, with one small natural area (a pan, 2.4 ha with buffer zone) considered to be of medium-high sensitivity (Figure 9, mapped in blue). Based on the small and isolated nature of the pan it is ranked as medium-high sensitivity. Other than the role played in biodiversity support by the extended provision of surface water following rainfall events, the functions performed by this pan are limited.

Transformed areas (roads, cleared areas for drilling and prospecting) of low ecological sensitivity make up approximately 2 ha of the total area.

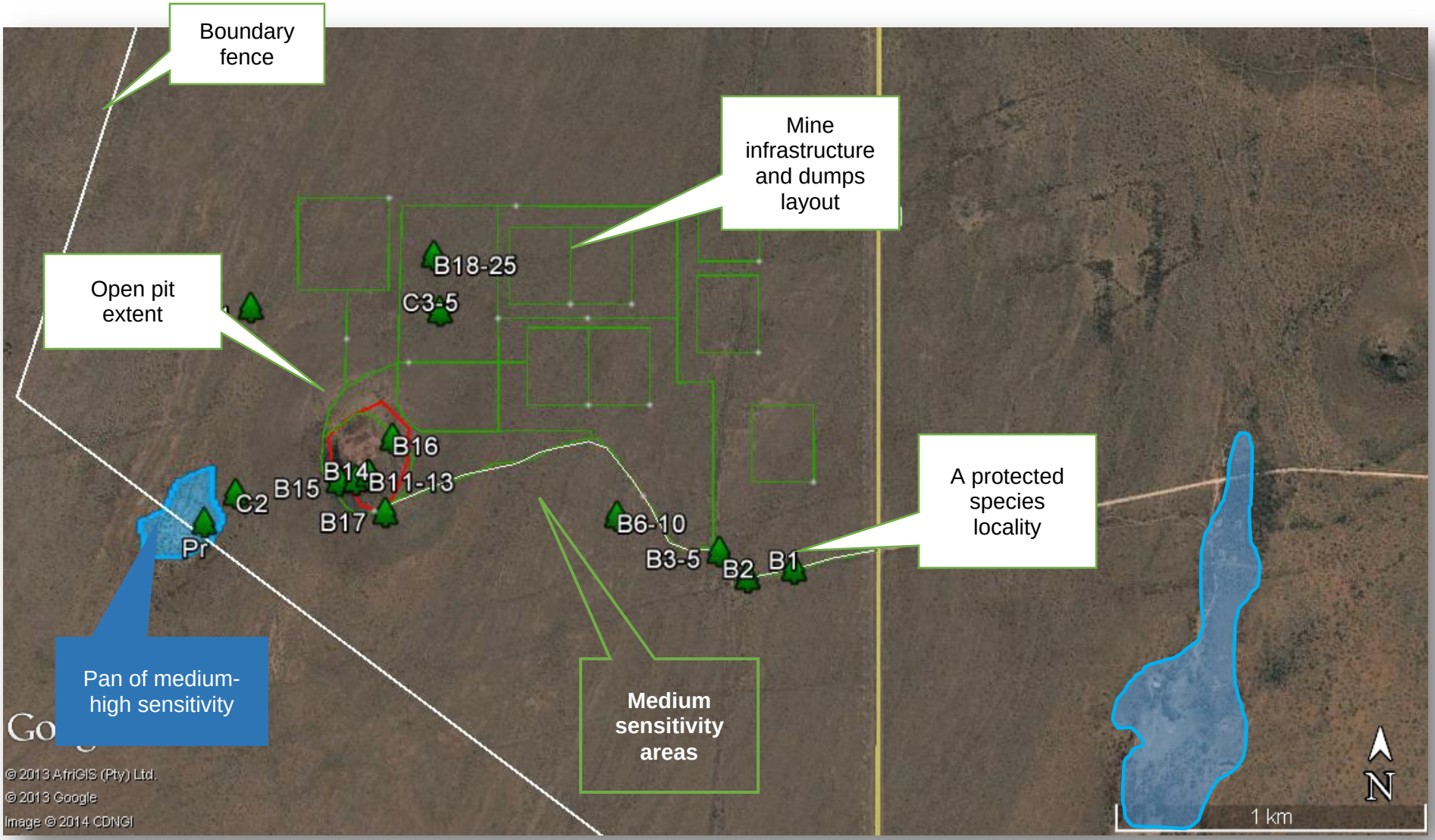


*Figure 9. Sensitivity map with sensitivity ratings for the Doornpan mining area. The positions of protected trees and other protected species are indicated by coded green trees. The codes are:* C = camel thorn, B = Boscia albitrunca (shepherd's tree), Pr = Prepodesma orpenii.

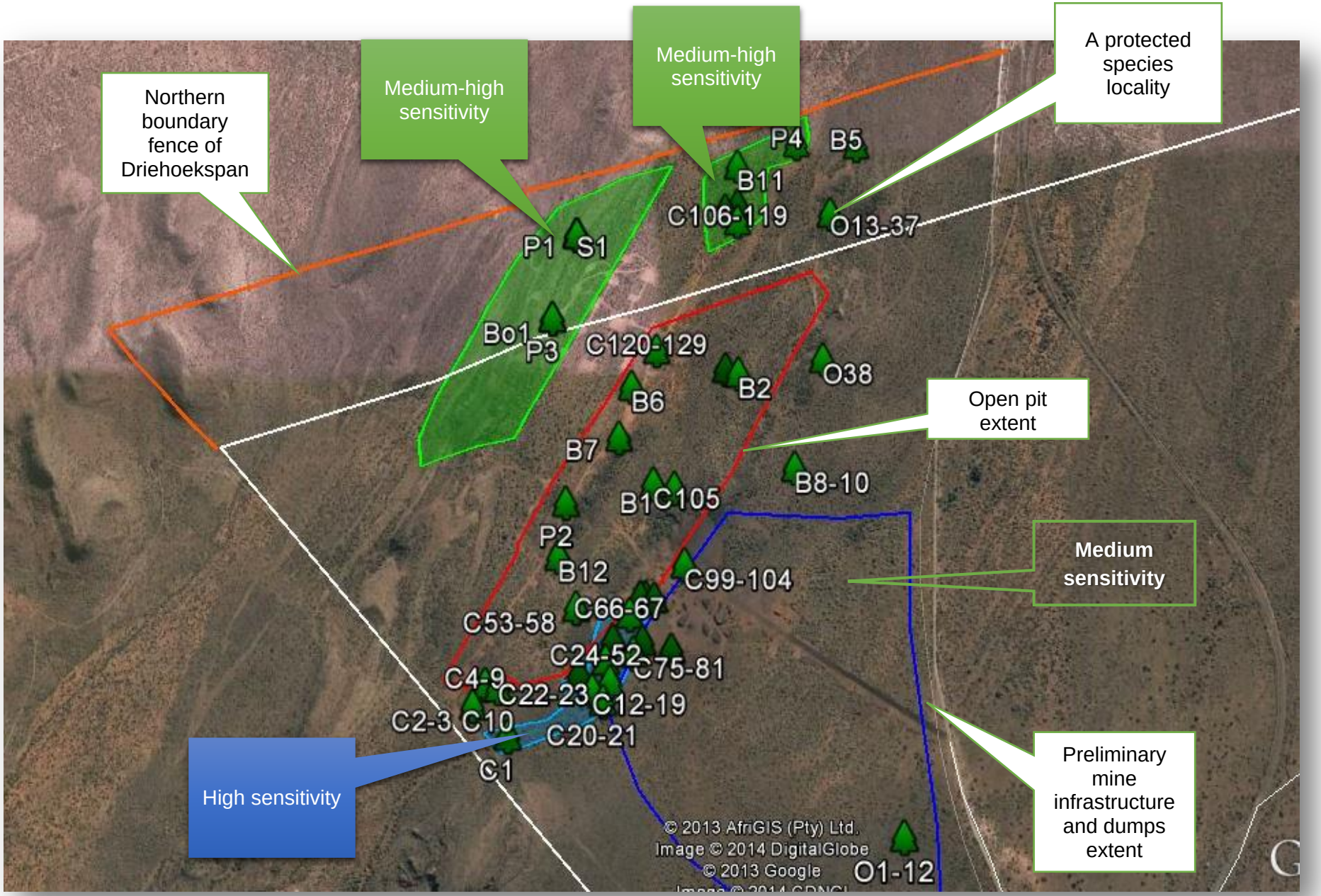


*Figure 10. Sensitivity map with sensitivity ratings for Driehoekspan. The protected species codes are:* C = camel thorn, B = Boscia albitrunca (shepherd's tree), O = Wild Olive (Olea europaea), P = Pachypodium succulentum, Bo = Boophone disticha, S = Sarcostemma viminale.

One dry watercourse (ephemeral wetland) is present on Driehoekspan, which supports a number of protected camel thorn trees. This habitat is considered to be of a high sensitivity (mapped in blue Figure10) based on its ecological function as a watercourse and ecological corridor, microhabitats which increase its biodiversity value and its medium to high value provision of ecosystem services. Its estimated size is approximately 4.7 ha.

Medium-high sensitivity areas, estimated to cover an area of 24 ha, meet the following criteria:

- Confirmed habitat for species of lower threat status (protected and declining species).
- Habitat with individuals of extreme age.
- Habitat with low ability to recover from disturbance.
- Habitat with a unique species composition and narrow distribution.

The medium-high sensitivity areas are mapped in green in Figure 10.

## 6. POTENTIAL IMPACTS

In general, the issues relevant to the impacts on the ecology of the area are impacts on biodiversity, impacts on sensitive habitats, impacts on ecosystem function, secondary (indirect) and cumulative impacts on the ecology, and impacts on the economic use of the vegetation.

Activities that could potentially impact on the ecology and vegetation include:

- Clearing of land for construction.
- Construction of access roads.
- Operation of construction camps.
- Haulage and stockpiling.
- Placement of pipelines and powerlines.
- Water management and dewatering.
- Storage of chemicals and materials required for construction and operation of machinery/ vehicles.

Potential impacts that can be expected to occur as a result of the construction and operation of this mine are discussed below. These impacts have been considered as the most important after a review of previous specialist studies for other similar projects in the Northern Cape.

### 6.1 Loss of natural vegetation

Construction of infrastructure and the development of the mine will lead to a direct loss of vegetation, which leads to a localised or more extensive reduction in over the overall extent of vegetation. Should the vegetation already be transformed to some extent and therefore stressed, the loss can lead to increased vulnerability of the vegetation and habitats and a change in the conservation status. Consequences of the impact of loss of natural vegetation may include a) a negative change in conservation status of the vegetation type/ecosystem, b) increased vulnerability of remaining portions to future disturbance, c) loss of habitat for sensitive species/species of special concern, d) loss in variation within sensitive habitats as portions are destroyed, e) general reduction in biodiversity, f) disturbance to processes maintaining biodiversity and ecosystem services, and g) loss of ecosystem services.

As a result of an area being cleared of vegetation, there may be an increase in surface water runoff and erosion into watercourses. Increased runoff as a result of infrastructure may increase the rates and extent of erosion, reduce percolation and aquifer recharge rates, change watercourse morphology and increase discharge rates.

## 6.2 Habitat fragmentation (loss of landscape connectivity)

Continuous development leads to greater habitat fragmentation, with progressively smaller patches of habitat created. As the proportion of suitable habitat decreases in the landscape, area and isolation effects start influencing the population size of resident species (Andrén 1994). Habitat fragmentation has the potential to affect plant reproduction by changing the community of pollinators and natural enemies, the neighbourhood of potential mates, the availability of resources, and microclimate (Cunningham, S.A. 2000). Fragmenting sensitive habitats with threatened species, protected species and endemic species further reduces the small area they are able to occupy as well as their population sizes. Fragmentation leads to a decline in the numbers of these species and eventual loss of biodiversity.

Isolated small habitats are unable to sustain larger mammal herbivores and small carnivores, and as a result these animals are excluded and important processes like animal-dependent seed dispersal (Milton & Dean 2001), and nutrient cycling (Dean et al. 1999) may eventually cease to occur. For example, large mammals such as kudu and eland feed on camel thorn and grey camel thorn pods and these seeds require scarification to germinate. Scarification takes place as the seeds pass through their digestive tract. The seeds are then deposited in nutrient-rich dung while these herbivores move in and between habitats as they forage, and so these trees are dispersed across the landscape. Seed dispersal processes also include dispersal of the fruit of large and small shrubs by small mammals, bats and birds, pollination by invertebrates, herbivores and other wildlife, and the distribution of seeds by smaller animals like tortoises. Nutrient cycling in small or fragmented habitats could be reduced with reduced numbers of mammals or no large mammal movement and foraging. To prevent the reduction or breakdown of these ecological processes in affected habitats, connectivity between habitats needs to be maintained. Movement and species richness are positively affected by corridors and connectivity, respectively (Debinski & Holt 2000). The fragmentation of highly sensitive habitats through vegetation clearing and thereby altering their natural ecosystem function should be avoided.

## 6.3 Impacts on species of special concern

Plant species are affected through clearing as well as an overall loss of habitat. For species that are not threatened or of special concern, a loss of individuals or localised populations is not likely to alter the conservation status of the species. However, a loss of individuals or populations of threatened species could lead to a change in the conservation status of a species (reducing its chance of survival) and even extinction. Consequences of impacts on species of special concern include fragmentation of populations of affected species, reduction in the area of occupancy and a loss of genetic variation within affected species.

The two protected tree species recorded in Table 4 and other protected species occur within the mine footprints on Doornpan and Driehoekspan, and the construction of infrastructure and mining operations will impact on a number of these trees and protected species. This can be avoided and reduced by careful positioning of the infrastructure, roads, waste dumps and stockpiles and management of staff and their activities.

A potential indirect impact that could affect protected tree species is dewatering to continue mining once the groundwater depth is reached. The camel thorn (*Acacia erioloba*) is a species which is sensitive to changes in depth to the water table. This ecological keystone species can have very deep root systems (30-60 m and depths of 68 m have been reported - Canadell et al. 1996) and it uses its deep roots to access and use (even brackish) deep water containing dissolved nitrates. Camel thorns are most common in alluvial settings and areas where the water table is relatively shallow (Colvin et al 2007).

Shallow semi-confined aquifers or perched aquifers below drainage lines/watercourses between 10-60 m are likely to support deep rooted, large camel thorn trees. The cone of depression that forms due to mine dewatering which reverses the groundwater flow towards the open pit can affect the upper perched aquifer.

This effect may also extend away from the mine. This implies that camel thorn trees dependent on the perched aquifer may be negatively affected up to a certain distance away from the mine.

## 6.4 Dust fallout impacts

There is the potential that fugitive dust from blasting, tipping and haulage will have an impact on the vegetation and species of special concern in particular. There are few detailed studies of the effects of dust deposition on plants. Although the potential for severe fugitive dust impacts is greatest within 100 m of dust-generating activities, there is still the potential for dust to affect vegetation up to five kilometres or more downwind. Dust deposited on the ground may cause changes in soil chemistry (chemical effects), and may over the long-term result in changes in plant chemistry, species composition and community structure. Should the dust fallout levels be significant, there is a high probability that dust deposition on plants will negatively impact plant vigour and cause die-off of parts of plants or death of individuals. The browsing and grazing value or palatability of the vegetation for livestock in areas downwind of mining activities and neighbouring farms may therefore decrease. Sensitivities to dust deposition of the various plant species present in the area are not known. It is therefore difficult to predict which species may be more susceptible. There is some scientific evidence to suggest that dust fallout from mining at Sishen Iron Ore Mine is impacting negatively on camel thorn trees and other large shrub species around Kathu and in the Kathu Nature Reserve (Van der Merwe 2001).

In a recent EIA for the Gamsberg zinc mine, the biodiversity specialists were of the opinion that any dust fallout exceeding 20 µg/m²/day of normal baseline (10% above background rates) is assumed to be detrimental to vegetation on quartzite rocky habitats (Botha et al 2013). Habitats where dust fallout exceeds 25% (50 µg/m²/day) of normal baseline can be considered to be significantly impacted. The air quality study by von Reiche (2014) states that the ambient annual average $PM_{10}$ concentration for the Postmasburg area is 22 µg/$m^3$/day. The potential for cumulative off-site $PM_{10}$ concentrations in excess of NAAQSs is notable since baseline PM10 concentrations are already in excess of NAAQSs. With mitigation as recommended, there is a predicted reduction in concentration levels that exceed only the 24-hour NAAQS over a small area over the south-western boundary of the mine rights area. Therefore dust can impact on the medium-high sensitivity area in the south-western corner of the property. However, as it is not expected to exceed 50 µg/m²/day, the impact on that sensitive area is not likely to be high.

## 6.5 Establishment of declared weeds and alien invader plants

Areas where the soil has been disturbed through construction activities will be prone to invasion by alien invasive plant species, such as mesquite *Prosopis* spp., Mexican poppy *Argemone ochroleuca,* blasiesbrak *Atriplex lindleyi subsp. inflata,* wild tobacco *Nicotiana glauca* and *Opuntia* species (Henderson 2001). These species are common on disturbed areas in the region, and have been recorded along with other weed species at Sishen Iron Ore Mine. Mesquites are invasive in drainage lines, pans and on plains in arid areas of the Northern Cape, disrupting stream flows (Le Maitre *et al.*, 1998), displacing native plant communities, reducing the grazing potential of invaded patches (Harding & Bate, 1991) and disrupting processes such as nutrient cycling. Dense stands of mesquite have been shown to have a lower plant and bird diversity than dense stands of the indigenous sweet thorn *Acacia karroo* in the Gamagara River near Dibeng, Northern Cape (Dean *et al*. 2002). There is the risk that the above-mentioned species and possibly others as listed in Henderson (2001) could invade the site and if left uncontrolled spread onto surrounding farmland. The consequences of alien plant establishment include loss of indigenous vegetation, sensitive habitats and species of special concern; change in vegetation structure leading to habitat change; change in plant species composition; change in soil chemical properties; hydrological impacts due to increased transpiration and runoff; and impairment of wetland function. Two invasive plant species were recorded at Doornpan and Driehoekspan (*Prosopis* cf. *glandulosa* & *Opuntia ficus-indica*), and these have the potential to spread as areas are disturbed/cleared.

Invasive species eradication should be done before the flowering and seeding period of the specific species to limit the spread of the species. Repetitive follow-up actions will be required before effective control is achieved. When controlling weeds and invaders, damage to the environment should be limited as far as possible. Negative ecological side effects associated with the removal or control of alien species can take several forms, the following common problems associated with alien control activities should be kept to a minimum:

- Herbicidal or physical damage to non-target plants,
- Chemical pollution of soil or water,
- The creation of a fire hazard by allowing flammable material to accumulate in fire-sensitive areas,
- Excessive disturbance or exposure of the soil, especially on riverbanks or slopes,
- Failure to rehabilitate denuded areas so as to prevent soil erosion and invasion by other undesirable species,
- Other actions that might upset the local ecology,
- Coarse droplet nozzles should be fitted to avoid drift onto neighbouring vegetation.
- Where possible, herbicide should be applied to cut stumps rather than used as a foliar spray.

If alien plant species are properly and timeously controlled in areas of the mine property as soon as they start invading, this should prevent their spread to surrounding farmland. Follow-up control of alien seedlings, saplings and coppice re-growth is essential to achieve and sustain the progress made with the initial control action. If follow-up control is not conducted the area will soon become re-infested with alien species.

## 6.6 Assessment methodology

An assessment of the potential impacts (discussed above) and impact significance was done using a method recommended by the CSIR, as follows:

**Nature of impact** – the type of effect that a proposed activity will have on the environment and includes what will be affected and how.

**Spatial Extent** – this should indicate whether the impact will be:

- Site specific
- Local (< 2 km from site)
- Regional (within 30 km of site)
- National.

**Duration** – the timeframe during which the impact will be experienced (lifetime of):

- Temporary (less than one year)
- Short term (1 - 6 years)
- Medium term (6 – 15 years)
- Long term (the impact will cease after the operational life of the activity)
- Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient).

**Intensity** – whether the impact is destructive or innocuous and described as either:

- High (severe alteration of natural systems, patterns or processes such that they temporarily or permanently cease)
- Medium (notable alteration of natural systems, patterns or processes; where the environment continues to function but in a modified manner)
- Low (negligible or no alteration of natural systems, patterns or processes).

**Probability** – the likelihood of the impact occurring and described as:

- Improbable (little or no chance of occurring)
- Probable (< 50% chance of occurring)
- Highly probable (50 – 90% chance of occurring)
- Definite (> 90% chance of occurring).

**Status of the impact:** A description as to whether the impact will be positive (environment overall benefits from impact), negative (environment overall adversely affected), or neutral (environment overall not affected).

**Degree of confidence in predictions:** The degree of confidence in the predictions, based on the availability of information and specialist knowledge - assessed as high, medium or low.

Based on the above considerations, an overall evaluation of the **significance** of the potential impact is provided, and described as follows:

- **Low to very low:** the impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on the decision-making.
- **Medium:** the impact will result in a moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated.
- **High:** the impacts will result in major alteration to the environment even with the implementation of the appropriate mitigation measures and will have an influence on decision-making.

**Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
**Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
**Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

Potential cumulative impacts as a result of the development of a solar park on the site include:

- impacts on SA's conservation obligations & targets,
- an increase in local and regional fragmentation/ loss of landscape connectivity, and
- an increase in environmental degradation and loss of ecosystem function.

The **reversibility** of impacts on the ecology will also be assessed.

Consideration will also be given to the confidence level that can be placed on the successful implementation of the mitigation measure as follows:

- **High Confidence:** mitigation measure easy and inexpensive to implement.
- **Medium Confidence:** mitigation measure expensive or difficult to implement.
- **Low Confidence:** mitigation measure expensive and difficult to implement.

# 7. IMPACT ASSESSMENT

## 7.1 Direct impacts

***Table 6: Assessment of the potential impacts of mining activities on Doornpan.***

| Impact | Extent | Duration | Intensity | Probability | Significance without mitigation & status | Mitigation | Significance with mitigation | Confidence level (mitigation confidence) |
|---|---|---|---|---|---|---|---|---|
| ***Construction and Operational phase*** | | | | | | | | |
| Loss of natural vegetation | Site specific | Permanent | Medium | Definite | Medium, negative | • Pre-construction the staff should receive environmental education to ensure that that no hunting, killing or harvesting of plants and animals occurs.<br>• Vegetation clearing during construction must be restricted to the mine footprint and planned infrastructure only.<br>• It would be a better environmental option to locate the infrastructure on transformed areas or areas adjacent to disturbed areas that are partly transformed.<br>• The medium-high sensitive habitat (Figure 9) must be avoided. Where these areas are close to the development area, they should be clearly demarcated as no go areas to avoid accidental impacts.<br>• A buffer zone of 50m is needed from the pan edge around the pan, in which no development or activities should take place.<br>• Unnecessary impacts (such as driving off road) on surrounding natural vegetation must be avoided.<br>• A storm-water management plan must be compiled, indicating how water velocities will be reduced before storm water enters natural channels and how natural processes for water infiltration of the affected landscape will be accommodated. It would be useful to channel and collect the runoff water into underground water | Medium, negative | High (Medium) |

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| | | | | | | tanks for future use, to reduce consumption of water in a water stressed environment.<br>• During construction the top soil should be removed and separately stored from sub-soil.<br>• Regular monitoring for erosion to ensure that no erosion problems are occurring at the site as a result of the roads and other infrastructure. All erosion problems observed should be rectified as soon as possible. | | |
| Habitat fragmen-tation. | Local | Long term | Medium | Definite | Medium, negative | • Vegetation clearing during construction must be restricted to the mining activities footprint only.<br>• Locating the infrastructure on disturbed areas or areas adjacent to disturbed areas that are partly transformed would reduce the amount of fragmentation.<br>• The medium-high sensitive habitat (Figure 9) must be avoided to prevent reducing their size. Where these areas are close to the development area, they should be clearly demarcated as no go areas to avoid accidental impacts.<br>• Regular monitoring for erosion to ensure that no erosion problems are occurring at the site as a result of the roads and other infrastructure. All erosion problems observed should be rectified as soon as possible. | Medium, negative | Medium (Medium) |
| Impacts on species of special concern | Local and regional (reduction in overall populatio n) | Permanent | Medium | Definite | Medium, negative | • Vegetation clearing during construction must be restricted to the mine footprint only.<br>• The medium-high sensitive habitat (Figure 9) must be avoided to prevent any impacts on species of special concern and an increased impact on protected trees. Where these areas are close to the development area, they should be clearly demarcated as no go areas to avoid accidental impacts.<br>• No roads are to be created in sensitive habitats.<br>• The harvesting of any protected trees for fuel wood on the site should be strictly forbidden and the staff educated to prevent this from happening.<br>• Use of branches of trees, shrubs or any vegetation for fire making purposes is strictly prohibited.<br>• Prohibit all open fires and provide demarcated fire- | Medium, negative | High (Low) |

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| | | | | | | safe zones, facilities and suitable fire control measures.<br>• The irresponsible use of welding equipment, torches and other open flames, which could result in veld fires are a hazard and should be guided by safe practice guidelines. | | |
| Establish-ment of declared weeds and alien invasive plants | Local | Long term | Medium | Highly Probable | Medium, negative | • Clearing of natural vegetation must be kept to a minimum.<br>• Cleared areas should be rehabilitated as quickly as possible once construction and an operation is completed.<br>• Soil stockpiles should not be translocated from areas with alien plants into the site, and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants.<br>• An on-going monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens according to best practice methods for each species.<br>• Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove. | Low, negative | High (Medium) |
| Dust fallout | Local | Long term | Low to Medium | Highly Probable | Medium, negative | • Implement dust suppression measures (e.g. use dusticides instead of water when there is no water available, and use groundwater during the dewatering phase).<br>• Cover all road surfaces, especially areas with heavy traffic (tar/gravel could be used).<br>• Ensure correct drainage of water from road surfaces to prevent erosion that leads to unstable soil that may contribute to the airborne dust.<br>• All vehicles on site must adhere to strict speed limits to prevent dust.<br>• Rehabilitate disused areas and erosion channels as soon as possible to stabilize the soil.<br>• If an excessive amount of dust is found on the vegetation or if the dust is impacting on ecosystem | Low, negative | Medium (Low) |

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| | | | | | | health, stricter dust suppression measures should be applied (especially on windy days).<br>• Water the truck loads of waste/overburden to be dumped before tipping on dump.<br>• Blasting on windless days only, if possible. | | |
| ***Rehabilitation and closure phase*** | | | | | | | | |
| On vegetation and species of special concern due to the activity and movement of people in the area, the creation of dust and the runoff of contaminated water. | Local | Short term | Low | Highly Probable | Low, negative | • Maintain the management measures and procedures which were required by employees during the construction and operational phases regarding the preservation of species of special concern (above).<br>• Dust suppression spraying; prohibiting activities outside of the demarcated mine area and the maintenance of storm water management infrastructure until rehabilitation is considered successful will minimize the impacts on the vegetation.<br>• Prevent contamination of natural habitat from any source of pollution.<br>• The use of welding equipment, torches and other naked flames, which could result in veld fire should follow safe practice guidelines.<br>• Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted. | Low, negative | Medium (Low) |

***Table 7. Assessment of the potential impact of the mining activities on Driehoekspan***

The impact assessments below are based on the preliminary mine footprint area before any detailed layout plan for the mine footprint has been drafted. As such it is difficult to determine the extent of the potential impact of the mine footprint on the high and medium-high sensitivity

areas at this stage. It is therefore assumed that the mine footprint will impact on 90% of the higher sensitivity areas. The assessment should be revised once the final mine footprint has been determined.

| Impact | Extent | Duration | Intensity | Probability | Significance without mitigation & status | Mitigation | Significance with mitigation | Confidence level (mitigation confidence) |
|---|---|---|---|---|---|---|---|---|
| ***Construction and Operational phase*** | | | | | | | | |
| Loss of natural vegetation | Site specific | Permanent | Medium | Definite | Medium, negative | • Pre-construction the staff should receive environmental education to ensure that that no hunting, killing or harvesting of plants and animals occurs.<br>• Vegetation clearing during construction must be restricted to the mine footprint and planned infrastructure only.<br>• It would be a better environmental option to locate the infrastructure on transformed areas or areas adjacent to disturbed areas that are partly transformed.<br>• High and medium-high sensitive habitats (Figure 10) must be avoided. Where these areas are close to the development area, they should be clearly demarcated as no go areas to avoid accidental impacts.<br>• A buffer zone of 50m is needed from the pan edge around the pan, in which no development or activities should take place.<br>• Unnecessary impacts (such as driving off road) on surrounding natural vegetation must be avoided.<br>• A storm-water management plan must be compiled, indicating how water velocities will be reduced before storm water enters natural channels and how natural processes for water infiltration of the affected landscape will be accommodated. It would be useful to channel and collect the runoff water into underground water tanks for future use, to reduce consumption of water in a water stressed environment.<br>• During construction the top soil should be removed and separately stored from sub-soil. | Medium, negative | High (Medium) |

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| | | | | | | • Regular monitoring for erosion to ensure that no erosion problems are occurring at the site as a result of the roads and other infrastructure. All erosion problems observed should be rectified as soon as possible. | | |
| Habitat fragmen-tation. | Local | Long term | Medium | Definite | High, negative | • Vegetation clearing during construction must be restricted to the mining activities footprint only.<br>• Locating the infrastructure on disturbed areas or areas adjacent to disturbed areas that are partly transformed would reduce the amount of fragmentation.<br>• High and medium-high sensitive habitats (Figure 10) must be avoided to prevent reducing their size. Where these areas are close to the development area, they should be clearly demarcated as no go areas to avoid accidental impacts.<br>• Regular monitoring for erosion to ensure that no erosion problems are occurring at the site as a result of the roads and other infrastructure. All erosion problems observed should be rectified as soon as possible. | Medium, negative | Medium (Medium) |
| Impacts on species of special concern | Local and regional (reduction in overall populatio n) | Permanent | Medium | Definite | High, negative | • Vegetation clearing during construction must be restricted to the mine footprint only.<br>• High and medium-high sensitive habitats (Figure 10) must be avoided to prevent any impacts on species of special concern and an increased impact on protected trees. Where these areas are close to the development area, they should be clearly demarcated as no go areas to avoid accidental impacts.<br>• No roads are to be created in sensitive habitats.<br>• The harvesting of any protected trees for fuel wood on the site should be strictly forbidden and the staff educated to prevent this from happening.<br>• Use of branches of trees, shrubs or any vegetation for fire making purposes is strictly prohibited.<br>• Prohibit all open fires and provide demarcated fire-safe zones, facilities and suitable fire control measures. | Medium, negative | High (Low) |

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| | | | | | | • The irresponsible use of welding equipment, torches and other open flames, which could result in veld fires are a hazard and should be guided by safe practice guidelines. | | |
| Establish-ment of declared weeds and alien invasive plants | Local | Long term | Medium | Highly Probable | Medium, negative | • Clearing of natural vegetation must be kept to a minimum.<br>• Cleared areas should be rehabilitated as quickly as possible once construction and an operation is completed.<br>• Soil stockpiles should not be translocated from areas with alien plants into the site, and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants.<br>• An on-going monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens according to best practice methods for each species.<br>• Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove. | Low, negative | High (Medium) |
| Dust fallout | Local | Long term | Low to Medium | Highly Probable | Medium, negative | • Implement dust suppression measures (e.g. use dusticides instead of water when there is no water available, and use groundwater during the dewatering phase).<br>• Cover all road surfaces, especially areas with heavy traffic (tar/gravel could be used).<br>• Ensure correct drainage of water from road surfaces to prevent erosion that leads to unstable soil that may contribute to the airborne dust.<br>• All vehicles on site must adhere to strict speed limits to prevent dust.<br>• Rehabilitate disused areas and erosion channels as soon as possible to stabilize the soil.<br>• If an excessive amount of dust is found on the vegetation or if the dust is impacting on ecosystem | Medium, negative | Medium (Low) |

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|---|---|---|---|---|---|---|---|---|
| | | | | | | health, stricter dust suppression measures should be applied (especially on windy days).<br>• Water the truck loads of waste/overburden to be dumped before tipping on dump.<br>• Blasting on windless days only. | | |
| ***Rehabilitation and closure phase*** | | | | | | | | |
| On vegetation and species of special concern due to the activity and movement of people in the area, the creation of dust and the runoff of contaminated water. | Local | Short term | Low | Highly Probable | Low, negative | • Maintain the management measures and procedures which were required by employees during the construction and operational phases regarding the preservation of species of special concern (above).<br>• Dust suppression spraying; prohibiting activities outside of the demarcated mine area and the maintenance of storm water management infrastructure until rehabilitation is considered successful will minimize the impacts on the vegetation.<br>• Prevent contamination of natural habitat from any source of pollution.<br>• The use of welding equipment, torches and other naked flames, which could result in veld fire should follow safe practice guidelines.<br>• Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted. | Low, negative | Medium (Low) |

## 7.2 Indirect impacts

A potential indirect impact that could affect protected tree species is dewatering to continue mining once the groundwater depth is reached. The camel thorn (*Acacia erioloba*) is a species which is sensitive to changes in depth to the water table. This ecological keystone species can have very deep root systems, 30-60 m and depths of 68 m have been reported (Canadell et al. 1996). It uses its deep roots to access and use (even brackish) deep water containing dissolved nitrates. Camel thorns are most common in alluvial settings and areas where the water table is relatively shallow (Colvin et al 2007).

Du Plessis (2014) reports that there is an upper semi-confined aquifer at the calcrete layer between 10 - 30 m below surface on Doornpan. There may be a shallow, semi-confined aquifer or alluvial perched aquifer present on Driehoekspan, possibly at roughly the same depths as Doornpan, but this has yet to be confirmed by the groundwater study for Driehoekspan. If so, it is likely to be supporting deep rooted, large camel thorn trees. The cone of depression which will reverse groundwater flow towards the open pit due to mine dewatering on Driehoekspan is unknown at this stage. An upper perched aquifer may be affected by the cone of depression, and if so, this effect may also extend away from the mine. This implies that camel thorn trees dependent on the perched aquifer may be negatively affected up to a certain distance away from the mine. This potential impact can only be assessed once the necessary information on the groundwater is available.

## 7.3 Cumulative impacts

Cumulative impacts arise from the combined presence of several similar developments within an area, which affect ecological processes operating at broader scales or where each have a small impact which becomes significant when combined. There are a number of other ore mines in the region between Postmasburg and Hotazel, the larger mines include Sishen Iron Ore Mine, Khumani (Assmang), Kolomela, and Beeshoek mines. Numerous smaller manganese mines are operating between Postmasburg and Kathu. Most of these mines occur in the same vegetation types as this project.

This project has the potential to cumulatively impact on our country's *conservation obligations and targets* at a local as well as national level. It should be viewed along with other types of local and regional impacts that affect conservation areas. The importance of vegetation types is based on the conservation status ascribed to regional vegetation types and while any impact that results in irreversible transformation of natural habitat is regarded significant, no significant disruption of ecosystem functioning is assumed in least threatened vegetation types (which still have more than 80% of their original extent intact). Loss of parts of the natural vegetation is expected to result in an insignificant, cumulative impact on the conservation status of the regional vegetation types; which are classified as Least Threatened.

There will be an increase in the local and regional *habitat fragmentation/loss of landscape connectivity*. The loss of even small sections of natural habitat implies that life forms have permanently lost their ability to occupy that space, and therefore a higher premium is placed on available food, water and habitat resources in the immediate surrounds. This, in some instances might mean that the viable population of plants or animals in a region will decrease proportionally with the loss of habitat, eventually decreasing beyond a viable population size. The danger in this type of cumulative impact is that effects often only become visible over a period of time, and at that stage they are likely to be beyond repair. Impacts on linear areas of natural habitat, such as watercourses, affect the migratory success of animals in particular. The Postmasburg region is characterised by moderate levels of transformation and habitat fragmentation. As the impacts from the proposed development are localised, not adjacent to other large developments and at a fairly small scale, they are not likely to increase regional levels of fragmentation and habitat isolation significantly.

The cumulative impact of a reduction in the *protected shepherd's tree* population size in South Africa is unknown, as quantitative data on the abundance and recruitment success of this tree is lacking (Seymour & Milton 2003). The impact can therefore not be quantified, but there will be a small reduction in the

population size as a result of the development. The cumulative secondary effect of this is that this tree's status will shift closer towards the next threshold of concern – Declining. The cumulative impact of a reduction in the *protected camel thorn tree* population size in South Africa is also unknown, and this tree is already classified as Declining. The impact can therefore not be quantified, but there will be a small reduction in the population size as a result of the development. The cumulative secondary effect of this is that this tree's status will shift closer towards the next threshold of concern, namely Near Threatened.

Should mitigation measures to prevent soil erosion and control alien plant invasion not be successful, these impacts could expand beyond the site and lead to additional impacts on watercourses and pans that will exacerbate the negative impacts of land use locally.

Cumulative impacts associated with this type of development could lead to initial, incremental or augmentation of existing types of *environmental degradation*, including impacts on the soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases are these effects are not bound and are dispersed, or diluted over an area that is much larger than the actual footprint of the causal factor. Significant environmental degradation is usually not visible in developments in untransformed and pristine areas, however these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced. The nature of the proposed development is such that the biological environment is unlikely to be significantly affected if effluents, spillages, chemicals and water pollution are properly managed.

The cumulative impact of numerous similar developments in the immediate area and on a regional scale, is significant and increasing, and a strategic environmental assessment of the mining corridor from Postmasburg and Danielskuil in the south to Hotazel and Moshaweng in the north is now urgently required.

## 7.4 Assessment of the reversibility of impacts

The reversibility of the four main impacts on the vegetation of the proposed site is ranked in Table 8.

***Table 8. Assessment of the reversibility of impacts on the vegetation.***

| Impact | Reversibility ranking |
|---|---|
| Loss of natural vegetation | Impacts are non- reversible |
| Habitat fragmentation (loss of landscape connectivity) | Low reversibility of impacts |
| Impact on species of special concern | Impacts are non- reversible |
| Establishment of declared weeds and alien invasive plants | High reversibility of impacts |

## 7.5 Assessment of the degree to which the impact causes irreplaceable vegetation loss

The degree to which the potential impacts are expected to cause irreplaceable loss to the vegetation of the proposed site is ranked in Table 9.

***Table 9. Assessment of the degree to which the impacts will cause irreplaceable vegetation loss.***

| Impact | Irreplaceability ranking |
|---|---|
| Loss of natural vegetation | Moderate irreplaceability of resources |
| Habitat fragmentation (loss of landscape connectivity) | Low irreplaceability of resources |
| Impact on species of special concern | High irreplaceability of resources |
| Establishment of declared weeds and alien invasive plants | Low irreplaceability of resources |

## 8. RECOMMENDATIONS FOR MITIGATION AND ENVIRONMENTAL MANAGEMENT

Flora permits must be acquired before commencement of construction phase and vegetation clearing. It is a permit requirement that a report is submitted to DENC on all the species and numbers which are cleared. An ECO may be necessary to identify the species in the field. As a start the photos provided in Annexure 2 can be used for identification purposes.

The EMP should be revised once the final mine footprint has been determined for Driehoekspan.

Table 10 provides more detailed mitigation objectives, actions required and the recommended monitoring for each of the main potential impacts on the vegetation and habitats.

***Table 10. Recommended mitigation measures and monitoring programme for the various impacts on the vegetation.***

| Impact | Mitigation objectives | Mitigation/ Management action | Monitoring | | |
|---|---|---|---|---|---|
| | | | **Methodology** | **Frequency** | **Responsibility** |
| <u>Construction and operation phases:</u><br>Loss of natural vegetation in development footprint area | Minimise loss of natural vegetation.<br><br>Prevent loss of natural vegetation through erosion.<br><br>Prevent impacts on natural vegetation in sensitive habitats and species of special concern.<br><br>Control loss of natural vegetation during operation. | • Locate the infrastructure on transformed areas or areas adjacent to disturbed areas that are partly transformed.<br>• Existing access roads/servitudes must be used as far as possible.<br>• A buffer zone of 50 m is needed from the pan edge around the pan on Doornpan and drainage line on Driehoekspan, in which no development or activities should take place.<br>• Sensitive habitats (Figures 9 & 10) must be avoided. Where these areas are close to the development area, they should be clearly demarcated as no go areas to avoid accidental impacts.<br>• A storm-water management plan must be compiled, indicating how water velocities will be reduced before storm water enters natural channels and how natural processes for water infiltration of the affected landscape will be accommodated. It would be useful to channel and collect the runoff water into underground water tanks for future use, to reduce consumption of water in a water stressed environment.<br>• Any roads running down a slope must have water diversion structures present. | ▪ When finalising layout plan.<br><br>▪ When finalising layout plan.<br><br>▪ Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction.<br><br>▪ Compile plan pre-construction.<br><br>▪ Monitor storm water management efficiency. | <br><br><br><br>Daily<br><br><br><br>After rainfall events. | Project management team<br>Project management team<br>ECO and Contractor<br><br>Project management team<br><br>ECO and management team. |

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| | | • Powerline pylons must be positioned a minimum of 50 m outside of watercourse boundaries.<br>• Vegetation clearing during construction must be restricted to the mine footprint only. It should be phased to ensure that the minimum area of soil is exposed to potential erosion at any one time.<br>• Unnecessary impacts on surrounding natural vegetation must be avoided during construction & operation. No construction vehicles should be allowed to drive around the veld. All construction vehicles should remain on properly demarcated roads.<br>• During construction the top soil should be removed and separately stored from sub-soil (in piles not > 2 m high). Stockpiles not used in 3 months after stripping must be seeded to prevent dust and erosion.<br>• Re-vegetation of disturbed surfaces must occur immediately after construction activities are completed. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction.<br>• The collection, hunting or harvesting of any plants, fuel wood or animals at the site should be strictly forbidden and the staff educated to prevent this from happening.<br>• All hazardous materials should be stored in the appropriate manner to prevent impacts on vegetation. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.<br>• Fires should only be allowed within fire-safe demarcated areas.<br>• The vegetative (grass) cover on the soil stockpiles (berms) must be continually monitored in order to maintain a high basal cover. | -<br>▪ ECO to be on site to monitor vegetation clearing.<br>▪ ECO must monitor activities and record and report non-compliance.<br>• ECO to research and advise on seed to be used, based on plant checklist for that area (Annexure 1).<br>▪ Regular monitoring for erosion to ensure that no erosion problems are occurring at the site. All erosion problems observed should be rectified as soon as possible.<br>▪ Strict control and proper education of staff to prevent misconduct. If ECO is absent, there should be a designated EO present to deal with any urgent issues. | <br>Daily<br>Weekly initially, then monthly<br><br><br>Monthly or as needed.<br><br>Weekly | Contractor<br>Contractor<br>ECO and contractor<br>ECO<br>ECO and Contractor<br>ECO or EO and Contractor |
| Construction | Minimise habitat | • Most of the above actions to prevent loss of natural | | | |

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| <u>and Operation phases:</u> Habitat fragmentation (loss of landscape connectivity) | fragmentation and loss of connectivity | vegetation will also minimise habitat fragmentation.<br>• Security fencing should be constructed in manner which allows for the passage of small and medium-sized mammals. Steel palisade fencing (with 20 cm gaps) is a good option as it allows most small mammals to move through. Alternatively the lowest strand or bottom of the fence should be elevated to 15 cm above the ground at least at strategic places to allow for fauna to pass under the fence.<br>• Regular monitoring for erosion to ensure that no erosion problems are occurring at the site as a result of the roads and other infrastructure. All erosion problems observed should be rectified as soon as possible. | • ECO to assist if necessary.<br>• Regular monitoring for erosion. | <br><br>Monthly | Project management team<br><br>ECO and Contractor |
| <u>Construction and operational phases:</u> Impacts on species of special concern | Minimise impacts on species of special concern and protected trees. | • Existing access roads must be used and new roads should be located along the boundaries of existing disturbed areas where possible. Vegetation clearing must be limited to the mine footprint.<br>• Sensitive habitats (Figures 9 & 10) must be avoided to prevent any impacts on species of special concern and an increased impact on protected trees. Where these areas are close to the development area, they should be clearly demarcated as no go areas to avoid accidental impacts.<br>• Unnecessary impacts on surrounding natural vegetation must be avoided. All construction and maintenance vehicles to remain on the roads and no driving off road allowed.<br>• The harvesting of any protected trees for fuel wood, or collection of other species of special concern, should be strictly forbidden and the staff educated to prevent this from happening.<br>• Implement dust suppression measures (e.g. use dusticides instead of water when there is no water available, and use groundwater during the dewatering phase if the quantity is sufficient); b) Cover all road surfaces, especially areas with heavy traffic (tar/gravel could be used); c) Ensure correct drainage of water from road surfaces to prevent erosion, that leads to unstable soil that | ▪ ECO must monitor activities and record and report non-compliance.<br>• Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction and maintenance.<br>• ECO must monitor activities and record and report non-compliance.<br>• ECO must monitor activities and record and report non-compliance. | Weekly or monthly<br><br>Weekly<br><br>Daily<br><br>Daily | ECO<br><br>ECO and contractor<br><br>ECO and contractor<br><br>Mine management team |

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| | | may contribute to the airborne dust; d) All vehicles on site must adhere to strict speed limits to prevent dust; e) Rehabilitate disused areas and erosion channels as soon as possible to stabilize the soil; f) If monitoring shows that there is an excessive amount of dust is found on the vegetation or if the dust is impacting on ecosystem health, stricter dust suppression measures should be applied (especially on windy days).<br>• Water the truck loads of waste/overburden to be dumped before tipping on dump.<br>• Blasting on windless days only. | • Monitoring of the amount of dust on vegetation as well as the species composition, structure and health of the vegetation at fixed points located at variable distances from the mining activities to determine the impact of the dust on the vegetation. | Quarterly | ECO or ecologist/ specialist advice |
| <u>Construction and operational phases:</u><br>Establishment of alien invasive plants | No establishment and spread of alien invasive plants | ▪ Establish an ongoing monitoring programme to detect and quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act and Biodiversity Act) for construction phase.<br>▪ Do not import soil stockpiles from areas with alien plants.<br>▪ Rehabilitate disturbed areas as quickly as possible.<br>▪ Keep disturbance of indigenous vegetation to a minimum.<br>▪ Continue with ongoing monitoring programme to detect and quantify any alien species that may become established and identify the problem species during operation phase.<br>▪ Immediately control any alien plants that become established using registered control methods.<br>▪ Local labour should be utilised for the removal of alien plants. | ▪ If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of plants or concentrations of plants), number of individuals (whole site), age and/or size classes of plants and aerial cover of plants.<br>▪ The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area.<br>▪ Take action to control alien plants as advised by a specialist or the Plant Protection Research Institute.<br>▪ Annual audit of project area and immediate surroundings.<br>▪ See rehabilitation measures below. | Monthly<br><br>Reporting frequency depends on legal compliance framework.<br><br>Immediately | Management team & ECO & contractor<br><br>Auditor |
| <u>Rehabilitation</u> | Re-vegetation of | ▪ All remaining damaged areas shall be | • ECO must monitor | | Contractor with |

| | | | | | |
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| and closure/ de-commissioning | the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to construction.<br><br>Keep impact of rehabilitation operations as low as possible. | rehabilitated upon completion of operations in such a manner as to maintain a good basal vegetation cover.<br>▪ Re-vegetation of disturbed surfaces must occur immediately after deconstruction activities are completed.<br>▪ All natural areas impacted must be rehabilitated with species indigenous to the area. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction.<br>▪ Ripping of compacted areas (e.g. roads) followed by adequate top soiling, fertilisation, irrigation and correct choice of grasses.<br>▪ Rehabilitation must be executed in such a manner that surface run-off will not cause erosion of disturbed areas.<br>▪ Maintain the management measures and procedures which were required by employees during the construction and operational phases regarding the preservation of species of special concern.<br>▪ Dust suppression spraying; prohibiting activities outside of the demarcated mine area and the maintenance of storm water management infrastructure until rehabilitation is considered successful will minimize the impacts on the vegetation.<br>▪ Prevent contamination of natural habitat from any source of pollution.<br>▪ Prevent veld fires through safe practice guidelines when using equipment.<br>▪ Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted. | activities and report on progress.<br><br>• ECO must monitor activities and record and report non-compliance.<br><br>• ECO must monitor activities and record and report non-compliance.<br><br>• Audit of rehabilitation on completion.<br>• Monitoring of rehabilitation success for at least 5 years after closure. | As required<br><br>Monthly/ quarterly<br><br>Monthly<br><br>Daily<br><br>Daily | advice from specialist.<br><br>ECO and mine management<br><br>Auditor<br><br>Ecologist and auditor |

## 9. CONCLUSION

There are two major vegetation types present in the study area, and both the Kuruman Thornveld and Kuruman Mountain Bushveld are considered to be Least Threatened and have a wide distribution and extent. The vegetation types therefore do not have a high conservation status.

Most of the area appears to be in a natural condition with little transformation. Parts of the study area may have a higher ecological sensitivity, such as the dry watercourses, pans and any habitats with populations of species of special concern. The species diversity based on the number of species recorded is moderate to high, with a total of 118 species listed for the quarter degree square in which the study area is located.

Seventeen species of special concern listed and recorded for the area are tabled in this report, and ten species were recorded as present. These include two protected trees (under the National Forests Act), one declining species (*Boophone disticha*), and seven species protected under the NCNCA (2009). Another seven protected species have a medium to high probability of occurrence. On Doornpan, two protected trees and one protected species are present, while on Driehoekspan two protected trees, one declining species and six protected species occur.

Habitats containing significant populations of species of special concern are considered to be areas of higher sensitivity, as indicated in the criteria used to rank the sensitivity (Table 1). The sensitivity analysis indicated that Doornpan has one area (a small pan) of medium-high sensitivity. At Driehoekspan, the watercourse can be considered an area of high sensitivity, and sections of the hills of medium-high sensitivity.

Five main potential negative impacts on the vegetation of the study area were identified and assessed. These were the following:

- Loss of natural vegetation
- Habitat fragmentation
- Impacts on species of special concern
- Dust fallout impacts
- Establishment of declared weeds and alien invasive species

The overall potential impacts of this proposed project are predicted to be of medium significance. With all avoidance and mitigation measures implemented, it should be possible to reduce most negative impacts to a medium or low significance, and only if the medium-high to high sensitivity areas are avoided or impacts on these are minimal, and all areas impacted on by mining activities are properly rehabilitated on closure.

The proposed development, when viewed in isolation, will not significantly affect the conservation status of species of special concern on a regional scale. However, it will add to the cumulative impacts on these species. The cumulative impact of numerous similar developments in the immediate area and on a regional scale, is however significant and increasing, and a strategic environmental assessment of the mining corridor from Postmasburg and Danielskuil in the south to Hotazel and Moshaweng in the north is now urgently required.

Permits for the removal or destruction of protected species and protected tree species will be required from the Department of Environment and Nature Conservation in Kimberley and the Sub-directorate Forestry of the Department of Agriculture, Forestry and Fisheries before any vegetation is cleared.

A potential indirect impact that could affect protected tree species is dewatering to continue mining once the groundwater depth is reached. The camel thorn (*Acacia erioloba*) is a species which is sensitive to changes in depth to the water table. There may be a shallow, semi-confined aquifer or alluvial perched aquifer present on Driehoekspan but this has yet to be confirmed. If so, it is likely to be

supporting deep rooted, large camel thorn trees. An upper perched aquifer may be affected by the cone of depression, and if so, this effect may also extend away from the mine. This implies that camel thorn trees dependent on the perched aquifer may be negatively affected up to a certain distance away from the mine.

It is important to note that no detailed mine layout plan was provided for the proposed Driehoekspan mining site. As a result a review by an ecologist or vegetation specialist is needed when the mine layout plan is available before any clearing for mining starts. The positioning of infrastructure may need to be revised based on the areas of ecological sensitivity, and recommendations, mitigating measures and/or management actions revised to ensure that potential impacts are kept to a minimum. The EMP would also need to be revised. Groundwater depth will be required to assess the potential impacts of dewatering during mining activities on any protected trees that are dependent on a possible shallow aquifer.

Table 10 provides mitigation objectives, measures, management actions and monitoring recommendations for the EMP for the proposed Doornpan and Driehoekspan mines.

## 10. REFERENCES


Andrén, H. 1994. Effects of habitat fragmentation on birds and mammals in landscapes with different proportions of suitable habitat: a review. *Oikos* 71:355 - 366.

Anderson, T.A. 2003. Sishen Iron Ore Mine farms Botanical Survey Report. Specialist report for WSP Walmsley & Sishen Iron Ore.

Anderson, T.A. 2007. Development of a direct rail link between iron ore operations at Postmasburg and Sishen-Saldanha export line. For Synergistics Environmental Services.

Anderson, T.A. 2009a. Vegetation assessment for the Sishen Expansion Project 2 (SEP2) site selection study, Sishen Iron Ore Mine, Kathu. Specialist report.

Anderson, T.A. 2009b. Vegetation assessment for the EIA for the relocation of infrastructure at Sishen Iron Ore Mine, Kathu. Specialist report for Synergistics Environmental Services.

Anderson, T.A. 2009c. Baseline vegetation survey of areas of the farm Fritz 540 and Woon 469 for roads required for sterilization drilling, SIOM, Kathu. Sishen Iron Ore Mine.

Anderson, T.A. 2009d. Vegetation assessment of Dingleton for the relocation of Dingleton village, Sishen Iron Ore Mine, Kathu. Specialist report for Synergistics Environmental Services.

Anderson, T.A. 2010a. Vegetation assessment for a mining right application for portion 2 farm Lomoteng 669, north of Postmasburg. For MS Consulting.

Anderson, T.A. 2010b. Vegetation assessment for a mining right application for a section of the remaining extent of the farm Helpebietjie 738, Kathu region. For MS Consulting.

Anderson, T.A. 2010c. Environmental Impact Assessment Report: specialist vegetation study on the potential impacts of the proposed open pit mine on Lylyveld south, SIOM, Kathu. AGES Pty Ltd.

Anderson, T.A. 2011. Specialist vegetation study for the EIA for the mining right application for the Sishen Iron Ore Mine complex. For AGES.

BiodiversityGIS (BGIS). Available at http://bgis.sanbi.org/index.asp?screenwidth=1366 (Accessed April 2013).

BGIS Online mapping. Available at http://bgis.sanbi.org/vegmap/map.asp (Accessed April 2013).

Botha, M., Desmet, P. & Brownlie, S. 2013. Draft scope Gamsberg Biodiversity Offset. Report for Black Mountain Mining (Pty) Ltd/Vedanta Zinc International.

Brownlie, S. 2005. Guideline for involving biodiversity specialists in EIA processes: Edition 1. *CSIR Report No. ENV-S-C 2005-053 C*. Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning.

Canadell, J., R. B., Jackson, J. R., Ehleringer, H. A., Mooney, O. E. Sala & Shulze, E.-D. 1996. Maximum rooting depth of vegetation types at the global scale. *Oecologia* 108:583-595.

Colvin, C., Le Maitre, D., Saayman, I. & Hughes, S. 2007. *Aquifer Dependent Ecosystems in Key Hydrogeological Typesettings in South Africa.* WRC Report No TT 301/07, CSIR.

Cunningham, S.A. 2000. Effects of Habitat Fragmentation on the Reproductive Ecology of Four Plant Species in Mallee Woodland. *Conservation Biology* 14 (3), 758–768.

Dean, W. R. J., S. J. Milton, and F. Jeltsch. 1999. Large trees, fertile islands and birds in arid savanna. *Journal of Arid Environments* 41:61-78.

Dean, W.R.J., Anderson, M.D., Milton, S.J. & Anderson, T. A. 2002. Avian assemblages in native *Acacia* and alien *Prosopis* drainage line woodland in the Kalahari, South Africa. *Journal of Arid Environments* 51:1-19.

Debinski, D.M. & Holt, R.D. 2000. A Survey and Overview of Habitat Fragmentation Experiments. *Conservation Biology* 14 (2), 342–355.

De Villiers, C.C., Driver, A., Clark, B., Euston-Brown, D.I.W., Day, E.G. Job, N. Helme, N.A., Holmes, P. M., Brownlie, S. & Rebelo, A. G. 2005. *Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape. Fynbos Forum*, Cape Town.

Driver, A., Maze, K., Rouget, M., Lombard, A.T., Nel, J.,Turpie, J.K., Cowling, R.M., Desmet, P., Goodman, P., Harris, J., Jonas, Z., Reyers, B., Sink, K. & Strauss, T. 2005. *National Spatial Biodiversity Assessment 2004: priorities for biodiversity conservation in South Africa.* Strelitzia 17, SANBI.

Du Plessis, W. 2014. COZA Iron Ore Mine Project – report on the geohydrological investigation as part of the EIA and EMP. Groundwater Complete report.

GDACE 2009. *GDACE requirements for biodiversity assessments version 2*. Dept of Agriculture, Conservation and Environment: Directorate Nature Conservation.

Harding, G.B. and Bate, G.C. 1991. The occurrence of invasive *Prosopis* species in the north-western Cape, South Africa. *South African Journal of Science* 87, 188-192.

Henderson, L. 2001. *Alien weeds and invasive plants*. Plant Protection Research Institute Handbook No. 12. ARC, Pretoria.

Hoare, D. 2011. Specialist ecological study on the potential impacts of the proposed African Rainbow Energy Upington PV solar energy facility near Upington, Northern Cape. Savanna SA.

IUCN (International Union for the Conservation of Nature). 2001. IUCN Red List Categories and Criteria: version 3.1. IUCN Species Survival Commission. IUCN, Gland, Switzerland, and Cambridge, U.K.

Le Maitre, D., Versveld, D. & Chapman, A. 2000. The impact of invading alien plants on surface water resources in South Africa: a preliminary assessment. *Water SA* 26: 397-408.

Milton, S. J., and W. R. J. Dean. 2001. Seeds dispersed in dung of insectivores and herbivores in arid southern Africa. *Journal of Arid Environments* 47:465-483.

Mucina, L. & Rutherford, M. 2006. *The Vegetation of South Africa, Lesotho and Swaziland.* Strelitzia 19. South African National Biodiversity Institute, Pretoria.

NEMBA TOPs list. 2007. National Environmental Management: Biodiversity Act, 2004: Publication of lists of critically endangered, endangered, vulnerable and protected species. *R151 of Government Gazette No. 29657.*

NPAES 2008. Available at http://bgis.sanbi.org/protectedareas/NPAES.asp (accessed April 2013). Plants of South Africa (POSA). Available at http://posa.sanbi.org/searchspp.php. (Accessed April 2013).

Rouget, M., Reyers, B., Jonas, Z., Desmet, P., Driver, A., Maze, K., Egoh, B. & Cowling, R.M. 2005. *South African National Spatial Biodiversity Assessment 2004: Technical Report, vol. 1 Terrestrial Component.* SANBI, Pretoria.

SANBI. 2010. *Red Data list of plant species of South Africa.* South African National Biodiversity Institute. http://www.speciesstatus.sanbi.org (Accessed November 2011).

SANBI. 2011. General guidelines for environmental assessment practitioners and botanical specialists http://redlist.sanbi.org/eiaguidelines.php. (Accessed November 2011).

Seymour, C., Anderson, T. & Curtis, O. 2006. Botanical and ornithological aspects of an ecological study of the impacts of the Gamagara River sinkhole, Sishen Iron Ore Mine. Specialist report.

Seymour, C. & Milton, S. 2003. A collation and overview of research information on *Boscia albitrunca* (Shepherd's Tree) and identification of relevant research gaps to inform protection of the species. Department of Water Affairs And Forestry. Contract No. 2003/089.

Smit, J.H.L. 2000. *Fitososiologie en veldbestuur van die oostelike Kalahari doringveld*. MSc. dissertation. University of Pretoria, Pretoria.

TSP Red List of South African Plants. 2009. Available from http://www.sanbi.org/index.php?option=com_content&view=article&id=250&Itemid=793 (Accessed November 2011).

Van der Merwe, K. 2001. *An investigation into the possible causes of decline in the Acacia erioloba population of the Kathu area.* MSc thesis, University of the Orange Free State.

Van Rooyen, N & Van Rooyen, M.W. 1998. Vegetation of the south-western arid Kalahari: an overview. *Trans. Roy. Soc. S. Afr.* 53: 113-140.

Van Wyk, A.E. & Smith, G.F. 2001. *Regions of Floristic Endemism in Southern Africa. A review with emphasis on succulents.* Umdaus Press, Hatfield, South Africa.

Victor, J.E. & Keith, M. 2004. The Orange List: a safety net for biodiversity in South Africa. *South African Journal of Science 100:* pp 139-141.

Visser, D. 2006. Report on the geology and geohydrology of the Kathu area. SRK Consulting, Cape Town.

Von Reiche, N. 2014. Air Quality Specialist Report for the Proposed COZA Iron Ore Project on the Farm Doornpan in the Tsantsabane Local Municipality of the Northern Cape Province. Airshed Planning Professionals (Pty) Ltd.

## Annexure 1. PLANT SPECIES CHECKLIST FOR QDS 2823AA (POSA) AND SPECIES RECORDED IN THE STUDY AREA.

| Species | Threat Status | SA Endemic |
|---|---|---|
| ACANTHACEAE | | |
| Justicia puberula | LC | No |
| Justicia thymifolia | LC | No |
| Monechma divaricatum | LC | No |
| AIZOACEAE | | |
| *Galenia sarcophylla* | LC | No |
| AMARYLLIDACEAE | | No |
| *Boophone disticha* | **Declining** | |
| ANACARDIACEAE | | |
| *Searsia burchellii* | LC | No |
| *Searsia lancea* | LC | No |
| *Searsia tridactyla* | End | No |
| APOCYNACEAE | | |
| *Asclepias fruticosa* | **P** | No |
| *Pachypodium succulentum* | **P** | No |
| Pergularia daemia subsp. daemia | **P** | No |
| *Sarcostemma viminale* | **P** | No |
| ASPARAGACEAE | | |
| *Asparagus laricinus* | LC | No |
| *Asparagus striatus* | LC | No |
| ASTERACEAE | | |
| *Blumea gariepina* | LC | No |
| Chrysocoma ciliata | LC | No |
| Cichorium intybus subsp. intybus | * | No |
| *Eriocephalus ericioides* | LC | No |
| Helichrysum zeyheri | LC | No |
| *Kleinia longiflora* | LC | No |
| Lopholaena cneorifolia | LC | No |
| *Pentzia incana* | LC | No |
| *Plinthus sp.* | LC | No |
| Pteronia undulata | LC | No |
| Nidorella hottentotica | LC | No |
| *Tarchonanthus obovatus* | LC | Yes |
| *Tarchonanthus camphoratus* | LC | No |
| BIGNONIACEAE | | |
| *Rhigozum obovatum* | LC | No |
| *Rhigozum trichotomum* | LC | No |
| BORAGINACEAE | | |
| *Ehretia rigida* | LC | No |

| | | |
|---|---|---|
| BRASSICACEAE | | |
| Lepidium africanum subsp. divaricatum | LC | No |
| CACTACEAE | | |
| *Opuntia ficus-indica* | *I | No |
| CAPPARACEAE | | |
| *Boscia albitrunca* | **P NFA** | No |
| Cadaba aphylla | LC | No |
| *Cleome gynandra* | LC | No |
| Cleome rubella | LC | No |
| CARYOPHYLLACEAE | | |
| *Pollichia campestris* | LC | No |
| CELASTRACEAE | | |
| *Gymnosporia buxifolia* | **P** | No |
| Putterlickia saxatilis | LC | No |
| CHENOPODIACEAE | | |
| Chenopodium schraderianum | * | No |
| Salsola geminiflora | LC | No |
| COMMELINACEAE | | |
| Commelina africana var. krebsiana | LC | No |
| CONVOLVULACEAE | | |
| Convolvulus boedeckerianus | LC | No |
| Evolvulus alsinoides | LC | No |
| CRASSULACEAE | | |
| *Cotyledon orbiculata* | **P** | No |
| Crassula capitella subsp. nodulosa | **P** | No |
| Kalanchoe rotundifolia | **P** | No |
| CUCURBITACEAE | | |
| Acanthosicyos naudinianus | LC | No |
| Citrullus lanatus | LC | No |
| Peponium caledonicum | LC | No |
| CYPERACEAE | | |
| Bulbostylis humilis | LC | No |
| EBENACEAE | | |
| *Diospyros lycioides* | LC | No |
| *Euclea undulate* | LC | No |
| EUPHORBIACEAE | | |
| Acalypha indica var. indica | LC | No |
| *Croton gratissimus* | LC | No |
| Euphorbia mauritanica | **P** | No |
| FABACEAE | | |
| *Acacia erioloba* | **Declining, P NFA** | No |
| *Acacia karroo* | LC | No |
| *Acacia mellifera subsp detinens* | LC | No |
| *Acacia tortilis subsp heteracantha* | LC | No |

| | | |
|---|---|---|
| *Elephantorrhiza elephantina* | LC | No |
| *Indigofera daleoides* | LC | No |
| *Indigofera pungens* | LC | No |
| *Lebeckia macrantha* | LC | Yes |
| *Prosopis cf glandulosa* | *I | No |
| Rhynchosia totta var. totta | LC | No |
| HYACINTHACEAE | | |
| *Dipcadi sp.* | LC | No |
| *Ledebouria sp.* | LC | No |
| LAMIACEAE | | |
| Stachys burchelliana | LC | No |
| MALVACEAE | | |
| *Grewia flava* | LC | No |
| Hermannia bryoniifolia | LC | No |
| *Hermannia comosa* | LC | No |
| Hermannia jacobeifolia | LC | No |
| Sida cordifolia subsp. cordifolia | LC | No |
| MESEMBRYANTHEMACEAE | | |
| Hereroa wilmaniae | **DDT** | Yes |
| *Prepodesma orpenii* | **P** | Yes |
| *Ruschia griquensis* | **P** | Yes |
| MOLLUGINACEAE | | |
| *Hypertelis salsoloides var. salsoloides* | LC | No |
| Pharnaceum viride | LC | No |
| MORACEAE | | |
| Ficus cordata subsp. cordata | LC | No |
| NYCTAGINACEAE | | |
| Phaeoptilum spinosum | LC | No |
| OLEACEAE | | |
| *Olea europaea subsp. africana* | **P** | No |
| OPHIOGLOSSACEAE | | |
| *Ophioglossum polyphyllum var. polyphyllum* | LC | No |
| OXALIDACEAE | | |
| *Oxalis sp.* | LC | No |
| PHYLLANTHACEAE | | |
| Phyllanthus parvulus var. parvulus | LC | No |
| POACEAE | | |
| Andropogon schirensis | LC | No |
| Aristida adscensionis | LC | No |
| *Aristida diffusa* | LC | No |
| Aristida engleri var. ramosissima | LC | No |
| Brachiaria brizantha | LC | No |
| Brachiaria nigropedata | LC | No |
| Cenchrus ciliaris | LC | No |

| | | |
|---|---|---|
| Cynodon dactylon | LC | No |
| Digitaria polyphylla | LC | No |
| *Enneapogon desvauxii* | LC | No |
| Enneapogon scaber | LC | No |
| *Eragrostis echinochloidea* | LC | No |
| *Eragrostis lehmanniana subsp lehmanniana* | LC | No |
| *Eragrostis obtusa* | LC | No |
| Eustachys paspaloides | LC | No |
| *Heteropogon contortus* | LC | No |
| *Melinis repens* | LC | No |
| Microchloa caffra | LC | No |
| Panicum arbusculum | LC | No |
| Panicum maximum | LC | No |
| *Pogonarthria squarrosa* | LC | No |
| *Schmidtia pappophoroides* | LC | No |
| Sporobolus fimbriatus | LC | No |
| *Stipagrostis uniplumis* | LC | No |
| RHAMNACEAE | | |
| *Ziziphus mucronata subsp. mucronata* | LC | No |
| SANTALACEAE | | |
| *Thesium hystrix* | LC | No |
| SCROPHULARIACEAE | | |
| Sutera griquensis | LC | Yes |
| SINOPTERIDACEAE | | |
| Cheilanthes eckloniana | LC | No |
| *Pellaea calomelanos* | LC | No |
| VERBENACEAE | | |
| Chascanum gariepense | LC | No |
| *Lantana rugosa* | LC | No |
| VISCACEAE | | |
| *Viscum rotundifolium* | LC | No |
| ZYGOPHYLLACEAE | | |
| *Zygophyllum lichtensteinianum* | LC | No |

**DDT = 1, Declining = 2, Protected (P) = 12, Protected trees (NFA) = 2. Total species = 118.**
* = weeds/exotic. *I = invasive plants.

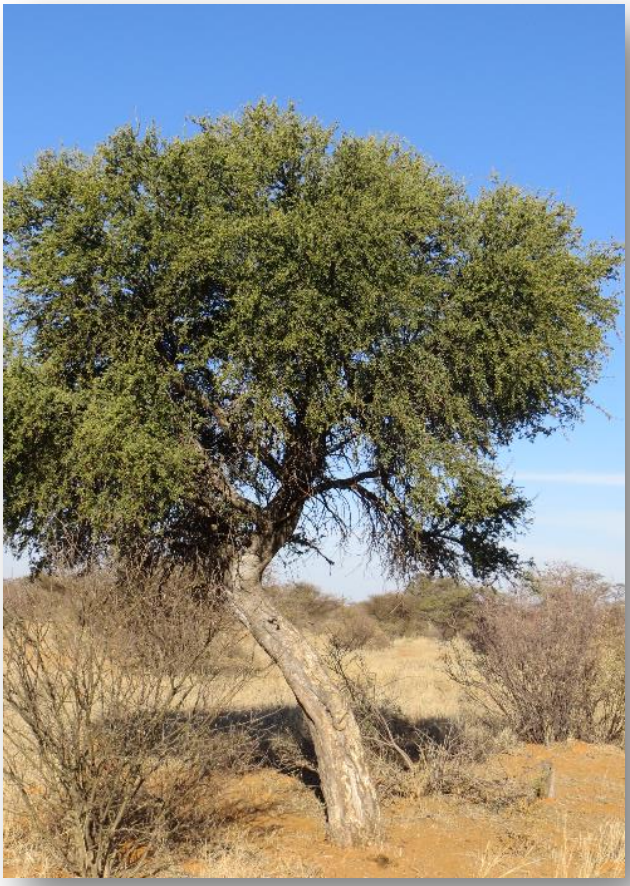
Species names in italics are additional **63** species that were recorded during the field surveys which were not previously listed for this QDS.

## Annexure 2. Photos of the species of special concern for identification purposes

Camel thorn *Acacia erioloba*

Bushman's poison *Boophone disticha*

T. Anderson, vegetation EIA report COZA project Jan 2014

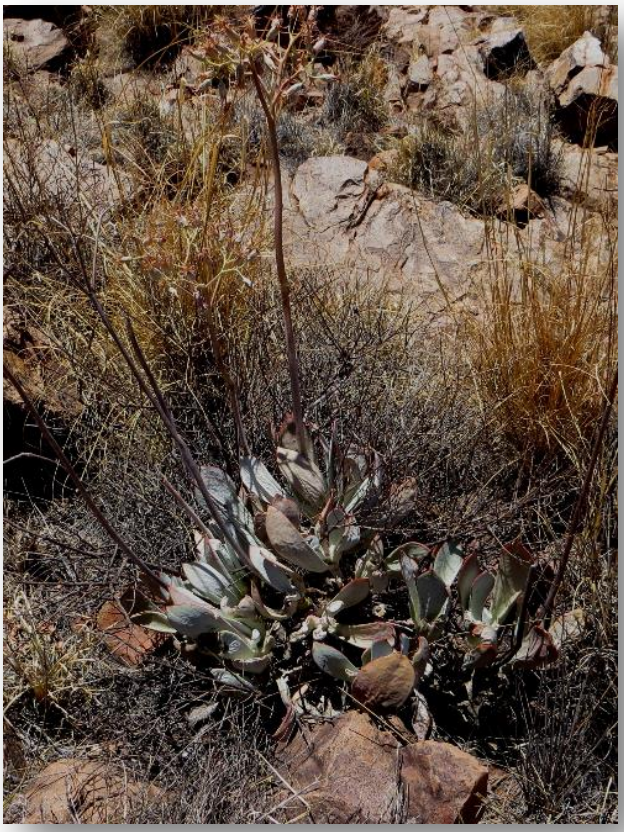


Shepherd's tree *Boscia albitrunca,* more spindly growth on rocky hills.

Wild Olive *Olea europaea* subsp *africana*

T. Anderson, vegetation EIA report COZA project Jan 2014

*Pachypodium succulentum*



*Cotyledon orbiculata*

*Prepodesma orpenii*

*Ruschia griquensis*

## Annexure 3. GPS coordinates (Degrees degrees) of the localities of species of special concern (mapped in Figure 9 and 10)

**Doornpan**

| Species | S | E |
|---|---|---|
| C1 | -28.20456 | 23.06069 |
| C2 | -28.210018 | 23. 060209 |
| C3-5 | -28.20467 | 23.06702 |
| B1 | -28.21221 | 23.07879 |
| B2 | -28.21246 | 23.07725 |
| B3-5 | -28.21170 | 23.07632 |
| B6-10 | -28.21067 | 23.07292 |
| B11-13 | -28.209450 | 23.064755 |
| B14 | -28.20961 | 23.064326 |
| B15 | -28.209640 | 23.063750 |
| B16 | -28.208404 | 23.065529 |
| B17 | -28.210557 | 23.065259 |
| B18-25 | -28.20304 | 23.06681 |
| Pr | -28.21087 | 23.05915 |

**Driehoekspan**

| Species | S | E |
|---|---|---|
| C1 | -28.14694 | 23.02719 |
| C2-3 | -28.14626 | 23.02621 |
| C4-9 | -28.14577 | 23.02653 |
| C10 | -28.14585 | 23.02689 |
| C11 | -28.14556 | 23.02913 |
| C12-19 | -28.14591 | 23.02950 |
| C20-21 | -28.14616 | 23.02980 |
| C22-23 | -28.14572 | 23.02998 |
| C24-52 | -28.14525 | 23.02985 |
| C53-58 | -28.14404 | 23.02902 |
| C59-65 | -28.14478 | 23.03004 |
| C66-67 | -28.14419 | 23.03049 |
| C68-74 | -28.14381 | 23.03078 |
| C75-81 | -28.14507 | 23.03060 |
| C82-85 | -28.14481 | 23.03085 |
| C86-88 | -28.14500 | 23.03164 |
| C89 | -28.14384 | 23.03116 |
| C90-98 | -28.14380 | 23.03092 |
| C99-104 | -28.14305 | 23.03198 |
| C105 | -28.14119 | 23.03111 |
| C106-119 | -28.13487 | 23.03341 |

| | | |
|---|---|---|
| C120-129 | -28.13805 | 23.03116 |
| C130-132 | -28.13445 | 23.03341 |
| C133-136 | -28.13458 | 23.03306 |
| B1 | -28.14129 | 23.03169 |
| B2 | -28.13859 | 23.03345 |
| B3-4 | -28.13848 | 23.03309 |
| B5 | -28.13298 | 23.03681 |
| B6 | -28.13893 | 23.03048 |
| B7 | -28.14013 | 23.03006 |
| B8-10 | -28.14081 | 23.03502 |
| B11 | -28.13346 | 23.03340 |
| B12 | -28.14287 | 23.02851 |
| Bo1 | -28.13736 | 23.02828 |
| Co1 | -28.13530 | 23.02889 |
| O1-12 | -28.14914 | 23.03790 |
| O13-37 | -28.13469 | 23.03605 |
| O38 | -28.13826 | 23.03581 |
| P1 | -28.13530 | 23.02889 |
| P2 | -28.14164 | 23.02870 |
| P3 | -28.13736 | 23.02828 |
| P4 | -28.13289 | 23.03510 |
| Ru1 | -28.13530 | 23.02889 |
| S1 | -28.13530 | 23.02889 |

Codes:
C = camel thorn, B = Boscia albitrunca (shepherd's tree), O = Olive (Olea europaea ssp africana),
P = Pachypodium succulentum, Ru = Ruschia griquensis, Bo = Boophone disticha,
Co = Cotyledon orbiculata, Pr = Prepodesma orpenii, S = Sarcostemma viminale.

# *WETLAND ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR THE COZA IRON ORE MINING PROJECT, NORTHERN CAPE PROVINCE*

Prepared for

## SYNERGISTICS ENVIRONMENTAL SERVICES (PTY) Ltd (PART OF THE SLR GROUP)

JULY 2014


| | |
|---|---|
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## Declaration

This report has been prepared according to the requirements of 32 (3b) of the Environmental Impact Assessments (EIA) Regulations, 2010 (GNR 543). We (the undersigned) declare the findings of this report free from influence or prejudice.

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# EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a wetland assessment as part of the environmental assessment and authorisation process for the COZA Iron Ore mining project located approximately 10km to the north of Postmasburg and approximately 400m west of the R325 within the Northern Cape Province. A field assessment was undertaken in July 2014 in order to determine the Present Ecological State (PES) of an ephemeral pan located approximately 400m to the south west of the proposed open pit area, and in order to determine the possible impact the proposed mining activities could have on the Ecological Importance and Sensitivity (EIS) of the feature.

**WETLAND ASSESSMENT**

The following general conclusions were drawn on completion of the wetland assessment:

- Although additional wetland features are located within the property boundary only the ephemeral pan is located within 500m of the proposed mine footprint. Mining activity within 500m of this feature will require a Water Use Licence (WUL). The Environmental Assessment Practitioner (EAP) therefore requested the assessment of only the pan;
- The ephemeral pan is indicated by the National Freshwater Ecosystems Priority Areas database (NFEPA, 2011) as a seep wetland in a natural and good condition (percentage natural land cover >75%), however upon assessment of the site the feature was considered to be more representative of a depression wetland than a seep wetland;
- The wetland habitat associated with the ephemeral pan can be defined as a wetland temporary zone in which soil is saturated for a short period of the year, but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soils and the growth of facultative wetland vegetation species;
- The ephemeral pans ability to hold water for extended periods is due to the presence of a shallow, intact impermeable calcrete layer which prevents the movement of water through the soil;
- From the results of the assessment, it is evident that ephemeral pan cannot be regarded to be of exceptional importance in terms of function and service provision. This is mainly a result of lack of surface water for extended periods of time limiting the ability to support any aquatic communities or the formation of seasonal and permanent wetland zones that could support a more diverse wetland floral community, that would increase the wetland features assimilation capacity as well as sediment trapping ability;
- The ephemeral pan calculated a very high PES score (Category A – unmodified, natural), mainly due to anthropogenic activity being limited near the feature. Some disturbance was encountered as a result of small scale cattle grazing and as a result of the development of a farm fence through the feature but these activities have not resulted in any significant impact on the hydrology or the vegetation of the feature;
- It is deemed possible that a PES Category A can be maintained for the feature during mining activities, provided that future planning and overall monitoring takes the mitigation measures and recommendations contained within this report into consideration and ensures effective implementation;
- Based on the findings of the study it is evident that the ephemeral pan has an EIS falling within Category C (moderate sensitivity). Although the pan is in an unmodified, natural PES, the feature contains surface water for very limited periods of the year thereby decreasing its importance in terms of function and service provision. Furthermore, no rare or endangered floral species were encountered within the pan at the time of the assessment and the feature is indicated as a least threatened wetland vegetation type according to NFEPA Wetveg which further decreases its EIS;
- The ephemeral pan was delineated according to the guidelines advocated by the Department of Water Affairs (DWA, 2005) and was allocated a 100 meter buffer zone as advocated by Regulation GN 704 of the National Water Act (NWA, Act no. 36 of 1998);
- It should be noted that any activity occurring within 500m of the ephemeral pan will require a WUL.

**WETLAND IMPACT ASSESSMENT**

The ephemeral pans ability to hold water for extended periods is due to the presence of a shallow, intact impermeable calcrete layer which prevents the movement of water through the soil. Therefore, persisting wetland conditions are dependent upon precipitation and surface water from the pans catchment and are not dependent on groundwater. Dewatering due to mining activity is therefore considered highly unlikely to impact on the pan feature due to its independence on groundwater. The impact associated with dewatering was therefore not assessed.

According to the assessment undertaken by Groundwater Complete (2014) an evaporation rate of approximately 165 000 $m^3$/y calculated to occur from the surface of the backfilled pit far exceeds the expected recharge volume of ± 4 400 $m^3$/y, which means that the water level within the backfilled opencast pit is unlikely to reach the surface and decant should not occur. The most probable route the water will follow as a result of decant, should it occur, was also estimated to be within a south western direction from where the mining activities took place, therefore any water is unlikely to reach the ephemeral pan. Impact due to decant is therefore considered highly unlikely and was not assessed as part of the impact assessment.

It should be noted that mining activities will not take place directly within the ephemeral pan. The proposed mine footprint area is located approximately 400m to the north east of the ephemeral pan and the possibility that mining activities will impact on the feature is therefore reduced. The distance of the ephemeral pan from the proposed mine footprint is also likely to reduce the severity of the impact as well as the overall impact significance.

The table below serves to summarise the significance of potential impacts on the ephemeral pan. Impacts associated with the operational and decommissioning and closure phases have been assessed separately.

**Table A: Summary of impact assessment results.**

| Impact | Unmanaged | Managed |
|---|---|---|
| IMPACT 1: LOSS OF WETLAND HABITAT AND ECOLOGICAL STRUCTURE | | |
| Operational Phase | Low (-ve) | Very Low (-ve) |
| Decommissioning and Closure Phase | Low (-ve) | Very Low (-ve) |
| IMPACT 2: CHANGES TO WETLAND ECOLOGICAL AND SOCIO-CULTURAL SERVICE PROVISION | | |
| Operational Phase | Low (-ve) | Very Low (-ve) |
| Decommissioning and Closure Phase | Low (-ve) | Very Low (-ve) |
| IMPACT 3: IMPACTS ON WETLAND HYDROLOGICAL FUNCTION AND SEDIMENT BALANCE | | |
| Operational Phase | Low (-ve) | Very Low (-ve) |
| Decommissioning and Closure Phase | Low (-ve) | Very Low (-ve) |

From the results of the impact assessment it was observed that 3 impacts are likely to affect the ephemeral pan. All the impacts are likely to have an effect on the receiving environment if unmanaged. However, the majority of the impacts can be mitigated by adequate planning, management and implementation of an effective rehabilitation plan.

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# GLOSSARY OF TERMS

| | |
|---|---|
| **Alien vegetation** | Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. |
| **Alien Invasive vegetation** | Alien invaders are plants that are of exotic origin and are invading previously pristine areas or ecological niches |
| **Wetland** | land which is transitional between terrestrial and aquatic systems where the water table is at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soils. |

# ACRONYMS

| | |
|---|---|
| ***BGIS*** | *Biodiversity Geographic Information Systems* |
| ***CARA*** | *Conservation of Agricultural Resources Act* |
| ***DEMC*** | *Desired Ecological Management Class* |
| ***DWA*** | *Department of Water Affairs* |
| ***DWAF*** | *Department of Water Affairs and Forestry* |
| ***EAP*** | *Environmental Assessment Practitioner* |
| ***EIA*** | *Environmental Impact Assessment* |
| ***EIS*** | *Ecological Importance and Sensitivity* |
| ***FEPA*** | *Freshwater Ecological Support Area* |
| ***GIS*** | *Geographic Information System* |
| ***GPS*** | *Global Positioning Systems* |
| ***NEMA*** | *National Environmental Management Act* |
| ***NFEPA*** | *National Freshwater Ecosystem Priority Areas* |
| ***NWA*** | *National Water Act* |
| ***NWCS*** | *National Wetland Classification System* |
| ***PEMC*** | *Present Ecological Management Class* |
| ***PES*** | *Present Ecological State* |
| ***REC*** | *Recommended Ecological Category* |
| ***SANBI*** | *South African National Biodiversity Institute* |
| ***SAS*** | *Scientific Aquatic Services* |
| ***WMA*** | *Water Management Area* |
| ***WUL*** | *Water Use Licence* |

# 1 INTRODUCTION

## 1.1 *Background*

Scientific Aquatic Services (SAS) was appointed to conduct a wetland assessment as part of the environmental assessment and authorisation process for the COZA Iron Ore mining project located approximately 10km to the north of Postmasburg and approximately 400m west of the R325 within the Northern Cape Province (hereafter referred to as the project boundary) (Figure 1). A field assessment was undertaken in July 2014 in order to determine the Present Ecological State (PES) of an ephemeral pan located approximately 400m to the south west of the proposed mine footprint, and in order to determine the possible impact the proposed mining activities could have on the Ecological Importance and Sensitivity (EIS) of the feature.


**Figure 1: Location of the property boundary depicted on an aerial photograph in relation to surrounding areas**

## 1.2 Legislative requirements

**National Environmental Management Act (NEMA, Act 107 of 1998)**

- The NEMA (Act 107 of 1998) and the associated Regulations (Listing No R. 544, No R. 545 and R. 546) as amended, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment process or the Environmental Impact Assessment (EIA) process depending on the nature of the activity and scale of the impact.

**National Water Act (NWA, Act 36 of 1998)**

- The NWA (Act 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved;
- No activity may therefore take place within a watercourse unless it is authorised by the Department of Water Affairs (DWA); and
- Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from DWA in terms of Section 21.

**General Notice 1199 as published in the Government Gazette 32805 of 2009 as it relates to the NWA**

- Wetlands are extremely sensitive environments and as such, the Section 21 (c) and (i) water use General Authorisation does not apply to any development within a distance of 500 meters upstream or downstream from the boundary of any wetland or estuary.

**GN 704 – Regulations on use of water for mining and related activities aimed at the protection of water resources, 1999**

- These Regulations, forming part of the NWA (Act no. 36 of 1998), were put in place in order to prevent the pollution of water resources and protect water resources in areas where mining activity is taking place from impacts generally associated with mining.
- It is recommended that the proposed project complies with Regulation GN 704 of the NWA (Act no. 36 of 1998) which contains regulations on use of water for mining and related activities aimed at the protection of water resources. GN 704 states that:

*No person in control of a mine or activity may-*

*(a) locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year flood-line or within a horizontal distance of 100 metres from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on water-logged ground, or on ground likely to become waterlogged, undermined, unstable or cracked;*

According to the above, the activity footprint must fall outside of the 1:100 year floodline of the wetland or 100m from the edge of the feature, whichever distance is the greatest.

## 1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The wetland assessment is confined to the property boundary as well as the immediate adjacent areas of relevance and does not include the neighbouring and adjacent properties;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. A more accurate assessment would require that assessments take place in both summer and winter;
- Wetlands areas form transitional areas where an ecotone is formed as vegetation species change from terrestrial species to facultative and obligate wetland species. Within this transition zone some variation of opinion on the wetland boundary may occur, however if the DWA 2005 method is followed, all assessors should get largely similar results; and

- Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required the wetland will need to be surveyed and pegged according to surveying principles.

## *1.4 Indemnity and Terms of Use of this Report*

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and SAS CC and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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# 2 METHOD OF ASSESSMENT

The scope of work includes a literature review, followed by a site assessment undertaken on the 10th of July 2014. Delineation of the wetland zone took place according to "DWAF, 2005: A practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones". Aspects such as soil morphological characteristics, vegetation types and wetness were used to delineate the temporary zone of the wetland according to the guidelines. The buffer zone was then delineated around the temporary zone. The wetland classification assessment was then undertaken according to the *Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems* (Ollis *et al*., 2013). In addition, the WET-Health (Macfarlane *et al.,* 2009), wetland ecological and socio-economic service provision (Kotze *et al.* 2009) and EIS of wetlands was determined. The method used for the EIS determination was adapted from the method as provided by DWA (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS Category for the wetland feature or group being assessed.

A detailed explanation of the wetland method of assessment is provided in Appendix A.

# 3 RESULTS OF LITERATURE REVIEW

## 3.1 *National Freshwater Ecosystem Priority Areas (2011)*

The National Freshwater Ecosystem Priority Areas (NFEPAs, 2011)[1] database was consulted with regards to areas close to or within the property boundary that may be of ecological importance. Aspects applicable to the property boundary and surroundings are discussed below:

- The property boundary falls within the Lower Vaal Water Management Area (WMA). Each WMA is divided into several subWMA, where catchment or watershed is defined as a topographically defined area which is drained by a stream or river network. The subWMA indicated for the property boundary is the Molopo subWMA;
- The subWMA is not regarded important in terms of fish sanctuaries, rehabilitation or migration corridors or important in terms of translocation and relocation zones for fish;
- The property boundary is located within a quaternary catchment which has been indicated as a FEPA. This indicates that the surrounding land and smaller stream network needs to be managed in a way that maintains the good/near natural condition (Category A or B condition) of the river reach;
- According to the NFEPA database three natural wetland features are located within the property boundary. However, only the ephemeral pan falls within 500m of the open pit area and will therefore require a water use licence;
- The ephemeral pan is indicated by the NFEPA database (2011) as a seep wetland in a natural and good condition (percentage natural land cover >75%) (Figure 2 and 3), however upon assessment of the site the feature was considered to be more representative of a depression wetland than a seep wetland;
- The wetland vegetation group for the ephemeral pan is identified as the Eastern Kalahari Bushveld which is listed as least threatened.

[1] www.bgis.sanbi.org

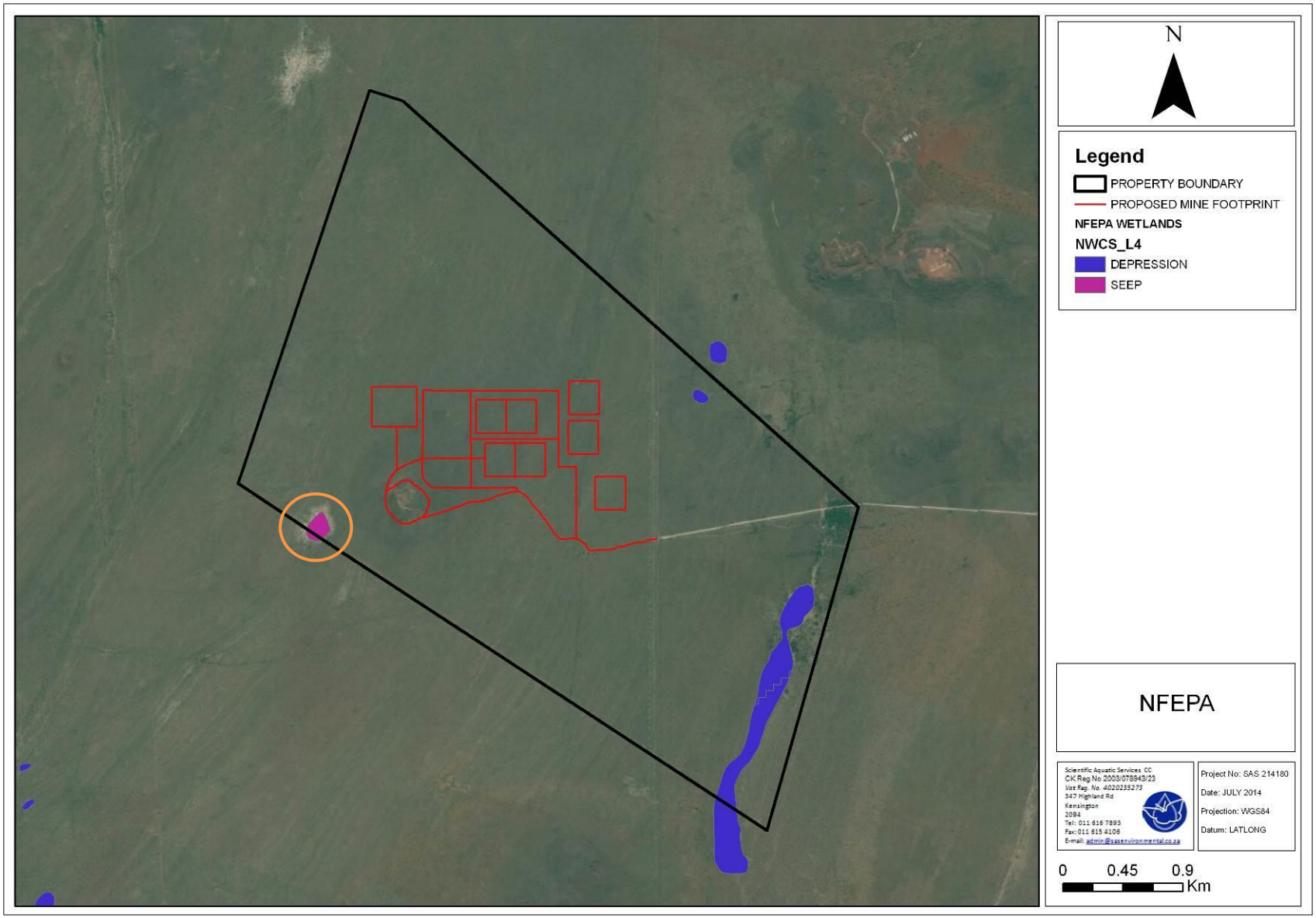


**Figure 2: Wetland features indicated by the NFEPA database (2011). The ephemeral pan is indicated by an orange circle.**

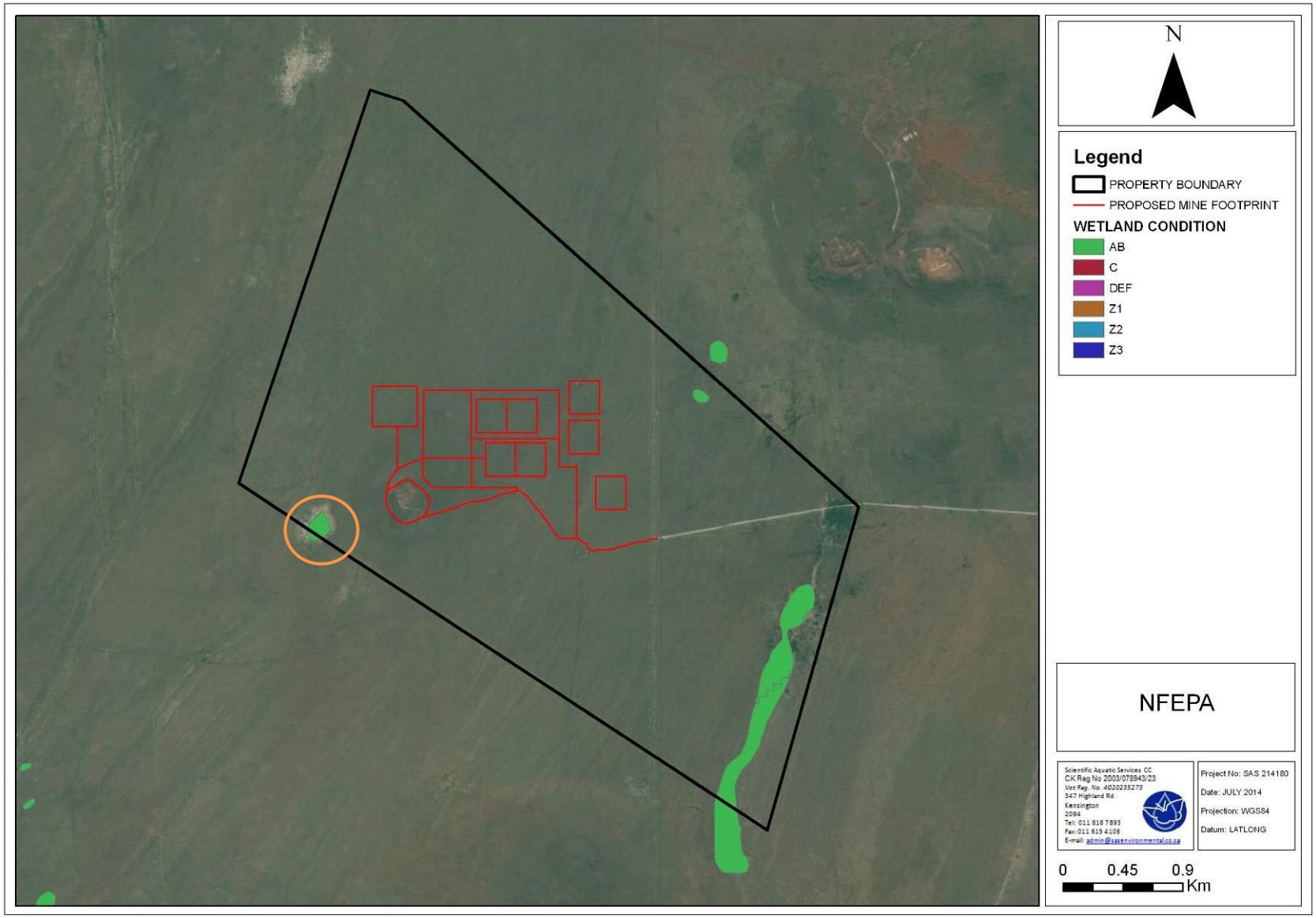


**Figure 3: Wetland conditions as indicated by the NFEPA database (2011). The ephemeral pan is indicated by an orange circle.**

# 4 WETLAND ASSESSMENT RESULTS

## 4.1 *Wetland System Characterisation*

Although additional wetland features are located within the property boundary only the ephemeral pan is located within 500m of the proposed mine footprint. Mining activity within 500m of this feature will require a WUL. The Environmental Assessment Practitioner (EAP) therefore requested the assessment of only the pan. The ephemeral pan was categorised with the use of the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis et. al, 2013). After the field assessment it can be concluded that the pan can be classified as an endorheic depression wetland. The results are illustrated in the tables below.

**Table 1: SANBI National Wetland Classification for the ephemeral pan.**

| Level 1: System | Level 2: Regional Setting | Level 3: Landscape unit | Level 4: Hydrogeomorphic (HGM) unit | |
|---|---|---|---|---|
| | | | HGM Type | Longitudinal zonation / landform |
| **Inland:** An ecosystem that has no existing connection to the ocean but which is inundated or saturated with water, either permanently or periodically. | **Southern Kalahari:** The property boundary falls within the Southern Kalahari ecoregion and within the least threatened Eastern Kalahari Bushveld vegetation group (NFEPA WetVeg). | **Plain:** An extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land. | **Depressions (Endorheic):** A landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth. | **N/A** |

## 4.2 *General Wetland Assessment*

### 4.2.1 Soil

**Figure 4: Distinctive gleyed soils identified within the ephemeral pan.**

The pan within the property boundary is an ephemeral feature which contains surface water for very limited periods of the year, mostly after heavy rainfall events. After the assessment of the feature it

became apparent that the pan consists of a temporary zone only. No evidence of mottling was encountered within the feature; however soil had a low chroma compared to surrounding terrestrial zones, a sign of anaerobic conditions under which minerals such as iron becomes soluble and leaches from soil. This characteristic is known as gleying and was very useful in terms of determining the extent of the wetland feature.

The ephemeral pans ability to hold water for extended periods is due to the presence of a shallow, intact impermeable calcrete layer which prevents the movement of water through the soil.

### 4.2.2 Vegetation

**Figure 5: *Scirpus* sp. growing in gleyed soils (left) and mixed facultative gramminoid species within the wetland temporary zone (right).**

The ephemeral pan was dominated by a variety of floral species including the grass species *Eragrostis echinocloidea, Eragrostis trichophora, Themeda triandra* and *Tragus racemosus* which are often found growing around pans or in damp areas; as well as scattered individuals of the obligate sedge species *Scirpus* sp. Tree and shrub species including *Searsia ciliata, Ziziphus mucronata, Searsia burchelii, Acacia karroo, Tarconanthus camphoratus* and *Searsia lancea* were also encountered growing within the pan. This is considered a result of soil being transported by water, forming areas of increased soil depth that are able to support larger tree and shrub species. It is also possible that the root systems of these tree species have broken through cracks within the calcrete layer and are therefore able to access deeper soil layers.

Terrestrial zones were dominated by species such as *Acacia melifera*, *Tarconanthus camphoratus* and *Stipagrostis* sp. which were encountered within red terrestrial soils surrounding the pan.

### 4.2.3 Surface Water

The field assessment was undertaken during the onset of winter, as a result no surface water was present within the feature. However, the ephemeral pan is located within a relatively dry region within the province and a field assessment undertaken in summer is not likely to result in a significant change to the final findings of the assessment.

### 4.2.4 Ephemeral Pan Biodiversity

Wetland Pans are considered to be of increased sensitivity due to their ability to retain water for longer periods of time that would provide habitat for wetland dependant floral and faunal species for longer periods.

### 4.2.5 Synthesis

The wetland habitat associated with the ephemeral pan can be defined as a wetland temporary zone in which soil is saturated for a short period of the year, but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soils and the growth of facultative vegetation.

## 4.3 *Wetland Function Assessment*

The function and service provision was calculated for the ephemeral pan according to characteristics discussed in the previous sections. The average score is presented in the following table as well as the radar plot in the figure that follow the table. When considering the average score for the feature it is evident that the ephemeral pan can be considered of a moderately low importance in terms of service and function provision.

**Table 2: Wetland service and function assessment.**

| Ecosystem service | PES |
|---|---|
| Flood attenuation | 0.6 |
| Streamflow regulation | 0 |
| Sediment trapping | 0.96 |
| Phosphate assimilation | 0.9 |
| Nitrate assimilation | 1.17 |
| Toxicant assimilation | 0.77 |
| Erosion control | 1.25 |
| Biodiversity maintenance | 3.33 |
| Carbon Storage | 0 |
| Water Supply | 0 |
| Harvestable resources | 0 |
| Cultural value | 0 |
| Cultivated foods | 0 |
| Tourism and recreation | 0.25 |
| Education and research | 0 |
| **SUM** | **9.2** |
| **Average score** | **0.6** |

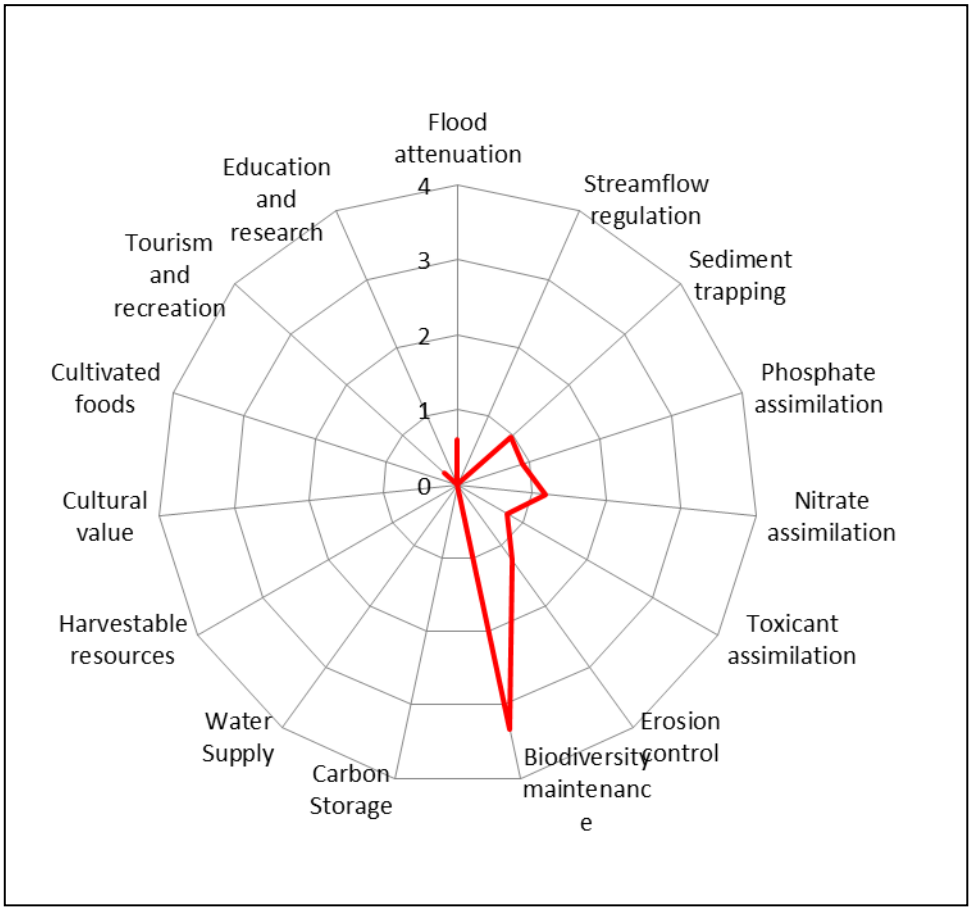


**Figure 6: Radar plot of wetland services.**

From the results of the assessment, it is evident that the ephemeral pan encountered within the property boundary is not regarded to be of exceptional importance in terms of function and service provision. This is mainly as a result of lack of water for extended periods of time limiting the ability of the pan to support any aquatic ecological communities or the formation of seasonal and permanent wetland zones that could support a more diverse wetland floral community, that would also in turn increase the wetland features assimilation capacity as well as sediment trapping ability.

The ephemeral pan is a depression and is an endorheic system which is hydrologically isolated. As a result, the feature will not play any role in terms of stream flow regulation and would only be of limited importance in terms of flood attenuation and sediment trapping. The ephemeral pan calculated the highest score for biodiversity maintenance, due to the high likelihood that the pan will provide breeding and foraging habitat for faunal species when surface water is present, due to the general lack of disturbance within the feature and due to the connectivity of the feature to surrounding natural areas.

No evidence was encountered during the site assessment that the ephemeral pan is used by the local community and therefore the feature cannot be considered to be of significant importance in terms of water supply, harvestable resources, cultivated foods or cultural value.

## *4.4 Wetland Health*

A level 2 WET-health assessment was undertaken to determine the PES of the Wetland Pan. However, it should be noted that the present geomorphological state of wetland features can only be assessed for features which are connected to the drainage network in some way (Macfarlane *et. al*

2009). The pan is an isolated, endorheic feature and the geomorphological health of this feature was therefore not assessed.

**Table 3: Summary of the overall health of the ephemeral pan based on impact score and change score including the trajectory of change should the mining activities proceed.**

| Feature Type | Hydrology | | Vegetation | |
|---|---|---|---|---|
| | Impact Score | Change Score | Impact Score | Change Score |
| Natural pan | A | ↓ | A | ↓ |

The present hydrological state and vegetation state of the pan calculated scores that fall within Category A (unmodified, natural). This high score is mainly due to anthropogenic activity being limited near the feature. Some disturbance was encountered as a result of small scale livestock grazing and as a result of the development of an informal farm fence through the feature. However, grazing and the development of this fence have not resulted in the significant alteration of the hydrology or vegetation of the feature and have not caused the proliferation of alien and invasive species within the feature.

The overall score for the pan which aggregates the scores for the two modules, namely hydrology and vegetation, was calculated using the formula as provided by the Wet-Health methodology[2]. The pan calculated an overall score falling within the PES Category A (unmodified, natural). The PES was then used as a benchmark for the identification of an appropriate category for the EIS (section 3.6 below).

In terms of anticipated trajectory[3], should the mining of the pit area not take place, it is considered to be highly likely that the PES of the pan would remain the same. However, should mining activities commence there is a chance that the edge effects of these activates may have an impact on the pan and may result in a slight decrease in the health of the feature.

## 4.5 Hydrological Function

Wetland hydrology generally refers to the inflow and outflow of water through a wetland. Therefore land is characterised as having wetland hydrology when, under normal circumstances, the land surface is either inundated or the upper portion of the soil is saturated at a sufficient frequency and duration to create anaerobic conditions[4].

The ephemeral pan is hydrologically isolated and can be considered endorheic (a landform with closed elevation contours). The feature therefore receives water from precipitation, diffuse surface flow, and groundwater and the dominant hydrodynamics within the feature are bidirectional vertical fluctuations. The pan is also defined as an ephemeral feature which only contains surface water for limited periods of the year, usually after high rainfall events. Should the mining of the pit area proceed there is a chance that runoff patterns from disturbed areas in the pans surroundings may be altered and that the hydrological function of the pan may be affected.

## 4.6 EIS Determination

The method used for the EIS determination was adapted from the method as provided by DWA (1999) for floodplains. The method takes into consideration PES scores obtained for the IHI

[2] ((Hydrology score) x 3 + (vegetation score) x 2))/ 5 = PES (altered with the removal of the geomorphology module)
[3] Anticipated change over the next 5 years.
[4] www.*forestandrange.org/new_wetlands*

assessment as well as function and service provision to enable the assessor to determine the most representative EIS Category for the wetland feature or group being assessed.

A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The median of the determinants is used to assign the EIS Category as listed in Table 4 below.

**Table 4: EIS determination**

| Determinant | Ephemeral pan | |
|---|---|---|
| | Scrore | Confidence |
| **PRIMARY DETERMINANTS** | | |
| 1. Rare & Endangered Species | 0 | 3 |
| 2. Populations of Unique Species | 1 | 3 |
| 3. Species/taxon Richness | 2 | 4 |
| 4. Diversity of Habitat Types or Features | 1 | 4 |
| 5. Migration route/breeding and feeding site for wetland species | 2 | 4 |
| 6. PES as determined by WetHealth | 4 | 4 |
| 7. Importance in terms of function and service provision | 1 | 4 |
| **MODIFYING DETERMINANTS** | | |
| 8. Protected Status according to NFEPA Wetveg | 0 | 4 |
| 9. Ecological Integrity | 4 | 4 |
| TOTAL | 15 | |
| MEDIAN | 1.7 | |
| **OVERALL EIS** | **C** | |

Based on the findings of the study it is evident that the ephemeral pan has an EIS falling within Category C (moderate sensitivity). Although the pan is in an unmodified, natural PES, the feature contains surface water for very limited periods of the year thereby decreasing its importance in terms of function and service provision. Furthermore, no rare or endangered floral species were encountered within the pan at the time of the assessment and the feature is indicated as a least threatened wetland vegetation type according to NFEPA Wetveg which further decreases its EIS.

## *4.7 Recommended Ecological Category*

The ephemeral pan was calculated to fall within PES Category A (unmodified, natural). It is deemed possible that a PES Category A can be maintained for the feature during mining activities, provided that future planning and overall monitoring takes the mitigation measures and recommendations, into consideration;

## *4.8 Wetland Delineation*

The ephemeral pan was delineated on site according to the guidelines advocated by DWA (2005) (refer to Figure 8). It should be noted that the identification of the wetland temporary zone did prove difficult in some areas as a result of the lack of a distinctive wetland vegetation community. However, the delineation as presented in this report is regarded as a best estimate of the boundary based on the site conditions present at the time of assessment.

*During the assessment, the following temporary zone indicators were used:*

- The presence of gleyed soils (most of the iron has been leached out of the soil leading to a greyish/greenish/bluish colour) was used as the primary indicator of the wetland boundary;
- The presence of facultative wetland species including *Eragrostis echinocloidea, Eragrostis trichophora, Themeda triandra* and *Tragus racemosus* could be used as a secondary indicator in determining the temporary zone boundary; and
- Terrain units were used to guide the delineation of the outer temporary zone.

**Figure 7: Gleyed soils with evidence of standing water encountered.**

## *4.9 Buffer Allocation*

The ephemeral pan can be defined as wetland habitat (DWA, 2005) and it is therefore recommended that the proposed project complies with Regulation GN 704 of the NWA (Act 36 of 1998) which contains Regulations on use of water for mining and related activities aimed at the protection of water resources. GN 704 states that:
*No person in control of a mine or activity may-*
*(a) locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year flood-line or within a horizontal distance of 100 metres from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on water-logged ground, or on ground likely to become waterlogged, undermined, unstable or cracked;*

According to the above, the mining footprint must fall outside of the 1:100 year floodline of the ephemeral pan or 100m from the edge of the feature, whichever distance is the greatest.

In addition, it should be noted that the open pit area falls within 500 meters of the ephemeral pan and therefore General Notice no. 1199 of 2009 as it relates to the NWA (Act 36 of 1998) will also apply (both the 100m buffer as well as 500m radius are depicted in Figure 8 below).

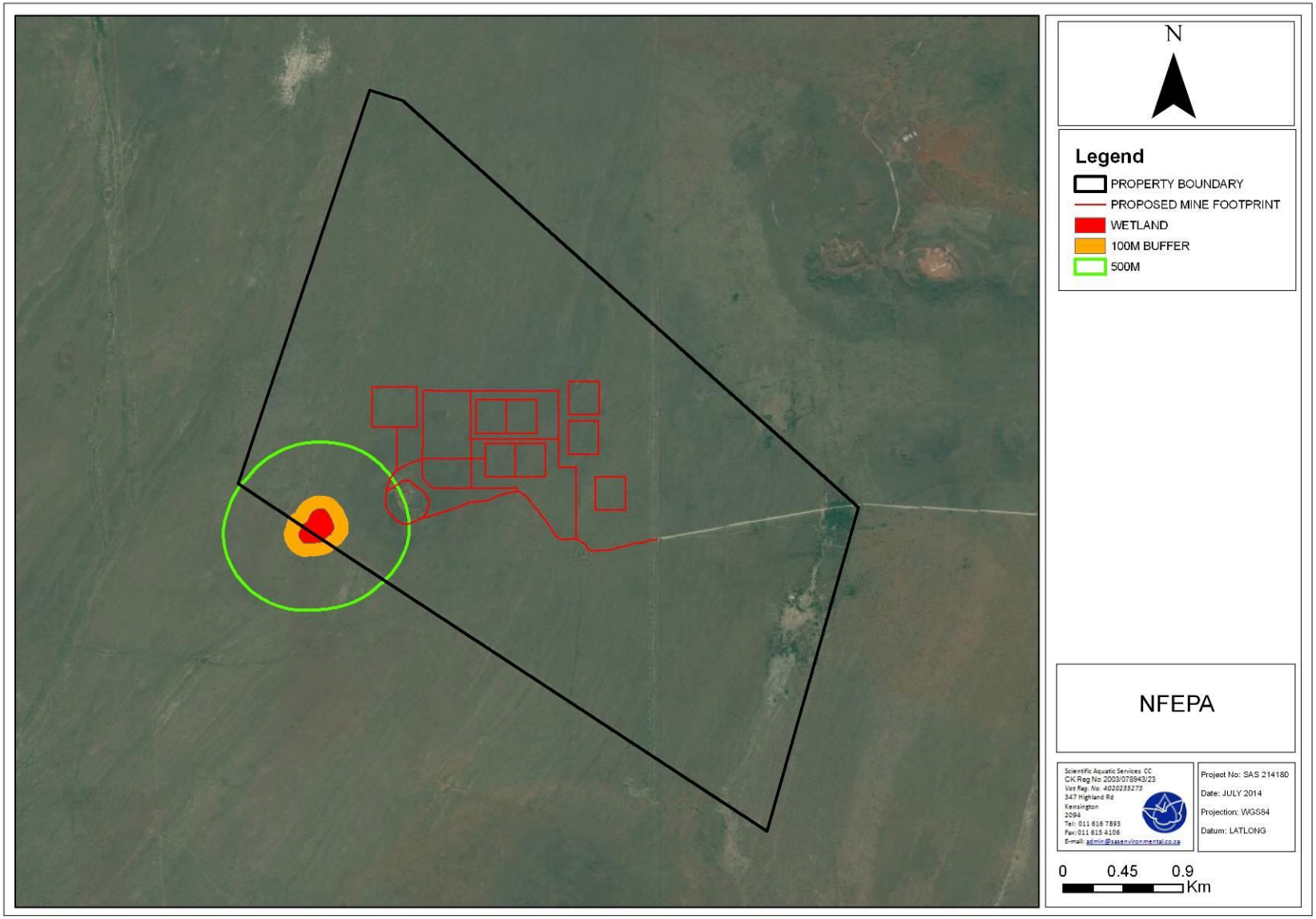


**Figure 8: Natural wetland pan as delineated on site with associated 100m buffer and an indication of the 500m radius surrounding the pan.**

# 5 IMPACT ASSESSMENT

The tables below serve to summarise the significance of potential impacts on the ephemeral pan. Impacts associated with the operational as well as decommissioning and closure phases have been assessed separately. The sections below present the impact assessment according to the method described in Appendix A. In addition, it also indicates the required mitigatory and management measures needed to minimise potential ecological impacts and presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures, assuming that they are fully implemented.

It should be noted that mining activities will not take place directly within the ephemeral pan. The proposed mine footprint area is located approximately 400m to the north east of the ephemeral pan and the possibility that mining activities will impact on the feature is therefore reduced. The distance of the ephemeral pan from the proposed mine footprint is also likely to reduce the severity of the impact as well as the overall impact significance.

The ephemeral pans ability to hold water for extended periods is due to the presence of a shallow, intact impermeable calcrete layer which prevents the movement of water through the soil. Therefore, persisting wetland conditions are dependent upon precipitation and surface water from the pans catchment and are not dependent on groundwater. Dewatering due to mining activity is therefore considered highly unlikely to impact on the pan feature due to its independence on groundwater. The impact associated with dewatering was therefore not assessed.

According to the assessment undertaken by Groundwater Complete (2014) an evaporation rate of approximately 165 000 $m^3$/y calculated to occur from the surface of the backfilled pit far exceeds the expected recharge volume of ± 4 400 $m^3$/y, which means that the water level within the backfilled opencast pit is unlikely to reach the surface and decant should not occur. The most probable route the water will follow as a result of decant, should it occur, was also estimated to be within a south western direction from where the mining activities took place, therefore any water is unlikely to reach the ephemeral pan. Impact due to decant is therefore considered highly unlikely and was not assessed as part of the impact assessment.

## *5.1 Impact 1: Loss of Wetland Habitat and Ecological Structure*

**Aspects and activities register**

| Planning of mine | Operational | Decommissioning and closure |
|---|---|---|
| Poor planning of infrastructure placement | Site clearing and the disturbance of soils within the open pit area and the associated erosion and sedimentation of wetland habitat in the vicinity of the open pit | Inadequate rehabilitation of disturbed areas resulting in continued erosion and sedimentation of wetland habitat |
| Inadequate design of infrastructure | Increased runoff or altered runoff patterns from disturbed areas and areas where vegetation has been cleared | Lack of alien and weed control |
| | Contamination of groundwater as a result of spillages and seepage of hazardous waste material | |
| | Dust generation | |

During the operational phase the potential edge effects of mining activities may impact on the ephemeral pan. The disturbance of soils and removal of vegetation from the open pit area may result in an increase in stormwater runoff from disturbed areas and an increase in the erosion and sedimentation of surrounding areas. Mining activities will not take place within the ephemeral pan

however; the pan is located down gradient from the open pit area and may therefore be impacted as a result of this erosion and sedimentation. The probability of this impact is considered to be possible and the EIS of the receiving environment is considered to be moderate. However, because mining activities will not take place within the ephemeral pan and the only impacts on the pan will be as a result of the edge effects of mining activities, the severity of the impact is decreased. The overall impact significance is therefore considered to be low (negative) prior to the implementation of mitigation measures. However, with the implementation of mitigation measures the impact may be reduced to a very low (negative) significance.

Inadequate rehabilitation during the decommissioning phase and the continued erosion and sedimentation of surrounding areas as well as dust generation from disturbed areas may result in an impact on wetland habitat. Furthermore, alien and invasive species, if left uncontrolled may proliferate and may spread into the ephemeral pan. The overall significance of the impact is considered to be low (negative) prior to the implementation of mitigation measures. However, with the implementation of mitigation measures the impact can be reduced to a very low (negative) significance.

**Impact on wetland habitat and ecology**

| Without Management | Probability of Impact | Sensitivity of receiving environment | Severity | Spatial scale | Duration of impact | Likelihood | Consequence | Significance |
|---|---|---|---|---|---|---|---|---|
| Construction and Operational phase | 2 | 3 | 2 | 2 | 5 | 5 | 9 | 45 (Low) Negative |
| Decommissioning and closure phase | 2 | 3 | 1 | 2 | 5 | 5 | 8 | 40 (Low) Negative |

**Essential mitigation measures during the construction and operational phase:**

- The mining footprint area must be limited to what is absolutely essential in order to minimise environmental damage;
- The boundaries of footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas;
- Edge effects of activities including erosion and alien/ weed proliferation need to be strictly controlled;
- Incorporate adequate erosion and stormwater management measures in order to prevent erosion and the associated sedimentation of the ephemeral pan. Management measures may include berms, silt fences, hessian curtains, stormwater diversion away from areas susceptible to erosion and stormwater attenuation. Care should however be taken so as to avoid additional disturbance during the implementation of these measures In this regard specific attention should be given to the attenuation of stormwater in order to prevent erosion;
- Prevent run-off from mining areas entering wetland habitats;
- Ensure that seepage from dirty water systems is prevented as far as possible;
- Remove alien and weed species in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998). Species specific and area specific eradication recommendations:
    - Take care with the choice of herbicide to ensure that no additional impacts on wetland habitat occur due to the herbicide used;
    - Keep footprint areas as small as possible when removing alien plant species;
    - Do not allow vehicles to drive through designated sensitive wetland areas during the eradication of alien and weed species;
    - Dispose of removed alien plant material at a registered waste disposal site;
- Implement waste management as contemplated in the Environmental Management Programme in order to prevent construction related waste from entering the wetland environment;
- Implement dust control measures;
- Ensure no dumping of waste material or temporary storage of any material take place within any wetland or buffer zone;
- Inspect all vehicles for leaks regularly;
- All vehicles must remain on designated roads with no indiscriminate driving through adjacent wetland areas;
- Re-fuel vehicles in a designated area;
- All spills should be immediately cleaned up and treated accordingly; and
- Obtain the relevant approvals from DWA for any activities within 500m of the ephemeral pan. In this regard special mention is made of water use licences (WUL) in terms of section 21 c and i of the NWA.

**Recommended mitigation measures during the construction and operational phase:**

- N/A.

**Essential mitigation measures during the decommissioning and closure phase:**

- All vehicles must remain on designated roads with no indiscriminate driving through adjacent wetland areas;
- Remove alien and weed species in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998); and
- Rehabilitate and reshape all areas disturbed by mining to be as representative of pre-mining terrain units as possible in order to re-instate natural runoff patterns.

**Recommended mitigation measures during the decommissioning and closure phase:**

- N/A.

| With Management | Probability of Impact | Sensitivity of receiving environment | Severity | Spatial scale | Duration of impact | Likelihood | Consequence | Significance |
|---|---|---|---|---|---|---|---|---|
| **Operational phase** | **1** | **3** | **1** | **1** | **1** | **4** | **3** | **12 (Very Low) Negative** |
| **Decommissioning and closure phase** | **1** | **3** | **1** | **1** | **1** | **4** | **3** | **12 (Very Low) Negative** |

**Probable latent impacts**

- Alien vegetation proliferation; and
- Localised erosion and sedimentation

## *5.2 Impact 2: Changes to wetland ecological and socio-cultural service provision*

**Aspects and activities register**

| Planning of mine | Operational | Decommissioning and closure |
|---|---|---|
| Poor planning of infrastructure placement | Site clearing and the disturbance of soils within the open pit area and the associated erosion and sedimentation of wetland habitat in the vicinity of the open pit | Inadequate rehabilitation of disturbed areas resulting in continued erosion and sedimentation of wetland habitat |
| Inadequate design of infrastructure | Increased runoff or altered runoff patterns from disturbed areas and areas where vegetation has been cleared | Lack of alien and weed control |
| | Dust generation | |
| | Contamination of groundwater as a result of spillages and seepage of hazardous waste material | |

Potential edge effects of mining related activities during the operational phase may result in the loss of ecoservices and function from the ephemeral pan. Furthermore, impacts may result an inability of the system to support biodiversity as a result of changes to water quality, increased sedimentation and alteration of natural hydrological regimes. However, the overall score calculated for function and service provision by the ephemeral pan was calculated to be of a moderately low level and therefore the sensitivity of the receiving environment and the severity of the impact are decreased. The impact is therefore considered to be of a low (negative) significance prior to the implementation of mitigation measures. However, with the implementation of mitigation measures the impact can be reduced to a very low (negative) significance.

Ineffective rehabilitation and continued erosion and sedimentation during decommissioning and closure activities may have a negative impact on the function and service provision of the pan. The proliferation of alien and invasive species may also result in the loss of species diversity from within the pan. The overall significance of the impact is considered to be low (negative) prior to the

implementation of mitigation measures. However, if mitigation measures are implemented, impact probability, severity, duration and spatial scale can be reduced and the overall impact significance can be decreased to a very low (negative) significance.

| Without Management | Probability of Impact | Sensitivity of receiving environment | Severity | Spatial scale | Duration of impact | Likelihood | Consequence | Significance |
|---|---|---|---|---|---|---|---|---|
| Construction and operational phase | 2 | 2 | 2 | 2 | 5 | 4 | 9 | 36 (Low) Negative |
| Decommissioning and closure phase | 2 | 2 | 1 | 2 | 5 | 4 | 8 | 32 (Low) Negative |

**Essential mitigation measures during the construction and operational phase:**

- Limit the footprint area of the mining activities to what is absolutely essential in order to minimise environmental damage;
- Incorporate adequate erosion and stormwater management measures in order to prevent erosion and the associated sedimentation of the ephemeral pan. Management measures may include berms, silt fences, hessian curtains, stormwater diversion away from areas susceptible to erosion and stormwater attenuation. Care should however be taken so as to avoid additional disturbance during the implementation of these measures In this regard specific attention should be given to the attenuation of stormwater in order to prevent erosion;
- All vehicles must remain on designated roads with no indiscriminate driving through adjacent wetland areas;
- Implement waste management as contemplated in the Environmental Management Programme in order to prevent waste from entering the wetland environment;
- Edge effects of activities including erosion and alien/weed control need to be strictly managed; and
- Obtain the relevant approvals from DWA for any activities within 500m of the ephemeral pan. In this regard special mention is made of WUL in terms of section 21 c and i of the NWA.

**Recommended mitigation measures during the construction and operational phase:**

- N/A.

**Essential mitigation measures during the decommissioning and closure phase:**

- All vehicles must remain on designated roads with no indiscriminate driving through adjacent wetland areas;
- Remove alien and weed species in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998); and
- Rehabilitate and reshape all areas disturbed by mining to be as representative of pre-mining terrain units as possible in order to re-instate natural runoff patterns.

**Recommended mitigation measures during the decommissioning and closure phase:**

- N/A

| With Management | Probability of Impact | Sensitivity of receiving environment | Severity | Spatial scale | Duration of impact | Likelihood | Consequence | Significance |
|---|---|---|---|---|---|---|---|---|
| Construction and operational phase | 1 | 2 | 2 | 1 | 1 | 3 | 4 | 12 (Very Low) Negative |
| Decommissioning and closure phase | 1 | 2 | 1 | 1 | 1 | 3 | 3 | 9 (Very Low) Negative |

## 5.3 *Impact 3: Impacts on wetland hydrological function and sediment balance*

**Aspects and activities register**

| Planning of mine | Operational | Decommissioning and closure |
|---|---|---|
| Poor planning of infrastructure placement | Site clearing and the disturbance of soils within the open pit area and the associated erosion and sedimentation of wetland habitat in the vicinity of the open pit | Inadequate rehabilitation of disturbed areas resulting in continued erosion and sedimentation of wetland habitat |
| Inadequate design of infrastructure | Increased runoff or altered runoff patterns from disturbed areas and areas where vegetation has been cleared | |
| Inadequate design of clean and dirty water separation systems | Inadequate construction and maintenance of clean and dirty water separation systems | |

Potential edge effects of mining related activities during the operational phase are likely to have an impact on the hydrology of the ephemeral pan. Site clearing and the removal of vegetation may result in an increase in runoff from disturbed areas and an increase in the erosion and sedimentation of the feature. An increase in runoff from disturbed areas may also alter flow patterns within the feature and may result in a change of the natural hydrological zonation within the feature. The overall impact significance is considered to be low (negative) prior to the implementation of mitigation measures. However, with the implementation of mitigation measures the impact may be reduced to a very low (negative) significance.

Ineffective rehabilitation and continued erosion, sedimentation and increased runoff during decommissioning and closure activities may have a negative impact on the hydrological function of the pan. The impact of decommissioning and closure activities, if left unmitigated, will have a low (negative) significance. However, with the implementation of mitigation measures the impact significance may be reduced to a very low (negative) significance.

**Impact on wetland hydrology and sediment balance**

| Without Management | Probability of Impact | Sensitivity of receiving environment | Severity | Spatial scale | Duration of impact | Likelihood | Consequence | Significance |
|---|---|---|---|---|---|---|---|---|
| **Construction and operational phase** | **2** | **3** | **2** | **2** | **5** | **5** | **9** | **45 (Low) Negative** |
| **Decommissioning and closure phase** | **2** | **3** | **1** | **2** | **5** | **5** | **8** | **40 (Low) Negative** |

**Essential mitigation measures during the construction and operational phase:**

- Limit the footprint area of the mining activities to what is absolutely essential in order to minimise environmental damage;
- According to Regulation GN704 e mining footprint must fall outside of the 1:100 year floodline of the ephemeral pan or 100m from the edge of the feature, whichever distance is the greatest;
- Curtail sheet runoff from roads;
- Prevent run-off from mining areas entering wetland habitats;
- Clear separation of clean and dirty water in the vicinity of the proposed mining infrastructure must take place;
- Ensure that seepage from dirty water systems is prevented as far as possible;
- Incorporate adequate erosion and stormwater management measures in order to prevent erosion and the associated sedimentation of the ephemeral pan. Management measures may include berms, silt fences, hessian curtains, stormwater diversion away from areas susceptible to erosion and stormwater attenuation. Care should however be taken so as to avoid additional disturbance during the implementation of these measures In this regard specific attention should be given to the attenuation of stormwater in order to prevent erosion;
- Inspect and maintain infrastructure installed for stormwater management regularly; and
- Obtain the relevant approvals from DWA for any activities within 500m of the ephemeral pan. In this regard special mention is made of WUL in terms of section 21 c and i of the NWA.

**Recommended mitigation measures during the construction and operational phase:**

- N/A.

**Essential mitigation measures during the decommissioning and closure phase:**

- All vehicles must remain on designated roads with no indiscriminate driving through the ephemeral pan;
- Remove alien and weed species in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998); and
- Rehabilitate and reshape all areas disturbed by mining to be as representative of pre-mining terrain units as possible in order to re-instate natural runoff patterns.

**Recommended mitigation measures during the decommissioning and closure phase:**

- N/A.

| With Management | Probability of Impact | Sensitivity of receiving environment | Severity | Spatial scale | Duration of impact | Likelihood | Consequence | Significance |
|---|---|---|---|---|---|---|---|---|
| Construction and operational phase | 1 | 3 | 1 | 1 | 1 | 4 | 3 | 12 (Very Low) Negative |
| Decommissioning and closure phase | 1 | 3 | 1 | 1 | 1 | 4 | 3 | 12 (Very Low) Negative |

## 5.4 *Impact Assessment Conclusion*

If mitigation and management measures are implemented as outlined in this document, the likelihood of impacts occurring and the consequence of all potential impacts may be significantly reduced. The table below serves as a summary of the key findings made during the impact assessment process.

**Table 5: A summary of impact significance before and after mitigation.**

| Impact | Unmanaged | Managed |
|---|---|---|
| IMPACT 1: LOSS OF WETLAND HABITAT AND ECOLOGICAL STRUCTURE | | |
| Operational Phase | Low (-ve) | Very Low (-ve) |
| Decommissioning and Closure Phase | Low (-ve) | Very Low (-ve) |
| IMPACT 2: CHANGES TO WETLAND ECOLOGICAL AND SOCIO-CULTURAL SERVICE PROVISION | | |
| Operational Phase | Low (-ve) | Very Low (-ve) |
| Decommissioning and Closure Phase | Low (-ve) | Very Low (-ve) |
| IMPACT 3: IMPACTS ON WETLAND HYDROLOGICAL FUNCTION AND SEDIMENT BALANCE | | |
| Operational Phase | Low (-ve) | Very Low (-ve) |
| Decommissioning and Closure Phase | Low (-ve) | Very Low (-ve) |

From the results of the impact assessment it was observed that 3 impacts are likely to affect the ephemeral pan. All the impacts are likely to have an effect on the receiving environment if unmanaged. However, the majority of the impacts can be mitigated by adequate planning, management and implementation of an effective rehabilitation plan.

## 5.5 *Cumulative Impacts*

Wetlands within the region are under continued threat due to ongoing mining development in the area. The disturbance of the ephemeral pan may therefore add to the cumulative effect on the loss of wetland habitat from within the region. However, with the implementation of mitigation measures impacts on the ephemeral pan may be reduced to very low levels and the cumulative impact of the mining activity on the wetland resources of the region may be significantly decreased.

# 6 CONCLUSION

SAS was appointed to conduct a wetland assessment as part of the environmental assessment and authorisation process for the COZA Iron Ore mining project located approximately 10km to the north of Postmasburg and approximately 400m west of the R325 within the Northern Cape Province. A field assessment was undertaken in July 2014 in order to determine the PES of an ephemeral pan located approximately 400m to the south west of the proposed open pit area, and in order to determine the possible impact the proposed mining activities could have on the EIS of the feature.

**WETLAND ASSESSMENT**

The following general conclusions were drawn on completion of the wetland assessment:

- Although additional wetland features are located within the property boundary only the ephemeral pan is located within 500m of the proposed mine footprint. Mining activity within 500m of this feature will require a WUL. The EAP therefore requested the assessment of only the pan;
- The ephemeral pan is indicated by the NFEPA (2011) as a seep wetland in a natural and good condition (percentage natural land cover >75%), however upon assessment of the site the feature was considered to be more representative of a depression wetland than a seep wetland;
- The wetland habitat associated with the ephemeral pan can be defined as a wetland temporary zone in which soil is saturated for a short period of the year, but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soils and the growth of facultative wetland vegetation species;
- The ephemeral pans ability to hold water for extended periods is due to the presence of a shallow, intact impermeable calcrete layer which prevents the movement of water through the soil;
- From the results of the assessment, it is evident that ephemeral pan cannot be regarded to be of exceptional importance in terms of function and service provision. This is mainly a result of lack of surface water for extended periods of time limiting the ability to support any aquatic communities or the formation of seasonal and permanent wetland zones that could support a more diverse wetland floral community, that would increase the wetland features assimilation capacity as well as sediment trapping ability;
- The ephemeral pan calculated a very high PES score (Category A – unmodified, natural), mainly due to anthropogenic activity being limited near the feature. Some disturbance was encountered as a result of small scale cattle grazing and as a result of the development of a farm fence through the feature but these activities have not resulted in any significant impact on the hydrology or the vegetation of the feature;
- It is deemed possible that a PES Category A can be maintained for the feature during mining activities, provided that future planning and overall monitoring takes the mitigation measures and recommendations contained within this report into consideration and ensures effective implementation;
- Based on the findings of the study it is evident that the ephemeral pan has an EIS falling within Category C (moderate sensitivity). Although the pan is in an unmodified, natural PES, the feature contains surface water for very limited periods of the year thereby decreasing its importance in terms of function and service provision. Furthermore, no rare or endangered floral species were encountered within the pan at the time of the assessment and the feature is indicated as a least threatened wetland vegetation type according to NFEPA Wetveg which further decreases its EIS;
- The ephemeral pan was delineated according to the guidelines advocated by DWA (2005) and was allocated a 100 meter buffer zone as advocated by Regulation GN 704 of the NWA (Act no. 36 of 1998);
- It should be noted that any activity occurring within 500m of the ephemeral pan will require a WUL.

**WETLAND IMPACT ASSESSMENT**

The ephemeral pans ability to hold water for extended periods is due to the presence of a shallow, intact impermeable calcrete layer which prevents the movement of water through the soil. Therefore, persisting wetland conditions are dependent upon precipitation and surface water from the pans catchment and are not dependent on groundwater. Dewatering due to mining activity is therefore considered highly unlikely to impact on the pan feature due to its independence on groundwater. The impact associated with dewatering was therefore not assessed.

According to the assessment undertaken by Groundwater Complete (2014) an evaporation rate of approximately 165 000 $m^3$/y calculated to occur from the surface of the backfilled pit far exceeds the expected recharge volume of ± 4 400 $m^3$/y, which means that the water level within the backfilled opencast pit is unlikely to reach the surface and decant should not occur. The most probable route the water will follow as a result of decant, should it occur, was also estimated to be within a south western direction from where the mining activities took place, therefore any water is unlikely to reach the ephemeral pan. Impact due to decant is therefore considered highly unlikely and was not assessed as part of the impact assessment.

It should be noted that mining activities will not take place directly within the ephemeral pan. The proposed mine footprint area is located approximately 400m to the north east of the ephemeral pan and the possibility that mining activities will impact on the feature is therefore reduced. The distance of the ephemeral pan from the proposed mine footprint is also likely to reduce the severity of the impact as well as the overall impact significance.

The table below serve to summarise the significance of potential impacts on the ephemeral pan. Impacts associated with the operational and decommissioning and closure phases have been assessed separately.

**Table B: Summary of impact assessment results.**

| Impact | Unmanaged | Managed |
|---|---|---|
| IMPACT 1: LOSS OF WETLAND HABITAT AND ECOLOGICAL STRUCTURE | | |
| Operational Phase | Low (-ve) | Very Low (-ve) |
| Decommissioning and Closure Phase | Low (-ve) | Very Low (-ve) |
| IMPACT 2: CHANGES TO WETLAND ECOLOGICAL AND SOCIO-CULTURAL SERVICE PROVISION | | |
| Operational Phase | Low (-ve) | Very Low (-ve) |
| Decommissioning and Closure Phase | Low (-ve) | Very Low (-ve) |
| IMPACT 3: IMPACTS ON WETLAND HYDROLOGICAL FUNCTION AND SEDIMENT BALANCE | | |
| Operational Phase | Low (-ve) | Very Low (-ve) |
| Decommissioning and Closure Phase | Low (-ve) | Very Low (-ve) |

From the results of the impact assessment it was observed that 3 impacts are likely to affect the ephemeral pan. All the impacts are likely to have an effect on the receiving environment if unmanaged. However, the majority of the impacts can be mitigated by adequate planning, management and implementation of an effective rehabilitation plan.

# 7 REFERENCES

**Bromilow, C.** 2001. Revised Edition, First Impression. *Problem Plants of South Africa.* Briza Publications, Pretoria, RSA.

**Buschke F.T., Adendorff, J. and Seaman, M.T.** 2011. *A biomonitoring report for pan ecosystems at Kolomela Mine Property, Northern Cape Province*. Centre for Environmental Management at the University of the Free State.

**Dada R., Kotze D., Ellery W. and Uys M.** 2007. WET-RoadMap: *A Guide to the Wetland Management Series*. WRC Report No. TT 321/07. Water Research Commission, Pretoria.

**Department of Water Affairs**, South Africa *Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999* [Appendix W3].

**Department of Water Affairs and Forestry**. 1999. IER (Floodplains): Determining the Ecological Importance and Sensitivity (EIS) and the Ecological Management Class (EMC). DWA, Pretoria, RSA.

**Department of Water Affairs and Forestry** 2005. A practical field procedure of identification and delineation of wetlands and riparian areas. DWA, Pretoria.

**De Villiers, C., Driver, A., Clark, B., Euston-Brown, D., Day, L., Job, N., Helme, N., Van Ginkel, CE., Glen, RP., Gordon-Gray, KD., Cilliers, CJ., Muasya, M and van Deventer, PP.** 2011. *Easy identification of some South African Wetland Plants*. WRC Report No TT 479/10.

**Groundwater Complete** 2014. Coza Iron Ore Project. Report on geohydrological investigation as part of the EIA and EMP.

**Henderson, L.** 2001. *Alien Weeds and Invasive Plants*. Agricultural Research Council, RSA.

**Kotze D.C., Marneweck G.C., Batchelor A.L., Lindley D.S. and Collins N.B.** 2009. *WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands*. WRC Report No. TT 339/09. Water Research Commission, Pretoria.

**Nel, JL, Driver, A., Strydom W.F., Maherry, A., Petersen, C., Hill, L., Roux, D.J, Nienaber, S., Van Deventer, H., Swartz, E. & Smith-Adao, L.B.** 2011a. Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources. Water Research Commission Report No. TT 500/11, Water Research Commission, Pretoria.

**Ollis, DJ; Snaddon, CD; Job, NM & Mbona, N.** 2013. *Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems*. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria.

**The South African National Biodiversity Institute -** Biodiversity GIS (BGIS) *[online].* Retrieved 2014/07/14 URL: http://bgis.sanbi.org

**Van Oudtshoorn, F.** 2004. Second Edition, Third Print. *Guide to Grasses of South Africa.* Briza Publications, Pretoria, RSA.

**Van Rooyen, N.** 2001. Flowering plants of the Kalahari Dunes. Ecotrust cc, RSA.

# APPENDIX A

## *Method of Assessment*

## *Desktop Study*

A desktop study was compiled with all relevant information as presented by the South African National Biodiversity Institutes (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org). Wetland specific information resources taken into consideration during the desktop assessment of the property boundary included:

- National Freshwater Ecosystem Priority Areas (NFEPAs) (2011)

  - NFEPA water management area (WMA);
  - NFEPA wetlands/National wetlands map;
  - Wetland and estuary Fresh Water Ecosystem Priority Areas (FEPA);
  - FEPA (sub)WMA % area;
  - Sub water catchment area FEPAs;
  - Water management area FEPAs;
  - Fish sanctuaries;
  - Wetland ecosystem types;

***Classification System for Wetlands and other Aquatic Ecosystems in South Africa***

All wetland features encountered within the property boundary were assessed using the *Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems* (Ollis *et al*., 2013).

A summary of Levels 1 to 4 of the proposed Classification System for Inland Systems are presented in Table 1 and 2, below.

**Table 1: Proposed classification structure for Inland Systems, up to Level 3.**

| WETLAND / AQUATIC ECOSYSTEM CONTEXT | | |
|---|---|---|
| LEVEL 1:<br>SYSTEM | LEVEL 2:<br>REGIONAL SETTING | LEVEL 3:<br>LANDSCAPE UNIT |
| Inland Systems | DWA Level 1 Ecoregions<br>OR<br>NFEPA WetVeg Groups<br>OR<br>Other special framework | Valley Floor |
| | | Slope |
| | | Plain |
| | | Bench<br>(Hilltop / Saddle / Shelf) |

**Table 2: Hydrogeomorphic (HGM) Units for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.**

| FUNCTIONAL UNIT | | |
|---|---|---|
| LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT | | |
| *HGM type* | Longitudinal zonation/ Landform / Outflow drainage | Landform / Inflow drainage |
| **A** | **B** | **C** |
| River | Mountain headwater stream | Active channel |
| | | Riparian zone |
| | Mountain stream | Active channel |
| | | Riparian zone |
| | Transitional | Active channel |
| | | Riparian zone |
| | Upper foothills | Active channel |
| | | Riparian zone |
| | Lower foothills | Active channel |
| | | Riparian zone |
| | Lowland river | Active channel |
| | | Riparian zone |
| | Rejuvenated bedrock fall | Active channel |
| | | Riparian zone |
| | Rejuvenated foothills | Active channel |
| | | Riparian zone |
| | Upland floodplain | Active channel |
| | | Riparian zone |
| Channelled valley-bottom wetland | (not applicable) | (not applicable) |
| Unchannelled valley-bottom wetland | (not applicable) | (not applicable) |
| Floodplain wetland | Floodplain depression | (not applicable) |
| | Floodplain flat | (not applicable) |
| Depression | Exorheic | With channelled inflow |
| | | Without channelled inflow |
| | Endorheic | With channelled inflow |
| | | Without channelled inflow |
| | Dammed | With channelled inflow |
| | | Without channelled inflow |
| Seep | With channelled outflow | (not applicable) |
| | Without channelled outflow | (not applicable) |
| Wetland flat | (not applicable) | (not applicable) |

**Level 1: Inland systems**

For the proposed Classification System, Inland Systems are defined as ***an aquatic ecosystem that have no existing connection to the ocean***[5] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but ***which are inundated or saturated with water, either permanently or periodically.*** It is important to bear in mind, however, that certain Inland Systems may have had an historical connection to the ocean, which in some cases may have been relatively recent.

**Level 2: Ecoregions**

For Inland Systems, the regional spatial framework that has been included at Level 2 of the proposed Classification System is that of DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et al.,* 2005). There are a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland

[5] Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.

(figure below). DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

**Level 2: NFEPA Wet Veg Groups**

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) groups vegetation types across the country according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the NFEPA project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting Bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

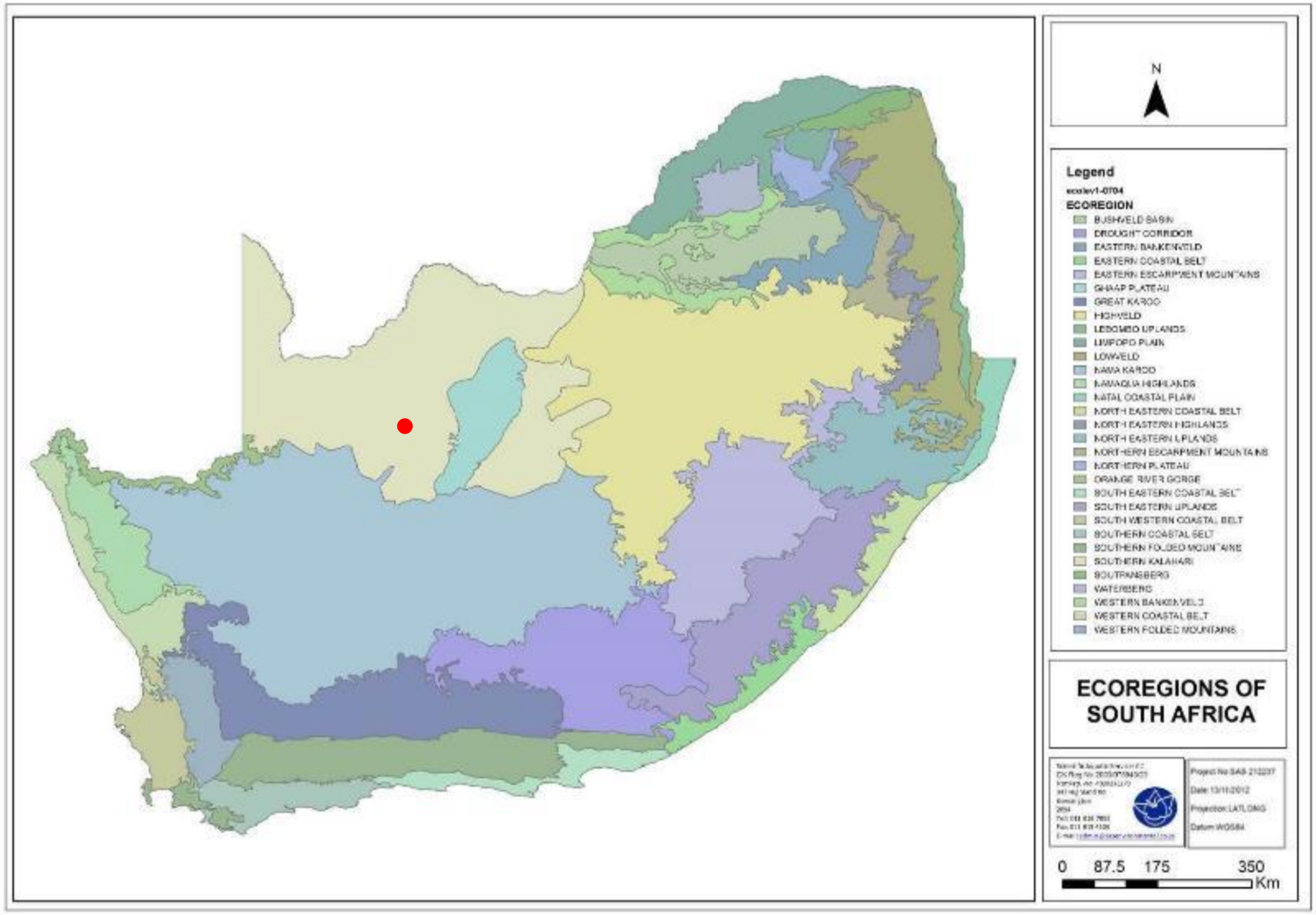


**Figure 1: Map of Level 1 Ecoregions of South Africa, with the approximate position of the property boundary indicated in red.**

**Level 3: Landscape Setting**

At Level 3 of the proposed classification System, for Inland Systems, a distinction is made between four Landscape Units (Table 3) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et al.,* 2013):

- ***Slope*****:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley.
- ***Valley floor:*** The base of a valley, situated between two distinct valley side-slopes.
- ***Plain:*** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land.
- ***Bench (hilltop/saddle/shelf):*** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately permendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

**Level 4: Hydrogeomorphic Units**

Eight primary HGM Types are recognised for Inland Systems at Level 4A of the proposed National Wetland Classification Systems (NWCS) (Table 2), on the basis of hydrology and geomorphology (Ollis *et al*., 2013), namely:

- ***River:*** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water.
- ***Channelled valley-bottom wetland:*** a valley-bottom wetland with a river channel running through it.
- ***Unchannelled valley-bottom wetland:*** a valley-bottom wetland without a river channel running through it.
- ***Floodplain wetland:*** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank.
- ***Depression:*** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.
- ***Wetland Flat:*** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat
- ***Seep:*** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the Classification System to try and ensure consistency with the wetland classification terms currently in common usage in South Africa. Similar terminology (but excluding categories for “channel”, “flat” and “valleyhead seep”) is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et al.,* 2009) and WET-EcoServices (Kotze *et al.,* 2008).

## *WET-Health*

Healthy wetlands are known to provide important habitats for wildlife and to deliver a range of important goods and services to society. Management of these systems is therefore essential if these attributes are to be retained within an ever changing landscape. The primary purpose of this

assessment[6] is to evaluate the ecophysical health of wetlands, and in so doing promote their conservation and wise management.

### Level of Evaluation

Two levels of assessment are provided by WET-Health:

- Level 1: Desktop evaluation, with limited field verification. This is generally applicable to situations where a large number of wetlands need to be assessed at a very low resolution;
- Level 2: On-site evaluation. This involves structured sampling and data collection in a single wetland and its surrounding catchment; and

### Framework for the Assessment

A set of three modules has been synthesised from the set of processes, interactions and interventions that take place in wetland systems and their catchments: hydrology (water inputs, distribution and retention, and outputs), geomorphology (sediment inputs, retention and outputs) and vegetation (transformation and presence of introduced alien species).

### Units of Assessment

Central to WET-Health is the characterisation of hydrogeomorphic (HGM) units, which have been defined based on geomorphic setting (e.g. hillslope or valley-bottom; whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated) and pattern of water flow through the wetland unit (diffusely or channelled) as described under the *Classification System for Wetlands and other Aquatic Ecosystems* in Section 2.2.

### Quantification of Present State of a wetland

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. This takes the form of assessing the spatial *extent* of impact of individual activities and then separately assessing the *intensity* of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall *magnitude* of impact. The impact scores and Present State categories are provided in Table 3.

**Table 3: Impact scores and categories of present State used by WET-Health for describing the integrity of wetlands.**

| Impact category | Description | Impact score range | Present State category |
|---|---|---|---|
| None | Unmodified, natural | 0-0.9 | A |
| Small | Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place. | 1-1.9 | B |
| Moderate | Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact. | 2-3.9 | C |
| Large | Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred. | 4-5.9 | D |

[6] Kleynhans et al., 2007

| | | | |
|---|---|---|---|
| Serious | The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable. | 6-7.9 | E |
| Critical | Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota. | 8-10 | F |

**Assessing the Anticipated Trajectory of Change**

As is the case with the Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or from within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (Table 4).

**Table 4: Trajectory of Change classes and scores used to evaluate likely future changes to the present state of the wetland.**

| Change Class | Description | HGM change score | Symbol |
|---|---|---|---|
| Substantial improvement | State is likely to improve substantially over the next 5 years | 2 | ↑↑ |
| Slight improvement | State is likely to improve slightly over the next 5 years | 1 | ↑ |
| Remain stable | State is likely to remain stable over the next 5 years | 0 | → |
| Slight deterioration | State is likely to deteriorate slightly over the next 5 years | -1 | ↓ |
| Substantial deterioration | State is expected to deteriorate substantially over the next 5 years | -2 | ↓↓ |

**Overall health of the wetland**

Once all HGM units have been assessed, a summary of health for the wetland as a whole needs to be calculated. This is achieved by calculating a combined score for each component by area-weighting the scores calculated for each HGM unit. Recording the health assessments for the hydrology, geomorphology and vegetation components provides a summary of impacts, Present State, Trajectory of Change and Health for individual HGM units and for the entire wetland.

## *Wetland function assessment*

"The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class".[7] The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze *et* al (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation
- Stream flow regulation
- Sediment trapping
- Phosphate trapping
- Nitrate removal

[7] Department of Water Affairs and Forestry, South Africa *Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999*

- Toxicant removal
- Erosion control
- Carbon storage
- Maintenance of biodiversity
- Water supply for human use
- Natural resources
- Cultivated foods
- Cultural significance
- Tourism and recreation
- Education and research

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the wetlands. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the wetland.

**Table 5: Classes for determining the likely extent to which a benefit is being supplied.**

| Score | Rating of the likely extent to which the benefit is being supplied |
|---|---|
| <0.5 | Low |
| 0.6-1.2 | Moderately low |
| 1.3-2 | Intermediate |
| 2.1-3 | Moderately high |
| >3 | High |

## *Defining Ecological Importance and Sensitivity*

The method used for the Ecological Importance and Sensitivity (EIS) determination was adapted from the method as provided by DWA (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed.

A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The median of the determinants is used to assign the EIS category.

**Table 6: EIS Category definitions**

| EIS Category | Range of Median | Recommended Ecological Management Class[8] |
|---|---|---|
| Very high<br>Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. | >3 and <=4 | A |
| High<br>Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. | >2 and <=3 | B |
| Moderate<br>Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. | >1 and <=2 | C |

[8] Ed's note: Author to confirm exact wording for version 1.1

| | | |
|---|---|---|
| Low/marginal<br>Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. | >0 and <=1 | D |

## *Recommended Ecological Category*

"A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability, but carries a higher risk of ecosystem failure." [9]

The REC was determined based on the results obtained from the PES, reference conditions and Ecological Importance and Sensitivity of the resource (sections above). Followed by realistic recommendations, mitigation, and rehabilitation measures to achieve the desired REC.

A wetland may receive the same class for the PES, as the REC if the wetland is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as to enhance the PES of the wetland feature.

**Table 7: Description of REC classes.**

| Class | Description |
|---|---|
| A | Unmodified, natural |
| B | Largely natural with few modifications |
| C | Moderately modified |
| D | Largely modified |

## *Wetland Delineation*

For the purposes of this investigation, a wetland habitat is defined in the NWA (1998) as including the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas.

The wetland zone delineation took place according to the method presented in the final draft of "A practical field procedure for identification and delineation of wetlands and riparian areas" published by the Department of Water Affairs and Forestry (DWAF) in February 2005. Attention was also paid to wetland soil guidelines as defined by Job (2009) for the Western Cape. The foundation of the method is based on the fact that wetlands have several distinguishing factors including the following:

- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils; and
- Vegetation adapted to saturated soils.

By observing the evidence of these features, in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWAF 2005).

[9] Department of Water Affairs and Forestry, South Africa *Version 1.0 of Resource Directed Measures for Protection of Water Resources 1999*

Riparian and wetland zones can be divided into three zones (DWAF 2005). The permanent zone of wetness is nearly always saturated. The seasonal zone is saturated for a significant part of the rainy season and the temporary zone surrounds the seasonal zone and is only saturated for a short period of the year, but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soils and the growth of wetland vegetation. The object of this study was to identify the outer boundary of the temporary zone and then to identify a suitable buffer zone around the wetland area.

## *Ecological Impact Assessment*

In order for the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts, environmental impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[10]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or well being, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** Receptors can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to the below. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood

[10] The definition has been aligned with that used in the ISO 14001 Standard.

and consequence of the impact are then read off a significance rating matrix and is used to determine whether mitigation is necessary[11].

The assessment of significance is undertaken twice. Initial significance is based only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (No. 108 of 1997) in instances of uncertainty or lack of information by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

[11] Some risks/impacts that have low significance will however still require mitigation

### LIKELIHOOD DESCRIPTORS

| **Probability of impact** | **RATING** |
|---|---|
| Highly unlikely | 1 |
| Possible | 2 |
| Likely | 3 |
| Highly likely | 4 |
| Definite | 5 |
| **Sensitivity of receiving environment** | **RATING** |
| Ecology not sensitive/important | 1 |
| Ecology with limited sensitivity/importance | 2 |
| Ecology moderately sensitive/ /important | 3 |
| Ecology highly sensitive /important | 4 |
| Ecology critically sensitive /important | 5 |

## CONSEQUENCE DESCRIPTORS

| **Severity of impact** | **RATING** |
|---|---|
| Insignificant / ecosystem structure and function unchanged | 1 |
| Small / ecosystem structure and function largely unchanged | 2 |
| Significant / ecosystem structure and function moderately altered | 3 |
| Great / harmful/ ecosystem structure and function Largely altered | 4 |
| Disastrous / ecosystem structure and function seriously to critically altered | 5 |
| **Spatial scope of impact** | **RATING** |
| Activity specific/ < 5 ha impacted / Linear features affected < 100m | 1 |
| Development specific/ within the site boundary / < 100ha impacted / Linear features affected < 100m | 2 |
| Local area / within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m | 3 |
| Regional within 5 km of the site boundary / < 2000ha impacted / Linear features affected < 3000m | 4 |
| Entire habitat unit / Entire system / > 2000ha impacted / Linear features affected > 3000m | 5 |
| **Duration of impact** | **RATING** |
| One day to one month | 1 |
| One month to one year | 2 |
| One year to five years | 3 |
| Life of operation or less than 20 years | 4 |
| Permanent | 5 |

**Table 8: Significance Rating Matrix.**

| LIKELIHOOD (Frequency of activity + Frequency of impact) | CONSEQUENCE (Severity + Spatial Scope + Duration) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
| | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 | 45 |
| | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 | 52 | 56 | 60 |
| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 |
| | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 | 78 | 84 | 90 |
| | 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 | 77 | 84 | 91 | 98 | 105 |
| | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 | 88 | 96 | 104 | 112 | 120 |
| | 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 | 99 | 108 | 117 | 126 | 135 |
| | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 |

**Table 9: Positive/Negative Mitigation Ratings.**

| Significance Rating | Value | Negative Impact Management Recommendation | Positive Impact Management Recommendation |
|---|---|---|---|
| Very high | 126-150 | Improve current management | Maintain current management |
| High | 101-125 | Improve current management | Maintain current management |
| Medium-high | 76-100 | Improve current management | Maintain current management |
| Medium-low | 51-75 | Maintain current management | Improve current management |
| Low | 26-50 | Maintain current management | Improve current management |
| Very low | 1-25 | Maintain current management | Improve current management |

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for all stages of the project cycle including:
  - Construction;
  - Operation; and
  - Rehabilitation.
- If applicable, transboundary or global effects were assessed;
- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.
- Particular attention was paid to describing any residual impacts that will occur post-closure.

## Mitigation Measure Development

The following points present the key concepts considered in the development of mitigation measures for the proposed development:

- *Mitigation* and *performance improvement measures* and actions that address the risks and impacts[12] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimization, mitigation or compensation.

Desired outcomes are defined, and have been developed in such a way as to be *measurable events with performance indicators, targets and acceptable criteria* that can be tracked over *defined periods*, with estimates of the *resources* (including human resource and training requirements) *and responsibilities for implementation*.

[12] Mitigation measures should address both positive and negative impacts

**Ms Tania Anderson**
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1 December 2015

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**SPECIALIST REPORTING REQUIREMENTS AS PER APPENDIX 6 OF THE EIA REGULATIONS 2014**

This letter has been prepared to report on the compliance of Tania Anderson, Ecologist (sole proprietor), as part of the specialist reporting requirements listed in Appendix 6 of the Environmental Impact Assessment Regulations, 2014 from the National Environmental Management Act, 1998 (Act no. 107 of 1999).

**1.(a)(i) Details of the specialist who prepared the report**

See cover page of the report.

**1.(a).(ii) The expertise of that specialist to compile a specialist report including a curriculum vitae**

Refer to section 1.1 Regulations and specialist details (page 4) in the report.

**1.(b) a declaration that the specialist is independent in a form as may be specified by the competent authority**

Refer to section 1.1 Regulations and specialist details (page 4) in the report.

I, Tania Anderson, declare that -

- I acted as the independent specialist in this application;
- I performed the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that compromised my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I complied with the applicable legislation;
- I had no, and did not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent

authority; and - the objectivity of any report, plan or document prepared by myself for submission to the competent authority;

- All the particulars furnished by me in this form are true and correct 

**1.(c) an indication of the scope of, and the purpose for which, the report was prepared**

Refer to section 1.2 page 5 of the report.

**1.(d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment**

Refer to section 3.1 page 11 of the report.

**1.(e) A description of the methodology adopted in preparing the report or carrying out the specialised process**

Refer to section 3.1 page 10 - 11 of the report.

**1.(f) The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure**

Refer to section 5.1 to 5.4 page 22-28 in the report.

**1.(g) An identification of any areas to be avoided, including buffers**

Refer to sections 5.4 page 28 – 29 and mitigation column in section 7.1 from page 34 onwards.

**1.(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers**

Refer to Figure 10 on page 28 of the report.

**1.(i) A description of any assumptions made and any uncertainties or gaps in knowledge**

Refer to section 3.2 page 13 in the report.

**1.(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment**

Refer to section 6 page 29-32 in the report.

**1.(k) Any mitigation measures for inclusion in the EMPr**

Refer to section 8 in Table 10 pages 44-48 in the report.

**1.(l) Any conditions for inclusion in the environmental authorisation**

Refer to section 5.3 permit requirements on page 25 in the report, and section 8 first paragraph on page 44.

**1.(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation**

Refer to section 8 in Table 10 pages 44-48 in the report.

**1.(n)(i) A reasoned opinion as to whether the proposed activity or portions thereof should be authorised**

Refer to section 9 pages 49-50 in the report.

**1.(n)(ii) A reasoned opinion if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan**

Refer to section 8 in Table 10 pages 44-48 in the report.

**1.(o) A description of any consultation process that was undertaken during the course of preparing the specialist report;**

Consultation with interested and affected parties was undertaken as part of the environmental impact assessment and environmental management programme process conducted by SLR Consulting (Africa) (Pty) Ltd.

**1.(p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto**

Comments and responses that were raised by interested and affected parties are included in the issues table, an Appendix of the EIA report.

**1.(q) any other information requested by the competent authority.**

No information requested.

If you have any queries regarding the above, please do not hesitate to contact me.

Yours Sincerely

Tania Anderson