FAUNAL AND FLORAL ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS FOR THE PROPOSED GRUISFONTEIN MINING PROJECT, LIMPOPO PROVINCE

Prepared for

Jacana Environmentals CC

June 2019

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EXECUTIVE SUMMARY

The farm Gruisfontein 230 LQ, on which the proposed mining project is located, is currently utilised for cattle and game ranching and disturbance to the land was minimal at the time of the assessment. Degraded habitat had a small footprint and was restricted to areas where disturbances such as overgrazing, regular vehicular movement and anthropogenic structures persisted. Overall, the veld is in a good condition and able to support a variety of both faunal and floral species.

Based on the results of the floral assessment, it is the opinion of the specialist that the proposed Gruisfontein project will negatively impact on floral ecology within the study area resulting from extensive vegetation clearing. Regional impacts on floral ecology are expected to be minimal as the reference vegetation type, i.e. the Limpopo Sweet Bushveld (Mucina and Rutherford, 2006), is well-represented within the region. With several floral SCC recorded at high abundances within the footprint area of the proposed Gruisfontein Project, including species listed under the National Forest Act, 1998 (Act 84 of 1998, as amended in September 2011) (NFA), the Limpopo Environmental Management Act, 2003 (Act 7 of 2003) (LEMA) - Schedule 12 (Protected Plants), as well as the NEMBA TOPS regulations, the study area is of increased conservation significance. With the current proposed layout, negative impacts on the number of SCC within the study area are unavoidable.

From a faunal perspective, the results obtained from the field assessment and the analysis of background data indicate that the proposed mining activities will negatively impact upon faunal species within the study area, predominantly as a result of the loss of habitat and faunal species displacement. Additional risks are posed to small and slower moving species as well as those which are fossorial, as they may be unable to relocate out of the study area during the commencement of vegetation clearing and earth moving activities. Several faunal SCC were observed within the study area, whilst a number of other SCC are expected to utilise the study area periodically during foraging activities. Due to the increased species diversity and presence of faunal SCC, the study area is considered to be of increased sensitivity and conservation importance.

It is essential that cogent, well-conceived and ecologically sensitive site development plans, and the mitigation measures provided in Section B and C be strictly adhered to. Of importance is the exclusion of floral SCC from the mining footprint as far as is possible.

MANAGEMENT SUMMARY

Scientific Terrestrial Services (STS) was appointed to conduct a faunal and floral ecological assessment as part of the Environmental Impact Assessment (EIA) process for the proposed Gruisfontein coal mine project within the Limpopo Province.

The purpose of this report is to define the biodiversity of the area, including both floral and faunal aspects as well as mapping and defining areas of increased Ecological Importance and Sensitivity (EIS) and to define the Present Ecological State (PES) of the study area. It is the objective of this study to provide detailed information to guide the activities associated with the proposed mining activities within the study area, to ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements and the provision of ecological services in the local area.

The study area is largely in an undisturbed condition and the farm is well-managed as was evident with the low levels of bush encroachment in comparison to neighbouring farms. The vegetation was intact and representative of the reference state, i.e. the Limpopo Sweet Bushveld, a vegetation type that is favourable for game and cattle farming due to the high grazing capacity of sweet veld.

Floral Assessment

Three habitat units for the study area was defined based on the results of the field assessment, namely Sweet Bushveld A, Sweet Bushveld B and Degraded habitat. The ecological sensitivity of the habitat

units varied between moderately high (Sweet Bushveld B), intermediate (Sweet Bushveld A) and moderately low (Degraded Habitat).

- The Limpopo Sweet Bushveld vegetation type (Mucina and Rutherford, 2006) is well-represented within the region although several areas have been severely impacted by bush encroachment – the study area was minimally affected by bush encroachment;
- Floristically the study area is considered of increased ecological importance: The vegetation within the study area, being largely undisturbed and intact, has retained a moderately high habitat integrity that supports a moderate to moderately high diversity of floral species;
- Overall, the floral structure and composition of the study area is representative of the reference state (Limpopo Sweet Bushveld) with the southern section comprising a denser, more floristically diverse community described as the Sweet Bushveld B habitat unit. This habitat unit is associated with a high abundance of floral species of conservation concern (SCC), of which *Vachellia erioloba* (Camel thorn) was widely distributed – a protected species under the NFA. *Boscia albitrunca* (Shepard's tree, NFA protected) and *Combretum imberbe* (Leadwood, NFA protected) were present at lower abundances;
- Most of the study area falls within the Sweet Bushveld A habitat unit, which was floristically less diverse than the Sweet Bushveld B habitat unit, and associated with several floral SCC, i.e. the NFA protected *Boscia albitrunca* (Shepherd's tree), *Sclerocarya birrea* subsp. *caffra* (Marula tree) and *Vachellia erioloba* (Camel Thorn). One species protected under the LEMA was present in moderately low abundances within this habitat unit, i.e. *Adenium oleifolium* (Bitterkambro). More SCC are expected to be present due to the availability of suitable growing conditions;
- All affected floral SCC individuals within the footprint area of the proposed Gruisfontein Project should be marked prior to vegetation clearance and be rescued and relocated, where feasible, or the relevant permits to remove these species should be obtained from the Department of Agriculture, Forestry and Fisheries (DAFF) and the Limpopo Department of Economic Development, Environment and Tourism (LEDET); and
- The remainder of the study area includes the Degraded Habitat Unit, which is present in small, isolated patches throughout. This habitat unit is characterised by either a lack of vegetation or by areas of increased floral species associated with areas of disturbance, including the presence of alien and invasive plant (AIP) species resulting from disturbances such as overgrazing, regular vehicular movement and anthropogenic structures.

Within the study area, several NFA protected tree species are present, the majority of which were recorded within the southern section where most of the proposed mine infrastructure is proposed. The Gruisfontein coal mine project will thus impact not only on habitat integrity and floral diversity within the study area but will lead to a large reduction in the number of floral SCC. It is recommended that infrastructure within the southern-most section be reconsidered; however, new placements should not hinder habitat connectivity.

Faunal Assessment

Three habitat units for the study area was defined based on the results of the field assessment, namely Sweet Bushveld A, Sweet Bushveld B and Degraded habitat. The ecological sensitivity of the Sweet Bushveld habitat units do not vary with both being considered moderately high in sensitivity. The Degraded Habitat on the other hand is considered to be moderately low due to the level of habitat degradation observed.

- The Sweet Bushveld Habitat units provide habitat and food resources for numerous species of all classes. Currently the study area is managed as a mixed-use game and cattle farm, with the nett result being that of an overall moderately high diversity of species;
- The Degraded Habitat provided a low level of habitat provision and food resources with the nett result being that of a low overall species diversity and abundance in this habitat. Some alien plant proliferation has also contributed to the degradation of this habitat, and must be controlled to avoid the further spread of these species into the surrounding habitats;
- Currently there is limited restriction to movement within the study area ensuring high levels of habitat connectivity and faunal species movement. The small cattle fences present, although movement limiting to cattle, are passable by most antelope species as they can either crawl under the fence (small antelope) or jump over the fence due to its low height;

- Although the Degraded Habitat is considered unimportant in terms of habitat and food resources, this habitat unit is associated with the current artificial water points, providing an important source of freshwater in the study area, notably as there are no natural freshwater sources available;

Several faunal SCC are likely to make use of the study area, either permanently or on a periodic basis whilst foraging, The proposed mine is likely to impact upon faunal SCC movement between the study area and the surrounding natural areas, most notably for avifaunal species and larger carnivores who have extensive home ranges. Many of the species below are known to range over large distances and as such the study area is likely to form part of their larger home ranges or foraging grounds, the loss of which may result in significant impacts to these individuals. The table below indicates the various faunal SCC that are expected to utilise or occur, both permanently and on a periodically, the study area and must be taken into consideration at all times during planning, construction and operational activities.

Faunal SCC that have an increased probability of occurring within the study area.

Scientific name	Common Name	Conservation listing	POC %
Mammals			
Panthera pardus	Leopard	VU	100%
Felis lybica	African Wild Cat,	VU	100%
Acinonyx jubatus	Cheetah	VU	100%
Oryx gazelle	Gemsbok	NEMBA TOPS	100%
Hyaena brunnea	Brown Hyaena	NT	80%
Hippotragus niger	Sable	VU	100%
Orycteropus afer	Aardvark	NEMBA TOPS	100%
Avifauna			
Gyps africanus	White Backed Vulture	CR	80%
Ardeotis kori	Kori Bustard	NT	90%
Torgos tracheliotos	Lappet-faced Vulture	EN	80%
Buphagus erythrorhynchus	Red-billed Oxpecker	T	80%
Polemaetus bellicosus	Martial Eagle	VU	80%
Aquila rapax	Tawny Eagle	VU	80%
Gyps coprotheres	Cape Vulture	EN	80%
Reptiles			
Python natalensis	African Python	VU	90%

Impact Assessment

Impacts on the floral and faunal ecology associated with the proposed mining footprint in the study area will be significant. Even with high levels of mitigation, there will still be significant impacts associated with the clearance of vegetation, including the loss of faunal and floral habitat, species diversity and faunal and floral SCC. However, where the proposed activities are to proceed, the following recommendations are made in order to minimise the further impact on the faunal and floral ecology:

- The footprint areas of all surface infrastructure must be minimised to what is essential;
- As far as possible disturbance of sensitive habitats other than that included within the footprint areas must be actively avoided;
- Disturbance of faunal SCC must be avoided, and where necessary/applicable, rescue and relocation activities must be implemented by a suitably qualified specialist;
- All areas of increased sensitivity outside that of the mining footprint must be designated as no-go areas during both the construction and operational phases of the mine, except for designated management personnel;
- Strict management of edge effects must be implemented in order to ensure that footprint creep does not occur;
- It is recommended that a specialist avifaunal study be conducted as part of the mines Biodiversity Action Plan (BAP) in order to better manage and mitigate the impacts to avifaunal species, notably that of large birds of prey and vultures;
- An Alien and Invasive Plant (AIP) Control Plan and Erosion Control Plan must be developed and implemented during all mining phases, to lower the risk of erosion and the increase in proliferation of AIPs within the study area;
- Where necessary, permits should be obtained from LEDET and DAFF to rescue and relocate or remove, cut or destroy any protected species before construction of infrastructure takes

place. Consequently, before any construction activities can occur a detailed walk down of the area must occur, during which all protected species should be marked; and

- The rehabilitation of the infrastructure during closure of the mine must take place in such a way as to ensure that the post closure land use objectives are met, i.e. a post-mining grazing capability class (current post-closure objective). In order to meet this objective, rehabilitation will need to be well-planned and a suitably qualified ecologist must form part of the management team through the entire life cycle of the project and to guide the rehabilitation and closure objectives of the mine.

The impact significance of the proposed mining plans associated with the loss of floral and faunal species and habitat is considered to be medium to high prior to the implementation of mitigation measures. Following the implementation of mitigation measures, it is feasible that several of the impacts can be decreased to lower levels of significance.

It is the opinion of the ecologists that this study provides the relevant information required in order to implement Integrated environmental management (IEM) and to ensure that the best long-term use of the resources on the subject property will be made in support of the principle of sustainable development.

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June 2019

Section A: Background Information

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DOCUMENT GUIDE

The Document Guide below is for reference to the procedural requirements for environmental authorisation applications in accordance to GN267 of 24 March 2017, as it pertains to NEMA.

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Appendix D
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Appendix D
b)	A declaration that the specialist is independent	Appendix D
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1.1
cA)	An indication of the quality and age of base data used for the specialist report	Section 2.1 and 3.1
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section B and C
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1.2 and 2.1
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section B and C
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Section B and C
g)	An identification of any areas to be avoided, including buffers	Section B and C
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section B and C
i)	A description of any assumptions made and any uncertainties or gaps in knowledge	Section 1.2
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Section B and C
k)	Any mitigation measures for inclusion in the EMPr	Section B and C
l)	Any conditions for inclusion in the environmental authorisation	Section B and C
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section B and C
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Section B and C
(iA)	Regarding the acceptability of the proposed activity or activities	Section B and C
(ii)	If the opinion is that the proposed activity, activities 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	Section B and C
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q)	Any other information requested by the competent authority	N/A

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GLOSSARY OF TERMS

Alien and Invasive species	A species that is not an indigenous species; or an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.
Biome	A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.
CBA (Critical Biodiversity Area)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges.
Endangered	Organisms in danger of extinction if causal factors continue to operate.
Endemic species	Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g. southern Africa), national (South Africa), provincial, regional or even within a particular mountain range.
ESA (Ecological Support Area)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
IBA (Important Bird and Biodiversity Area)	The IBA Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that: are globally threatened, have a restricted range, are restricted to specific biomes/vegetation types or sites that have significant populations.
Indigenous vegetation (as per the definition in (NEMA)	Vegetation occurring naturally within a defined area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Invasive species	Means any species whose establishment and spread outside of its natural distribution range; they threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species; and may result in economic or environmental harm or harm to human health
Least Threatened	Least threatened ecosystems are still largely intact.
RDL (Red Data listed) species	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
SCC (Species of Conservation Concern)	The term SCC in the context of this report refers to all RDL (Red Data) and IUCN (International Union for the Conservation of Nature) listed threatened species as well as protected species of relevance to the project.

LIST OF ACRONYMS

BGIS	Biodiversity Geographic Information Systems
CARA	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)
CBA	Critical Biodiversity Area
CR	Critically Endangered
EIA	Environmental Impact Assessment
EN	Endangered
ESA	Ecological Support Area
GIS	Geographic Information System
GPS	Global Positioning System
IBA	Important Bird Area
IUCN	International Union for the Conservation of Nature
LEMA	Limpopo Environmental Management Act, 2003 (Act 7 of 2003)
LoM	Life of Mine
MAP	Mean Annual Precipitation
MAPE	Mean Annual Potential for Evaporation
MASMS	Mean Annual Soil Moisture Stress
MAT	Mean Annual Temperature
MFD	Mean Frost Days
MPRDA	Minerals and Petroleum Resources Development Act, 2002 (Act 28 of 2002)
NBA	National Biodiversity Assessment (2011)
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NEMBA	National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004)
NPAES	National Protected Areas Expansion Strategy
NT	Near Threatened
PES	Present Ecological State
PRECIS	Pretoria Computer Information Systems
QDS	Quarter Degree Square (1:50,000 topographical mapping references)
RDL	Red Data List
SABAP 2	Southern African Bird Atlas 2
SANBI	South African National Biodiversity Institute
SAPAD	South Africa Protected Area Database
SCC	Species of Conservation Concern
STS	Scientific Terrestrial Services CC
TSP	Threatened Species Programme
VU	Vulnerable

1 INTRODUCTION

Scientific Terrestrial Services (STS) was appointed to conduct a faunal and floral ecological assessment as part of the Environmental Impact Assessment (EIA) process for the proposed Gruisfontein coal mine project within the Limpopo Province; henceforth referred to as the "study area" (Figure 1 - 2).

The study area extends over 1137 hectares (ha) and is located within the savanna biome in the Waterberg region, approximately 6 km southeast of the portion of the Limpopo River that forms the border between South Africa and Botswana. The Botswana border post is located roughly 17 km northeast of the study area, with the R510 (± 14.6 km northeast of the study area) the closest main road within the area. The study area is thus located in an isolated, natural area where the Matimba Power Station is the closest built-up development (± 24 km southeast of the study area), with Steenbokpan (± 20 km south of the study area) and Lephalale (± 46 km southeast of the study area) the closest towns.

The purpose of this report is to define the terrestrial ecology of the study area from a desktop conservation database perspective. It is the objective of this study to provide detailed information to guide the fieldwork components to ensure that all relevant ecological aspects were considered prior to performing the field assessments.

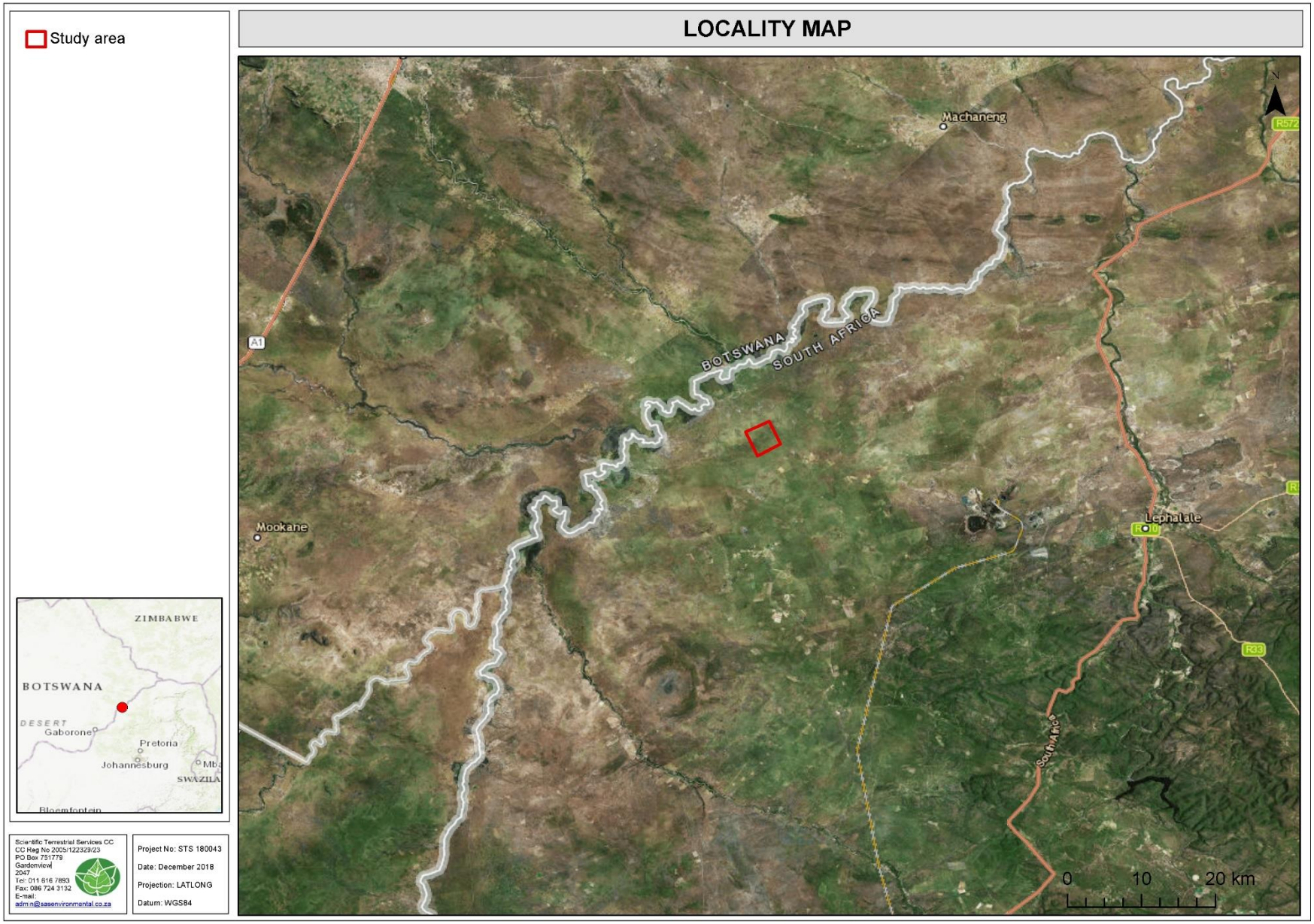

Figure 1: Digital satellite image depicting the study area in relation to surrounding areas.

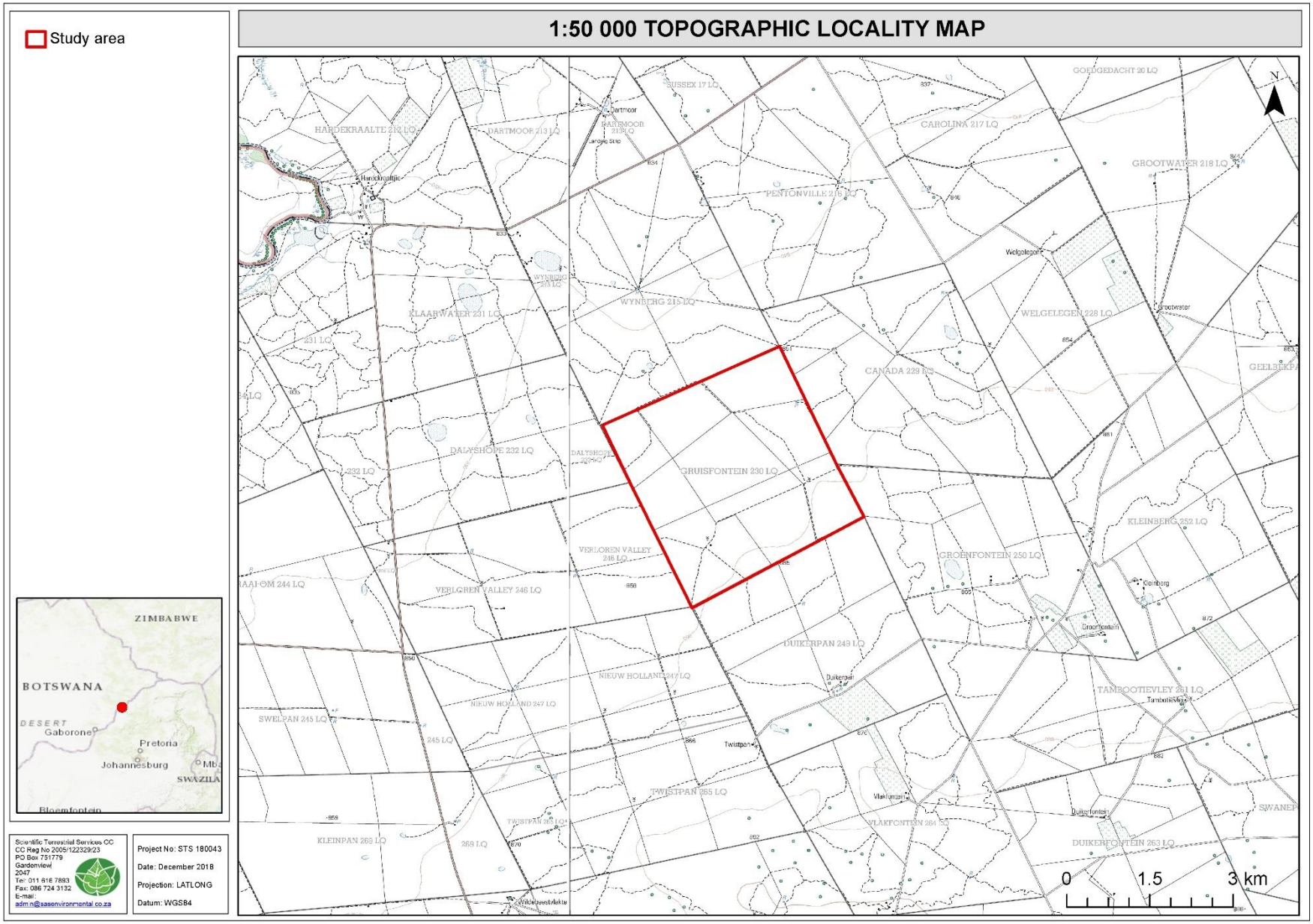

Figure 2: Location of the study area depicted on a 1:50 000 topographical map in relation to surrounding area.

1.1 *Project Description*

The proposed project is for an open cast coal mine on the farm Gruisfontein 230-LQ located on the Waterberg Coalfields (RSV ENCO, 2018), for which Nozala Coal (Pty) Ltd. holds a coal prospecting right. On the study area, all coal seams are covered by 30 – 100 m of overburden, with a faulted area identified within the southwestern corner (weathering has removed several coal zones). The Life of Mine (LoM) is scheduled to be 16 years. Figure 3 illustrates the proposed mine layout.

The proposed procedures and footprint of the project that will be implemented during the mining process include[1]:

- Removing and stockpiling of topsoil;
- Diversion of stormwater away from the Open Pit by means of trenches around the mining footprint area;
- Excavation of the initial strip of the box-cut;
- Stripping of topsoil and soft overburden from initial box-cut. This will be followed by the drilling, blasting and removal of hard overburden:
  - Topsoil, soft overburden dump and hard overburden dump will each be stockpiled separately.
  - Hard overburden dump, soft overburden dump and discard dump to be placed within the south-eastern section of the study area.
- Formation of the Open Pit through blasting and the excavation of coal (load and haul method). Proposed Open Pit will be within the western section of the study area, roughly centrally located;
- Construction of all mining-related infrastructure, including internal roads and facilities for on-site personnel (offices, training facilities, workshops, parking etc.). Proposed locality for most infrastructure to be within the southwestern corner of the study area, i.e. within the faulted area where coal extraction is not deemed feasible; and
- Preliminary Rehabilitation Plan: To rehabilitate the open pit and other disturbed areas to a post-mining grazing capability class. All stockpiled material (overburden, discard) will be utilised to backfill and rehabilitate the opencast area; no surface dumps will remain post-closure. Backfilling of the Open Pit over the 16-year LoM was not considered during the first phase of the concept study but will be considered within the second phase. Currently, it is foreseen that backfilling will only start after decommissioning of the mine.

[1] RSV ENCO (2018). CONCEPT STUDY GRUISFONTEIN PROJECT by RSV ENCO Consulting (Pty) Ltd. Project number: 02520004D-20-REP-0002

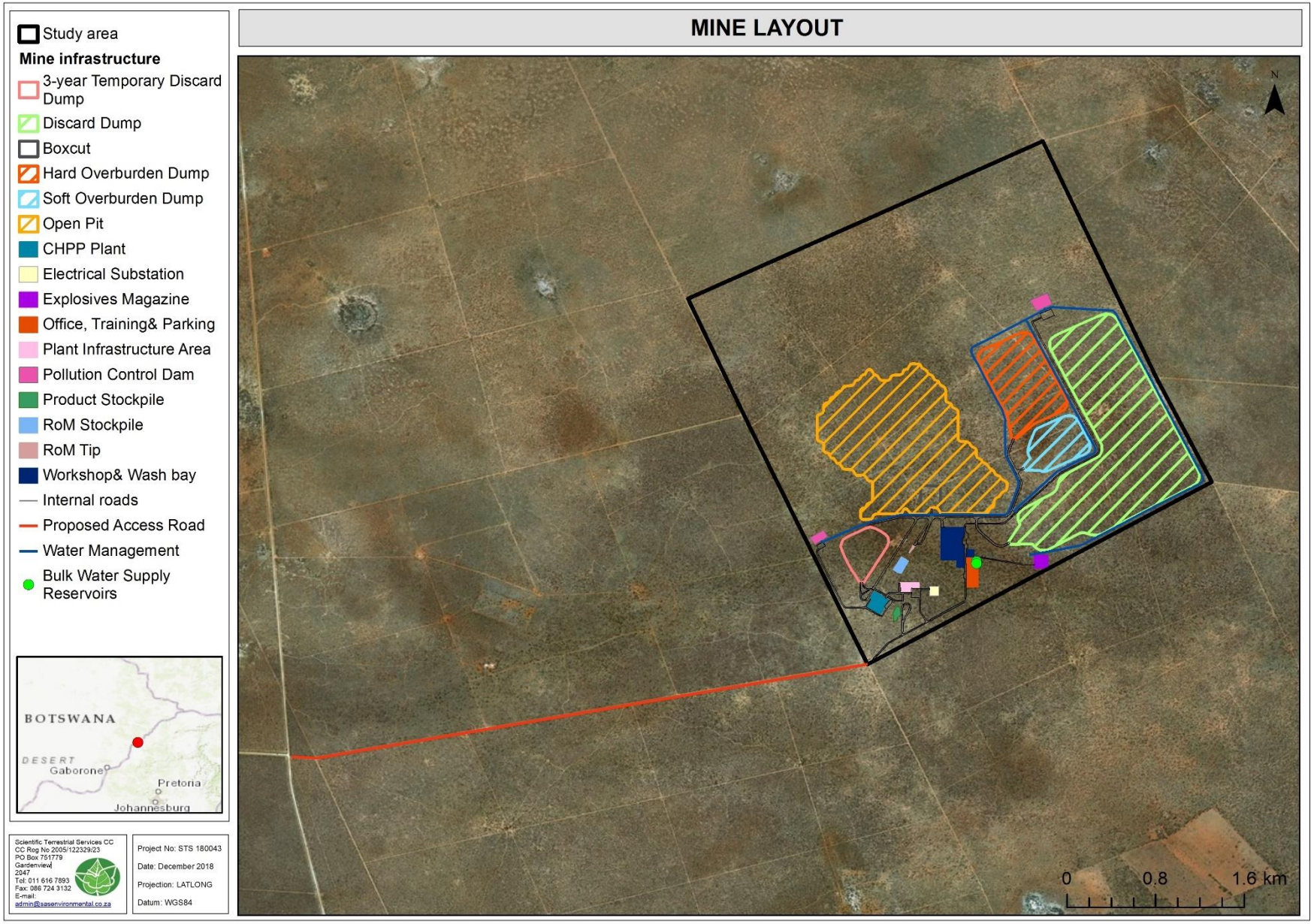

Figure 3: The proposed mine layout for the study area.

1.2 *Scope of Work*

Specific outcomes in terms of the report are as follows:

- Compile a desktop study with all relevant information as presented by South African National Biodiversity Institute's (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org), including the Limpopo Conservation Plan Version 2 (2013), to gain background information on the physical habitat and potential floral and faunal biodiversity associated with the study area.

1.3 *Assumptions and Limitations*

The following assumptions and limitations are applicable to this report:

- The terrestrial ecological desktop assessment is confined to the study area and does not include detailed results of the neighbouring and adjacent properties; although the sensitivity of surrounding areas is included on the respective maps;
- It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics within the study area at the scale required to inform the Environmental Impact Assessment (EIA) process. However, this information is considered to be useful as background information to the study and, based on the desktop results, sufficient decision making can take place with regards to the development activities; and
- A single field assessment was undertaken from the 22nd to the 23rd of January 2019 (Summer season), to determine the ecological status of the study area, and to "ground-truth" the results of the desktop assessment.

1.4 *Legislative Requirements*

The following legislative requirements were considered during the assessment:

- National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA);
- National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) (NEMBA);
- Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA);
- Minerals and Petroleum Resources Development Act, 2002 (Act 28 of 2002) (MPRDA);
- The National Forest Act, 1998 (Act 84 of 1998, as amended in September 2011) (NFA); and
- Limpopo Environmental Management Act, 2003 (Act 7 of 2003) (LEMA);

The details of each of the above, as they pertain to this study, are provided in Appendix B of this report.

2 ASSESSMENT APPROACH

2.1 *General Approach*

In order to accurately determine the Present Ecological State (PES) of the study area and capture comprehensive data with respect to faunal and floral taxa, the following methodology was used:

- Maps and digital satellite images were consulted prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. An initial visual on-site assessment of the study area was made in order to confirm the assumptions made during the consultation of the maps; and
- Relevant databases considered during the assessment of the study area included the South African National Biodiversity Institute (SANBI) Threatened Species Programme (TSP), the Limpopo Conservation Plan version 2 (2013), Mucina and Rutherford (2012), National Biodiversity Assessment (2011), Important Bird Areas in conjunction with the South African Bird Atlas Project (SABAP 2) (2015), International Union for Conservation of Nature (IUCN), and Pretoria National Herbarium Computer Information Systems (PRECIS).

3 RESULTS OF THE DESKTOP ANALYSIS

3.1 *Conservation Characteristics of the Study Area based on National and Provincial Datasets*

The following section contains data accessed as part of the desktop assessment and are presented as a “dashboard” report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible in order to allow for improved assimilation of results by the reader to take place. Where required, further discussion and interpretation are provided.

Table 1: Summary of the terrestrial conservation characteristics for the study area (QDS 2327CA & 2327CB).

DETAILS OF THE STUDY AREA IN TERMS OF MUCINA & RUTHERFORD (2012)	
Biome	The study area is situated within the **Savanna Biome.**
Bioregion	The study area is located within the **Central Bushveld Bioregion.**
Vegetation type	The study area is situated within the **Limpopo Sweet Bushveld.**
CONSERVATION DETAILS PERTAINING TO THE STUDY AREA (VARIOUS DATABASES)	
NBA (2011)	The study area falls within an area that is currently **poorly protected**. Ecosystem types are categorised as "not protected", "poorly protected", "moderately protected" and "well protected" based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act, 2003 (Act 57 of 2003), and compared with the biodiversity target for that ecosystem type. Poorly protected areas are areas where < 50% of the biodiversity target protection level is met within protected areas as per the Protected Areas Act.
National Ecosystem Threat Status (2011)	According to the National Threatened Ecosystems (2011) database, the study area falls within an area that is of **least concern**.
IBA (2015)	There is no Important Bird and Biodiversity Areas (IBA) located within 10 km of the study area.
NPAES (2009); SACAD (2018); SAPAD (2018) (Figure 4)	The South Africa Protected Areas Database (SAPAD, 2018) indicates four Private Nature Reserves (PNR) within 10 km of the study area. The Jacobs PNR is located ± 0.56 km to the north of the study area with the Emaria PNR ± 3.1 km northeast, the Jancornel PNR ± 4 km north and the Jee Lee PNR ± 9.2 km northeast of the study area. No other conservation or protected areas are located within 10 km of the study area according to the various databases assessed.
LIMPOPO CONSERVATION PLAN VERSION 2 (C-PLAN, 2013) (FIGURE 5)	
According to the Limpopo Conservation Plan v.2, the study area does not fall within any Protected Areas, Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs). However, the northern boundary of the study area borders a CBA 1 with additional small, isolated areas surrounding the study area considered to be ESAs 1. CBA 1 areas are considered to be irreplaceable areas that are required to meet biodiversity pattern and/or ecological processes targets. No alternative sites are otherwise available to meet such targets. An ESA 1 include natural, near natural and degraded areas supporting CBA's by maintaining ecological processes.	
Other Natural Areas	The entire study area falls within an area considered to be **natural**. These are natural and intact areas but are not required to meet targets, nor have they been identified as Critical Biodiversity Areas or Ecological Support Areas.
Faunal ecology	According to the Limpopo Conservation Plan v.2, the study area falls within a location that provides special habitat for cheetah populations. (Figure 6)

DESCRIPTION OF THE VEGETATION TYPE(S) RELEVANT TO THE STUDY AREA ACCORDING TO MUCINA & RUTHERFORD (2012)					
Vegetation Type	**Limpopo Sweet Bushveld (SVcb 19)**				
Climate	Summer rainfall with very dry winters including the shoulder months of May and September. **Remark**: Though limited by low rainfall, this is a good area for game and cattle farming due to the high grazing capacity of sweet veld.				
	MAP* (mm)	**MAT* (°C)**	**MFD* (Days)**	**MAPE* (mm)**	**MASMS* (%)**
	421	20.2	9	2422	82
Altitude (m)	700–1 000 m.				
Distribution	Limpopo Province: Extends from the lower reaches of the Crocodile and Marico Rivers around Makoppa and Derdepoort, respectively, down the Limpopo River Valley including Lephalale and into the tropics past Tom Burke to the Usutu border post and Taaiboschgroet area in the north. The unit also occurs on the Botswana side of the border.				
Conservation	**Least threatened**. Target 19%. Less than 1% statutorily conserved and limited to reserves straddling the southeastern limits of the unit, for example, the D'Nyala Nature Reserve. Very little conserved in other reserves. About 5% transformed, mainly by cultivation. Erosion is low to high.				
Geology & Soils	The northern half of the area is dominated by gneisses, metasediments and metavolcanics of the Malala Drift Group, Beit Bridge Complex (Swazian Erathem), basalts of the Letaba Formation (Lebombo Group of the Karoo Supergroup) are also found in the northeast. Sandstone, siltstone and mudstone of the Clarens Formation (Karoo Supergroup), as well as of the Matlabas Subgroup (Mokolian Waterberg Group) are found to the south and west. Soils with calcrete and surface limestone layers, brownish sandy (Clovelly soil form) clayey-loamy soils (Hutton soil form) on the plains and low-lying areas, with shallow, gravelly, sandy soils on the slightly undulating areas, localised areas of black clayey soils (Valsrivier or Arcadia soil forms) and Kalahari sand. Land types mainly Ae, Ah and Fc.				
Vegetation & landscape features (Dominant Floral Taxa in Appendix E)	Plains, sometimes undulating or irregular, traversed by several tributaries of the Limpopo River. Short open woodland; in disturbed areas thickets of *Senegalia erubescens, S. mellifera* and *Dichrostachys cinerea* are almost impenetrable.				
MINING AND BIODIVERSITY GUIDELINES (2013) (FIGURE 7)					
The Mining and Biodiversity Guidelines (2013) have not identified any areas of significance within the study area. There is, however, several small areas surrounding the study area that is of High Biodiversity Importance. An area considered to be of Highest Biodiversity Importance is located approximately 1.1 km northwest of the study area.					

CBA = Critical Biodiversity Area, ESA = Ecological Support Area, IBA = Important Bird and Biodiversity Area, MAP = Mean Annual Precipitation, MAT = Mean Annual Temperature, MFD = Mean Frost Days, MAPE = Mean Annual Potential for Evaporation, MASMS = Mean Annual Soil Moisture Stress, NBA = National Biodiversity Assessment, NPAES = National Protected Areas Expansion Strategy, SACAD = South African Conservation Areas Database, SAPAD = South African Protected Areas Database.

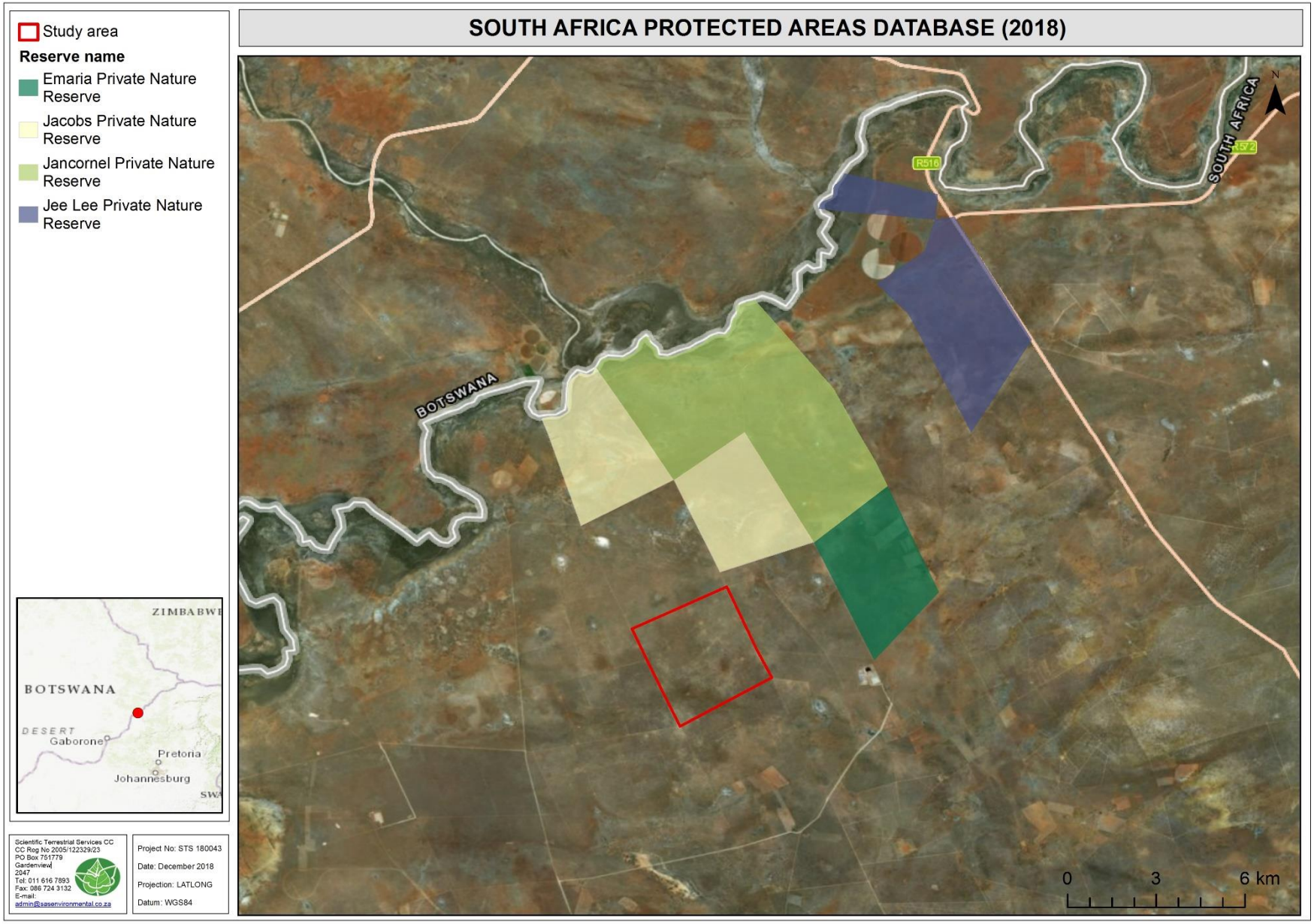

Figure 4: Protected and Conservation Areas in close proximity (within 10 km) of the study area (SAPAD, 2018 (Q3)).

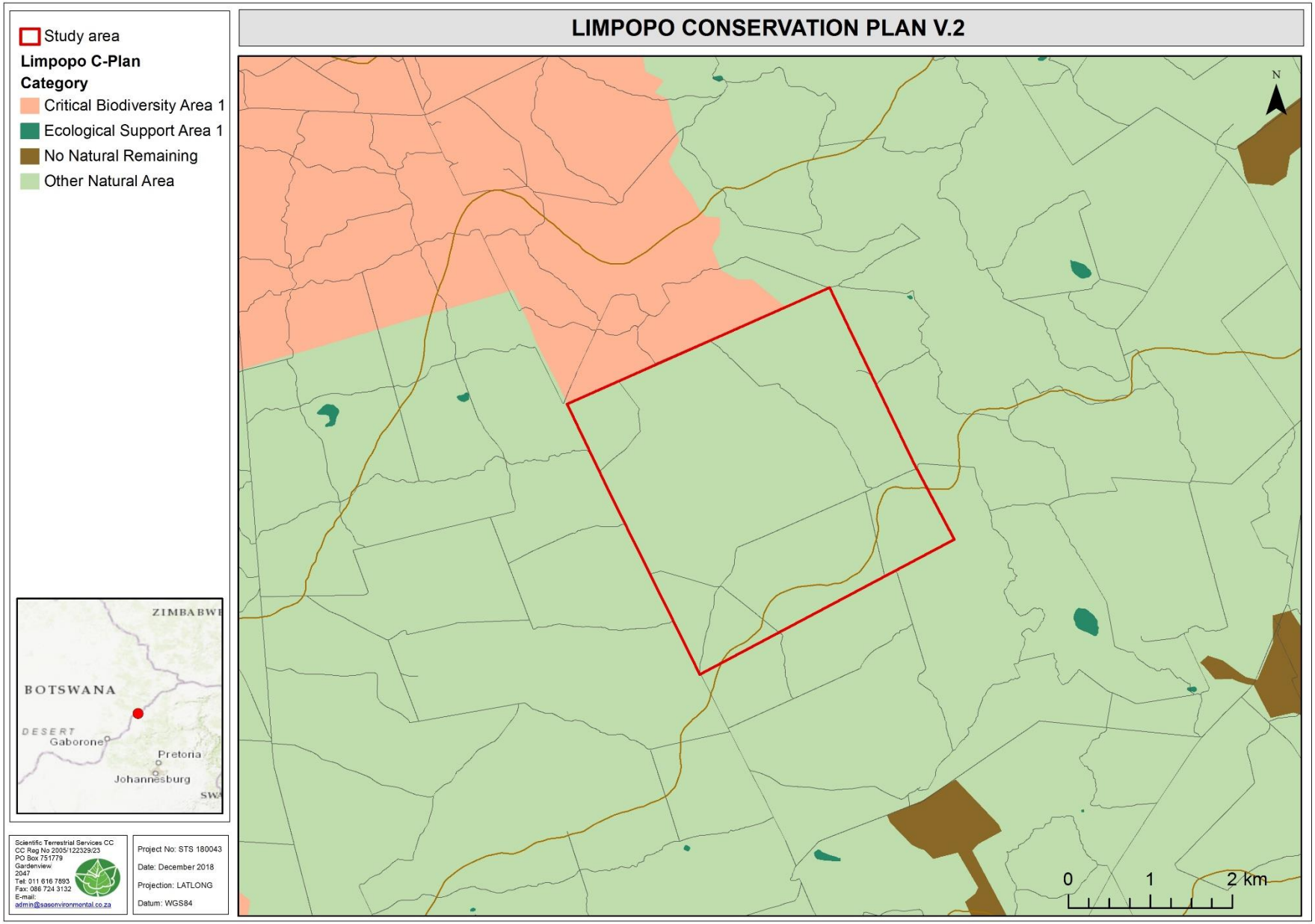

Figure 5: CBA 1, ESA 1 and natural areas associated with the study area according to the Limpopo Conservation Plan V2 (2013).

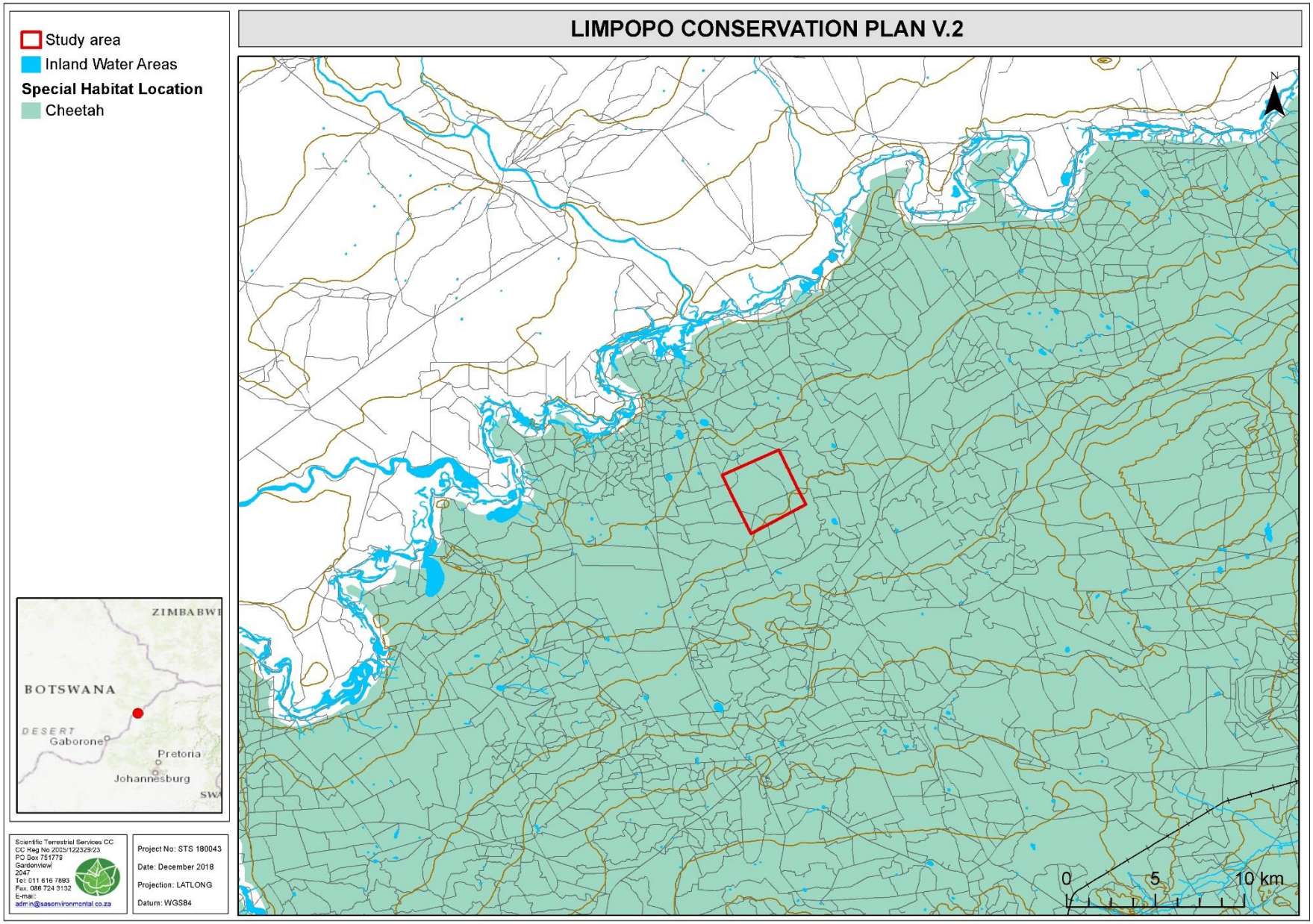

Figure 6: Special habitat for Cheetah species associated with the study area according to the Limpopo Conservation Plan V2 (2013).

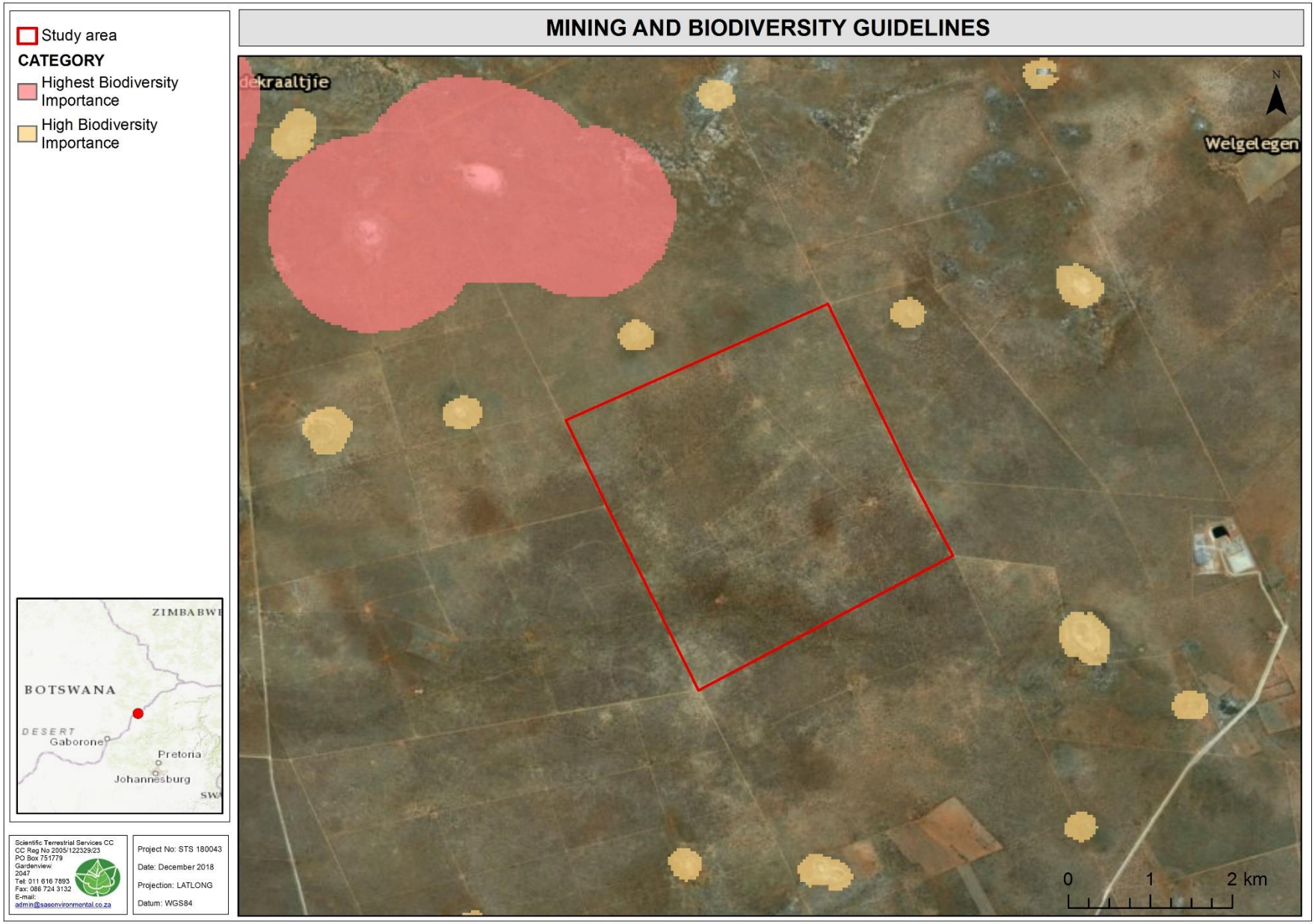

Figure 7: Importance of the study area according to the Mining and Biodiversity Guidelines (2013).

4 STRUCTURE OF THE REPORT

Section A of this report served to provide an introduction to the study area, as well as the general approach to the study. Section A also presents the results of general desktop information reviewed as part of the study including the information generated by the relevant authorities as well as the context of the site in relation to the surrounding anthropogenic activities and ecological character.

Section B addresses all the issues pertaining to the assessment of the floral ecology of the study area.

Section C addresses all the issues pertaining to the assessment of the faunal ecology of the study area.

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APPENDIX A: 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 STS 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.

Although STS CC exercises due care and diligence in rendering services and preparing documents, STS CC accepts no liability and the client, by receiving this document, indemnifies STS CC and its directors, managers, agents and employees against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by STS CC and by the use of the information contained in this document.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

APPENDIX B: LEGISLATIVE REQUIREMENTS

Constitution of the Republic of South Africa, 1996 (Act 108 of 1996)

The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive realisation of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.

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

The National Environmental Management Act (NEMA; Act 107 of 1998) and the associated Environmental Impact Assessment (EIA) Regulations (GN R982 of 2014) and well as listing notices 1, 2 and 3 (GN R983, R984 and R985 of 2014), state that prior to any development taking place which triggers any activity as listed within the abovementioned regulations, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment process or the EIA process depending on the nature of the activity and scale of the impact.

Minerals and Petroleum Resources Development Act, 2002 (Act 28 of 2002) (MPRDA)

The obtaining of a New Order Mining Right (NOMR) is governed by the MPRDA. The MPRDA requires the applicant to apply to the DMR for a NOMR which triggers a process of compliance with the various applicable sections of the MPRDA. The NOMR process requires environmental authorisation in terms of the MPRDA Regulations and specifically requires the preparation of a Scoping Report, an Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP), and a Public Participation Process (PPP).

National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004) (NEMBA)

The objectives of this act are (within the framework of NEMA) to provide for:

- The management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity;
- The use of indigenous biological resources in a sustainable manner;
- The fair and equitable sharing among stakeholders of the benefits arising from bio prospecting involving indigenous biological resources;
- To give effect to ratify international agreements relating to biodiversity which are binding to the Republic;
- To provide for cooperative governance in biodiversity management and conservation; and
- To provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of the surrounding areas are not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of the benefits arising from indigenous biological resources. Furthermore, a person may not carry out a restricted activity involving either:

a) A specimen of a listed threatened or protected species;
b) Specimens of an alien species; or
c) A specimen of a listed invasive species without a permit.

National Environmental Management Biodiversity Act (NEMBA) (Alien and Invasive Species Regulations, Notice number 864 of 29 July 2017 in Government Gazette 40166)

NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. In terms of alien and invasive species. This act in terms of alien and invasive species aims to:

- Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur,
- Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and
- Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats.

Alien species are defined, in terms of the National Environmental Management: Biodiversity Act, 2004 (Act no 10 of 2004) as:

(a) A species that is not an indigenous species; or
(b) An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.

Categories according to NEMBA (Alien and Invasive Species Regulations, 2017):

- **Category 1a:** Invasive species that require compulsory control;
- **Category 1b:** Invasive species that require control by means of an invasive species management programme;
- **Category 2:** Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread; and
- **Category 3:** Ornamentally used plants that may no longer be planted.

Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA)

Removal of the alien and weed species encountered in the application area must take place in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998). Removal of species should take place throughout the construction and operation, phases.

Limpopo Environmental Management Act, 2003 (Act 7 of 2003) (LEMA)

The objectives of this Act are:

- to manage and protect the environment in the Province;
- to secure ecologically sustainable development and responsible use of natural resources in the Province;
- generally, to contribute to the progressive realisation of the fundamental rights contained in section 24 of the Constitution of the Republic of South Africa Act, 1996 (Act No. 108 of 1996), and
- to give effect to international agreements effecting environmental management which are binding on the Province.

This Act must be interpreted and applied in accordance with the national environmental management principles set out in Section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

The National Forest Act, 1998 (Act 84 of 1998, as amended in September 2011) (NFA)

Principles to guide decisions affecting forestry resources applicable to land development management are contained in the following principle:

Principle 3
3) The principles are that—
(a) natural forests must not be destroyed save in exceptional circumstances where, in the opinion of the Minister, a proposed new land use is preferable in terms of its economic, social or environmental benefits;

(b) a minimum area of each woodland type should be conserved, and forests must be developed and managed to -
(i) conserve biological diversity, ecosystems and habitats;
(ii) sustain the potential yield of their economic, social and environmental benefits.
This section of the Act alludes to the fact that the conservation status of all vegetation types needs to be considered when any development is taking place to ensure that the adequate conservation of all vegetation types is ensured.

Principle 6
(6) Criteria and indicators may include but are not limited to, those for determining—
the level of maintenance and development of—
(i) forest resources:
(ii) biological diversity in forests:
(iii) the health and vitality of forests:
(iv) the productive functions of forests:
(v) the protective and environmental functions of forests; and
(vi) the social functions of forests.

Applicable sections
Section 12: Declaration of trees as protected
(1) The Minister may declare-
a) particular tree,
b) a particular group of trees,
c) a particular woodland; or
d) trees belonging to a particular species,
to be a protected tree, group of trees, woodland or species.
(2) The Minister may make such a declaration only if he or she is of the opinion that the tree, group of trees, woodland or species is not already adequately protected in terms of other legislation.
(3) In exercising a discretion in terms of this section, the Minister must consider the principles set out in section 3(3) of the NFA.

Section 15(1):
No person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence granted by the Minister or in terms of an exemption from the provisions of this subsection published by the Minister in the Gazette.
Contravention of this declaration is regarded as a first category offence that may result in a person who is found guilty of being sentenced to a fine or imprisonment for a period up to three years, or both a fine and imprisonment.

APPENDIX C: VEGETATION TYPE

SVcb 19 Limpopo Sweet Bushveld

Figure C1: SVcb 19 Limpopo Sweet Bushveld: Open bushveld dominated by S*enegalia senegal* at 740 m on the Farm Kwarel between Maasstroom and Alldays (Limpopo Province). Mucina and Rutherford (2006) page 474.

Dominant and typical floristic species of Limpopo Sweet Bushveld (Mucina & Rutherford, 2006). The table contains the important taxa associated with the vegetation type.

Woody Layer	
Tall Trees	*Vachellia robusta (d), Senegalia burkei.*
Small Trees	*Albizia anthelmintica (d), Boscia albitrunca (d), Combretum apiculatum (d), Senegalia erubescens (d), Senegalia cinerea (d), Senegalia senegal* var. *rostrata (d), Vachellia nilotica (d), Terminalia sericea.*
Tall Shrubs	*Catophractes alexandri (d), Dichrostachys cinerea (d), Phaeoptilum spinosum (d), Rhigozum obovatum (d), Cadaba aphylla, Combretum hereroense, Commiphora pyracanthoides, Ehretia rigida* subsp. *rigida, Euclea undulata, Grewia flava, Gymnosporia senegalensis.*
Low Shrubs	*Vachellia tenuispina (d), Commiphora africana, Felicia muricata, Gossypium herbaceum* subsp. *africanum, Leucosphaera bainesii.*
Forb layer	
Herbs	*Acanthosicyos naudinianus, Commelina benghalensis, Harpagophytum procumbens* subsp. *transvaalense, Hemizygia elliottii, Hermbstaedtia odorata, Indigofera daleoides.*
Succulent Herbs	*Kleinia fulgens, Plectranthus neochilus.*
Grass layer	
Graminoids	*Digitaria eriantha* subsp. *eriantha (d), Enneapogon cenchroides (d), Eragrostis lehmanniana (d), Panicum coloratum (d), Schmidtia pappophoroides (d), Aristida congesta, Cymbopogon nardus, Eragrostis pallens, E. rigidior, E. trichophora, Ischaemum afrum, Panicum maximum, Setaria verticillata, Stipagrostis uniplumis, Urochloa mosambicensis.*
Biogeographically Important Taxon (Central Bushveld endemic)	
Succulent Herb	*Piaranthus atrosanguineus.*

(d) = dominant species

(The genus for all *Senegalia* and *Vachellia* spp. were formerly *Acacia*)

APPENDIX D: DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

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

Stephen van Staden	MSc Environmental Management (University of Johannesburg)
Nelanie Cloete	MSc Botany and Environmental Management (University of Johannesburg)
Kim Dalhuijsen	BSc (Hons) Zoology (Herpetology) (University of the Witwatersrand)
Christopher Hooton	BTech Nature Conservation (Tshwane University of Technology)
Christien Steyn	MSc Plant Science (University of Pretoria)

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

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Nelanie Cloete		
Postal address:	PO. Box 751779, Gardenview		
Postal code:	2047	Cell:	084 311 4878
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	Nelanie@sasenvgroup.co.za		
Qualifications	MSc Environmental Management (University of Johannesburg) MSc Botany (University of Johannesburg) BSc (Hons) Botany (University of Johannesburg) BSc (Botany and Zoology) (Rand Afrikaans University)		
Registration / Associations	Professional member of the South African Council for Natural Scientific Professions (SACNASP) Member of the South African Association of Botanists (SAAB) Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa group Member of the Grassland Society of South Africa (GSSA)		

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
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Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Chris Hooton		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
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E-mail:	Chris@sasenvgroup.co.za		
Qualifications	BTech Nature Conservation (Tshwane University of Technology) National Diploma Nature Conservation (Tshwane University of Technology)		
Registration / Associations	N/A		

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E-mail:	christien@sasenvgroup.co.za		
Qualifications	BSc (Hons) Plant Science (Invasion Biology) (University of Pretoria) BSc (Hons) Plant Science (Invasion Biology) (University of Pretoria) BSc Environmental Science (University of Pretoria)		
Registration / Associations	N/A		

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Kim Marais		
Postal address:	221 Riverside Lofts, Tygerfalls Boulevard, Bellville,		
Postal code:	7530	Cell:	071 413 2245
Telephone:	011 616 7893	Fax:	086 724 3132
E-mail:	kim@sasenvgroup.co.za		
Qualifications	BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP) Member of the South African Wetland Forum		

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

I, Christopher Hooton, declare that -

- I act as the **independent specialist** in this application;
- I will perform 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 may compromise 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 will comply with the applicable legislation;
- I have not, and will 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 to be prepared by myself for submission to the competent authority;
  All the particulars furnished by me in this form are true and correct

Signature of the Specialist

I, Christien Steyn, declare that -

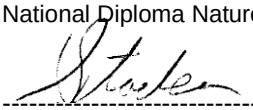
- I act as the **independent specialist** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity 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 will comply with the applicable legislation;
- I have not, and will 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 to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

Signature of the Specialist

I, Stephen van Staden, declare that -

- I act as the **independent specialist (reviewer)** in this application;
- I will perform 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 may compromise 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 will comply with the applicable legislation;
- I have not, and will 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 to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

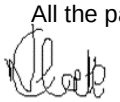
National Diploma Nature Conservation (Tshwane University of Technology)



Signature of the Specialist

I, Nelanie Cloete, declare that -

- I act as the **independent specialist (reviewer)** in this application;
- I will perform 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 may compromise 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 will comply with the applicable legislation;
- I have not, and will 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 to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

I, Kim Dalhuijsen, declare that -

- I act as the **independent specialist (reviewer)** in this application;
- I will perform 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 may compromise 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 will comply with the applicable legislation;
- I have not, and will 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 to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

Signature of the Specialist

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTOPHER HOOTON

PERSONAL DETAILS

Position in Company	Ecologist
Date of Birth	24 June 1986
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2013

EDUCATION

Qualifications

BTech Nature Conservation (Tshwane University of Technology)	2013
National Diploma Nature Conservation (Tshwane University of Technology)	2008

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Eastern Cape, Western Cape, Northern Cape, Freestate
Zimbabwe

SELECTED PROJECT EXAMPLES

Faunal Assessments

- Faunal assessment as part of the environmental assessment and authorisation process for the proposed Mzimvubu Water Project, Eastern Cape.
- Faunal assessment as part of the environmental assessment and authorisation process for the proposed Setlagole Mall Development, North West.
- Faunal assessment as part of the environmental assessment and authorisation process for the proposed Expansion and Upgrade of the Springlake Railway Siding, Hattingspruit, Kwa-Zulu Natal.
- Faunal assessment as part of the environmental assessment and authorisation process for the proposed Styldrift tailings storage facility, return water dams, topsoil stockpile and other associated infrastructure, North West.
- Faunal assessment as part of the environmental assessment and authorisation process for the development of a proposed abalone farm, Brand se Baai, Western Cape.
- Faunal assessment as part of the environmental assessment and authorisation process for the development of a proposed abalone farm, Doringbaai, Western Cape.
- Vegetation composition and subsequent loss of carrying capacity for the Rand Water B19 and VG Residue Pipeline Project, Freestate.
- Faunal assessment as part of the environmental assessment and authorisation process for the Evander Shaft 6 Plant Upgrade, New Tailings Dam Area and Associated Tailings Delivery and Return Water Pipeline, Evander, Mpumalanga.

Previous Work Experience

- Spotted Hyaena Research Project, Phinda Private Game Reserve, KwaZulu Natal.
- Camera Trap Survey as part of the Munyawana Leopard Project, Mkuze Game Reserve, KwaZulu Natal.
- Lowveld Wild Dog Project, Savé Valley Conservancy, Zimbabwe.
- Lion collaring and Tracking as part lion management program, Savé Valley Conservancy, Zimbabwe.
- Junior Nature Conservator, Gauteng Department of Rural Development and Land Reform.

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION
CURRICULUM VITAE OF CHRISTIEN STEYN

PERSONAL DETAILS

Position in Company	Junior Field Biologist
Joined SAS	2018
Date of Birth	20 September 1991
Nationality	South African
Languages	English, Afrikaans
Other Business	NA

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Association of Botanists (SAAB)

EDUCATION

Qualifications

MSc (Plant Science) (University of Pretoria)	2017
BSc (Hons) Plant Science (Invasion Biology) (University of Pretoria)	2014
BSc Environmental Science (University of Pretoria)	2013

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Limpopo, Free State, Mpumalanga, Northern Cape

PROJECTS WORKED ON

Specialist studies

- Ecological status quo determination and ecological input into the design masterplan for the proposed development of Rosslyn x 60 in Rosslyn, Gauteng province.
- Terrestrial Ecological Habitat Integrity Assessment as part of the Environmental Impact Assessment and Authorisation process for the proposed development of Northam ext 20, Northam, Limpopo Province.
- Terrestrial Rehabilitation Plan and an Alien and Invasive Plant Management Plan for the demolition of the unauthorised boardwalk and pathways in Klipriviersberg Nature Reserve.
- Faunal and floral ecological scan as part of the environmental impact assessment process for the proposed development of a cellular mast in Witpoort Beaulieu North, Centurion, Gauteng Province.
- An investigation into the ecological status quo of Portion 9 of the Farm Grootfontein 394-JR in Pretoria, Gauteng.
- Terrestrial ecological assessment as part of the environmental assessment and authorisation process of the proposed development situated on the Remaining Extent of Portion 154 of the farm Diepsloot 388, JR.
- Opinion and compilation of memorandum for a student accommodation construction of four storey buildings, located at 455 Frederick Street, Pretoria West, Gauteng.

Background Information, Mapping and Desktop Studies

- Freshwater and Terrestrial Ecological Assessment as part of the Emp Amendment / Water Use License Application for the Bokone Mine Operations near Brits, North West Province.
- Baseline Biodiversity Assessment as part of the Environmental Impact Assessment process for the Mining Right Application for the proposed Goose Bay Project near Parys, Free State Province.
- Baseline Scoping Report as part of the Environmental Impact Assessment process for the Mining Right for Opencast and Underground mining of gold for the Soweto Cluster West Wits Project, north of Soweto, Gauteng Province.
- Terrestrial ecological sensitivity scan as part of the Basic Assessment (BA) Application for the upgrade or supplement of the existing bulk water supply scheme in Bedfordview, Gauteng Province.

- Ecological status quo determination and ecological input into the design masterplan for the proposed sewer pipeline Zithobeni Heights, Bronkhorstspruit, Gauteng Province.
- Terrestrial ecological assessment as part of the environmental assessment and authorisation process for the proposed Elsburgspruit pedestrian bridges and footpaths project, located in the Gauteng province.

Previous Work Experience

- Alien and invasive plant species surveying and collection for the measurement of their plant functional traits on Marion Island (April/May of 2015 & 2016) as part of the scientific research publication:
  - Greve, M., R. Mathakutha, C. Steyn, and S. L. Chown. 2017. Terrestrial invasions on sub-Antarctic Marion and Prince Edward Islands. Bothalia, v.47, n.2, p.21. Available at: https://abcjournal.org/index.php/abc/article/view/2143
- Alien plant species monitoring along the Sani Pass in January 2013/2014, as part of the research publication:
  - C. Steyn, M. Greve, M.P. Robertson, J.M. Kalwij, P.C. le Roux 2016. Alien plant species that invade high elevations are generalists: support for the directional ecological filtering hypothesis. J Veg Sci, 28: 337–346. Available at: http://onlinelibrary.wiley.com/doi/10.1111/jvs.12477/abstract; and
  - J.M. Kalwij, C. Steyn, P.C. le Roux 2014. Repeated monitoring as an effective early detection means: first records of naturalised *Solidago gigantea* Aiton (Asteraceae) in southern Africa. South African Journal of Botany. Available at: https://www.sciencedirect.com/science/article/pii/S025462991400088X

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION
CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Managing member, Ecologist, Aquatic Ecologist
Date of Birth	13 July 1979
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2003 (year of establishment)
Other Business	Trustee of the Serenity Property Trust

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of IAIA South Africa

EDUCATION

Qualifications

MSc (Environmental Management) (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000
Tools for wetland Assessment short course Rhodes University	2016

COUNTRIES OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

PROJECT EXPERIENCE (Over 2500 projects executed with varying degrees of involvement)

1 Mining: Coal, Chrome, PGM's, Mineral Sands, Gold, Phosphate, river sand, clay, fluorspar
2 Linear developments
3 Energy Transmission, telecommunication, pipelines, roads
4 Minerals beneficiation
5 Renewable energy (wind and solar)
6 Commercial development
7 Residential development
8 Agriculture
9 Industrial/chemical

REFERENCES

- Terry Calmeyer (Former Chairperson of IAIA SA)
  Director: ILISO Consulting Environmental Management (Pty) Ltd
  Tel: +27 (0) 11 465 2163
  Email: terryc@icem.co.za
- Alex Pheiffer
  African Environmental Management Operations Manager
  SLR Consulting
  Tel: +27 11 467 0945
  Email: apheiffer@slrconsulting.com
- Marietjie Eksteen
  Managing Director: Jacana Environmental
  Tel: 015 291 4015

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION
CURRICULUM VITAE OF NELANIE CLOETE

PERSONAL DETAILS

Position in Company	Senior Scientist Botanical Science and Terrestrial Ecology
Date of Birth	6 June 1983
Nationality	South African
Languages	English, Afrikaans

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP)
Member of the South African Association of Botanists (SAAB)
Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa group
Member of the Grassland Society of South Africa (GSSA)
Member of the Botanical Society of South Africa (BotSoc)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2013
MSc Botany (University of Johannesburg)	2007
BSc (Hons) Botany (University of Johannesburg)	2005
BSc (Botany and Zoology) (Rand Afrikaans University)	2004

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Eastern Cape, Free State
Africa - Democratic Republic of the Congo (DRC)

SELECTED PROJECT EXAMPLES

Floral Assessments

- Floral assessment as part of the environmental assessment and authorisation process for the proposed Mzimvubu water project at Maclear, Eastern Cape.
- Floral assessment as part of the environmental authorisation process for the proposed Assmang Iron Ore Black Rock, Northern Cape Province.
- Floral assessment as part of the environmental authorisation process for the proposed Bloemwater Knellpoort water project pipeline assessment, Free State Province.
- Terrestrial ecological scan as part of the environmental authorisation process for the proposed Sappi Pipeline, Gauteng.
- Floral assessment as part of the proposed Setlagole Mall development, North West Province.
- Floral assessment as part of the coastal habitat changes in the Brand-se Baai area, Western Cape.

Environmental and Ecological Management Plans

- Biodiversity Action plans for African Exploration, Mining and Finance Corporation in line with the NEMBA requirements.
- Biodiversity Action plans for Twickenham Platinum mining operations in line with the NEMBA requirements, Limpopo Province.
- Biodiversity Action plans for Bokoni Platinum mining operations in line with the NEMBA requirements, Limpopo Province.
- Maintenance and Management Plan for the Gamagara River, Northern Cape.

- Development of the Limpopo Province Environmental Outlook Report.

Permit applications for protected tree and floral species

- Permit application for the removal and propagation of protected tree species for the Open Cast Operations within Bokoni Platinum Mine in the Limpopo Province.
- Permit application for the removal of protected tree species for Modikwa Mine within the Limpopo Province.
- Permit application for the removal of protected tree species for the Umfolozi Power line within the Kwa-Zulu Natal Province.
- Permit application for the removal of protected tree species for the expansion activities at Black Rock Mining Operations, Northern Cape Province.
- Permit application for the removal of protected tree species for the expansion activities at Assmang Dwars Rivier Mine, Limpopo Province.

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION
CURRICULUM VITAE OF KIM DALHUIJSEN

PERSONAL DETAILS

Position in Company	Consultant
Date of Birth	28 February 1989
Nationality	The Netherlands
Languages	English, Afrikaans
Joined SAS	2015 - Present

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered member of the South African Affiliation of the International Association of Impact Assessment (IAIAsa)

EDUCATION

Qualifications

Certificate in Environmental Law for Environmental Managers (CEM)	2014
Certificate for Introduction to Environmental Management (CEM)	2013
BSc (Hons) Zoology (Herpetology) (University of the Witwatersrand)	2012
BSc (Zoology and Environment, Ecology and Conservation) (University of Witwatersrand)	2011

COUNTRIES OF WORK EXPERIENCE

South Africa – All Provinces
West Africa – Uganda

PREVIOUS EMPLOYMENT

Position	Junior Environmental Scientist
Company	ILISO Consulting (Pty) Ltd
Employment	2013 - 2015

SELECTED PROJECT EXAMPLES

Wetland delineation and wetland function assessment

- Wetland Assessment for the sewage Bulk Service System for the Val de Vie development, Paarl, Western Cape.
- Wetland Assessment for the Riverfarm Development for the Val de Vie development, Paarl, Western Cape
- Wetland Assessment for the development of three agricultural dams for irrigation of crops, Cape Farms, Western Cape.
- Wetland Assessment for the Willow Wood Estate Sewage pipeline upgrade, D'Urbanvale, Western Cape
- Wetland Assessment for the rectification of infilling of a freshwater feature, D'Urbanvale, Western Cape.
- Freshwater Assessment for the stabilisation of the Franschhoek River embankment, Leeu Estates, Franschhoek, Western Cape.

Water Use Authorisations

- WUA for the SANRAL N3 De Beers Pass Section within the Free State and KwaZulu-Natal.
- Assistance with the WULA for the Mzimvubu Water Project, Eastern Cape.
- WUA for the Excelsior Wind Energy Farm and associated powerline infrastructure, Swellendam, Western Cape.
- WUA for the Golden Valley Phase II Wind Energy Facility, Eastern Cape.
- WUA for the sewage Bulk Service system for the Val de Vie Polo and Lifestyle Estate, Paarl, Western Cape.
- WUA for the Riverfarm Development for the Val de Vie Polo and Lifestyle Estate, Paarl, Western Cape.
- WUA for the Pearl Valley II development for the Val de Vie Polo and Lifestyle Estate, Paarl, Western Cape.
- WUA for the Levendal Village for the Val de Vie Polo and Lifestyle Estate, Paarl, Western Cape.
- WUA for a residential development, Klapmuts, Western Cape.

Public Participation and Environmental Impact Assessments

- Public Participation for the Environmental Impact Assessment for the Eskom Photovoltaic Plant at Arnot and Duvha Power Station.

- Eskom Hendrina to Gumeni sub-stations 400 kV Powerline. Co-ordination of Heritage and Ecological Assessment and updating the Construction and Operation Environmental Management Plan.
- Public Participation Team Leader for the Mzimvubu Dam Environmental Impact Assessment.
- Public Participation Process for Eskom Exemption from and Postponement of Air Emission Licence Applications.
- EIA for Eskom Vierfontien to Wawielpark 22 kV Transmission line refurbishing.
- Junior Environmental Scientist for the Hartbeespoort Waste Charge Discharge System.
- Public Participation Process for City of Tshwane's Bus Rapid Transit from Pretoria Station to Rainbow Junction.
- EIA for the Rwengaaju Model Village Irrigation Scheme in Kabarole District, Uganda.
- EIA for tte Water supply and Sanitation system in Moroto, Bugaddem Kacheri-Lokona, Nakapelimoru and Kotido, Uganda.
- EIA for the Farm Income Enhancement and Forestry Conservation Project: Irrigation Scheme for Katete, Kibimba and Mubuku II, Uganda.

FAUNAL AND FLORAL ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS FOR THE PROPOSED GRUISFONTEIN MINING PROJECT, LIMPOPO PROVINCE

Prepared for

Jacana Environmentals CC

June 2019

Section B: Floral Assessment

Prepared by: **Scientific Terrestrial Services**
Report author **C. Steyn**
Report Reviver **N. Cloete (Pr. Sci. Nat)**
Report Reference: **STS 180043**
Date: **June 2019**

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GLOSSARY OF TERMS

Alien and Invasive species	A species that is not an indigenous species; or an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention;
Biome	A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.
Biosphere Reserve	Areas identified either on terrestrial or marine ecosystems (or both) that are internationally recognized under the framework of UNESCO's Man and Biosphere (MAB) programme. Spatial zonation of a Biosphere Reserve: • **Core zone/s** - these are areas that must have a legal/long term protection status in terms of national laws; • **Buffer zone/s** – these areas usually surround or adjoin the core zones; and • **Transition zone** – is the area which contains diversity of sustainable activities.
CBA (Critical Biodiversity Area)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges.
Endangered	Organisms in danger of extinction if causal factors continue to operate.
Endemic species	Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g. southern Africa), national (South Africa), provincial, regional or even within a particular mountain range.
ESA (Ecological Support Area)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
Indigenous vegetation (as per the definition in (NEMA)	Vegetation occurring naturally within a defined area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Invasive species	Means any species whose establishment and spread outside of its natural distribution range; they threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species; and may result in economic or environmental harm or harm to human health
Least Threatened	Least threatened ecosystems are still largely intact.
RDL (Red Data listed) species	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.

ACRONYMS

AIP	Alien and Invasive Plants
BGIS	Biodiversity Geographic Information Systems
CR	Critically Endangered
DAFF	Department: Agriculture, Forestry and Fisheries
EAP	Environmental Assessment Practitioner
EIS	Ecological Importance and Sensitivity
EN	Endangered
EW	Extinct in the Wild
GIS	Geographic Information System
GPS	Global Positioning System
Ha	Hectare
IEM	Integrated Environmental Management
IUCN	International Union for Conservation of Nature and Natural Resources
LEDET	Limpopo Department of Economic Development and Tourism
LEMA	Limpopo Environmental Management Act
MRA	Mining Right area
NFA	National Forest Act
NT	Near Threatened
P	Protected
PES	Present Ecological State
POC	Probability of Occurrence
PRECIS	Pretoria Computerised Information System
QDS	Quarter Degree Square
RDL	Red Data Listed
RE	Regionally Extinct
SANBI	South Africa National Biodiversity Institute
SP	Specially Protected
STS	Scientific Terrestrial Services
SCC	Species of Conservation Concern
TOPS	Threatened or Protected Species
VBR	Vhembe Biosphere Reserve
VU	Vulnerable

DOCUMENT GUIDE

The Document Guide below is for reference to the procedural requirements for environmental authorisation applications in accordance to Government Notice (GN) 267 of 24 March 2017, as it pertains to National Environmental Management Act, 1998 (Act 107 of 1998).

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Section A: Appendix D
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Section A: Appendix D
b)	A declaration that the specialist is independent	Section A: Appendix D
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
cA)	An indication of the quality and age of base data used for the specialist report	Section 2 and Section A: 3
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 2
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Appendix A and B
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Section 3 and 4
g)	An identification of any areas to be avoided, including buffers	Section 4
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section 4
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 1.2
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Section 5
k)	Any mitigation measures for inclusion in the EMPr	Section 5
l)	Any conditions for inclusion in the environmental authorisation	Section 5
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 5
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Section 5
(iA)	Regarding the acceptability of the proposed activity or activities	Section 5
(ii)	If the opinion is that the proposed activity, activities 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	Section 5
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q)	Any other information requested by the competent authority	N/A

1 INTRODUCTION

Scientific Terrestrial Services (STS) was appointed to conduct a faunal and floral ecological assessment as part of the Environmental Impact Assessment (EIA) process for the proposed Gruisfontein coal mine project within the Limpopo Province; henceforth referred to as the "study area" (Section A: Figures 1 - 2).

The study area extends over 1137 hectares (Ha) and is located within the savanna biome in the Waterberg region, approximately 6 km southeast of the Limpopo River. The Botswana border post is located roughly 17 km northeast of the study area, with the R510 (± 14.6 km northeast of the study area) the closest main road within the area. The study area is thus located in an isolated, natural area where the Matimba Power Station is the closest built-up development (± 24 km southeast of the study area), with Steenbokpan (± 20 km south of the study area) and Lephalale (± 46 km southeast of the study area) the closest towns.

The purpose of this report is to define the floral ecology of the study area, to identify areas of increased Ecological Importance and Sensitivity (EIS), as well as the mapping of such areas in relation to the proposed project footprint, and to describe the Present Ecological State (PES) of the study area. It is the objective of this study:

- To provide inventories of floral species as encountered within the study area;
- To determine and describe habitat types, communities and the ecological state of the study area and to rank each habitat type based on conservation importance and ecological sensitivity;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and/ or any other special features;
- To conduct a Red Data Listed (RDL) species assessment as well as an assessment of other Species of Conservation Concern (SCC), including the potential for such species to occur within the study area;
- To provide detailed information to guide the activities associated with the proposed development activities within the study area; and
- To ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements and the provision of ecological services in the local area.

1.1 Project Description

The proposed project is for an open cast coal mine on the farm Gruisfontein 230-LQ located on the Waterberg Coalfields (RSV ENCO, 2018), for which Nozala Coal (Pty) Ltd holds a coal prospecting right. On the study area, all coal seams are covered by 30 – 100 m of overburden, with a faulted area identified within the southwestern corner (weathering has removed several coal zones). The Life of Mine (LoM) is scheduled to be 16 years. Figure 1 illustrates the proposed mine layout. The proposed procedures and footprint of the project that will be implemented during the mining process include[1]:

- Removing and stockpiling of topsoil;
- Diversion of stormwater away from the Open Pit by means of trenches around the mining footprint area;
- Excavation of the initial strip of the box-cut;
- Stripping of topsoil and soft overburden from initial box-cut. This will be followed by the drilling, blasting and removal of hard overburden:
  - Topsoil, soft overburden dump and hard overburden dump will each be stockpiled separately.
  - Hard overburden dump, soft overburden dump and discard dump to be placed within the south-eastern section of the study area.
- Formation of the Open Pit through blasting and the excavation of coal (load and haul method). Proposed Open Pit will be within the western section of the study area, roughly centrally located;
- Construction of all mining-related infrastructure, including internal roads and facilities for on-site personnel (offices, training facilities, workshops, parking etc.). Proposed locality for most infrastructure to be within the southwestern corner of the study area, i.e. within the faulted area where coal extraction is not deemed feasible; and
- Preliminary Rehabilitation Plan: To rehabilitate the open pit and other disturbed areas to a post-mining grazing capability class. All stockpiled material (overburden, discard) will be utilised to backfill and rehabilitate the opencast area; no surface dumps will remain post-closure. Backfilling of the Open Pit over the 16-year LoM was not considered during the first phase of the concept study but will be considered within the second phase. Currently, it is foreseen that backfilling will only start after decommissioning of the mine.

[1] RSV ENCO (2018). CONCEPT STUDY GRUISFONTEIN PROJECT by RSV ENCO Consulting (Pty) Ltd. Project number: 02520004D-20-REP-0002

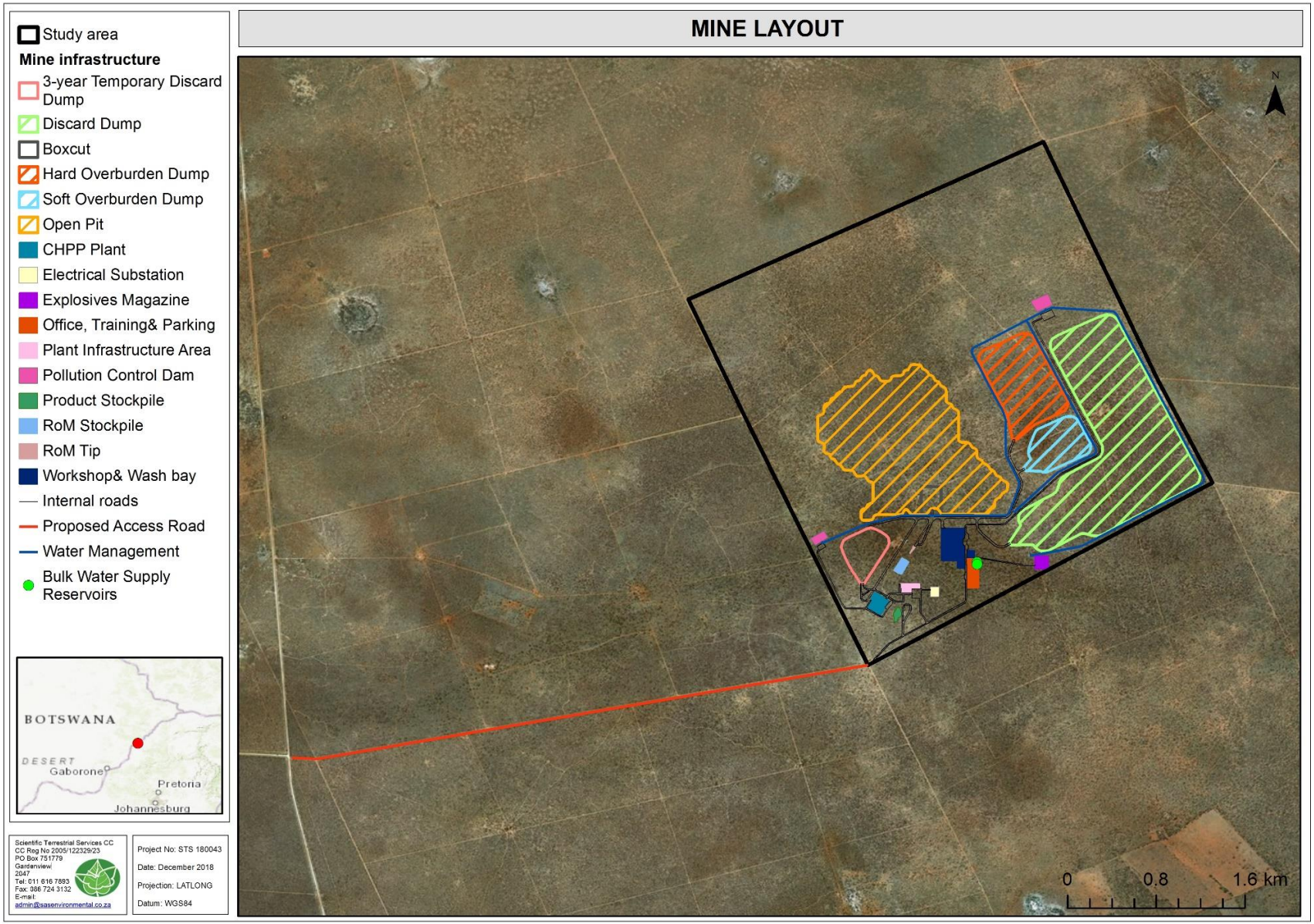


Figure 1: The proposed mine layout for the study area.

1.2 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The floral assessment is confined to the study area and does not include the neighbouring and adjacent properties; these were however considered as part of the desktop assessment (Section A);
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most floral communities and populations had been accurately assessed and considered and the information provided is considered sufficient to allow informed decision making to take place and facilitate integrated environmental management;
- Sampling by its nature means that not all individuals are assessed and identified. Some species and taxa within the study area may, therefore, have been missed during the assessment. This is particularly relevant within arid regions where many floral species only respond to a good rain event, e.g. many bulbous plants only emerge and flower after sufficient rains; and
- A single field assessment was undertaken from the 22nd to the 23rd of January 2019 (summer season), to determine the ecological status of the study area, and to "ground-truth" the results of the desktop assessment. A more accurate assessment would require that assessments take place in all seasons of the year. However, on-site data was significantly augmented with all available desktop data, together with project experience in the area, and the findings of this assessment are considered to be an accurate reflection of the ecological characteristics of the study area.

2 ASSESSMENT APPROACH

A single field assessment was undertaken from the 22nd to the 23rd of January 2019 (summer season) in order to determine the ecological status of the infrastructure areas associated with the study area.

In order to accurately determine the ecological state of the study area and to capture comprehensive data with respect to floral ecology, the following methodology was followed:

- Maps and digital satellite imagery were consulted prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. The results of these analyses were then used to focus the field work on specific areas of concern and to identify areas where target specific investigations were required;

- Historical data and previous specialist studies were available for the study area and were utilised as background information to this report;
- All relevant information as presented by SANBI's Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org), including the Limpopo Conservation Plan v.2 (2013), to gain background information on the physical habitat and potential floral and faunal diversity associated with the study area;
- For the field assessments, a reconnaissance 'walkabout' was initially undertaken to determine the general habitat types found throughout the study area. Following this, specific study sites were selected that were considered to be representative of the habitats found within the area, with special emphasis being placed on areas that may potentially support floral SCC – particularly within the areas where infrastructure is proposed. Sites were investigated on foot in order to identify the occurrence of the dominant plant species and habitat diversities. A detailed explanation of the method of assessment is provided in **Appendix A** of this report; and
- For the methodologies relating to the impact assessment and development of the mitigation measure, please refer to **Appendix B** of this section of the report.

2.1 Sensitivity Mapping

All the ecological features of the study area were considered, and sensitive areas were assessed. In addition, identified locations of protected species were marked by means of a Global Positioning System (GPS). A Geographic Information System (GIS) was used to project these features onto satellite imagery and/or topographic maps. The sensitivity map should guide the final design and layout of the proposed development activities.

3 RESULTS OF FLORAL ASSESSMENT

During the field assessment it was evident that the vegetation within the study area is representative of the Limpopo Sweet Bushveld vegetation type, as described by Mucina and Rutherford (2006), i.e. the reference state. Within the study area, species characteristic of the reference state was well-represented throughout, including the woody species *Boscia albitrunca*, *Commiphora pyracanthiodes* and *Terminalia sericea*, as well as grasses such as *Enneapogon cenchroides, Eragrostis lehmanniana*, *Schmidtia pappophoroides* and *Stipagrostis uniplumis*.

A noticeable change in vegetation structure within the southern section of the study area was evident, i.e. there was an increase in species diversity (especially noticed for forb and woody species) and denser vegetation. The change in vegetation structure seems to be moisture driven; however, no freshwater features were identified for the area by the Aquatic and Wetland Specialist Report[2]. The likely cause of the change seen within the vegetation structure is the high abundance of *Vachellia erioloba* present within the southern section of the study area. *Vachellia erioloba* is a deep-rooted tree (records of up to 60m) able to cycle nutrients from great depths to the surface (Seymour and Milton, 2003) - thereby potentially facilitating the growth and survival of a greater diversity of floral species.

To better describe the differences in vegetation composition, the Limpopo Sweet Bushveld vegetation within the study area was divided into two habitat units, i.e. Sweet Bushveld A and Sweet Bushveld B (denser vegetation). A third smaller habitat unit is also described, i.e. Degraded habitat.

The three identified habitat units, and the floral sensitivities thereof are described in the below sections (3.1 – 3.3). The distribution of the habitat units within the study area is depicted in Figure 2 with the mine layout superimposed onto the habitat units presented in Figure 3.

[2] Environmental Impact Assessment for the Proposed Temo Coal Rail Loop, Road Diversion and Pipeline Project, near Lephalale, Limpopo Province - Aquatic and Wetland Specialist Report. Project Number: NAM5335

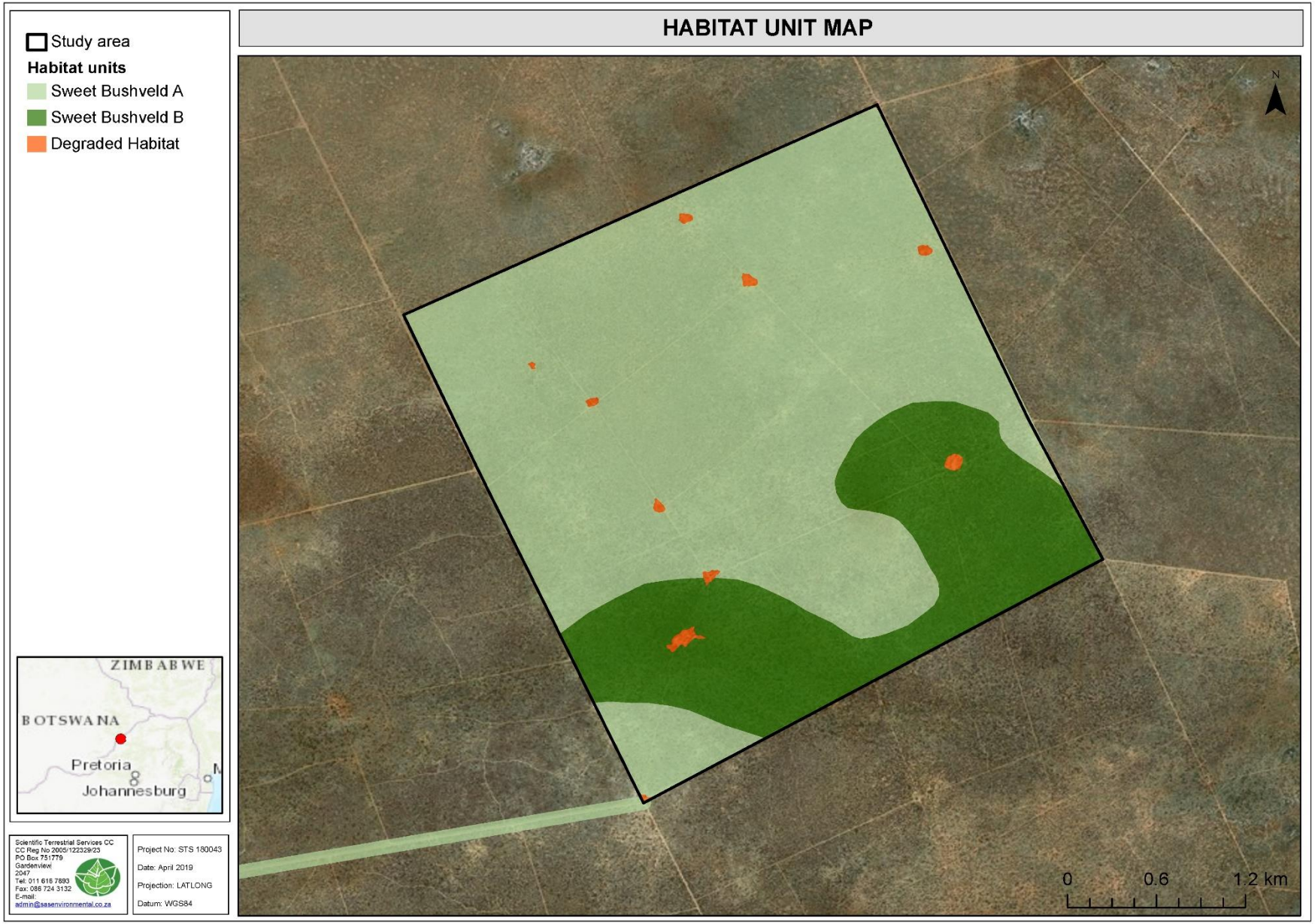


Figure 2: Conceptual illustration of the habitat units within the study area.

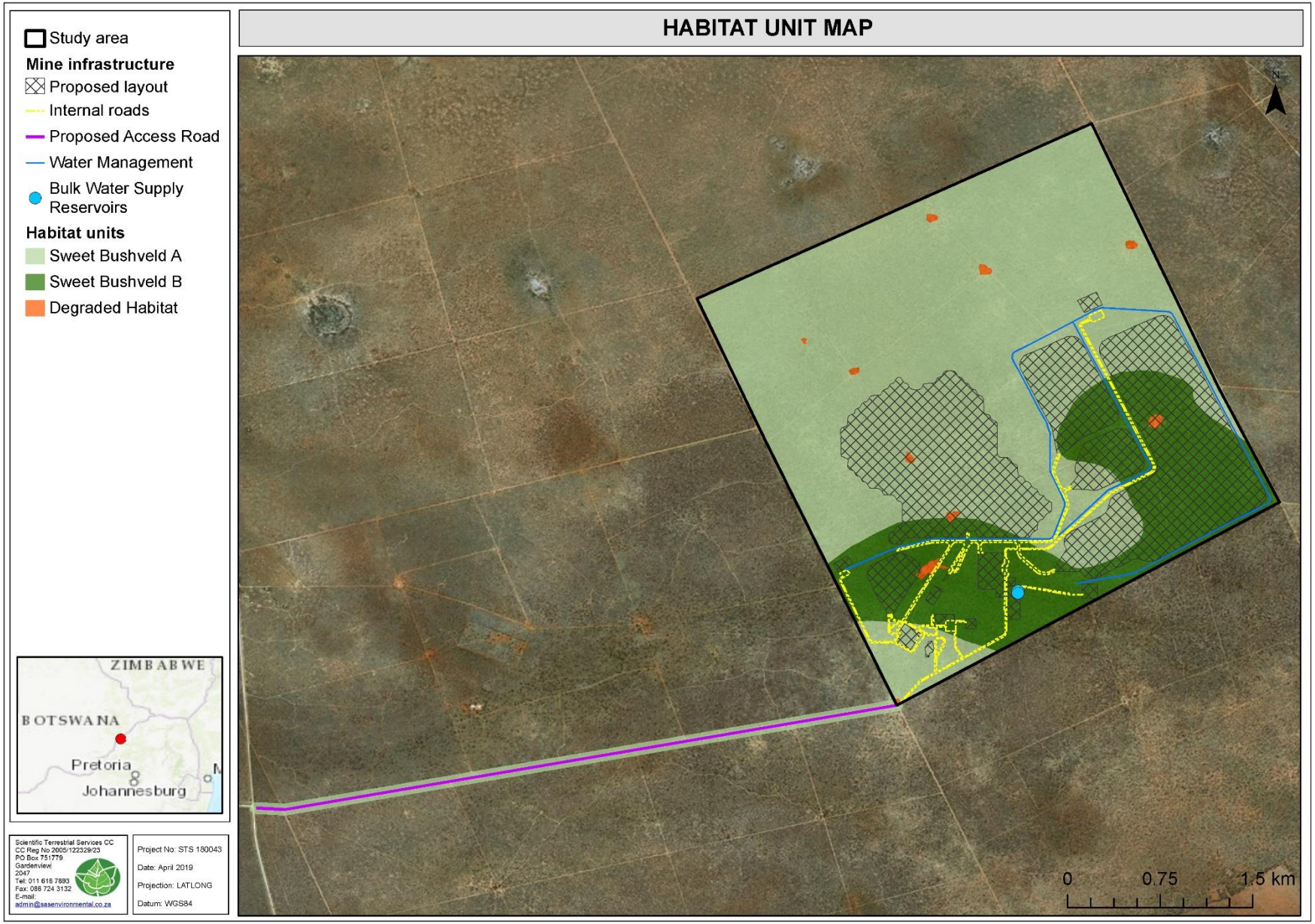


Figure 3: Conceptual illustration of the habitat units within the study area in relation to the proposed mine layout.

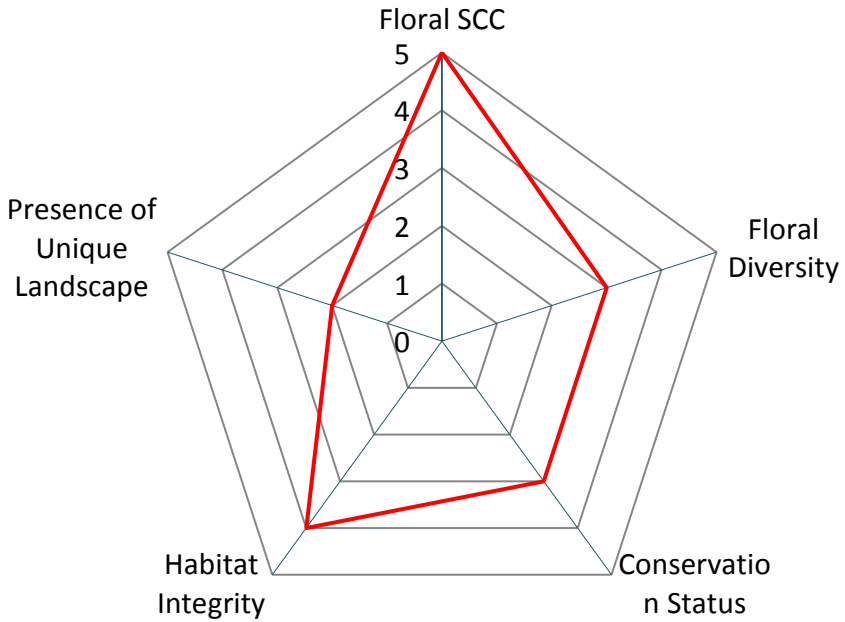
3.1 Habitat Unit 1: Sweet Bushveld A Habitat Unit

Floral Habitat Sensitivity	Intermediate

Habitat Unit:

The Sweet Bushveld A habitat unit is characteristic of the Limpopo Sweet Bushveld vegetation type and can be described as short, open woodland with a grass cover of 40 – 60% and woody species mainly consisting of small trees and/or tall shrubs. The dominant woody species included *Terminalia sericea* and *Peltophorum africanum*. This habitat unit extends across the majority of the study area and, at the time of the field assessment, the vegetation showed low levels of disturbance. This was particularly evident as *Dichrostachys cinerea* was not encroaching within the study area, whereas it was seen to form dense stands within the surrounding farms.

Floral Habitat Sensitivity Graph



Reference photos of vegetation associated with, and typically occurring within, the Sweet Bushveld A habitat unit.

Floral Species of Conservation Concern (SCC)	Within the Sweet Bushveld A habitat unit there were several floral SCC encountered, most of which were tree species protected under the National Forest Act, 1998 (Act 84 of 1998, as amended in September 2011) (NFA), including: • *Boscia albitrunca* (Shepherd's tree) – scattered throughout the Sweet Bushveld A; • *Sclerocarya birrea* subsp. *caffra* (Marula tree) – low abundance within Sweet Bushveld A; and • *Vachellia erioloba* (Camel Thorn) – moderately low abundance within Sweet Bushveld A. One species protected under the Limpopo Environmental Management Act, 2003, (Act 7 of 2003) (LEMA) - Schedule 12 (Protected Plants) - was present in moderately low abundances within this habitat unit, i.e. *Adenium oleifolium* (Bitterkambro). More species are expected to be present. Additionally, one species protected under the Threatened or Protected Species (TOPS) Regulations (GN 255 of 2015) under Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) (NEMBA), i.e. *Harpagophytum zeyheri,* was encountered in low abundances; however, more species are expected to occur throughout the study area. Based on the results of the floral SCC assessment, the following species received a high Potential of Occurrence (POC) score and, although not recorded on site during the field assessment, these species are deemed likely to occur within the Sweet Bushveld A habitat unit: *Corchorus psammophilus* (VU), *Drimia sanguinea* (near threatened and TOPS protected), *Harpagophytum procumbens* (Devil's Claw, TOPS protected) and *Securidaca longepedunculata* (Fibre Tree, NFA protected). This habitat unit can also support additional LEMA protected species such as *Huernia zebrina* subsp. *insigniflora*, *Orbea* spp., *Stapelia gettliffei* and *Stapelia kwebensis*. Refer to section 3.4 and Appendix C for the results and discussion of the floral SCC assessment.
Floral Diversity	The Sweet Bushveld A habitat unit has a moderate diversity of floral species. The floral composition within this habitat unit is characteristic of the reference vegetation type, i.e. the Limpopo Sweet Bushveld, with graminoid and woody species best represented within the landscape. The well-developed grass layer included the dominant grass species *Eragrostis lehmanniana* and *Stipagrostis uniplumis* var. *uniplumis*, with *Enneapogon cenchroides*, *Perotis patens* and *Schmidtia pappophoroides* also common throughout the habitat unit. The woody layer mostly consisted of small trees and shrubs such as *Commiphora africana*, *Commiphora pyracanthoides*, *Elephantorrhiza elephantina*, *Grewia flava, Grewia flavescens, Heliotropium nelsonii Ozoroa paniculosa* and *Senegalia cinerea.* Taller tree species such as *Boscia albitrunca* (NFA), *Senegalia nigrescens* and *Vachellia erioloba* (NFA) were sparsely scattered throughout the habitat unit. *Peltophorum africanum* and *Terminalia sericea* were the dominant woody species. The forb layer was less prominent in this habitat unit than within the Sweet Bushveld B habitat unit (refer to section 3.2). Scattered populations of *Adenium oleifolium* (LEMA), *Chamaecrista mimosoides*, *Commelina africana*, *Hibiscus physaloides*, *Indigofera daleoides* var. *daleoides, Indigofera ingrata* and several *Ledebouria* spp were present. A low forb diversity is characteristic of the Limpopo Sweet Bushveld vegetation type.  Some of the well-represented species within the Sweet Bushveld A habitat unit (left to right): *Peltpphorum africanum, Schmidtia pappophoroides* (gramminoid), *Commiphora pyracanthoides*, *Indigofera daleoides* var. *daleoides* and *Ozoroa paniculosa.*

<table>
<tr><td rowspan="4">Conservation Status of Vegetation Type/Ecosystem</td><td rowspan="4">The Sweet Bushveld A habitat unit does not fall within a Threatened Ecosystem, nor within any protected or conservation areas. The Mining and Biodiversity Guidelines (2013) also does not recognise an important biodiversity area associated with this habitat unit.

The entire study area falls within a natural area as defined within the Limpopo Conservation Plan v.2 (2013), for which no management objectives, land management recommendations or land-use guidelines are prescribed (Limpopo Conservation Plan v.2: Technical Report).</td><td>Habitat integrity/Alien and Invasive species</td></tr>
<tr><td>The vegetation is intact and very few alien and invasive plant (AIP) species were recorded. The veld is in a good condition; however, Grewia flava, Grewia flavescens and Heliotropium nelsonii formed dense, encroaching stands in some sections of this habitat unit.</td></tr>
<tr><td>Presence of Unique Landscapes</td></tr>
<tr><td>The Sweet Bushveld A habitat unit is well represented within the study area as well as the surrounding areas. No unique habitat important for floral diversity is present. However, the LEMA protected Adenium oleifolium (Bitterkambro) is present within this habitat unit and is considered to be rare in the area (Van der Walt, 2009). Therefore, Sweet Bushveld A provides important habitat for floral SCC.</td></tr>
<tr><td>Business Case, Conclusion and Mitigation Requirements:</td><td colspan="2">This habitat unit is of intermediate ecological sensitivity and importance from a floral perspective.

Proposed mining infrastructure that will impact on floral habitat, diversity and SCC associated with the Sweet Bushveld A habitat unit include:
• Majority of the proposed Open Pit and box cut;
• Sections of both the hard and soft overburden dump, as well as of the discard dump (the eastern portion of the study area);
• CHPP Plant;
• Pollution Control Dam (PCD);
• Sections of the Water Management System (trenches around footprint area); and
• Sections of the Internal roads.

The most significant impacts on floral ecology will mainly be associated with the clearing of vegetation during the construction phase of the project. This will include the loss of several individuals of tree species protected under the NFA and several plant species protected under LEMA and the TOPS regulations. Loss of some species diversity can be expected due to possible edge effects during the operational phase of the proposed mining project, including the potential proliferation of AIPs and encroachment of species such as Dichrostachys cinerea, Grewia flava, Grevia flavescens and Heliotropium nelsonii in response to mining-related disturbances.

Mining activities within this habitat unit will have a direct impact floral habitat and diversity within the study area and in order to ensure that the impacts on floral ecology be as low as possible, the following recommendations are made to minimise the impact on floral species:

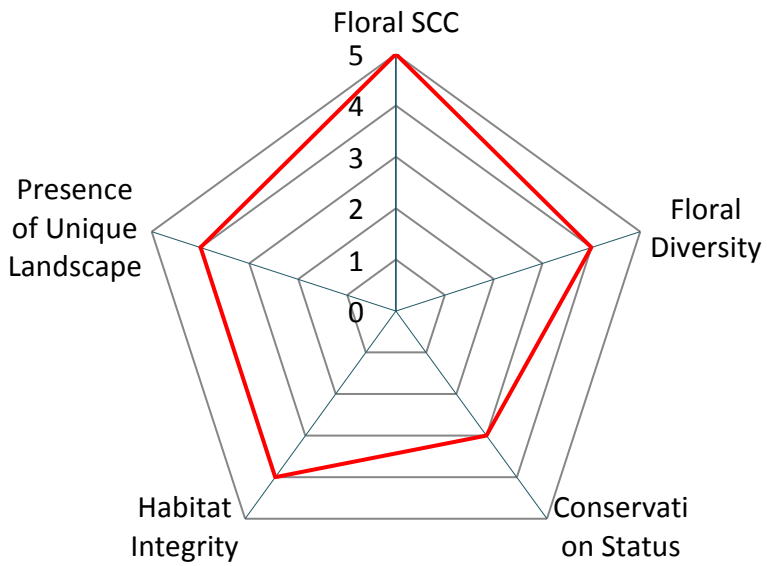
• All possible steps must be taken to ensure that infrastructure does not unnecessarily encroach so to prevent negative impacts due to construction-related disturbances;
• An AIP management plan should be implemented throughout the project so to both prevent the spread of AIPs into natural areas as well as to control current AIP populations;
• Spills and /or leaks from equipment must be immediately remedied and cleaned up to ensure that these chemicals do not enter into the soils;
• To minimise the need for additional vegetation clearance, existing access roads are to be used to gain access to the proposed infrastructure as far as possible;
• Before any construction activities can occur a detailed walk down of the area must take place, preferably within their flowering season (or fruiting season for some species) (refer to section 3.4), during which all protected species should be marked; and
• Permits from the relevant authorities, i.e. Limpopo Department of Economic Development and Tourism (LEDET) and Department of Agriculture, Forestry and Fisheries (DAFF), should be obtained before removal, cutting or destruction of protected species or floral SCC before any proposed mining activities may take place.</td></tr>
</table>

3.2 Habitat Unit 2: Sweet Bushveld B Habitat Unit

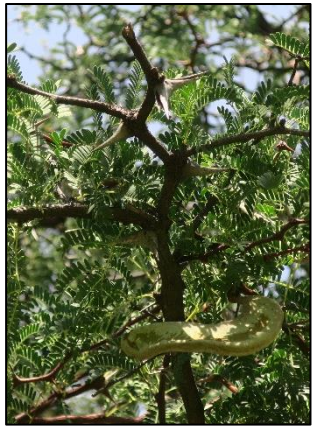
Floral Habitat Sensitivity	Moderately High

The Sweet Bushveld B habitat unit is also characteristic of the Limpopo Sweet Bushveld vegetation type but differs from the Sweet Bushveld A habitat unit in that there is a higher diversity of grasses, woody species and especially forbs. A noticeably lower abundance of *Terminalia sericea* was also evident. The denser vegetation seems to be moisture-driven as indicated by the presence is *Combretum imberbe* (Leadwood) and a particularly high abundance of *Vachellia erioloba* (Camel Thorn). Moreover, the increased shade caused by the increase in woody species allows for less moisture to evaporate. This habitat unit is located within the southern portion of the study area.

Floral Habitat Sensitivity Graph



Typical view of Forb-rich Bushveld habitat unit associated with the study area, with an increase in the number of taller woody species such as *Combretum imberbe* (bottom left), *Burkea africana* (bottom middle) and *Vachellia erioloba* (bottom right).



Floral Species of Conservation Concern (SCC)	Within the Sweet Bushveld B habitat unit there were several floral SCC encountered, i.e. several tree species protected under the NFA: • *Boscia albitrunca* (Shepherd's tree) – scattered throughout the habitat unit; • *Combretum imberbe* (Leadwood) – restricted distribution within the habitat unit**; and** • *Vachellia erioloba* (Camel Thorn) – moderately high abundance within the habitat unit, particularly clustered within the south-western section of the study area. Based on the results of the floral SCC assessment, the following species received a high Potential of Occurrence (POC) score and is deemed likely to occur within the Sweet Bushveld B habitat unit: *Drimia sanguinea* (near threatened and TOPS protected), *Harpagophytum procumbens* and *H. zeyheri* (Devil's Claw, TOPS protected), *Sclerocarya birrea* subsp. *caffra* (NFA protected) and *Securidaca longepedunculata* (Fibre Tree, NFA protected). Similar to the Sweet Bushveld A habitat unit, this habitat unit can also support several LEMA protected species such as *Huernia zebrina* subsp. *insigniflora*, *Orbea* spp., *Stapelia gettliffei* and *Stapelia kwebensis*. Refer to section 3.4 and Appendix C for the results and discussion of the floral SCC assessment.
Floral Diversity	Floral diversity within Sweet Bushveld B is moderately high with a well-developed graminoid, forb and woody layer. The graminoid layer included several species that were not encountered within Sweet Bushveld A and that are associated with areas where additional water is available, i.e. *Digitaria eriantha, Eragrostis pallens, Kyllinga alba* (sedge) and *Panicum coloratum*. The forb layer was noticeably more species-rich than within the adjacent Sweet Bushveld A habitat unit and included species such as *Commelina benghalensis (*a common species in shaded environments and thus corresponds to the denser woody vegetation), *Hibiscus palmatus* (mainly grows on alluvial soils), *Eriospermum cooperi* (fairly common), *Portulaca kermesina* (a species of sandy soils in hot and dry deciduous woodland and on the margins of pans), *Tricliceras glanduliferum* (widespread and common species) and *Vigna unguiculata* subsp*. dekindtiana* var *huillensis* (rare in the area). The increase in woody species diversity is accompanied by an overall denser vegetation and a taller canopy as more tree species are present, including *Burkea africana, Combretum hereroense, Commiphora africana* and *Vachellia nilotica* subsp. *kraussiana*. The shrub layer also increased in diversity with *Blepharis subvolubilis*, *Lantana rugosa*, *Lycium schizocalyx*, *Phyllanthus parvulus* and *Sida cordifolia* subsp. *cordifolia* more commonly occurring.  Well-represented species within the Sweet Bushveld B habitat unit (left to right): *Combretum hereroense, Hibiscus palmatus, Eragrostis pallens, Portulaca kermesina* and *Tylosema esculentum*.

<table>
<tr><td rowspan="4">Conservation Status of Vegetation Type/Ecosystem</td><td rowspan="4">The Sweet Bushveld B habitat unit does not fall within a Threatened Ecosystem, nor does it fall within any protected or conservation areas. The Mining and Biodiversity Guidelines (2013) does not recognise an important biodiversity area associated with the Sweet Bushveld B habitat unit.

The entire study area falls within a natural area for which no management objectives, land management recommendations or land-use guidelines are prescribed (Limpopo Conservation Plan v.2: Technical Report).</td><td>Habitat integrity/Alien and Invasive species</td></tr>
<tr><td>The habitat unit is representative of the reference state and is associated with low diversity and abundance AIPs. Some areas had high abundances of Aristida congesta subsp. congesta, which is an indication of veld degradation and likely a result of grazing pressures. However, the habitat unit as a whole is intact with habitat integrity still moderately high.</td></tr>
<tr><td>Presence of Unique Landscapes</td></tr>
<tr><td>This habitat unit is unique due to increased moisture availability. The vegetation is noticeably more species-rich than adjacent habitat units, which indicates that this habitat unit provides suitable growing conditions for a wider range of floral species.

The highest density of Vachellia erioloba (NFA protected) individuals were encountered within this habitat unit, along with Combretum imberbe (NFA) that was exclusively found within this habitat unit.</td></tr>
<tr><td>Business Case, Conclusion and Mitigation Requirements:</td><td colspan="2">The Sweet Bushveld B habitat unit is of moderately high floral ecological importance and sensitivity which can mainly be attributed to the presence of floral SCC (NFA protected species), a high diversity of species and the presence of natural habitat with moderately high integrity.

Most of the proposed mining activities and infrastructure will be located within this habitat unit:

• Southern section of the proposed Open Pit and box cut;
• PCD, RoM stockpile and Temporary Discard Dump;
• Most of the Discard Dump (the eastern portion of study area);
• A large section of the Soft Overburden Dump and the southern portion of the Hard Overburden Dump;
• Plant Infrastructure Area;
• Electrical substation;
• Workshop & Wash bay;
• Office, Training & Parking;
• Sections of the Water Management System (trenches around footprint area); and
• Sections of the Internal roads.

The construction phase will have a significant negative impact on the numbers of protected NFA tree species within this habitat unit and will likely pose a threat to LEMA and TOPS species within the footprint area associated with this habitat unit. Operational-phase impacts will include several potential threats to floral diversity and habitat integrity within the study area such as chemical leaks, dust pollution as well as AIP proliferation and bush encroachment in response to mine-related disturbances.

Were the proposed activities to proceed, the following recommendations are made to minimise the impact on floral ecology associated with the Sweet Bushveld B habitat unit:

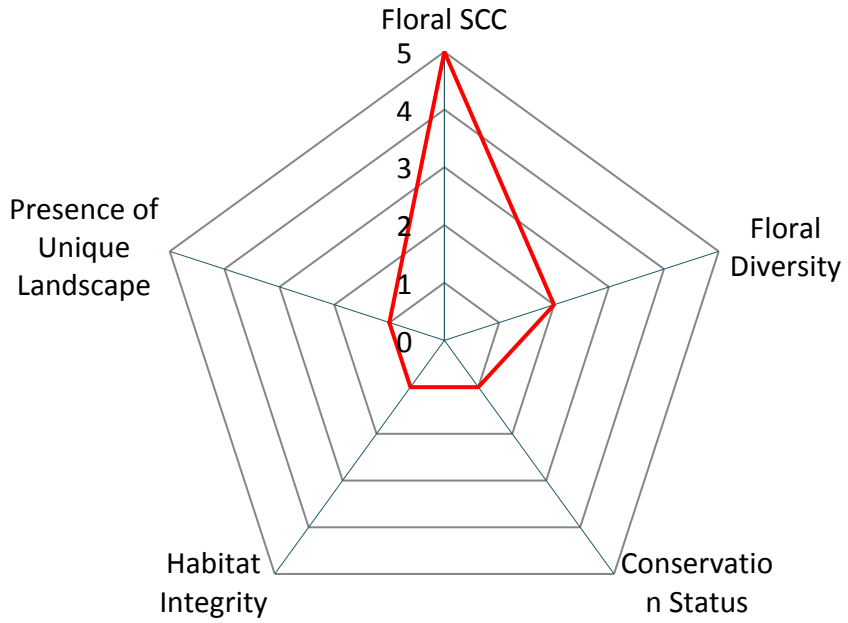
• The footprint areas of all surface infrastructure must be minimised to what is essential;
• Any disturbance of sensitive floral habitat and species of conservation concern must be actively avoided;
• An Alien and Invasive Plant (AIP) Control Plan and Erosion Control Plan must be developed and implemented during all phases of development, to lower the risk of erosion and the increase in proliferation of AIPs within the study area; and
• Due to high abundances of floral SCC present within this habitat unit, permits should be obtained from DAFF to remove, cut or destroy any protected species before construction of infrastructure takes place. Consequently, before any construction activities can occur, a detailed walk down of the area must take place, preferably within their flowering or fruiting season (refer to section 3.4), during which all protected species should be marked (i.e. LEMA, NFA and TOPS species).</td></tr>
</table>

3.3 Habitat Unit 3: Degraded Habitat Unit

Floral Habitat Sensitivity	Moderately Low

This habitat unit is characterised by either a lack of vegetation or by areas of increased floral species associated with disturbed areas as well as alien and invasive plant proliferation (AIP) due to disturbances such as overgrazing, regular vehicular movement and anthropogenic structures. Within the study area, the extent of the Degraded Habitat is small and restricted to the sources of disturbance.

Floral Habitat Sensitivity Graph



Typical view of areas that have been significantly degraded.

Anthropogenic water source for cattle where little to no vegetation remains.

Encroachment of *Heliotropium* spp. along the gravel road, which serves as a corridor of disturbance along which pioneer species (or AIPs) can be transported.

<table>
<tr><td>Floral Species of Conservation Concern (SCC)</td><td colspan="2">The only floral SCC encountered within this habitat unit was Combretum imberbe (Leadwood) and Vachellia erioloba (Camel Thorn) which is a species protected under the NFA. These species were present before any anthropogenic activities lead to disturbance of the habitat unit, and it is unlikely that they will be able to expand their range within this habitat unit.

Due to the current level of habitat disturbance, this habitat unit does not provide favourable growing conditions for floral SCC that have not yet established.</td></tr>
<tr><td>Floral Diversity</td><td colspan="2">Floral diversity was low and dominated by forb species that are indicators of disturbed veld such as Commelina benghalesis, Heliotropium lineare, Heliotropium ciliatum, Mollugo cerviana var. cerviana (alien species), Portulaca oleraceae (alien species), Portulaca quadrifida, Sesamum alatum and Tribulus terrestris. Woody species that were able to establish along the edges of this habitat unit also included species associated with disturbed habitat, e.g. Dichrostachys cinerea, Elephantorrhiza elephantina, Grewia bicolor, Grewia flava and Heliotropium nelsonii.

 
Well-represented floral species within the Degraded Habitat unit (left to right): mat-forming Tribulus terrestris with Vachellia erioloba in the background, several Solanum species were present, Heliotropium lineare and Portulaca oleraceae (alien species).</td></tr>
<tr><td>Conservation Status of Vegetation Type/Ecosystem</td><td>This habitat unit is not considered important for the conservation of floral species as native vegetation is degraded by the presence of heavy grazing.</td><td>Habitat integrity/Alien and Invasive species
Habitat is transformed and dominated by species that are indicative of disturbed areas with alien and invasive species such as Portulaca oleraceae present.
Presence of Unique Landscapes
No unique landscapes important to flora were present.</td></tr>
<tr><td>Business Case, Conclusion and Mitigation Requirements:</td><td colspan="2">This habitat unit is of moderately low ecological importance and sensitivity from a floral perspective. Development potential can be optimised for this habitat unit, but care must be taken to limit edge effects on the surrounding natural areas. To minimise the impact to floral species within this habitat unit, as well as to reduce potential impacts to adjacent more sensitive habitat units, the following recommendations are made:

• Demarcate floral SCC (tree species protected under the NFA) within and along the edges of this habitat unit, or obtain the required permits from DAFF to remove or destroy these species; and
• An Alien and Invasive Plant Control Plan and Erosion Control Plan must be developed and implemented during all phases of development, to lower the risk of erosion and the increased proliferation of alien and invasive plant species within the study area.</td></tr>
</table>

3.4 Floral Species of Conservation Concern Assessment

Threatened/protected species are species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) is a threatened species. Furthermore, SCC are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare and Declining.

An assessment considering the presence of any plant species of concern, as well as suitable habitat to support any such species, was undertaken. By making use of a grid search, the SANBI PRECIS Red Data Listed plants were acquired for the Quarter Degree Square (QDS) 2327AC, 2327AD, 2327BC, 2327CA, 2327CB and 2327DA using their new Plants of Southern Africa (newPOSA[3]) website (http://newposa.sanbi.org/).

Also taken into consideration was the Threatened or Protected Species (TOPS) Regulations (GN 255 of 2015) under Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004), the list of Schedule 11 (Specially protected) and Schedule 12 (Protected plants) under the Limpopo Environmental Management Act, 2003 (Act 7 of 2003), and the List of Protected Tree Species (GN 809 of 2014) under the National Forest Act (Act 84 of 1998).

For the purposes of this report, floral SCC refers to species listed in the above-mentioned datasets, Acts and Regulations.

Results of the SCC assessment:

From the POC assessment, several floral SCC listed for the area are likely occurring within the study area with the Sweet Bushveld A providing favourable conditions for more floral SCC than when compared to the Sweet Bushveld B habitat unit. The POC of each of the species listed for the area was calculated and is shown in Appendix C.

From the field assessment, the Sweet Bushveld A had the highest diversity of recorded floral SCC; however, the highest abundance of floral SCC was found in the Sweet Bushveld B habitat unit.

[3] Data from the new Plants of southern Africa (new POSA) online catalogue is obtained from the Botanical Database of Southern Africa (BODATSA), which contains records from the National Herbarium in Pretoria (PRE), the Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH).

No SANBI Red Data Listed species were encountered during the field assessment but following the POC calculations, it was determined that there are favourable growing conditions within the study area for several Red Data Listed plants (Table 1). Though these species were not found on site, it by no means suggests that they do not occur within the study area and a thorough walk-down of any area to be impacted by construction activities will be necessary. A Rescue and Relocation Plan is recommended if any Red Data Listed species are encountered on site.

The following protected species listed under the NFA were observed within the study area at the time of the assessment (Table 1, Figure 4 and 7):

- *Boscia albitrunca* (Shepard's tree)*;*
- *Combretum imberbe* (Leadwood);
- *Sclerocarya birrea* subsp*. caffra* (Marula)*;* and
- *Vachellia erioloba* (Camel Thorn).

In terms of this act, protected tree species may not be cut, disturbed, damaged or destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold - except under licence granted by the DAFF. Applications for such activities should be made to the responsible official in each province. Each application is evaluated on merit (including field assessments) before a decision is taken whether or not to issue a licence (with or without conditions). Such decisions must be in line with national policy and guidelines.

Figure 4: Protected tree species (NFA) encountered within the study area during the field assessments, i.e. (left to right) *Boscia albitrunca*, *Combretum imberbe, Sclerocarya birrea* subsp. *caffra* and *Vachellia erioloba*.

One species listed as protected under LEMA Schedule 12 was observed during the field assessment (Table 1, Figure 5 and 8), namely: *Adenium oleifolium*.

If individuals or communities of these species will be disturbed by construction/operational activities, they must be relocated to suitable, similar habitat in close proximity to where they

were removed from, but outside the disturbance footprint after obtaining the relevant permits from the Limpopo Department of Economic Development, Environment and Tourism (LEDET).

Figure 5: Several specimens of *Adenium oleifolium* were found in the Sweet Bushveld A habitat unit.

One species protected under the NEMBA TOPS regulations was encountered (Table 1, Figure 6 and 8, namely: *Harpagophytum zeyheri*. Any restricted activity for which a permit is required includes international import/ export/ re-export, gathering/ plucking/ collecting, conveying / moving/ translocation, growing/ breeding/ propagating, selling/ buying/ receiving/ giving/ donating, as well as nursery possession.

Figure 6: Several specimens of *Harpagophytum zeyheri* were found in the Sweet Bushveld A and the Sweet Bushveld B habitat units.

The table below provides summary information on the habitat where floral SCC were recorded or are expected to occur. The occurrence records of the floral SCC as recorded during the field assessment is depicted in Figures 7 and 8.

**It should be noted that marking the occurrences of all SCC within the study area was not part of the scope of work and that the depicted occurrences are merely a guideline to indicate that the species were present. The habitat is suitable to harbour higher abundances of the described SCC. Before any construction activities can take place, a detailed walk-down of the area is necessary, during which all SCC are marked and either considered for rescue and relocation or, if planning to destroy or move these species, permits would be required from relevant authorities (see sections below).*

Table 1: Floral SCC potentially occurring within the study area, with information on floral species encountered on site.

SCIENTIFIC NAME	HABITAT & DISTRIBUTION / RANGE	TOPS THREAT STATUS	NATIONAL RED LIST STATUS	POC (%)
SANBI Red and Orange Listed Species				
Corchorus psammophilus	Indigenous. Lephalale - Sandy flats in open Terminalia sericea veld.	-	VU	73
TOPS plant list for the Limpopo Province				
Drimia sanguinea	Open veld and scrubby woodland in a variety of soil types.	P	NT	73
Harpagophytum procumbens	Well-drained sandy habitats in open savanna and woodlands.	P	LC	67
Harpagophytum zeyheri subsp. *zeyheri*	On Kalahari sand in dry open woodland.	P	LC	100
List of Protected Tree Species (GN 809 of 2014) under the NFA				
Adansonia digitata	It is restricted to hot, dry woodland on stony, well-drained soils, in frost-free areas that receive low rainfall. In South Africa, it is found only in the warm parts of the Limpopo Province.	-	LC	73
Boscia albitrunca	Habitat mainly includes dry, open woodland and bushveld, mostly in hot, arid, semi-desert areas, often on termitaria.	-	LC	100
Combretum imberbe	The leadwood can be found in all the bushveld regions and in a mixed forest in southern Africa. Preferred habitat includes open bushveld, mixed woodland, rivers or dry watercourses and often on alluvial soils. It is widespread in Lowveld areas and grows along streams and rivers.	-	LC	100
Sclerocarya birrea subsp. *Caffra*	It occurs naturally in various types of woodland, on sandy soil or occasionally sandy loam.	-	LC	100
Securidaca longepedunculata	The violet tree is found in woodland and arid savanna soils.	-	LC	73
Vachellia erioloba	Found in dry woodland, bushveld, grassland and watercourses in arid areas usually on stony or sandy soil. Widespread in the arid northern provinces of South Africa.	-	LC	100
Schedule 12 (Protected) plants under the LEMA				
Adenium oleifolium	Rare in the area.	-	LC	100
All species of *Huernia*	*Huernia zebrina* subsp. *insigniflora* has a distribution range that falls within the study area.	-	-	73
All species of *Orbea*	he genus is distributed widely throughout Africa. Unlike most of the other stapeliad genera in southern Africa, which have their highest degree of diversification on the border between the winter-rainfall area and the dry karroid regions, *Orbea* has its highest diversification along the eastern escarpment, with a peak in the Soutpansberg and Blouberg areas.	-	-	73
All species of *Stapelia*	*Stapelia gettliffei* and *Stapelia kwebensis* have a distribution range that falls within the study area.	-	-	73

LC = Least Concern; NT = Near Threatened; P = Protected; VU= Vulnerable.

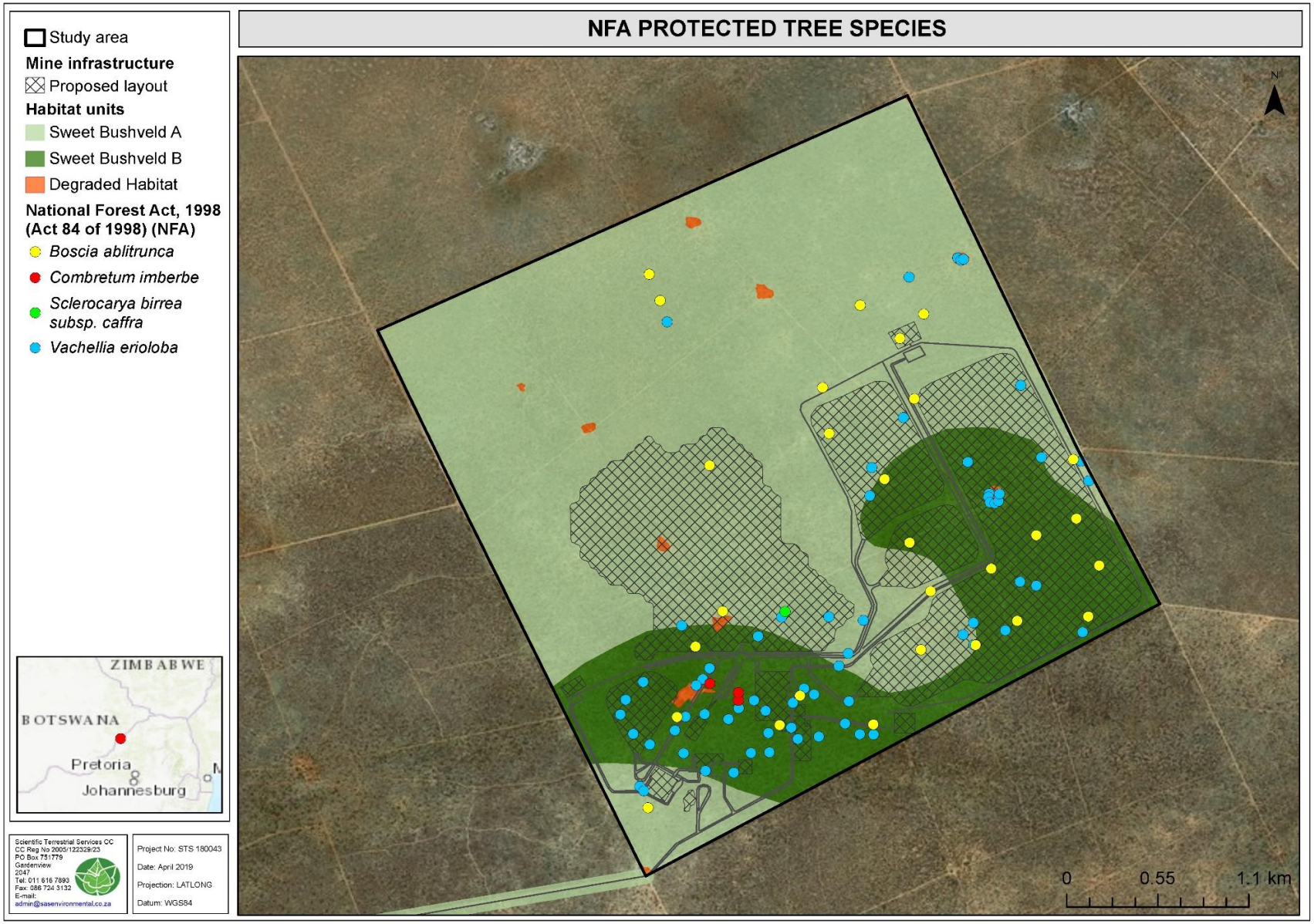


Figure 7: Sensitivity map for the study area with the proposed mining-related infrastructure. Floral species protected under NFA (1998) that was found on site are displayed in relation to the infrastructure areas.

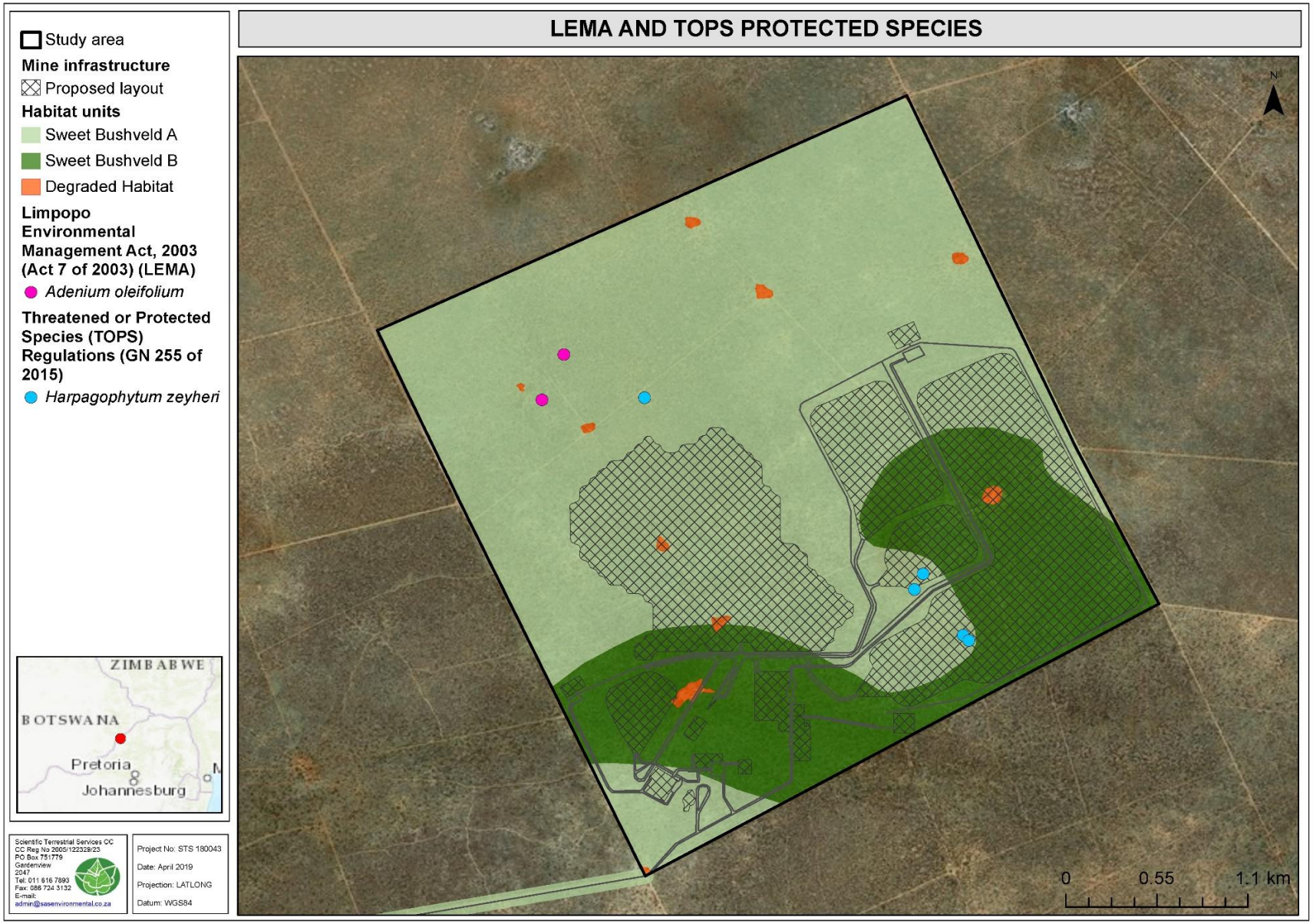


Figure 8: Sensitivity map for the study area with the proposed mining-related infrastructure. Floral species protected under LEMA (2003) and TOPS that was found on site are displayed in relation to the infrastructure areas.

3.5 Medicinal Plant Species

Medicinal plant species are not necessarily indigenous species, with many of them regarded as alien invasive weeds. The table below presents a list of dominant plant species with traditional medicinal value, plant parts traditionally used and their main applications, which were identified during the field assessment.

A moderately high diversity of medicinal species is present with most of the species being common and widespread and not confined to the study area. Some of the medicinal species that could be negatively impacted by the proposed mining activities due to being protected species (NFA or TOPS) include *Harpagophytum zeyheri* (TOPS), *Boscia albitrunca* (NFA), *Combretum imberbe* (NFA), *Sclerocarya birrea* subsp. *caffra* and *Vachellia erioloba* (NFA). The majority of the medicinal plants found within the study area, however, is unlikely to be significantly impacted locally and regionally by the proposed activities.

If individuals or communities of these species will be disturbed by mining activities, they must be relocated to suitable, similar habitat in close proximity to where they were removed from, but outside the disturbance footprint after obtaining the required permits from the relevant departments listed for species listed in Section 3.4.

Table 2: Dominant traditional medicinal floral species identified during the field assessment. Medicinal applications and application methods are also presented (van Wyk, Oudtshoorn, Gericke, 2009). Where information was not available in van Wyk et al. (2009), other sources were used to gather information, including SANBI's PlantZAfrica website (http://pza.sanbi.org/).

SPECIES	COMMON NAME	PLANT PARTS USED	MEDICINAL USES
Forb species			
Chamaecrista mimosoides	Fishbone dwarf cassia	Unsure	Used in traditional medicine to treat various skin disorders, dysentery, and loss of appetite in children (Van der Walt, 2009).
Commelina africana	Common yellow commelina	Various parts	The Ndebele use a decoction of the roots in the treatment of venereal diseases and as a medicine for women suffering unduly during the menstrual period. The ash of the plant is used as one of the ingredients in a Sotho charm application to the loins for sterility and an infusion is drunk for the same purpose.
Commelina benghalesis	Benghal blue wandering Jew	Various parts	In Zulu culture the plant is used as a poultice and it is also taken to reduce high blood pressure. It is used by the Sotho for treating barren women. It is used to treat infertility, burns, sore throats, sore eyes, dysentery, rashes and leprosy. The mucilage from the flowering parts is used to treat infants' thrush and bruised leaves are used for burns in Tanzania. The juice is used in East Africa for ophthalmia and sore throats. It is also used in the Phillippines to bathe sore eyes and for urethral pain and in India as demulcent, refrigerant and laxative. The leaf decoctions are taken for malaria in Madagascar.

SPECIES	COMMON NAME	PLANT PARTS USED	MEDICINAL USES
Harpagophytum sp. (LEMA)	Devil's claw	Roots (secondary)	It's a popular treatment for rheumatism and arthritis. Also formulated into an ointment for treatment of boils, sores and ulcers. Traditionally used as a tonic for treatment of digestive complaints, pain, during and after labour.
Portulaca kermesina	Haaskos	Leaves	Used to treat skin irritations and has been recorded to have antibacterial properties.
Pterodiscus ngamicus	Botswana-sandkambro	Roots	Pieces of the rootstock mixed with milk and boiled are used as a tonic to strengthen the body.
Sansevieria aethiopica	Common bowstring hemp	Rhizomes and leaves	The plant is a popular remedy for ear and tooth ache. It's traditionally for treatment of haemorrhoids, ulcers and intestinal worms.
Xenostegia tridentata subsp *angustifolia*	Miniature morning-glory	Herb	Used in traditional medicine to treat stomach complaints and headaches (Van der Walt, 2009).
Woody species			
*Boscia albitrunca (*NFA*)*	White-stem Shepherds-tree	Root	Root decoctions are used to treat haemorrhoids. Plant used both medicinally and magically.
Burkea africana	Wild seringa	Roots	[4]The roots are used to treat stomach pain and tooth ache.
Combretum imberbe	Leadwood	Bark, flowers, roots, leaves	[5]Parts of this tree are used by various tribes in a number of ways: smoke that comes from the burning leaves has been used to relieve coughs, colds and chest complaints. The flowers can also be used as a cough mixture. The leaves are believed to have magical powers. For treatment of diarrhoea and stomach pains, root decoctions are used. A combination of roots and leaves are taken against bilharzia.
Combretum apiculatum subsp. *apiculatum*	Red bushwillow	Leaves, stems	[6]Medicinally, a decoction of the leaves has been used as a steam bath and as an enema to relieve stomach disorders. As treatment for conjunctivitis, an ash from the burnt stem is mixed with white clay and water and the resulting paste is spread over the face.
Combretum hereroense	Russet bushwillow	Bark, Roots	[7]Root infusions used as enemas to treat stomach complaints; root decoctions treat venereal disease. Bark used for heart disease and heart-burn. Dried young shoots used for the treatment of tonsillitis and coughs.
Commiphora africana	Poison-grub corkwood	Bark and fruit	Washed bark mixed with salt is applied to snake bites. Stomach ailments are treated with the fruit. Abdominal spasms and fever are treated with the resin that has been made into a plaster. Several parts of the plant used for cosmetic uses such as perfumes and lotions. Soft sappy stems wood and clean stems are used
Dichrostachys cinerea	Sickle Bush	Roots, bark, leaves and fruit	Pods are very nutritious and eaten by game and stock. The wood is hard and durable, used as fencing posts. Roots, bark, leaves and fruit used in traditional medicine.
Elephantorrhiza elephantina	Elandsbean	Underground rhizomes, commonly referred to as roots, are used	Traditional remedy for a wide range of ailments, including diarrhoea and dysentery, stomach disorders, haemorrhoids and perforated peptic ulcers, and as emetics. It is popular for the treatment of skin diseases and acne.
Grewia bicolor	White-leaved resin	Bark and roots	Bark used medicinally. Roots used to treat chest complaints; tannins present in the roots.

[4] http://pza.sanbi.org/burkea-africana
[5] http://pza.sanbi.org/combretum-imberbe
[6] http://pza.sanbi.org/combretum-apiculatum-subsp-apiculatum
[7] https://www.thetreeapp.co.za/team/

SPECIES	COMMON NAME	PLANT PARTS USED	MEDICINAL USES
Grewia flava	Velvet Raisin Bush	Bark & fruit	The bark is used for making baskets, and an intoxicating drink is made from the fruit. Porridge is made from dried fruit
Grewia villosa	Mallow raisen	Roots	Roots used medicinally.
Peltophorum africanum	African-wattle	Roots, bark, leaves	[8]There are also various medicinal uses recorded. Roots are used to heal wounds, toothache and throat sores; root, leaves and bark used to clear intestinal parasites and relieve stomach problems; bark relieves colic; stem and root used for diarrhoea and dysentery. It is also used to treat eyes.
Sclerocarya birrea subsp. *caffra* (NFA)	Marula	Bark	Bark widely used for medicinal purposes (proven antihistamine and anti-diarrhoea properties) and to obtain a pale brown dye. Fruit is edible, eaten fresh or made into a jelly.
Senegalia mellifera	Black-thorn	Gum	Gum applied to mouth ulcers and to treat oral thrush.
Sida cordifolia subsp. *cordifolia*	Heart-leaf Sida	Herb	Used as a medicine for various ailments, e.g. dysentery (Van der Walt, 2009).
Terminalia sericea	Silver-cluster leaf	Bark, roots	Roots reputedly poisonous but widely used medicinally or treating stomach complaints and for relieving colic, diarrhoea, menstrual cramps, stomach disorders, eye infections, respiratory complaints, infertility venereal diseases and as an antidote to poisons. Extracts used as eye lotions and hot infusions of the root's underlayers makes a fermentation for treating pneumonia. Bark used to treat diabetes and wounds. A glucoside, nerifolin, has been isolated from parts of the plant, which has an effect on heart and pulse rate.
Vachellia erioloba	Camel thorn	Various parts of the plant	[9]Dry powdered pods can be used to treat ear infections. The gum can be used for the treatment of gonorrhoea and the pulverized, burned bark can be used to treat headaches. The root can be used to treat toothache. To treat tuberculosis, the root is boiled for a few minutes and the infusion is swirled around in the mouth and spat out.
Vachellia nilotica subsp. *kraussiana*	Scented pod thorn	Bark, leaves and other parts of the tree	The bark exudes an edible gum and is used medicinally according to Van Wyk et al. (2000). Other parts of the tree[10] were used to treat eye diseases, or as a tranquillizer and even as an aphrodisiac. A root extract was used in the treatment of tuberculosis, impotence, diarrhoea, haemorrhages, toothache, dysentery and gonorrhoea. Extracts made from the leaves are used in the treatment of menstrual problems, eye infections, sores (specifically those caused by leprosy), ulcers, indigestion and haemorrhage.
Vachellia tortilis subsp. *heteracantha*	Umbrella thorn	Bark	Bark used in traditional medicine.
Waltheria indica	Meidebossie	Various parts of the plant	[11]The plant is used for barrenness by Shangaan woman. The roots, leaves and whole plant have been used to combat sexually transmitted infections, urinary tract infections, and a variety of infant illnesses in Limpopo.

[8] http://pza.sanbi.org/peltophorum-africanum
[9] http://pza.sanbi.org/vachellia-erioloba
[10] http://pza.sanbi.org/vachellia-nilotica-subsp-kraussiana
[11] http://pza.sanbi.org/waltheria-indica

3.6 Sources of Land Degradation

Human activities and/ or climatic variation can gradually, or rapidly, lead to the deterioration of the conditions of land, which impacts on habitat integrity and tends to reduce floral diversity. The cost and effort it will take to restore habitat integrity of an area is positively correlated with the extent to which the veld has been degraded. To determine whether the vegetation of an area has been degraded there are several indicators to look out for (Van Oudtshoorn, 2015):

- Lack of vegetation and/or diversity;
- Bush encroachment; and
- Alien and invasive plant species.

Within the study area, only the Degraded habitat unit lacks a good vegetation cover. The Sweet Bushveld A and B habitat units have a good vegetation cover that is floristically diverse and representative of the reference vegetation type. Thus, the study area has low levels of veld degradation and habitat integrity of the study area at the time of assessment was good. Further vegetation indicators of veld degradation relevant to the study area are discussed below.

3.6.1 Alien and Invasive Plant (AIP) Species

Alien and invasive floral species are floral species of exotic origin which are invading previously pristine areas or ecological niches (Bromilow, 2001). Not all weeds are exotic in origin but, as these exotic plant species have very limited natural “check” mechanisms within the natural environment, they are often the most opportunistic and aggressively growing species within the ecosystem. Therefore, they are often the most dominant and noticeable within an area. Disturbances of the ground through trampling, excavations or landscaping often leads to the dominance of exotic pioneer species that rapidly dominate the area. Under natural conditions, these pioneer species are overtaken by sub-climax and climax species through natural veld succession. This process, however, takes many years to occur, with the natural vegetation never reaching the balanced, pristine species composition prior to the disturbance. There are many species of indigenous pioneer plants, but very few indigenous species can out-compete their more aggressively growing exotic counterparts.

Alien vegetation invasion causes degradation of the ecological integrity of an area, causing (Bromilow, 2001):

- A decline in species diversity;
- Local extinction of indigenous species;
- Ecological imbalance;

- Decreased productivity of grazing pastures; and
- Increased agricultural input costs.

During the floral assessment, dominant alien and invasive plant species were identified and are listed in the table below.

Table 3: Dominant AIPs identified during the field assessment.

Species	English name	NEMBA Category*	Habitat Unit
Mollugo cerviana var *cerviana*	Thread-stem carpetweed	Not listed	Degraded Habitat
Portulaca oleraceae	Common purslane	Not listed	Degraded Habitat

From the above, it is clear that a very low diversity and abundance of alien species currently occur within the study area. The presence of AIPs was limited to the Degraded Habitat Unit and the exclusion of these species within the natural areas is likely due to a lack of opportunity seeing that the area is largely isolated from anthropogenic sources of introduction such as towns or developments.

It is important that all AIPs located in the study area be removed on a regular basis as part of maintenance activities and if any species listed within the NEMBA: Alien and Invasive Species Regulations, GN R864 of 2016, their control as stipulated within the Alien and Invasive Species Regulations should be followed.

3.6.2 Bush encroachment

Bush encroachment is referred to as the densification of undesirable local plants that can outcompete valuable forage plants and also lead to the obstruction of animal movement (Van Oudtshoorn, 2015). Both grazing capacity and grass production can be greatly reduced by bush encroachment.

According to Mucina and Rutherford (2006) the Limpopo Sweet Bushveld vegetation type, though limited by low rainfall, is a good area for game and cattle farming due to the high grazing capacity of sweet veld[12]. However, in disturbed areas thickets of *Senegalia erubescens*, *Senegalia mellifera* and *Dichrostachys cinerea* can become almost impenetrable. On farms surrounding the study area it was evident that *Dichrostachys cinerea* was heavily encroaching, whereas this was not the case for the study area - thus indicating that the veld has not been greatly disturbed. However, in areas where there was increased disturbance such as selective grazing pressures, bush encroachment by *Grewia flava*, *Grewia flavescens*

[12] Veld in which the forage plants retain their acceptability and nutritive value after maturity or in which different plants are acceptable at different times so that the veld can be utilised by stock at all times of the year (Van Oudtshoorn, 2015).

and several *Heliotropium* spp. was evident. This encroachment by the above-mentioned species is of a low grade and to avoid further impacts to habitat integrity it is recommended that bush encroachment be managed – especially with any potential disturbances caused by the proposed mine activities.

4 SENSITIVITY MAPPING

The figures below conceptually illustrate the areas considered to be of increased ecological sensitivity with the proposed infrastructure layout overlaid. The areas are depicted according to their sensitivity in terms of the presence or potential for floral SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity. The table below presents the sensitivity of each identified habitat unit along with an associated conservation objective and implications for development.

Table 4: A summary of the sensitivity of each habitat unit and implications for development.

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Sweet Bushveld B	**Moderately High**	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.	This habitat unit has the highest floral ecological sensitivity and importance within the study area due to the higher species diversity and the high density and abundance of floral SCC. Most of the proposed mining infrastructure falls within this habitat unit, and due to its sensitivity, it is recommended that as far possible and feasible, the location of the infrastructure areas be reconsidered – especially all proposed infrastructure south-west of the Open Pit. New designs should not lead to increased habitat fragmentation. Management of AIPs and bush encroachment will be important as increased disturbances will arise from mining activities. A rehabilitation plan and fire management plan should be implemented throughout the proposed project.
Sweet Bushveld A	**Intermediate**	Preserve and enhance the biodiversity of the habitat unit and surrounds while optimising development potential.	The vegetation of the Sweet Bushveld A is intact and representative of the Limpopo Sweet Bushveld vegetation type. This habitat unit provides favourable growing conditions that support a moderate diversity of floral species, including a high diversity of floral SCC. The habitat unit as a whole is in a good ecological condition with moderately high habitat integrity. Several of the proposed mining activities fall within this habitat unit, including the majority of the proposed Open Pit. Backfilling of the Open Pit has not yet been considered and, therefore, it can be expected that floral diversity within this habitat unit, as well as within the study area, will be negatively impacted. However, floral diversity within the region will be minimally affected. All mining activities within this habitat unit should be kept to the footprint areas, and edge effects should be carefully managed. The control of AIPs and the management of bush encroachment is recommended.
Degraded Areas	**Moderately Low**	Optimise development potential.	The Degraded Habitat Unit is of moderately low sensitivity and importance from a floral ecological perspective. The vegetation within this habitat unit is no longer representative of the reference vegetation type and is dominated by species associated with disturbed areas. Several floral SCC occurs within this habitat unit, albeit along the edges thereof. These species will require permits if they will be impacted upon by mining activities. Due to the disturbed nature of this habitat unit, the vegetation is more susceptible to AIP proliferation. Thus an AIP management plan is recommended to control and prevent their spread.

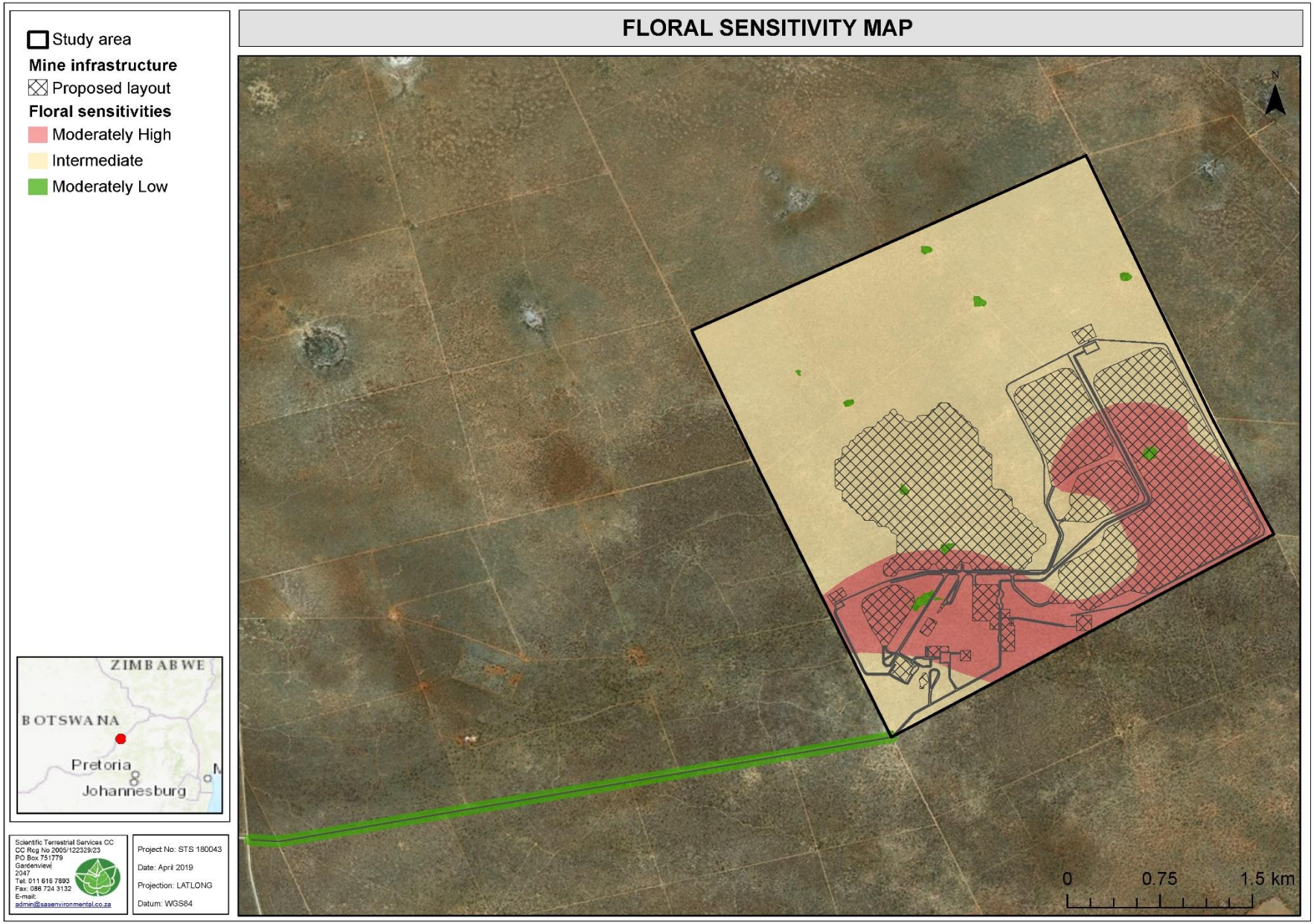


Figure 9: Sensitivity map for the study area with the proposed mining-related infrastructure.

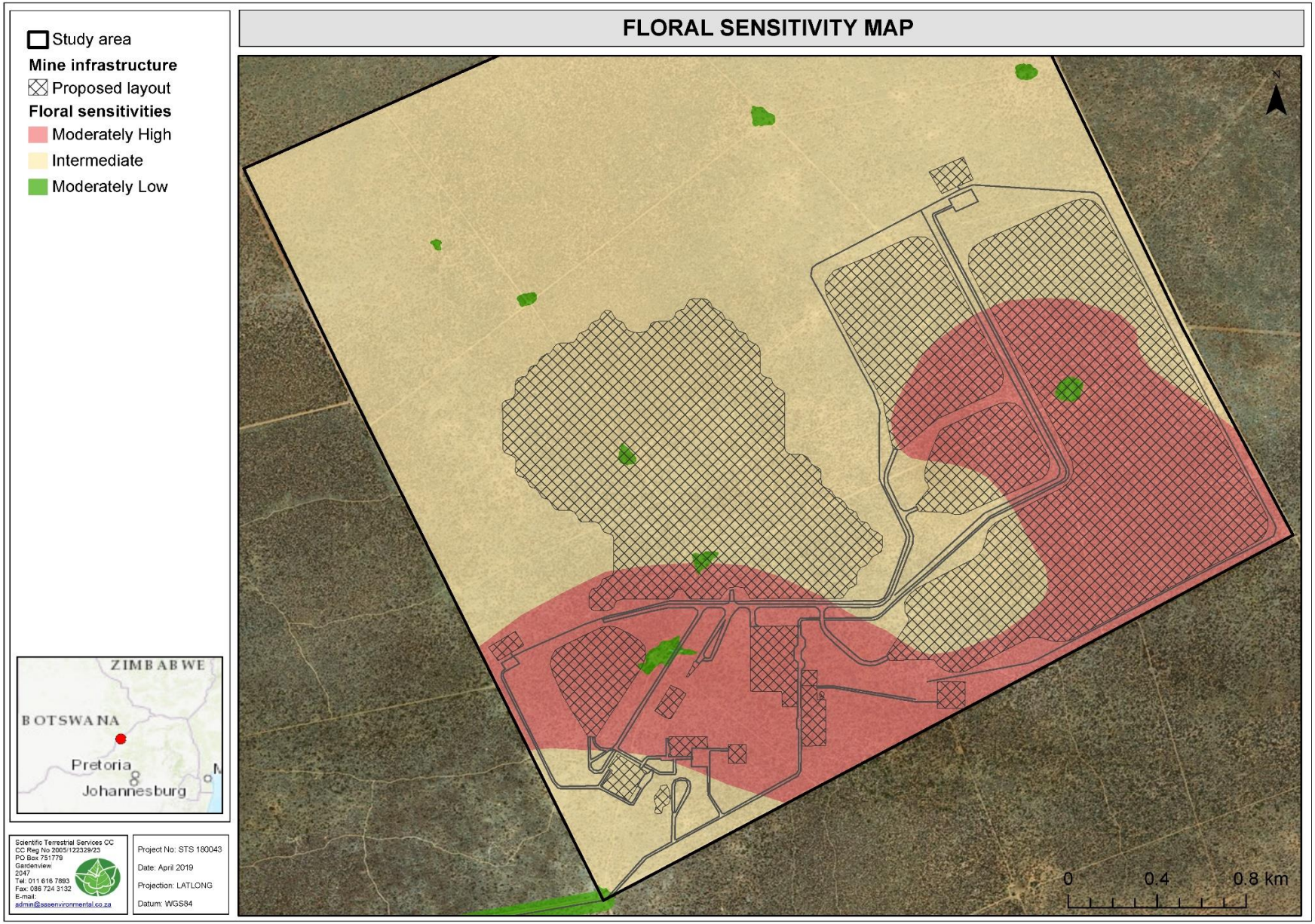


Figure 10: Sensitivity map for the study area zoomed in on the proposed mining related infrastructure.

5 FLORAL IMPACT ASSESSMENT

The sections below serve to summarise the significance of perceived impacts on the floral ecology of the study area, with impacts identified presented in Section 5.2 of this report.

Table 5 in Section 5.2 below presents the impact assessment according to the method described in Appendix B of this report. All impacts are considered without mitigation taking place as well as with mitigation fully implemented. All the required mitigatory measures needed to minimise the impact is presented in Table 5 with a short summary thereof in Section 5.3.

5.1 Impact discussion

The proposed mining infrastructure will negatively impact on the floral communities within the study area, especially within the southern portion where most infrastructure is planned and where there is a higher abundance and diversity of floral species.

Floral SCC that will be directly affected by the proposed infrastructure layout includes NFA protected trees such as *Boscia albitrunca* (Shepard's tree); *Sclerocarya birrea* subsp. *caffra* (Marula) and *Vachellia erioloba* (Camel Thorn). Moreover, the TOPS listed *Harpagophytum zeyheri* will also be directly affected. The above-mentioned species are also of medicinal value and it can be expected that the proposed Gruisfontein Project will increase the risk of harvesting of these species as human populations in the area increase.

There is also great potential for the proliferation of AIPs or the encroachment of species such as *Dichrostachys cinerea, Grewia flava* and *Senegalis melifera*, in response to disturbances. Therefore, it will be important to manage edge effects within the study area.

Activities which are likely to negatively impact floral species within the study area include, but are not limited to, the following:

- Placement of mining infrastructure within sensitive, natural floral habitat;
- Clearing of vegetation during construction and operational activities;
- Alien and invasive plant proliferation and erosion in disturbed areas;
- Increased possibility of collection of medicinal plants; and
- Edge effects compromising habitat integrity through, e.g., enabling AIPs to proliferate, decreasing habitat connectivity and increasing the extent of transformed habitat with little chance of habitat restoration.

The following section provides an indication of the anticipated impact significance pre- and post-mitigation.

5.2 Results of the Impact Assessment

The impact significance of the proposed mining expansion plans associated with the loss of floral species and habitat is considered to be medium to medium-high prior to the implementation of mitigation measures. Following the implementation of mitigation measures, it is likely that most of the impacts can be decreased to a medium-low to low significance level.

The following table provides an indication of the anticipated impact significance pre- and post-mitigation during all phases of the mining project.

Table 5: Summary of the Risk Assessment of the Pre-Construction Phase of the proposed Gruisfontein Project on the Floral ecology of the study area.

ID	Environmental Aspect	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Weigh value	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
Pre-Construction Phase														
1	Potential poorly planned placement of the proposed infrastructure within natural areas and areas identified as increasingly sensitive during ecological studies.	Extensive and unnecessary loss of favourable floral habitat, leading to a decline in floral diversity, including a decline in floral SCC (Species of Conservation Concern) numbers within the study area.	Negative	Long Term	Local	Probable	High	Medium	3	Low to Medium	39	• Minimise loss of indigenous vegetation where possible through planning and suitable layouts; • The footprint area of all proposed infrastructure should be limited to what is absolutely necessary. Disturbance to the surrounding natural habitat should be kept to a minimal; • It must be ensured that, as far as possible, all proposed infrastructure, including temporary infrastructure, is placed outside of sensitive habitat units; • Access roads should be kept to existing roads so to reduce fragmentation of existing natural habitat; and • Prior to construction activities floral SCC that will be directly impacted upon need to be marked and removed to a suitable similar habitat or nursery as part of a rescue and relocation plan; and • All relevant permits are to be obtained from LEDET and DAFF prior to the removal of floral SCC.	Medium	Low

ID	Environmental Aspect	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Weigh value	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
Pre-Construction Phase														
2	Potential failure to implement the required mitigation measures before and at the commencement of construction activities: • Failure to implement an Erosion Control Plan; • Failure to have a Rehabilitation Plan developed, and implemented, before commencement of mining activities; and • Failure to implement an Alien and Invasive Plant (AIP) Management/Control Plan before construction activities commence.	• Extensive and unnecessary loss of favourable floral habitat, leading to a decline in floral diversity, including a decline in floral SCC numbers within the study area. • Proliferation of AIPs within the study area and the surrounding areas due to a failure to implement AIP Control Plan during the pre-construction phase. If AIPs are not managed before construction activities, dispersal propagules such as seeds will end up in topsoil stockpiles and reintroduced during the rehabilitation phase.	Cumulative Negative	Permanent	District	Improbable	Very High	High	5	Medium to High	75	• Ensure that sound environmental management is in place during the planning phase; • It is recommended that prior to the commencement of construction activities that the entire construction servitude, including lay down areas and stockpile areas etc., be fenced off and clearly demarcated; • Prior to the commencement of construction activities on site an AIP Management/Control Plan should be compiled for implementation throughout the construction and operational phases; and • Prior to the commencement of construction activities on site, a rehabilitation plan should be developed for implementation throughout the development phases.	Medium to High	Low to Medium

ID	Environmental Aspect	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Weigh value	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
Pre-Construction Phase														
3	Potential failure to comply with national and regional legislation regarding permit applications for the removal / destruction of species listed under the: - Threatened or Protected Species (TOPS) Regulations (GN 255 of 2015) under Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004); - The list of Schedule 11 (Specially protected) and/or Schedule 12 (Protected plants) under the Limpopo Environmental Management Act, 2003 (Act 7 of 2003) (LEMA); and - The List of Protected Tree Species (GN 809 of 2014) under the National Forest Act (Act 84 of 1998) (NFA).	Unnecessary or unlawful destruction / removal of floral SCC leading to a decline in the numbers of NFA-Protected Tree species, TOPS flora and/or LEMA-Protected floral species within the study area. Potentially reducing the LEMA-Protected species within the broader region.	Negative	Permanent	Regional	Improbable	High	MediumtoHigh	4	Medium to High	60	• Before any construction activities can occur, a detailed walk down of the area must take place, during which all NFA-protected tree species should be marked and permits applied for to remove / cut / destroy these species; and • Permits from the relevant authorities, i.e. Limpopo Department of Economic Development and Tourism (LEDET) and Department of Agriculture, Forestry and Fisheries (DAFF), should be obtained before removal, cutting or destruction of protected species or floral SCC before any proposed mining activities may take place.	Medium to High	Low to Medium

ID	Environmental Aspect	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Weigh value	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
Pre-Construction Phase														
4	- Potential inadequate liaison with LEDET (Limpopo Department of Economic Development, Environment and Tourism) with regards to floral SCC rescue and relocation permits; - Potential failure to implement a Rescue and Relocation Plan for SANBI Red Data Listed (RDL) species; and - Potential inadequate planning with regards to new site locations for floral SCC.	Potential loss of floral SCC	Negative	Permanent	Provincial	Probable	High	MediumtoHigh	4	Medium to High	68	• Before any construction activities can occur a detailed walk down of the area must take place, during which all floral SCC should be identified and marked by a qualified specialist; • Prior to construction activities floral SCC that will be directly impacted upon need to be removed to a suitable similar habitat or nursery as part of a rescue and relocation plan; and • Permits from the relevant authorities, i.e. Limpopo Department of Economic Development and Tourism (LEDET) and Department of Agriculture, Forestry and Fisheries (DAFF), should be obtained before removal, cutting or destruction of protected species or floral SCC before any proposed mining activities may take place.	High	Low

Table 6: Summary of the Risk Assessment of the Construction Phase of the proposed Gruisfontein Project Project on the Floral ecology of the study area.

ID	Environmental Aspect	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Weigh value	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
Construction Phase														
5	Site preparation and clearing of vegetation for mine related infrastructure: Open Pit (135ha), including box-cut; - Discard Dump (154ha), soft overburden (18.3ha) and hard overburden (40.1ha) stockpiles; - 3-year Temporary Discard Dump (12ha); - Workshop and washbay (6.12ha); - Office, Training & Parking (2.52ha); - Explosives Magazine (1.37ha); - RoM Stockpile (1ha) and RoM Tip (0.12ha); - CHPP Plant (2.1ha) and Plant Infrastructure Area (1.16ha); - PCDs (1.67ha + 0.94); - Product Stockpile (0.58); - Electrical Substation (0.63ha); and - Bulk Water Supply Reservoirs (329m2 + 224m2). Continuous stretches of vegetation cleared along proposed linear developments: - 29.11 km of road (only 4.81km placed on existing road); and - approximately 9.8 km of trenches for water management.	**(5.1) The potential loss of floral SCC**: -Species listed under the National Forest Act (Act 84 of 1998) (NFA): *Boscia albitrunca* (Shepard's tree); *Combretum imberbe* (Leadwood); *Sclerocarya birrea* subsp. *caffra* (Marula) and *Vachellia erioloba* (Camel Thorn). -Species listed under the Limpopo Environmental Management Act (Act 7 of 2003) (LEMA): *Adenium oleifolium;* -Species listed under NEMBA TOPS (2015): *Harpagophytum zeyheri.* -Red and Orange Listed floral species. None recorded on site but there is a potential that the vulnerable (VU) *Corchorus psammophilus* occurs due to suitable habitat.	Negative	Long Term	Regional	Highly Probable	High	MediumtoHigh	4	Medium to High	64	• It is recommended that all construction personnel be educated in environmental awareness; • All floral SCC, with specific reference to species listed under LEMA and TOPS identified within the development footprint area, should be rescued and relocated to similar suitable habitat - permit applications from DAFF and LEDET will be required. Specific mention is made of the current proposed positions of the soft overburden dump and the discard dump that will directly impact on *Harpagophytum zeyheri*, listed under NEMBA TOPS (2015); however, its distribution within the study area is not necessarily restricted to the soft overburden dump and the discard dump. As part of a Rescue and Relocation Plan, these species should be relocated before impacted upon by the proposed mining activities; • The current proposed mine layout will directly impact on the NFA protected tree species, *Boscia albitrunca* (Shepard's tree); *Combretum imberbe* (Leadwood); *Sclerocarya birrea* subsp. *caffra* (Marula); and *Vachellia erioloba* (Camel Thorn). Rescue and Relocation of these species is not feasible. Thus, it is recommended that placement of infrastructure within the Sweet Bushveld B habitat unit, especially within the southern portion of the study area, be reconsidered due to the high abundance of *Boscia albitrunca*, and *Vachellia erioloba within* these sections; and • It is recommended that a thorough walkthrough of all footprint areas be completed to mark all protected tree species and that where feasible, infrastructure be placed around these trees (mostly applicable for linear developments and smaller infrastructure).	Low to Medium	Medium

5 continued…		**(5.2) Loss of floral diversity and favourable floral habitat due to construction activities**.	Negative	Long Term	Site-specific	Definite	Medium	Medium	3	Low to Medium	39	• The construction footprint must be kept as small as possible in order to minimise the impact on the surrounding environment, and vegetation clearing should be limited to what is absolutely essential; • Clearing of vegetation should take place in a phased manner to keep bare soil areas as small as possible and to limit the erosion potential. Additionally, construction personnel and construction vehicles should be kept to the bare minimal per site in order to reduce the construction footprint and potential for soil compaction; • All areas of increased ecological sensitivity, or with high abundances of floral SCC, should be designated as No-Go areas and be off-limits to all unauthorised construction vehicles and personnel; • Planning of temporary roads and access routes should take the site sensitivity plan into consideration. If possible, such roads should be constructed along existing roads and planned in such a manner that the habitat does not unnecessarily get fragmented; • Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities; • Roadsides serve as common corridors along which alien and invasive floral species are introduced and dispersed. Therefore an alien and invasive plant control plan should be implemented; • Edge effects of all construction activities, which may affect floral habitat within surrounding areas, are to be strictly managed, e.g. implement an alien and invasive plant control plan from the get-go, mitigate soil erosion by reducing soil compaction caused by movement of construction personnel and vehicles, suppress dust in order to mitigate the impact of dust on flora within a close proximity of construction activities; and • A rehabilitation plan must be in place and, for disturbed areas where work has been completed.	Medium	Low to Medium
		(5.3) Collection of medicinal/ protected floral species within the study area.	Negative	Long Term	Local	Probable	High	MediumtoHigh	4	Medium	52	• No collection of firewood, floral SCC or medicinal floral species must be allowed by construction or mining personnel.	High	Low

		(5.4) Soil compaction and erosion as a result of development activities and storm water runoff leading to a loss of favourable floral habitat and consequently a further loss of diversity	Cumulative Negative	Long Term	Local	Probable	High	MediumtoHigh	4	Medium	52	• All soils compacted as a result of construction activities falling outside of the proposed infrastructure areas should be ripped and profiled. Special attention should be paid to alien and invasive plant control within these areas.	Medium to High	Low to Medium
6	Disposal of construction related material	Waste from construction material leading to disturbance of natural vegetation	Negative	Temporary	Site specific	Probable	Low	Medium	3	Low to Medium	21	• All construction related waste and material is to be disposed of at a registered waste facility; and • No waste of construction rubble is to be dumped in the surrounding natural habitats.	High	Low
7	Increased personnel on site	Increased fire frequency and intensity, as well as uncontrolled fires due to increased human activity may impact on floral communities. Will potentially lead to loss of the remaining floral SCC; and Indiscriminate driving through veld leading to loss of floral species and destruction of floral habitat.	Negative	Long Term	Local	Probable	High	Medium	3	Low to Medium	39	• No illicit fires must be allowed during any phases of the proposed mining development. A Fire Management Plan (FMP) should be set in place to ensure that any fires that do originate can be managed and / or stopped before significant damage to the environment occurs; and • No indiscriminate driving through the veld is allowed. As far as possible vehicles are to utilise the existing roads. Where this is not feasible, new roads are to be located in areas of existing high disturbance, and not encroach upon sensitive habitats.	Medium	Low to Medium
8	Proliferation of Alien and Invasive Plants	Loss of surrounding floral diversity and floral SCC through the displacement of indigenous flora by AIP species - especially in response to disturbance in natural areas.	Cumulative Negative	Long Term	Regional	Probable	High	Medium to High	4	Medium to High	60	• Edge effects of all construction activities, such as erosion and alien and invasive plant species proliferation, which may affect natural habitat within surrounding areas, need to be strictly managed adjacent to the proposed infrastructure footprint areas; • Ongoing alien and invasive plant monitoring and eradication/control should take place throughout all phases of the development, and the project perimeters should be regularly checked during the operational phase for alien and invasive plant proliferation to prevent spread into surrounding natural areas; and • An alien and invasive plant control plan must be designed and implemented in order to monitor and control alien recruitment in disturbed areas.	Medium	Low to Medium

Table 7: Summary of the Risk Assessment of the Pre-Construction Phase of the proposed Gruisfontein Project on the Floral ecology of the study area.

ID	Environmental Aspect	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Weigh value	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
Operational Phase														
9	Blasting and removal of material from opencast pits	Dust and sediment from active mining areas may lead to the smothering of surrounding vegetation.	Negative	Long Term	Local	Definite	Medium	Medium	3	Medium	42	• Ecological footprint of open pit is to remain as small as possible whilst allowing for economical and optimal extraction of the material; • Suppress dust in order to mitigate the impact of dust on flora within a close proximity of blasting; • The alien and invasive plant management plan must be adhered to in order to control and manage alien floral species in the disturbed areas; • Edge effects relating to open cast blocks must be suitably managed to ensure that the surrounding habitat is not impacted upon.	Medium	Low to Medium
10	Operational phase disturbances and expansion of stockpiles and discard dumps	**(10.1) Loss of floral habitat** as a result of vegetation clearing related to the expansion of the Discard Dump (154ha), soft overburden (18.3ha) and hard overburden (40.1ha) stockpiles, the 3-year Temporary Discard Dump (12ha), RoM Stockpile (1ha), Product Stockpile (0.58) and PCDs (1.67ha + 0.94). **(10.2) Loss of floral diversity and favourable floral habitat** due to long-term habitat loss and disturbances associated with the above-mentioned mining activities.	Negative	Long Term	Local	Definite	High	Medium	3	Medium	45	• Stockpiles, discard dumps and PCD positions, and their expansion as material is deposited, should be kept as small as possible; and • The current proposed positions of surface infrastructure within the southern section of the study area will lead to the loss of a high abundance of NFA-protected floral species and it is recommended that their proposed positions be reconsidered to be placed within the Sweet Bushveld A habitat unit.	Medium	Low to Medium

ID	Environmental Aspect	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Weigh value	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
Operational Phase														
10 continued…		**(10.3) Loss of floral habitat due to vehicle access and other operational activities.**	Negative	Long Term	Site specific	Probable	Medium	Medium	3	Low to Medium	33	• No additional habitat is to be disturbed during the operational phase of the development; • Where possible existing roads are to be used for access purposes; • No vehicles are allowed to indiscriminately drive through sensitive habitat and natural areas; and • Upon completion of construction activities and decommissioning of access road, all impacted and disturbed areas should be ripped, reprofiled and reseeded with an indigenous veldgrass mixture that will assist to stabilise soils as soon as possible.	Medium to High	Low
		(10.4) Further loss of floral SCC through edge effects associated with mining activities.	Negative	Short Term	Local	Probable	Medium	Medium	3	Low to Medium	30	• Monitoring of relocation success of rescued and relocated floral SCC should take place during the operational phase; • Manage all edge effects stemming from mining operations and infrastructure areas; and • Harvesting of protected floral species by mining and operational personnel should be strictly prohibited.	Medium to High	Low

ID	Environmental Aspect	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Weigh value	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
Operational Phase														
11	Increase in alien vegetation as a result of disturbance	Decrease in floral habitat and diversity as AIPs outcompete native species in areas where operational-phase disturbances are not mitigated.	Cumulative Negative	Long Term	Local	Probable	High	Medium to High	4	Medium	52	• The proliferation of AIPs is expected within any disturbed areas. AIPs must be monitored and must be removed throughout the operational phase of the project to prevent their spread beyond the development footprint areas; • Alien plant seed dispersal within the top layers of the topsoil within footprint areas, that will have an impact on future rehabilitation, also has to be controlled; • Removal of the AIPs, with specific emphasis on Category 1b alien species, encountered within the study area and immediate surrounds must take place in order to comply with existing legislation (NEMBA: Alien and Invasive Species Regulations (Notice number 864 of 29 July 2016 in Government Gazette 40166)); • Removal of alien invasive species should preferably commence during the pre-construction and construction phases and continue throughout the operational, decommissioning and post-closure phase; and • An AIP Management/Control Plan should be implemented by a qualified professional. No chemical control of AIPs to occur without a certified professional.	Medium to High	Low to Medium

ID	Environmental Aspect	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Weigh value	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
Operational Phase														
12	Increased personnel on site as well as increased human populations within the surrounding area	Additional pressure on floral habitat by increased human populations associated with the proposed mining activities leading to a loss of floral habitat. - The increase in human population will also contribute to an increase in the collection of plant material for medicinal purposes. - Increased human activities also have the potential to lead to the introduction of alien and invasive plant species that can outcompete and displace native floral populations and reduce floral diversity within the study area. - Increase in fire frequencies is a risk.	Negative	Long Term	District	Probable	Medium	Medium	3	Low to Medium	39	• Manage all edge effects stemming from mining operations and infrastructure areas; • Implement erosion control measures where necessary to ensure that further habitat loss does not occur; • Any waste or toxic spills from vehicles or mining infrastructure must be dealt with immediately in accordance with the waste management plan; • No uncontrolled or unsanctioned fires are allowed. A Fire Management Plan should be in place; and • Implement an AIP Management / Control Plan that includes ongoing monitoring and control of the presence and/or re-emergence of such species.	Medium to High	Low
13	Increase in erosion as a result of disturbance	Loss of preferred floral habitat	Negative	Medium Term	Site specific	Probable	Medium	Medium	3	Low to Medium	30	• Implement erosion control measures where necessary to ensure that further habitat loss does not occur; • Erosion must be monitored on a continual basis throughout the operational phase, particularly in the vicinity of disturbed areas and where increased human activities will take place; and • Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed mining activities.	Medium to High	Low

ID	Environmental Aspect	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Weigh value	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
Operational Phase														
14	Waste, discharge and pollution	Loss of natural vegetation due to waste, discharge and pollution	Cumulative Negative	Long Term	District	Improbable	High	Medium to High	4	Medium	52	• No operational-related waste material is to enter natural habitats; • It must be ensured that the mine process water system is managed in such a way as to prevent discharge to the receiving environment; • In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practised near the surface area to prevent the ingress of hydrocarbons into the topsoil and subsequent habitat loss; and • Any waste or toxic spills from vehicles or mining infrastructure must be dealt with immediately in accordance with the waste management plan.	Medium to High	Low to Medium
15	Operational-phase edge effects	On-going disturbance of soils, including erosion and sedimentation due to operational activities leading to altered floral habitat. Dust generation during operational activities leading to a loss of floral habitat.	Negative	Long Term	Local	Probable	High	Medium to High	4	Medium	52	• All soils compacted as a result of operational activities falling outside of the proposed infrastructure areas should be ripped and profiled. Special attention should be paid to alien and invasive plant control within these areas; and • An effective dust management plan must be designed and implemented in order to mitigate the impact of dust on floral species throughout the operational phase.	Medium	Low to Medium

ID	Environmental Aspect	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Weigh value	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
Decommissioning Phase														
16	Decommissioning/ removal of surface infrastructure: - Potential failure to implement and manage biodiversity action plan, rehabilitation plan, alien and invasive control plan; - Compacted soils limiting the re-establishment of natural vegetation; - Increased risk of erosion in disturbed areas; - Improper rehabilitation of disturbed areas leading to permanent floral habitat loss.	Highly compacted soils limiting the re-establishment of natural vegetation. Increased risk of erosion in disturbed areas. Proliferation of alien and invasive plant species leading to ongoing floral loss. Inadequate rehabilitation of open pit mining blocks and disturbed areas leading to permanent floral habitat loss.	Cumulative Negative	Long Term	Local	Improbable	High	High	5	Medium to High	60	• Ensure sound implementation of AIP Management / Control Plan; • Where soils have been compacted, they are to be ripped and where necessary reprofiled; • Indigenous grass species are to be used for revegetation of disturbed areas; • All surface infrastructure is to be removed and waste material disposed of at a registered dump site. Waste and remnant mine related material are not to be dumped or left within the focus area.	Medium to High	Low to Medium
17	Proliferation of alien and invasive floral species in disturbed areas	Altered vegetation communities within the study area	Cumulative Negative	Long Term	Local	Improbable	High	Medium	3	Low to Medium	36	• A bi-annual alien vegetation clearance programme should be implemented for up to 2 years after closure; • Follow up with alien and invasive plant control measures for a period of 5 years post-closure;	Medium to High	Low

ID	Environmental Aspect	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Weigh value	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
Decommissioning Phase														
18	Ongoing mining development and ineffective rehabilitation	Ongoing erosion, habitat loss, alien plant proliferation and the loss of floral species diversity Potentially lead to permanent transformation of floral habitat. Cumulative loss of natural vegetation in the region	Cumulative Negative	Permanent	Local	Probable	High	High	5	Medium to High	70	• Implement all recommendations as per the mine closure plan; • Use of a nursery developed by the mine to cultivate indigenous/endemic and SCC plant species with a focus on rehabilitation during the post-closure phase in conjunction with a suitably qualified specialist. This will assist in areas where regrowth is not to an acceptable standard; and • Continue monitoring of rehabilitation activities for a minimum period of 5 years following the mine closure or until an acceptable level of habitat and biodiversity re-instatement has occurred, in such a way as to ensure that natural processes and veld succession will lead to the re-establishment of the natural wilderness conditions which are analogous to the pre-mining conditions of the area.	Medium	Medium

5.3 Probable Latent Impacts

Even with mitigation, latent impacts on the receiving floral ecological environment are deemed likely, with particular reference to impacts stemming from inadequate rehabilitation or continual disturbances, thus decreasing habitat integrity through the proliferation of AIPs and bush encroachment. The following points highlight the key latent impacts that have been identified that will be relevant within the MRA:

- Permanent loss of ecologically intact floral habitat;
- Loss of, or impairment of, and altered floral species diversity;
- Alien and invasive plant proliferation; and
- Permanent loss of, or impairment of and altered floral SCC and suitable habitat.

5.4 Floral Monitoring

A floral monitoring plan must be designed and implemented throughout all phases of the mining development, should it be approved. The following points aim to guide the design of the monitoring plan, and it must be noted that the monitoring plan must be continually updated and refined for site-specific requirements:

- Upon agreement of the final mine layout, permanent monitoring plots must be established in areas surrounding the surface infrastructure and rehabilitated areas. These plots must be designed to accurately monitor the following parameters:
  - Measurements of crown and basal cover;
  - Species diversity;
  - Species abundance;
  - Impact of dust on flora;
  - Recruitment of indigenous species;
  - Alien vs. Indigenous plant ratio;
  - Recruitment of alien and invasive plant species;
  - Erosion levels and the efficacy of erosion control measures;
  - Vegetation community structure including species composition and diversity which should be compared to pre-development conditions; and
  - Presence, abundance and condition of floral SCC communities.
- Monitoring of rehabilitation trials in light of the above parameters must also take place throughout all phases of the proposed mining development and for a period of 5 years after decommissioning and closure;

- The rehabilitation plan must be regularly updated in accordance with the monitoring results in order to ensure that optimal rehabilitation measures are employed;
- Results of the monitoring activities must be considered during all phases of the proposed mining development and action must be taken to mitigate impacts as soon as negative effects from mining-related activities become apparent; and
- The method of monitoring must be designed to be subjective and repeatable in order to ensure consistent results.

6 CONCLUSION

Scientific Terrestrial Services (STS) was appointed to conduct a faunal and floral ecological assessment as part of the Environmental Impact Assessment (EIA) process for the proposed Gruisfontein coal mine project within the Limpopo Province.

Three habitat units for the study area was defined based on the results of the field assessment, namely Sweet Bushveld A, Sweet Bushveld B and Degraded habitat. The ecological sensitivity of the habitat units varied between moderately high (Sweet Bushveld B), intermediate (Sweet Bushveld A) and moderately low (Degraded Habitat).

The study area is largely in an undisturbed condition and the farm is well-managed as was evident with the low levels of bush encroachment in comparison to neighbouring farms. Within the study area, several NFA protected tree species are present, the majority of which were recorded within the southern section where most of the proposed mine infrastructure is proposed. The Gruisfontein coal mine project will thus impact not only on habitat integrity and floral diversity within the study area but will lead to a large reduction in the number of individual floral SCC. It is recommended that infrastructure within the southern-most section be reconsidered; however, new placements should not hinder habitat connectivity.

The perceived impact significance of the proposed mining activities prior to mitigation affecting floral habitat, diversity and SCC are medium-low to medium-high significance impacts. If effective mitigation takes place, many of the impacts may be reduced to a low to medium significance rating. It is thus deemed essential that a cogently developed, documented and managed biodiversity management plan be implemented and maintained throughout the life of the proposed Gruisfontein coal mine.

The objective of this study was to provide sufficient information on the floral ecology of the area, together with other studies on the physical and socio-cultural environment, in order for the Environmental Assessment Practitioner (EAP) and the relevant authorities to apply the principles of Integrated Environmental Management (IEM) and the concept of sustainable development. The needs for conservation as well as the risks to other spheres of the physical and socio-cultural environment need to be compared and considered along with the need to ensure economic development of the country. It is the opinion of the ecologists that this study provides the relevant information required in order to implement IEM and to ensure that the best long-term use of the ecological resources in the study area will be made in support of the principle of sustainable development.

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APPENDIX A: Floral method of Assessment

Floral Species of Conservational Concern Assessment

Prior to the field visit, a record of floral SCC and their habitat requirements was acquired from SANBI for the Quarter Degree Square in which the study area is situated, as well as relevant regional, provincial and national lists. Throughout the floral assessment, special attention was paid to the identification of any of these SCC as well as the identification of suitable habitat that could potentially support these species.

The Probability of Occurrence (POC) for each floral SCC was determined using the following calculations wherein the distribution range for the species, specific habitat requirements and level of habitat disturbance were considered. The accuracy of the calculation is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.

Each factor contributes an equal value to the calculation.

Distribution						
	Outside of known distribution range					**Inside known distribution range**
Site score						
EVC 1 score	0	1	2	3	4	5
Habitat availability						
	No habitat available					**Habitat available**
Site score						
EVC 1 score	0	1	2	3	4	5
Habitat disturbance						
	0	**Very low**	**Low**	**Moderate**	**High**	**Very high**
Site score						
EVC 1 score	5	4	3	2	1	0

[Distribution + Habitat availability + Habitat disturbance] / 15 x 100 = POC%

Floral Habitat Sensitivity

The floral habitat sensitivity of each habitat unit was determined by calculating the mean of five different parameters which influence floral communities and provide an indication of the overall floristic ecological integrity, importance and sensitivity of the habitat unit. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Floral SCC:** The confirmed presence or potential for floral SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Unique Landscapes:** The presence of unique landscapes or the presence of an ecologically intact habitat unit in a transformed region;
- **Conservation Status:** The conservation status of the ecosystem or vegetation type in which the habitat unit is situated based on local, regional and national databases;
- **Floral Diversity:** The recorded floral diversity compared to a suitable reference condition such as surrounding natural areas or available floristic databases; and
- **Habitat Integrity:** The degree to which the habitat unit is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the floral habitat sensitivity class in which each habitat unit falls. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the habitat unit in question. In order to present the results use is made of spider diagrams to depict the significance of

each aspect of floral ecology for each vegetation type. The different classes and land-use objectives are presented in the table below:

Table A1: Floral habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1 < 1.5	Low	Optimise development potential.
≥1.5 <2.5	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
≥2.5 <3.5	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
≥3.5<4.5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
≥4.5 ≤5.0	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX B: Impact Assessment Methodology

Impact Significance

Nature and Status

The 'nature' of the impact describes what is being affected and how. The 'status' is based on whether the impact is positive, negative or neutral.

Spatial Extent

'Spatial Extent' defines the spatial or geographical scale of the impact.

Category	Rate	Descriptor
Site	1	Site of the proposed development
Local	2	Limited to site and/or immediate surrounds
District	3	Lephalale Local Municipal Area
Region	4	Waterberg District Municipal Area
Provincial	5	Limpopo Province
National	6	South Africa
International	7	Beyond South African borders

Duration

'Duration' gives the temporal scale of the impact.

Category	Rate	Descriptor
Temporary	1	0 – 1 years
Short term	2	1 – 5 years
Medium term	3	5 – 15 years
Long term	4	Where the impact will cease after the operational life of the activity either because of natural process or by human intervention
Permanent	5	Where mitigation either by natural processes or by human intervention will not occur in such a way or in such a time span that the impact can be considered as transient

Probability

The 'probability' describes the likelihood of the impact actually occurring.

Category	Rate	Descriptor
Rare	1	Where the impact may occur in exceptional circumstances only
Improbable	2	Where the possibility of the impact materialising is very low either because of design or historic experience
Probable	3	Where there is a distinct possibility that the impact will occur
Highly probable	4	Where it is most likely that the impact will occur
Definite	5	Where the impact will occur regardless of any prevention measures

Intensity

'Intensity' defines whether the impact is destructive or benign, in other words the level of impact on the environment.

Category	Rate	Descriptor
Insignificant	1	Where the impact affects the environment is such a way that natural, cultural and social functions and processes are not affected. Localised impact and a small percentage of the population is affected
Low	2	Where the impact affects the environment is such a way that natural, cultural and social functions and processes are affected to a limited extent
Medium	3	Where the affected environment is altered in terms of natural, cultural and social functions and processes continue albeit in a modified way

High	4	Where natural, cultural or social functions or processes are altered to the extent that they will temporarily or permanently cease
Very High	5	Where natural, cultural or social functions or processes are altered to the extent that they will permanently cease, and it is not possible to mitigate or remedy the impact

Ranking, Weighting and Scaling

The weight of significance defines the level or limit at which point an impact changes from low to medium significance, or medium to high significance. The purpose of assigning such weights serves to highlight those aspects that are considered the most critical to the various stakeholders and ensure that the element of bias is taken into account. These weights are often determined by current societal values or alternatively by scientific evidence (norms, etc.) that define what would be acceptable or unacceptable to society and may be expressed in the form of legislated standards, guidelines or objectives.

The weighting factor provides a means whereby the impact assessor can successfully deal with the complexities that exist between the different impacts and associated aspect criteria.

Spatial Extent	**Duration**	**Intensity / Severity**	**Probability**	**Weighting factor**	**Significance Rating (SR - WOM) Premitigation**	**Mitigation Efficiency (ME)**	**Significance Rating (SRWM) Post Mitigation**
Site (1)	Short term (1)	Insignificant (1)	Rare (1)	Low (1)	Low (0 – 19)	High (0.2)	Low (0 – 19)
Local (2)	Short to Medium term (2)	Minor (2)	Unlikely (2)	Low to Medium (2)	Low to Medium (20 – 39)	Medium to High (0.4)	Low to Medium (20 – 39)
District (3)							
Regional (4)	Medium term (3)	Medium (3)	Possible (3)	Medium (3)	Medium (40 – 59)	Medium (0.6)	Medium (40 – 59)
Provincial (5)	Long term (4)	High (4)	Likely (4)	Medium to High (4)	Medium to High (60 – 79)	Low to Medium (0.8)	Medium to High (60 – 79)
National (6)							
International (7)	Permanent (5)	Very high (5)	Almost certain (5)	High (5)	High (80 – 110)	Low (1.0)	High (80 – 110)

Impact significance without mitigation (WOM)

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned weightings, resulting in a value for each impact (prior to the implementation of mitigation measures).

Equation 1:

Significance Rating (WOM) = (Extent + Intensity + Duration + Probability) x Weighting Factor

Effect of Significance on Decision-makings

Significance is determined through a synthesis of impact characteristics as described in the above paragraphs. It provides an indication of the importance of the impact in terms of both tangible and intangible characteristics. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required.

Rating	Rate	Descriptor
Negligible	0	The impact is non-existent or insignificant, is of no or little importance to decision making.
Low	1-19	The impact is limited in extent, even if the intensity is major; the probability of occurrence is low and the impact will not have a significant influence on decision-making and is unlikely to require management intervention bearing significant costs.
Low to Medium	20 – 39	The impact is of importance, however, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels. The impact and proposed mitigation measures can be considered in the decision-making process
Medium	40 – 59	The impact is significant to one or more affected stakeholder, and its intensity will be medium or high; but can be avoided or mitigated and therefore reduced to acceptable levels. The impact and mitigation proposed should have an influence on the decision.
Medium to High	60 -79	The impact is of major importance but through the implementation of the correct mitigation measures, the negative impacts will be reduced to acceptable levels.
High	80 – 110	The impact could render development options controversial or the entire project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor and must influence decision making.

Mitigation

"Mitigation" is a broad term that covers all components of the 'mitigation hierarchy' defined hereunder. It involves selecting and implementing measures, amongst others, to conserve biodiversity and to protect, the users of biodiversity and other affected stakeholders from potentially adverse impacts because of mining or any other land use. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level. Offsetting of impacts is considered the last option in the mitigation hierarchy for any project.

The mitigation hierarchy in general consists of the following in order of which impacts should be mitigated:

- Avoid/prevent impact: can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases, if impacts are expected to be too high, the "no project" option should also be considered, especially where it is expected that the lower levels of mitigation will not be adequate to limit environmental damage and eco-service provision to suitable levels.
- Minimise (reduce) impact: can be done through utilisation of alternatives that will ensure that impacts on biodiversity and eco-services provision are reduced. Impact minimisation is considered an essential part of any development project.
- Rehabilitate (restore) impact is applicable to areas where impact avoidance and minimisation are unavoidable where an attempt to re-instate impacted areas and return them to conditions which are ecologically similar to the pre-project condition or an agreed post project land use, for example arable land. Rehabilitation can however not be considered as the primary mitigation toll as even with significant resources and effort rehabilitation that usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation should consist of the following phases in best practice:
    - Structural rehabilitation which includes physical rehabilitation of areas by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long terms sustainable ecological structure;
    - Functional rehabilitation, which focuses on ensuring that the ecological functionality of the ecological resources on the subject property supports the intended post-closure land use. In this regard, special mention is made of the need to ensure the continued functioning and integrity of wetland and riverine areas throughout and after the rehabilitation phase;
    - Biodiversity reinstatement that focuses on ensuring that a reasonable level of biodiversity is re-instated to a level that supports the local post-closure land uses. In this regard,

special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community of community suitable for supporting the intended postclosure land use; and

- Species reinstatement that focuses on the re-introduction of any ecologically important species, which may be important for socio-cultural reasons, ecosystem functioning reasons and for conservation reasons. Species re-instatement need only occur if deemed necessary.

➢ Offset impact: refers to compensating for latent or unavoidable negative impacts on biodiversity. Offsetting should take place to address any impacts deemed unacceptable which cannot be mitigated through the other mechanisms in the mitigation hierarchy. The objective of biodiversity offsets should be to ensure no net loss of biodiversity. Biodiversity offsets can be considered a last resort to compensate for residual negative impacts on biodiversity.

According to the DMR (2013) "Closure" refers to the process for ensuring that mining operations are closed in an environmentally responsible manner, usually with the dual objectives of ensuring sustainable post-mining land uses and remedying negative impacts on biodiversity and ecosystem services.

The significance of residual impacts should be identified on a regional as well as national scale when considering biodiversity conservation initiatives. If the residual impacts lead to irreversible loss or irreplaceable biodiversity, the residual impacts should be considered to be of very high significance and when residual impacts are considered to be of very high significance, offset initiatives are not considered an appropriate way to deal with the magnitude and/or significance of the biodiversity loss. In the case of residual impacts determined to have medium to high significance, an offset initiative may be investigated. If the residual biodiversity impacts are considered of low significance, no biodiversity offset is required.

Impact significance with mitigation measures (WM)

In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it is necessary to re-evaluate the impact.

Mitigation Efficiency (ME)

The most effective means of deriving a quantitative value of mitigated impacts is to assign each significance rating value (WOM) a mitigation effectiveness (ME) rating. The allocation of such a rating is a measure of the efficiency and effectiveness, as identified through professional experience and empirical evidence of how effectively the proposed mitigation measures will manage the impact. Thus, the lower the assigned value the greater the effectiveness of the proposed mitigation measures and subsequently, the lower the impacts with mitigation.

Equation 2: Significance Rating (WM) = Significance Rating (WOM) x Mitigation Efficiency (ME)

Mitigation Efficiency is rated out of 1 as follows:

Category	Rate	Descriptor
Not Efficient (Low)	1	Mitigation cannot make a difference to the impact
Low to Medium	0.8	Mitigation will minimize impact slightly
Medium	0.6	Mitigation will minimize impact to such an extent that it becomes within acceptable standards
Medium to High	0.4	Mitigation will minimize impact to such an extent that it is below acceptable standards
High	0.2	Mitigation will minimize impact to such an extent that it becomes insignificant

Significance Following Mitigation (SFM)

The significance of the impact after the mitigation measures are taken into consideration. The efficiency of the mitigation measure determines the significance of the impact. The level of impact is therefore seen in its entirety with all considerations taken into account.

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APPENDIX C: Floral SCC

Floral Species of Conservation Concern (SCC) that were assessed for the study area are listed within the tables below:

Table C1: Red and / or Orange Listed plant species for the study area and surrounding areas, including the QDS 2327AC, 2327AD, 2327BC, 2327CA, 2327CB and 2327DA. Data obtained from the new Plants of southern Africa (new POSA) online catalogue. Data is obtained from the Botanical Database of Southern Africa (BODATSA), which contains records from the National Herbarium in Pretoria (PRE), the Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH).

SCIENTIFIC NAME	ECOLOGY & DISTRIBUTION / RANGE	NATIONAL RED LIST STATUS	POC (%)
Acalypha caperonioides	Indigenous. Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, North West	DD	53
Crotalaria monophylla	Indigenous; Endemic. Steenkampsberg - Rocky quartzitic ridges in montane grassland.	VU	0
Corchorus psammophilus	Indigenous. Lephalale - Sandy flats in open Terminalia sericea veld.	VU	73
Eulalia aurea	Indigenous. Waterberg in Limpopo, widespread in southern and eastern Africa, from Botswana to Kenya. In water, along rivers and in occasionally inundated soils.	NT	47

Table C2: TOPS plant list for the Limpopo Province.

SCIENTIFIC NAME	HABITAT	DISTRIBUTION / RANGE	TOPS THREAT STATUS	NATIONAL RED LIST STATUS	POC (%)
Bowiea volubilis subsp. volubilis	Low and medium altitudes, usually along mountain ranges and in thickly vegetated river valleys, often under bush clumps and in boulder screes. Tolerates wet and dry conditions, growing predominantly in summer rainfall areas with an annual rainfall of 200-800 mm.	Eastern Cape to Limpopo Province. Widespread elsewhere in southern and eastern Africa.	VU	VU	20
Brackenridgea zanguebarica	**In South Africa**: stony, light grey and shallow sandy loam in woodland, 655m, also on the southern aspect of dry mountain bushveld.	One known subpopulation in South Africa occurs in the Thengwe district in Venda. Also occurs in Zimbabwe, Mozambique and northwards to Tanzania.	CR	CR	0
Dioscorea sylvatica	Wooded and relatively mesic places, such as the moister bushveld areas, coastal bush and wooded mountain kloofs.	Western Cape, Eastern Cape, KwaZulu-Natal, Free State, Gauteng, Mpumalanga, Limpopo Province, Swaziland, Zimbabwe and Zambia.	VU	VU	0
Drimia sanguinea	Open veld and scrubby woodland in a variety of soil types.	Northern Cape and across to Limpopo and Mpumalanga Provinces, Namibia, Botswana and Zimbabwe.	P	NT	73
Encephalartos brevifoliolatus	Short grassland in open protea savanna.	Formerly occurred near the Blyde River Canyon Nature Reserve	CR	EW	0
Encephalartos cupidus	Grassland, on steep, rocky slopes or cliffs and sometimes near seepage areas bordering gallery forests.	Extinct throughout most of the range in Limpopo and Mpumalanga, presently restricted to a small area in northern Mpumalanga.	CR	CR	0

SCIENTIFIC NAME	HABITAT	DISTRIBUTION / RANGE	TOPS THREAT STATUS	NATIONAL RED LIST STATUS	POC (%)
Encephalartos dolomiticus	Grassland, in shallow soils on dolomite ridges.	Sekhukhuneland.	CR	CR	0
Encephalartos dyerianus	Open grassland and shrubland on the slopes of low granite hills.	Phalaborwa.	CR	CR	0
Encephalartos eugene-maraisii	Sandstone hills and rocky ridges in open grassland and savanna.	Waterberg.	EN	EN	27
Encephalartos hirsutus	Exposed quartzite cliffs in mountain bushveld.	Soutpansberg Mountains.	CR	CR	0
Encephalartos inopinus	Shallow soils on steep, rocky slopes and gorges, restricted to dolomite.	Steelpoort and Olifants River valleys.	CR	CR	0
Encephalartos nubimontanus	Steep cliffs in low open woodland.	Formerly occurred in the Mountains north of Penge.	CR	EW	0
Encephalartos transvenosus	Tall grassveld and mixed bushveld, mainly on steep rocky slopes facing southeast in the mistbelt zone.	Limpopo Drakensberg Escarpment and Soutpansberg.	P	LC	20
Euphorbia groenewaldii	Gentle, northwest-facing slopes of small granite hills and ridges between bands of schist or in gritty red sandy loam soil, 1100-1500 m.	East of Polokwane	CR	CR	0
Harpagophytum procumbens	Well drained sandy habitats in open savanna and woodlands.	Within South Africa this species occurs in the Northern Cape, North West, Free State, and Limpopo Provinces and the largest populations are found in the communally owned areas of the North West Province and the north eastern parts of the Northern Cape.	P	LC	67
Harpagophytum zeyheri subsp. *zeyheri*	On Kalahari sand in dry open woodland.	Gauteng, Limpopo, Mpumalanga, North West.	P	LC	67
Mondia whitei	Mainly swamp forest in South Africa and occasionally in riverine and coastal forest, further north it is found in Afromontane forest. It is currently restricted to lower elevations, although historically it was recorded in higher altitude midlands forest.	From Guinea-Bissau through tropical Africa to KwaZulu-Natal.	EN	EN	0
Prunus africana	Evergreen forests near the coast, inland mistbelt forests and afromontane forests up to 2100 m.	Widespread in Africa from the southern Cape, through KwaZulu-Natal, Swaziland and northwards in to Zimbabwe and central Africa and the islands of Madagascar and Comoros.	VU	VU	0
Siphonochilus aethiopicus	Tall open or closed woodland, wooded grassland or bushveld.	Sporadically from the Letaba catchment in the Limpopo Lowveld to Swaziland. Extinct in KwaZulu-Natal. Widespread elsewhere in Africa.	CR	CR	27
Warburgia salutaris	Variable, including coastal, riverine, dune and montane forest as well as open woodland and thickets.	North-eastern KwaZulu-Natal, Mpumalanga and Limpopo Province. Also occurs in Swaziland, Mozambique and Zimbabwe and Malawi.	EN	EN	45

CR= Critically Endangered**, EN=** Endangered**, EW =** Extinct in the Wild**, NT =** Near Threatened**, VU=** Vulnerable**, P=** Protected, POC = Probability of Occurrence

Table C3: NFA plant list for species with a known distribution range falling within the study area[13].

SCIENTIFIC NAME	HABITAT & DISTRIBUTION[14] & [15]	NATIONAL RED LIST STATUS	POC (%)
Adansonia digitata	The baobab tree is found in areas of South Africa, Botswana, Namibia, Mozambique and other tropical African countries where suitable habitat occurs. It is restricted to hot, dry woodland on stoney, well drained soils, in frost-free areas that receive low rainfall. In South Africa it is found only in the warm parts of the Limpopo Province.	LC	73
Boscia albitrunca	Habitat mainly includes dry, open woodland and bushveld, mostly in hot, arid, semi-desert areas, often on termitaria. The vast distribution range covers Botswana, Limpopo, Gauteng, North-West, Swaziland, the Free State, Northern Cape and KwaZulu-Natal. It also extends into Zambia, Zimbabwe and Mozambique.	LC	100
Combretum imberbe	The leadwood can be found in all the bushveld regions and in mixed forest in southern Africa. Preferred habitat includes open bushveld, mixed woodland, rivers or dry watercourses and often on alluvial soils. It is widespread in Lowveld areas and grows along streams and rivers. Combretum imberbe is widespread in northern Namibia. It is also found in Mpumalanga, Limpopo, North-West Province, Mozambique, and into tropical Africa.	LC	100
Philenoptera violacea	Found in savanna and wooded grassland and frequently along rivers. Large specimens found near water. *Philenoptera violacea* is distributed in three provinces of South Africa: Limpopo, Mpumalanga and KwaZulu-Natal. In Limpopo it is found in the northern part of the province.	LC	53
Sclerocarya birrea* subsp. *Caffra	The Marula is widespread in Africa from Ethiopia in the north to KwaZulu-Natal in the south. In South Africa it is more dominant in the Baphalaborwa area in Limpopo. It occurs naturally in various types of woodland, on sandy soil or occasionally sandy loam.	LC	100
Securidaca longepedunculata	It occurs in the North-West and Limpopo provinces of South Africa, in Mozambique and is widely distributed in tropical Africa. The violet tree is found in woodland and arid savanna soils.	LC	73
Vachellia erioloba	Found in dry woodland, bushveld, grassland and watercourses in arid areas usually on stony or sandy soil. Widespread in the arid northern provinces of South Africa, also Namibia, Botswana, Zimbabwe, southern Angola and south-western Zambia.	LC	100

CR= Critically Endangered**, EN=** Endangered**, EW =** Extinct in the Wild**, NT =** Near Threatened**, VU=** Vulnerable**, P=** Protected, POC = Probability of Occurrence

[13] https://www.thetreeapp.co.za/team/
[14] http://pza.sanbi.org/
[15] http://redlist.sanbi.org/index.php

APPENDIX D: Floral Species List

Table D1: Dominant woody species encountered in MRA during the winter assessment. Alien species are indicated with an asterisk (*). Protected species are indicated in Bold.

Scientific name	Common name	Disturbed	Open Bushveld	Thicket
Asparagus suaveolens	Bushveld asparagus		X	X
Bauhinia petersiana subsp. macrantha	Kalahari bauhinia		X	X
Blepharis subvolubilis	Eyelash flower			X
***Boscia albitrunca* (NFA)**	**Shepherd's tree**		X	X
Boscia foetida			X	
Burkea africana	Wild seringa			X
Combretum apiculatum subsp. apiculatum	Red bush willow		X	X
Combretum hereroense	Russet Bushwillow			X
***Combretum imberbe* (NFA)**	**Leadwood**	X		X
Commiphora africana	Poison-grub corkwood			X
Commiphora neglecta	Sweet-root corkwood		X	X
Commiphora pyracanthoides	Firethorn corkwood		X	X
Dichrostachys cinerea	Sickle Bush	X	X	X
Elephantorrhiza elephantina	eland's bean, eland's wattle	X	X	X
Grewia bicolor	White raisin	X	X	X
Grewia flava	Velvet raisin	X	X	X
Grewia flavescens	Sandpaper raisin, rough-leaved raisinbus	X	X	X
Grewia villosa	Mallow raisin			X
Gymnosporia tenuispina	Bell Spike-thorn		X	X
Heliotropium nelsonii	Common string of stars	X	X	
Lantana rugosa	Bird's Brandy			X
Lycium schizocalyx	Savanna-kniedoring			X
Ozoroa paniculosa	Common resin tree, bushveld ozoroa		X	X
Peltophorum africanum	African-wattle		X	X
Phyllanthus parvulus	Dye bush			X
***Sclerocarya birrea* subsp. *caffra* (NFA)**	**Marula Tree**		X	
Senegalia cinerea	Bladdoringboom (a), Blade Thorn	X		X
Senegalia erubescens	Blue acacia		X	
Senegalia mellifera subsp. detinens	Black Thorn		X	
Senegalia nigrescens	Knob-thorn	X		X
Sida cordifolia subsp. *cordifolia*	Heart-leaf Sida			X
Solanum lichtensteinii	Large yellow bitter apple		X	
Solanum sp.1	Nightshade	X		
Solanum sp.2	Nightshade			X
Solanum tettense var. renschii				X
Terminalia sericea	Vaalboom	X	X	X
***Vachellia erioloba* (NFA)**	**Camel-thorn**	X	X	X
Vachellia nilotica subsp. *kraussiana*	Scented pod thorn			X
Vachellia tortilis	Umbrella thorn	X		
Waltheria indica	Meidebossie			X
Ximenia caffra var. caffra	Large sourplum		X	

1a: Category 1a – Invasive species that require compulsory control.
1b: Category 1b – Invasive species that require control by means of an invasive species management programme.
2: Category 2 – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.
3: Category 3 – Ornamentally used plants that may no longer be planted; existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread (Bromilow, 2001).

Table D2: Dominant forb species encountered within the study area during the field assessment. Alien species are indicated with an asterisk (*). Protected species are indicated in Bold.

Scientific name	Common name	Disturbed	Open Bushveld	Thicket
Acanthosicyos naudinianus				X
Adenium oleifolium (LEMA)	Bitterkambro		X	
Chamaecrista mimosoides	Fishbone dwarf cassia	X	X	X
Cleome maculata			X	X
Commelina africana	Common yellow commelina		X	X
Commelina benghalesis	Benghal blue wandering Jew	X		X
Cucumis africanus	Wild cucumber			X
Cucumis zeyheri	Wild cucumber			X
Dicoma sp.	-		X	
Dipcadi sp.	-		X	
Eriospermum cooperi	-			X
Harpagophytum sp.	Devil's claw			X
Heliotropium lineare	Narrow-leaved Heliotropium	X		X
Heliotropium ciliatum	Kalahari string of stars	X		
Hibiscus palmatus	Pale yellow hibiscus			X
Hibiscus physaloides	-		X	
Indigofera daleoides var. daleoides	-		X	
Indigofera heterotricha	Hairy indogo			X
Indigofera ingrata	--		X	
Ipomoea albivenia	Yellow Ipomoea			X
Ledebouria sp.	-		X	X
**Mollugo cerviana* var *cerviana*	Thread-stem carpetweed	X		
Neorautanenia amboensis	Gemsbokboontjie		X	
Oxygonum delagoense	Salt of the tortoise		X	X
Portulaca kermesina	-			X
**Portulaca oleraceae*	Common purslane	X		
Portulaca quadrifida	Pusley	X		
Pterodiscus ngamicus	Botswana-sandkambor		X	
Sansevieria aethiopica	Common bowsting hemp			X
Sesamum alatum	Wing-seeded sesame	X		
Tephrosia purpurea	Silver tephrosia			X
Tephrosia semiglabra	-	X		
Tribulus terrestris	Devil's thorn / Volstruisdubbeltjie	X		
Tricliceras glanduliferum	Yellow lion's eye			X
Tylosema esculentum	Marama bean			X
Vigna unguiculata subsp. *dekindtiana* var *huillensis*	Wild cow pea			X
Xenostegia tridentata subsp angustifolia	Miniature morning glory			X

1a: Category 1a – Invasive species that require compulsory control.

1b: Category 1b – Invasive species that require control by means of an invasive species management programme.

2: Category 2 – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.

3: Category 3 – Ornamentally used plants that may no longer be planted; existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread (Bromilow, 2001).

Table D3: Dominant grass species encountered within the study area during the field assessment. Alien species are indicated with an asterisk (*). Protected species are indicated in Bold.

Scientific name	Common name	Disturbed	Open Bushveld	Thicket
Aristida congesta subsp. barbicollis	Spreading Three-awn			X
Aristida congesta subsp. congesta	Tassel Three-awn		X	X
Bulbostylis hispidula subsp. *pyriformis*	Slender Sedge	X		
Digitaria eriantha	Common finger grass			X
Enneapogon cenchroides	Nine-awned Grass		X	X
Eragrostis biflora	Shade Eragrostis	X		X
Eragrostis curvula	Weeping love grass			X
Eragrostis lehmanniana	Lehman's Love Grass		X	X
Eragrostis pallens	Broom Love Grass			X
Eragrostis rigidior	Curly Leaf			X
Kyllinga alba	White (button) sedge			X
Melinis repens	Natal Red-Top	X		X
Panicum coloratum	Small Buffalo Grass			X
Panicum maximum	White Buffalo Grass			X
Perotis patens	Cat's tail		X	X
Schmidtia pappophoroides	Sand Quick		X	X
Stipagrostis uniplumis var *uniplumis*	Blinkblaar boesmangras		X	X
Urochloa mosambicensis	Bushveld signal grass	X		X
Urochloa panicoides	Garden Urochloa	X		

1b: Category 1b – Invasive species that require control by means of an invasive species management programme.

2: Category 2 – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.

3: Category 3 – Ornamentally used plants that may no longer be planted; existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread (Bromilow, 2001).

FAUNAL AND FLORAL ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS FOR THE PROPOSED GRUISFONTEIN MINING PROJECT, LIMPOPO PROVINCE

Prepared for

Jacana Environmentals CC

June 2019

Section C: Faunal Assessment

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Report Reference:	**STS 180043**
Date:	**June 2019**

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DOCUMENT GUIDE

The Document Guide below is for reference to the procedural requirements for environmental authorisation applications in accordance to Government Notice (GN) 267 of 24 March 2017, as it pertains to National Environmental Management Act, 1998 (Act 107 of 1998)..

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Section A: Appendix D
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Section A: Appendix D
b)	A declaration that the specialist is independent	Section A: Appendix D
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
cA)	An indication of the quality and age of base data used for the specialist report	Section 2.1 and Section A: 3
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 2.1
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Appendix A and B
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Section 3 and 4
g)	An identification of any areas to be avoided, including buffers	Section 4
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section 4
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 1.2
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Section 5
k)	Any mitigation measures for inclusion in the EMPr	Section 5
l)	Any conditions for inclusion in the environmental authorisation	Section 5
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 5
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Section 5
(iA)	Regarding the acceptability of the proposed activity or activities	Section 5
(ii)	If the opinion is that the proposed activity, activities 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	Section 5
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q)	Any other information requested by the competent authority	N/A

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ACRONYMS

AIP	Alien and Invasive Plants
BGIS	Biodiversity Geographic Information Systems
CR	Critically Endangered
DAFF	Department: Agriculture, Forestry and Fisheries
EAP	Environmental Assessment Practitioner
EIS	Ecological Importance and Sensitivity
EN	Endangered
EW	Extinct in the Wild
GIS	Geographic Information System
GPS	Global Positioning System
IBA	Important Bird Area
IEM	Integrated Environmental Management
IUCN	International Union for Conservation of Nature and Natural Resources
LC	Least Concern
LEDET	Limpopo Department of Economic Development and Tourism
LEMA	Limpopo Environmental Management Act
LoM	Life of Mine
NFA	National Forest Act
NT	Near Threatened
NYBA	Not yet been assessed
P	Protected
PES	Present Ecological State
POC	Probability of Occurrence
PRECIS	Pretoria Computerised Information System
QDS	Quarter Degree Square
RDL	Red Data Listed
RE	Regionally Extinct
SABAP	**Southern African Bird Atlas**
SANBI	South Africa National Biodiversity Institute
SP	Specially Protected
STS	Scientific Terrestrial Services
SCC	Species of Conservation Concern
TOPS	Threatened or Protected Species
VBR	Vhembe Biosphere Reserve
VU	Vulnerable

1. INTRODUCTION

1.1 Background

Scientific Terrestrial Services (STS) was appointed to conduct a faunal and floral ecological assessment as part of the Environmental Impact Assessment (EIA) process for the proposed Gruisfontein coal mine project within the Limpopo Province; henceforth referred to as the "study area" (Section A: Figure 1 - 2).

The study area extends over 1137 hectares (ha) and is located within the savanna biome in the Waterberg region, approximately 6 km southeast of the portion of the Limpopo River that forms the border between South Africa and Botswana. The Botswana border post is located roughly 17 km northeast of the study area, with the R510 (± 14.6 km northeast of the study area) the closest main road within the area. The study area is thus located in an isolated, natural area where the Matimba Power Station is the closest built-up development (± 24 km southeast of the study area), with Steenbokpan (± 20 km south of the study area) and Lephalale (± 46 km southeast of the study area) the closest towns.

The purpose of this report is to define the faunal ecology of the study area as well as mapping and defining areas of increased Ecological Importance and Sensitivity (EIS) and to define the Present Ecological State (PES) of the study area. The objective of this study:

- To provide inventories of faunal species as encountered within the study area;
- To determine and describe habitat types, communities and the ecological state of the study area and to rank each habitat type based on conservation importance and ecological sensitivity;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and/ or any other special features;
- To conduct a Red Data Listed (RDL) and Species of Conservation Concern (SCC) assessment, including species in the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) Threatened or Protected Species (TOPS) list (NEMBA, Notice 389 of 2013), and the overall potential for such species to occur within the study area;
- To provide detailed information to guide the activities associated with the proposed development activities associated within the study area; and
- To ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements and the provision of ecological services in the local area.

2.1 Project Description

The proposed project comprises of an open cast coal mine on the Farm Gruisfontein 230-LQ located on the Waterberg Coalfields (RSV ENCO, 2018), for which Nozala Coal (Pty) Ltd holds a coal prospecting right. On the study area, all coal seams are covered by 30 – 100 m of overburden, with a faulted area identified within the southwestern corner (weathering has removed several coal zones). The Life of Mine (LoM) is scheduled to be 16 years. Figure 3 illustrates the proposed mine layout.

The proposed procedures and footprint of the project that will be implemented during the mining process include[1]:

- Removing and stockpiling of topsoil;
- Diversion of stormwater away from the Open Pit by means of trenches around the mining footprint area;
- Excavation of the initial strip of the box-cut;
- Stripping of topsoil and soft overburden from initial box-cut. This will be followed by the drilling, blasting and removal of hard overburden;
    - Topsoil: soft overburden and hard overburden will each be stockpiled separately; and
    - Hard overburden, soft overburden and discard dumps to be placed within the south-eastern section of the study area;
- Formation of the Open Pit through blasting and the excavation of coal (load and haul method). Proposed Open Pit will be within the western section of the study area, roughly centrally located;
- Construction of all mining-related infrastructure, including internal roads and facilities for on-site personnel (offices, training facilities, workshops, parking etc.). Proposed locality for most infrastructure to be within the southwestern corner of the study area, i.e. within the faulted area where coal extraction is not deemed feasible; and
- Preliminary Rehabilitation Plan: To rehabilitate the open pit and other disturbed areas to a post-mining grazing capability class. All stockpiled material (overburden, discard) will be utilised to backfill and rehabilitate the opencast area, no surface dumps will remain post-closure. Backfilling of the Open Pit over the 16-year LoM was not considered during the first phase of the concept study but will be considered within the second phase. Currently, it is foreseen that backfilling will only start after decommissioning of the mine.

[1] RSV ENCO (2018). CONCEPT STUDY GRUISFONTEIN PROJECT by RSV ENCO Consulting (Pty) Ltd. Project number: 02520004D-20-REP-0002

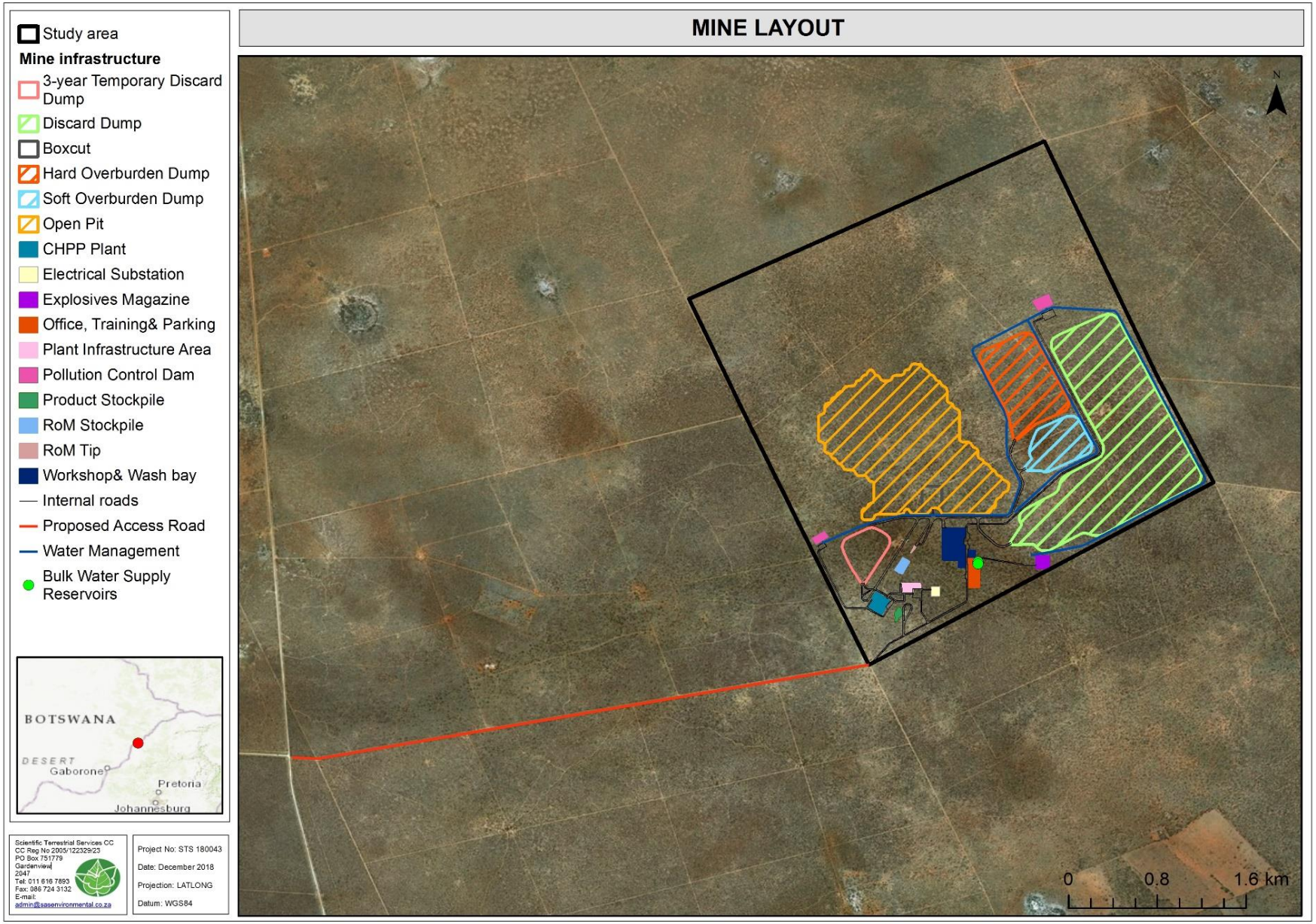


Figure 1: The proposed mine layout for the study area.

1.2 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The faunal assessment is confined to the study area and does not include the neighboring and adjacent properties; these were however considered as part of the desktop assessment;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most faunal communities have been accurately assessed and considered and the information provided is considered sufficient to allow informed decision making to take place and facilitate integrated environmental management;
- Due to the nature and habits of most faunal taxa, the high level of surrounding anthropogenic activities, it is unlikely that all species would have been observed during a field assessment of limited duration. Therefore, site observations were compared with literature studies where necessary;
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa within the study area may therefore have been missed during the assessment; and
- A single field investigation was undertaken from the 22nd to the 23rd of January 2019 (summer season), to determine the ecological status of the study area, and to "ground-truth" the results of the desktop assessment. A more accurate assessment would require that field investigations take place in all seasons of the year. However, on-site data was significantly augmented with all available desktop data, together with project experience in the area, and the findings of this assessment are considered to be an accurate reflection of the ecological characteristics of the study area.

3 ASSESSMENT APPROACH

The results presented in this report form part of the field investigation undertaken for a summer assessment from the 22nd to the 23rd of January 2019. The field investigation initially entailed a reconnaissance 'walkabout' to determine the general habitat types found throughout the study area. Following this, specific study sites were selected that were considered to be representative of the habitats found within the area, with special emphasis being placed on areas that may potentially support faunal SCC. These sites were further investigated on foot in order to identify the occurrence of fauna within the study area.

A detailed explanation of the method of assessment is provided in Appendix A of this report. For the methodologies relating to the impact assessment and development of the mitigation measure, please refer to Appendix B of this section of the report.

The faunal categories covered in this assessment are mammals, avifauna, reptiles, amphibians, general insects and arachnids.

3.1 Sensitivity Mapping

All the ecological features associated with the study area were considered, and sensitive areas were assessed. In addition, identified locations of protected species were marked by means of Global Positioning System (GPS). A Geographic Information System (GIS) was used to project these features onto satellite imagery and/or topographic maps. The sensitivity map should guide the final design and layout of the proposed development activities.

4 FAUNAL ASSESSMENT RESULTS

4.1 Faunal Habitat

During the field assessment, three habitat units were defined (Figure 2 and 3), namely:

- Sweet Bushveld A habitat;
- Sweet Bushveld B habitat; and
- Degraded habitat.

These habitat units are visually depicted in Figure 2 and Figure 3 (which includes the proposed mine layout). For a more detailed description and discussion of these habitat units see Section B (Floral Report).

The vegetation within the study area is representative of the Limpopo Sweet Bushveld vegetation type, as described by Mucina and Rutherford (2006), with species characteristic of the vegetation type well-represented throughout the study area. It was noted, however that there was a change in vegetation structure within the southern portion of the study area, possibly driven by an increased level of soil moisture.

The results pertaining to each faunal class are discussed in detail in the tables below and presented in a dashboard format.

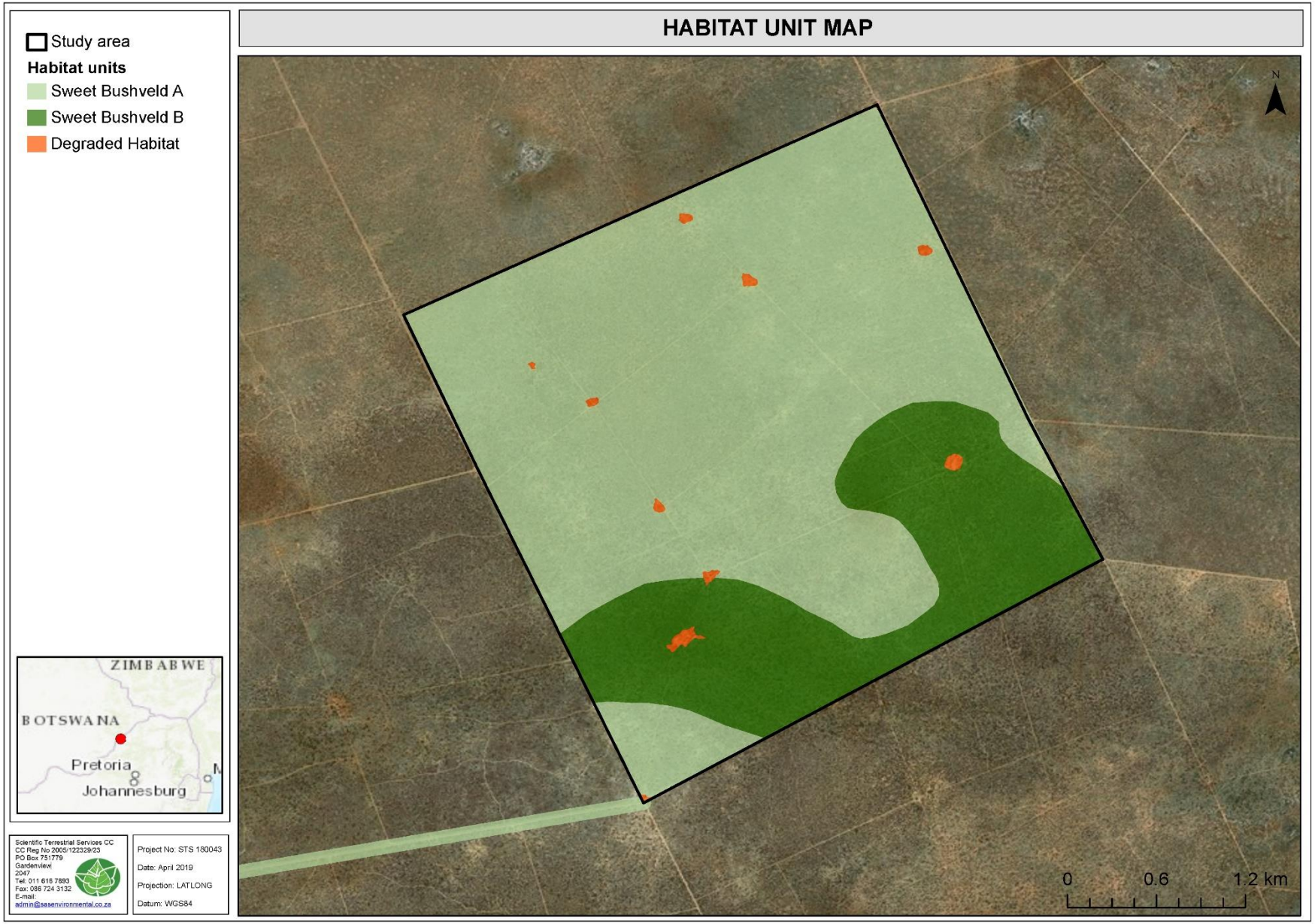


Figure 2: Conceptual illustration of the habitat units within the study area.

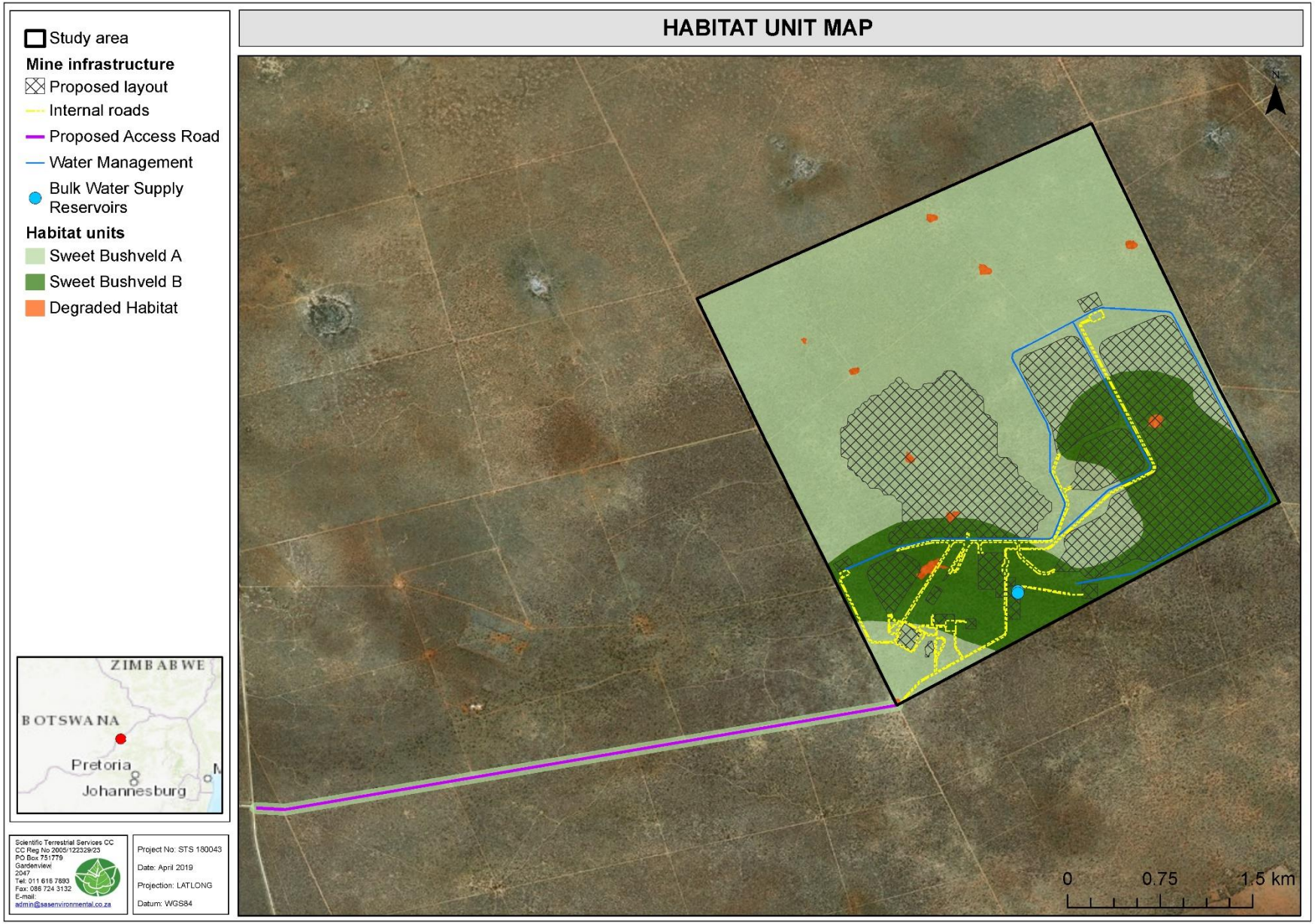


Figure 3: Conceptual illustration of the proposed mine layout and habitat units within the study area.

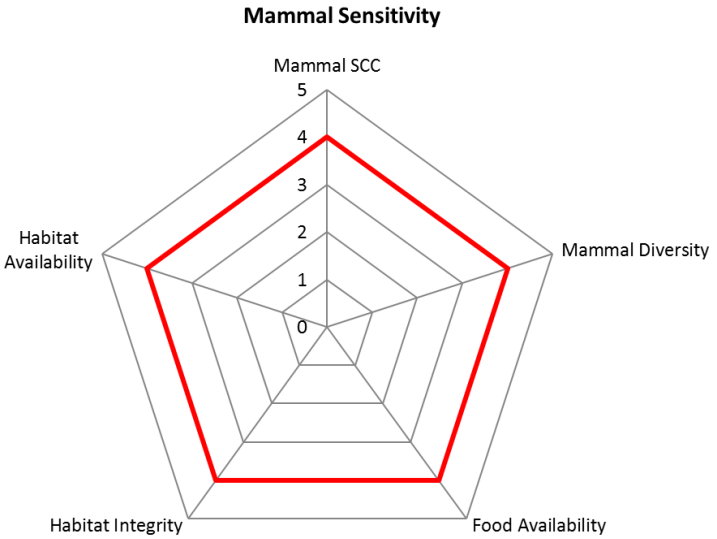
4.2 Mammals

Table 1: Field assessment results pertaining to mammal species within the study area

Mammal Habitat Sensitivity	Moderately High

Photograph Notes: *Phacochoerus aethiopicus* (Warthog) top and bottom right; *Oryx gazelle* (Gemsbok) middle and bottom left, *Sylvicapra grimmia* (Common Duiker) middle right.

Mammal Sensitivity Graph:



Photographs:

Faunal Species of Conservation Concern (SCC)	During field assessments it was noted that the locality, available habitat and size of the study area would predispose it to the probable presence of several mammal SCC. These species are listed as SCC due to an increased level of persecution, decreasing populations or the loss of habitat, the latter resulting in these species becoming increasingly weary and hard to detect. In such instances the use of spoor, scat, local knowledge and infrared camera traps is considered vital. *Oryx gazelle* (Gemsbok, TOPS) was observed a number of times on the camera traps that were set out in the study area. Additional SCC observations included spoor of *Hyaena brunnea* (Brown Hyaena, NT) whilst an indivudal *Felis lybica* (African Wild Cat, VU) was observed running across the road. Additional species previously observed wihtin the study area (pers.comms Hein Schonfeldt) include *Panthera pardus* (Leopard, VU), *Orycteropus afer* (Aardvark, TOPS), *Acinonyx jubatus* (Cheetah, VU) and *Hippotragus niger* (Sable, VU, TOPS).
Faunal Diversity	Mammal diversity varied across the study area, however species appeared to be more abundant in the northern half of the study area. Food and water resources were readily available throughout the study area, with the northern portion of the study area appearing to have a higher abundance of mammals. This may be attributable to the fact that at the time of the assessment there was a higher level of human activity and movement of cattle in the southern half of the study area, resulting in mammal species that are more elusive and density avoidant moving to the north of the study area. This, however is likely to fluctuate, with mammal species moving throughout the study area in search of food resources. Mammal species observed either directly or via spoor/scat/dung include but are not limited to *Sylvicapra grimmia* (Common Duiker), *Aepyceros melampus* (Impala), *Tragelaphus strepsiceros* (Kudu), *Hystrix africaeaustralis* (Cape Porcupine), *Phacochoerus aethiopicus* (Warthog), *Felis lybica* (African Wild Cat), *Galerella sanguinea* (Slender Mongoose), *Canis mesomelas* (Black-backed Jackal), *Lepus saxatilis* (Scrub Hare) and *Cryptomys hottentotus* (Common Mole-rat) amongst others. Please refer to the full list of species available in Appendix D.
Habitat integrity	Habitat integrity of the study area with regards to mammal species is considered to be moderately high. Although there are areas of disturbance, as a whole the integrity is sufficient to provide food resources and space requirements for species. Fences are located throughout the property, however as these are small cattle fences, they do not limit or inhibit the movement of mammals within the study area. Additionally, there was very limited evidence of alien plant species proliferation in the study area, mostly being isolated around the degraded habitat areas.

Habitat Availability	**Food Availability**
Habitat provision for mammal species is moderately high within the study area. The sweet bushveld habitat units provide a varying degree of floral diversity, with well-developed herbaceous and woody layers that satisfy the various habitat requirements for a diversity of species. The small and scattered nature of the degraded habitat does not detract from habitat continuity or connectivity for mammal species.	The degraded habitat unit provides the lowest levels of food resources for mammal species; however, the majority of these areas are associated with watering holes, which are important for water provision to mammal species. The low level and suitability of food resources in the degraded areas are as a result of the concentrated movement of mammal species through these areas when accessing the water, leading to higher levels of grazing and browsing. As such, the degradation of these small pockets is considered to be an indirect impact as a result of the placement of the water holes. The remaining areas of the sweet bushveld habitat units provided suitable and varied food resources for both grazers and browsers within the study area.

Business Case, Conclusion and Mitigation Requirements:	Overall the mammal sensitivity associated with the study area is considered to be moderately high, with a moderately high diversity of species being observed. Species abundance levels vary within the study area in accordance with available food resources and current anthropogenic and farming activities. The proposed mining activities and associated infrastructure will lead to the loss of approximately half the useable habitat and food resources within the study area, leading to a decreased diversity and abundance within the study area. In addition, the mining activities will lead to the displacement of mammal species, pushing them into the remaining habitat in the north of the study area, which will likely lead to increased levels of intra and inter species competition for space and food resources. Impacts to mammal species within the study area will be significant in terms of the loss of habitat, species diversity and abundance. Where the proposed activities are to proceed, the following recommendations are made to minimise (although not prevent) the impact to mammal species within the study area: • The footprint areas of all proposed surface infrastructure areas must be minimised to what is absolutely essential; • Disturbance of and direct persecution of SCC must be avoided; • No hunting or trapping/snaring is to occur within the study area; • Down lighting should be used wherever possible to limit the night glow effect and the amount of light emitted from the mine so as to limit insect attraction and consequently the attraction of bat species; • An Alien and Invasive Plant (AIP) Control Plan must be developed and implemented during all phases of development, to manage the proliferation of AIPs within the study area; and • If any mammal SCC needs to be removed and relocated, the relavent provincial authority must be contacted and the neccesary permits obtained prior to this.

4.3 Avifauna

Table 2: Field assessment results pertaining to avifaunal species within the study area

Avifaunal Habitat Sensitivity	Moderately High

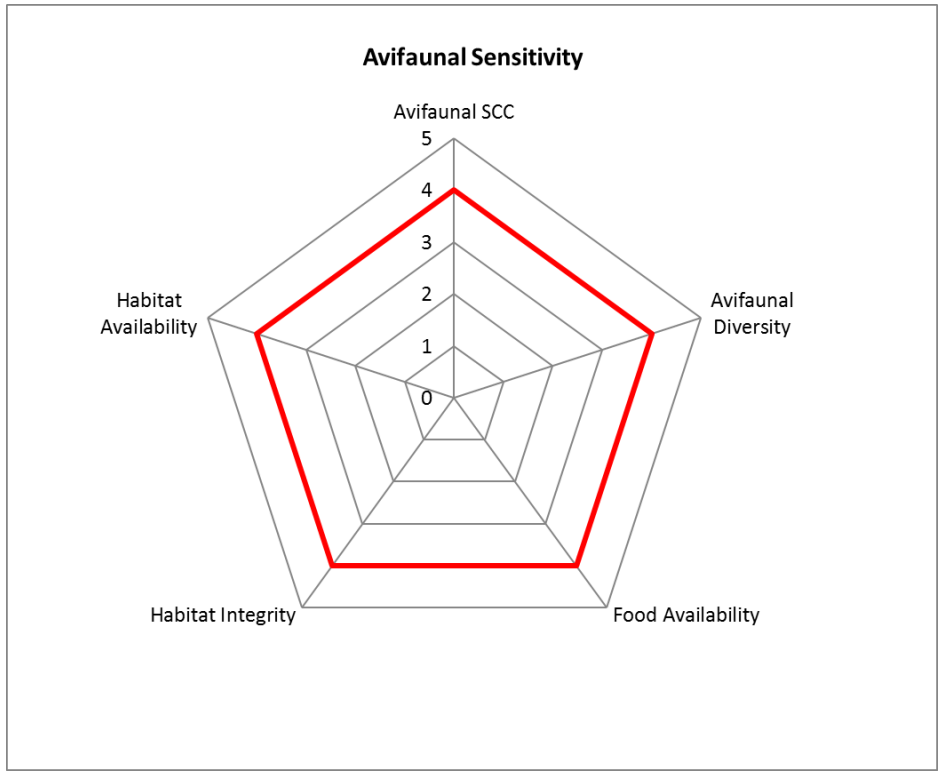
Photograph Notes:

Top: *Coracias caudatus* (Lilac-breasted Roller) left and *Upupa africana* (African Hoopoe) right;

Middle: *Turdoides bicolor* (Southern Pied Babbler) left and *Circaetus pectoralis* (Black-breasted Snake Eagle) right;

Bottom: *Quelea quelea* (Red-billed Quelea) left and *Prinia flavicans* (Black-chested Prinia) right.

Avifaunal Sensitivity Graph:



Photographs:

Faunal Species of Conservation Concern (SCC)	No avifaunal SCC were observed during the site assessment, however species such as *Torgos tracheliotos* (Lappet-faced Vulture, EN), *Gyps africanus* (White-backed Vulture, CR) and *Buphagus erythrorhynchus* (Red-billed Oxpecker, Threatened Limpop SoER 2004) have been previously recorded within the pentad (2330_2715). These listed species may occur wihtin the study area, using the available habitat for foraging and in the case of the vultures, large trees for nesting, notably large *Acacia* spp, of which there are numerous in the study area. The image to the right idicates a large solitary nest observed within the study area, however the nest was unused and it is not possible to verify which large avifaunal species consturcted the nest. In addition to the species mentioned above, although not recorded for the pentads 2330_2715 and 2335_2715, there remains the possiblity that species such as *Aquila rapax* (Tawny Eagle, VU), *Ardeotis kori* (Kori Bustard, NT) and *Polemaetus bellicosus* (Martial Eage, VU). These species may utilise the study area for breeding as well as for forgaing. Vegetation clearance activities will have a negative impact on avifaunal SCC, leading to a loss of potential breeding sites as well as foraging grounds. In addition, these impacts are likely to extend beyond the study area boundaries affecting avifaunal SCC within the surrounding areas through decreased breeding, nesting and foraging opportunities whilst also potentially impacting upon flight paths and movement patterns. 
Faunal Diversity	Avifaunal diversity within the study is considered moderately high, with numerous avifauna of all size classes being observed. Species observed are all known to occur and thrive within the more arid bushveld areas of Limpopo, being well adapted to the generally drier habitats herein. The majority of avifaunal species observed were insectivores and mixed feeders, feeding on both seeds and insects. Predatory avifauna were not readily observed, but such species often occur at lower abundances and forage over greater distances. Species observed on site other than those listed above and below include *Turdoides bicolor* (Southern Pied Babler), *Turdoides jardineii* (Arrow-marked Babler), *Batis molitor* (Chinspot Batis), *Corythaixoides concolor* (Grey Go-away-bird), *Pternistis natalensis* (Natal Spurfowl), *Lamprotornis nitens* (Cape Glossy Starling), *Tchagra senegalus* (Black-crowned Tchagra), *Granatina* (Violet-eared Waxbill), *Cercotrichas leucophrys* (White-browed Scrub-robin) and *Turtur chalcospilos* (Emerald-spotted Wood-dove) amongst others. Please refer to Appendix D for a full list of species.
Habitat integrity	Habitat integrity of the study area with regards to avifaunal species is considered to be moderately high. Although there are some areas of disturbance and of increased grazing, notably around the current watering points, as a whole the habitat integrity is sufficient to provides food resources, space requirements and nesting sites for a diversity of avifaunal species. Unlike other species, avifauna are less restricted in terms of movement by farm related infrastructures such as fences and buildings and are capable of utilising the whole study area unrestricted.

Habitat Availability	**Food Availability**
The varying vegetation stratum, open space areas comprising of forbs and herbaceous material and the densely wooded patches provide an extensive mosaic of habitat for avifaunal species. Large trees provide suitable nesting and roosting areas for large avifauna and raptors, as well as vantage points for hunting. The medium sized trees and denser wooded areas are well utilised by small to medium sized avifauna, which were seen actively foraging amongst the branches and along the ground during the site investigation.	Food resources are abundant within the study area for avifaunal species, notably in the summer months following good rains. Grass seeds form a staple food resource for granivorous species, of which a number are heavily reliant on as they cannot readily supplement the loss of this food resource with other food items. Food availability will be higher during the summer months as the overall food resource production of the herbaceous and woody layer increases, and as such a higher abundance of avifaunal can be supported. The seasonal increase in insect abundance is further important as insects provide an energy rich source of food for avifaunal species. Small mammals as well as lizards and skinks are an important food resource for larger avifauna, with large raptors often preying on rodents, hares and sometimes other small birds.

Business Case, Conclusion and Mitigation Requirements:	Overall the avifaunal sensitivity associated with the study area is considered moderately high, with a moderately high diversity of species being observed. Species abundance levels vary within the study area in accordance with available food resources and current anthropogenic and farming activities. The proposed mining activities and associated infrastructure will lead to the loss of approximately half the useable habitat and food resources within the study area, leading to a decreased avifaunal diversity and abundance. In addition, the mining activities will lead to the displacement of avifaunal species, pushing them into the habitat both to the north of the study area as well as into the surrounding areas, which is likely to lead to increased levels of intra and inter species competition for space and food resources. Impacts to avifaunal species within the study area will be significant in terms of the loss of habitat, species diversity and abundance. Where the proposed activities are to proceed, the following recommendations are made to minimise (although not prevent) the impact to avifaunal species within the study area: • The footprint areas of all proposed surface infrastructure areas must be minimised to what is absolutely essential; • Disturbance of and direct persecution of SCC must be avoided; • Areas excluded from mining activities should be designated conservation areas and managed accordingly; • Where overhead powerlines are constructed, it must be insured that bird flappers are placed on these structures in order to increase the visibility of the hanging cables in order to minimise bird strikes and mortality rates; • No poisons are to be used for small mammal pest control as poisoned small mammals may be consumed by raptors, owls or scavenging species which may lead to the death of such avifauna; • An Alien and Invasive Plant (AIP) Control Plan must be developed and implemented during all phases of development, to manage the proliferation of AIPs within the study area; and • Large trees which are evidently being used for breeding by raptors (nests present) are to be left and not cut down.

4.4 Amphibians

Table 3: Field assessment results pertaining to amphibian species within the study area

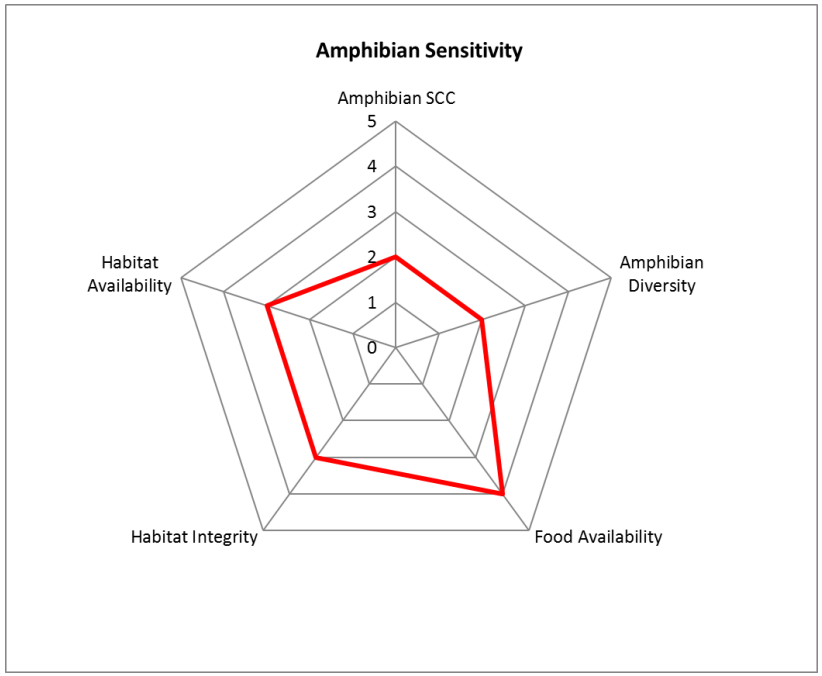
Amphibian Habitat Sensitivity	Intermediate	Photographs:

Photograph Notes:

Top: Image of a water point located in the south eastern portion of the study area where overflowing water troughs may present temporary areas of usage for some avifaunal species such as *Ptychadena anchietae* (Plain Grass Frog) and *Tomopterna cryptotis* (Tremelo Sand Frog);

Bottom: Open sandy areas with patchy herbaceous layer is likely to be utilised by *Breviceps adspersus* (Bushveld Rain Frog), notably when breeding as mating pairs can easily dig into the sandy substrate.

Amphibian Sensitivity Graph:



Faunal Species of Conservation Concern (SCC)	During the field assessment of the study area no amphibian SCC were observed. The study area provided limited habitat for amphibian species as there where no natural pans or seasonal water bodies present.
Faunal Diversity	Amphibian diversity of the study area is deemed to be moderately low, largely due to the arid nature and lack of permanent and seasonal water bodies necessary for continued sustainability of amphibian species. Although there were no water bodies observed, not all amphibian species are permanently reliant on these, notably some species of toads which are able to survive for long periods away from water. Although the study area can sustain amphibian species that are more water independent, these species do still require water bodies for breeding. Species that have been previously recorded in the QDS 2327CB and that may occur within the study area include *Breviceps adspersus* (Bushveld Rain Frog), *Sclerophrys garmani* (Olive Toad), *Ptychadena anchietae* (Plain Grass Frog) and *Tomopterna cryptotis* (Tremelo Sand Frog). *Breviceps adspersus* is the only species recorded for the QDS that does not require water bodies for breeding, as the breeding pair creates a breeding chamber in the soil in which the eggs are laid and hatch.
Habitat integrity	No permanent natural freshwater resources were observed within the study area. However, the overall habitat of the study area is still considered to be relatively intact and has sufficient food resources with limited fragmentation. As there are no permanent or seasonal water bodies within the study area, the habitat integrity for amphibian species is considered to be intermediate.

Habitat Availability	**Food Availability**
Limited habitat is available to freshwater dependant amphibian species; however, the study area does provide suitable levels of habitat to species which are able to survive for extended periods of time away from water resources.	The high insect abundance provides an ideal and consistent food resource for amphibian species.

Business Case, Conclusion and Mitigation Requirements:	Overall the amphibian sensitivity associated with the study area is considered intermediate. The lack of temporary and permanent surface water areas is a primary driver behind the decreased amphibian sensitivity, with only species that are largely water independent expected to occur within the study area The proposed mining activities and associated infrastructure will lead to the loss of approximately half the study area, with the loss of habitat and food resources being most notable. As there are no water bodies (permanent or seasonal), the impact to amphibian species is expected to be lower than to that of other faunal species. Impacts to amphibian species within the study area are not expected to be as significant in terms of the loss of habitat, species diversity and abundance. Where the proposed activities are to proceed, the following recommendations are made to minimise the impact to possible amphibian species: • The footprint areas of all proposed surface infrastructure areas must be minimised to what is absolutely essential; • Amphibian species found within the mining footprint area during the clearing and construction phase should be carefully relocated to suitable similar habitat within the study area, but outside of the disturbance footprint; and • Areas excluded from mining activities should be designated conservation areas and managed accordingly.

4.5 Reptiles

Table 4: Field assessment results pertaining to reptile species within the study area

Reptile Habitat Sensitivity	Moderately High

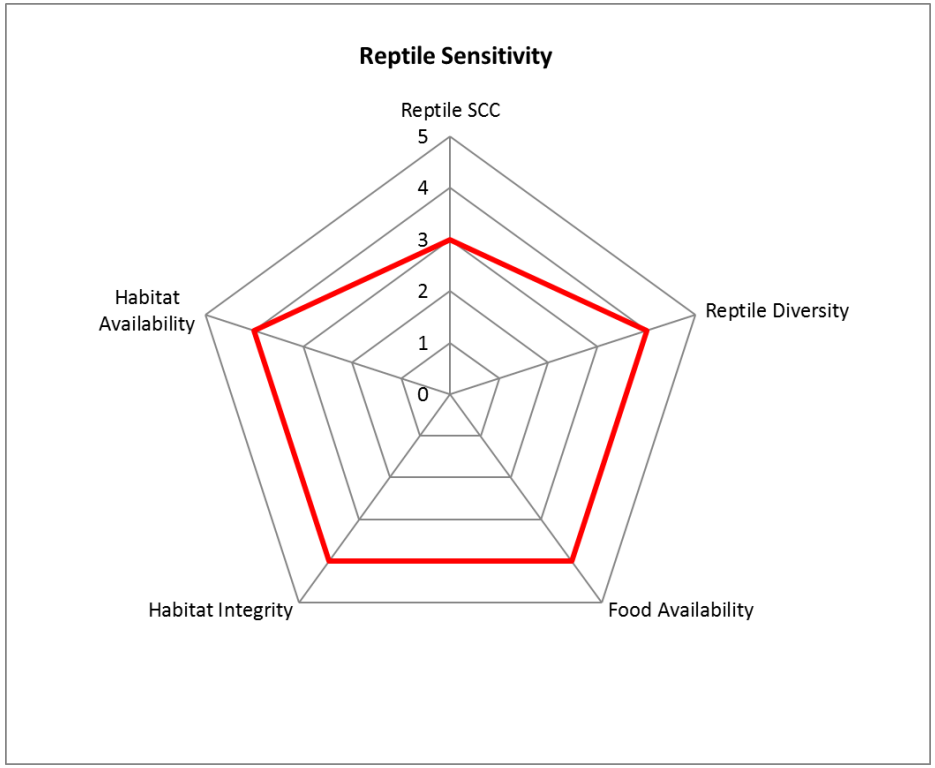
Photograph Notes:

Top: *Stigmochelys pardalis* (Leopard Tortoise) left and *Heliobolus lugubris* (Bushveld Lizard) right;

Middle: *Acanthocercus atricollis* (Southern Tree Agama); and

Bottom: *Nucras holubi* (Holub's Sandveld Lizard).

Reptile Sensitivity Graph:



Photographs:

<table>
<tr><td>Faunal Species of Conservation Concern (SCC)</td><td colspan="2">No reptile SCC were recorded during the assessment, however Python natalensis (African Python, VU and TOPS listed) has an increased probability of occuring wihtin the study area as the study area provides suitable habitat and food resources for this species.</td></tr>
<tr><td>Faunal Diversity</td><td colspan="2">Reptile diversity within the study area is considered to be moderately high, with a notable abundance of smaller skinks and sand lizards. The diversity of reptile species is largely attributable to the relatively undisturbed nature of that habitat, increased food resources, as well as the deeper soils in which reptiles can burrow. Reptile species observed include Heliobolus lugubris (Bushveld Lizzard), Trachylepis striata (Striped Skink), Stigmochelys pardalis (Leopard Tortoise) and Acanthocercus atricollis (Southern Tree Agama).

Additional reptiles that have been previously recorded by the Animal Demography Unit (ADU) ReptileMAP for the QDS include Elapsoidea sundevallii longicauda (Long-tailed Garter Snake), Ptenopus garrulus (Common Barking Gecko) and Ichnotropis capensis (Ornate Rough-scaled Lizard) amongst others. It is likely that the study area will present an even higher reptile diversity than that which was observed and listed above. Reptiles are inherently secretive and shy, making their detection and identification in the field difficult over short periods of time.</td></tr>
<tr><td>Habitat integrity</td><td colspan="2">Habitat integrity of the study area with regards to reptile species is considered to be moderately high. Reptiles are inherently adaptable and capable of surviving in a myriad of habitats. The study area has limited areas of disturbance/degradation and as such it enables for a greater diversity and abundance of reptile species to exist. Increased food resources and intact habitat ensure resource provision for species throughout the study area.</td></tr>
<tr><td colspan="2">Habitat Availability</td><td>Food Availability</td></tr>
<tr><td colspan="2">The study area provides suitable habitat for a diversity of reptiles species. The deeper sandy soils allow for the excavation of burrows in which to escape predation whilst the dense bushes and tall trees are readily utilised by larger more arboreal species. Dead / fallen over trees also provide additional habitat, basking areas and areas in which smaller reptiles can seek refuge.</td><td>Food resources are abundant and widely available throughout the study area for reptile species. Insect abundance is high, providing a continued and reliable food resource for many of the smaller and medium sized reptiles. Rodents, hares, small antelope and avifaunal nestlings provide a suitable food resource for larger predatory snakes.</td></tr>
<tr><td>Business Case, Conclusion and Mitigation Requirements:</td><td colspan="2">Overall the reptile sensitivity associated with the study area is considered moderately high, with a moderately high diversity of species being observed. The proposed mining activities and associated infrastructure will lead to the loss of approximately half the useable habitat and food resources within the study area, leading to a decreased diversity and abundance within the study area.

Where the proposed activities are to proceed, the following recommendations are made to minimise (although not prevent) the impact to reptile species within the study area:
• Personnel working at the mine are to be educated and made aware about snakes in the area, and that they are not to be harmed;
• Nominated personnel/volunteers working at the mine should be trained on how to catch, handle and relocate snakes that are found within the mine premises;
• Workspace areas and buildings are to be kept clean, avoiding the unnecessary collection of rubbish and food waste, as this will attract rodents leading to an influx of predatory snakes;
• As far as possible natural vegetation between buildings must be left intact and not cleared;
• No hunting/killing or trapping/capturing (unless for specific relocation reasons) is to occur within the study area;
• The footprint areas of all surface infrastructure must be minimised to what is absolutely essential; and
• Disturbance of and direct persecution of SCC and other reptile species must be avoided.</td></tr>
</table>

4.6 Insects

Table 5: Field assessment results pertaining to insect species within the study area

Insect Habitat Sensitivity	Moderately High

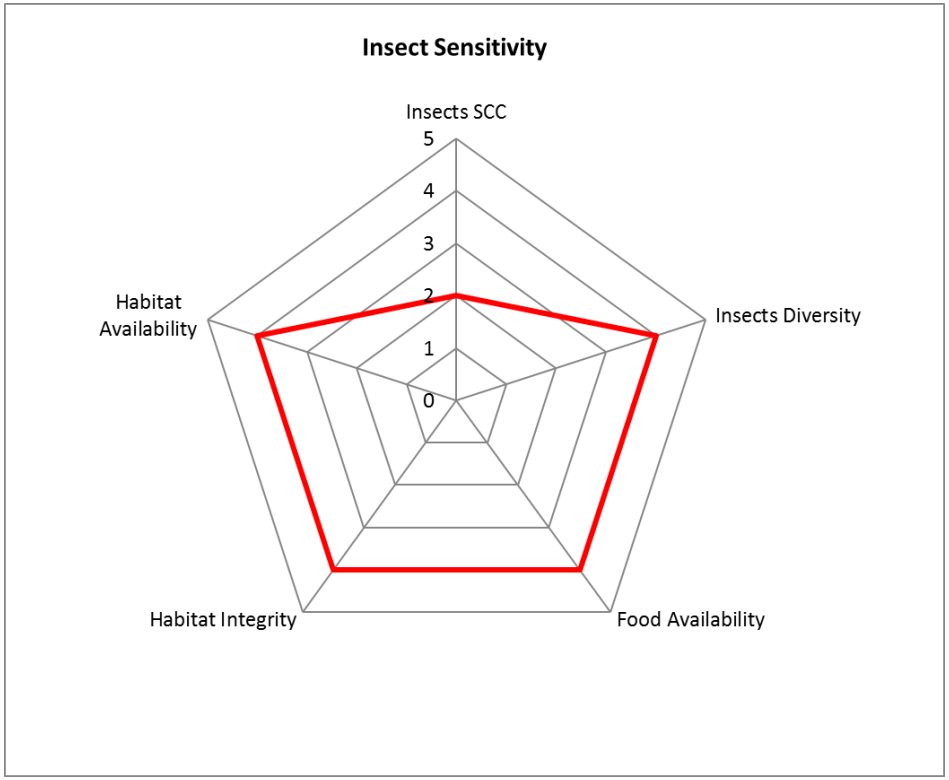
Photograph Notes:

Top: Genus *Platypleura* (Cicada) left and Family Psychidae (Bagworm) right;

Middle: *Cyligramma latona* (Cream-striped Owl) left and *Pachylomera femoralis* (Flattened Giant Dung Beetle) right, and

Bottom: *Cupidopsis jobates jobates* (Tailed Meadow Blue) left and *Acrea axina* (Little Acrea) right;

Insect Sensitivity Graph:



Photographs:

Faunal Species of Conservation Concern (SCC)	During the field assessment no insect SCC were observed. The insect species listed for the province of Limpopo are further unlikely to occur wihtin the study area as it is out of there known distribution range whilst the study area also lacks suitable food resources and host plants for some of the species.
Faunal Diversity	The study area has a moderately high insect diversity, with the several species belonging to the Coleoptera, Orthoptera, Hymenoptera, Odonata and Lepidoptera families being observed. The greatest diversity of insect species observed were that of the Orders Coleoptera and Lepidoptera. This increase in diversity and abundance is important for the overall ecological functioning of the study area, as many of these species serve as pollinators, remove detritus material and harvest and bury dung and scat below the surface, helping to cycle nutrients back into the soil. Additionally, insects serve as a food resource for many other faunal species and as such a high insect diversity and abundance is paramount to ensuring the continued sustainability of other faunal species from various classes.
Habitat integrity	The habitat integrity is considered to be moderately high. Alien plant proliferation was limited and restricted to the degraded areas, with the remaining areas being dominated by indigenous vegetation. Additionally, grazing by cattle has not led to significant impacts or degradation of the herbaceous layer through overutilisation. Habitat continuity within the study area has not be disrupted, and although cattle fences are present, these do not limit the movement and migration of insect species.

Habitat Availability	**Food Availability**
Insect species utilise a variety of habitat types at various strata levels in the habitats, from ground dwelling species to more arboreal species. The study area provides varying types of habitat for insect species in terms of sandy areas for species that burrow to fallen and dead trees in which numerous small terrestrial insects and larvae inhabit and seek refuge.	The herbaceous layer comprising of grasses and forbs provide extensive food resources for herbivorous insect species, whilst leaves of the larger trees and shrubs are utilised by the larval (caterpillar) stages of many species of the Order Lepidoptera. Predatory insect species feed upon several smaller insect species as well as small arachnids and in some instances small reptiles. Flowering species provide nectar and pollen resources across the study area which are important food and energy sources for species belonging to the Lepidoptera and Hymenoptera Order.

Business Case, Conclusion and Mitigation Requirements:	Overall the insect sensitivity associated with the study area is considered moderately high, with a moderately high diversity of species being observed. The proposed mining activities and associated infrastructure will lead to the loss of habitat and food resources, resulting in a decreased diversity and abundance of insect species in the impacted areas, which is likely to have a knock on impact to insect abundance levels within the larger study area. Insect species are considered a vital and important link in the ecosystem, fulfilling many vital ecological roles, including pollination, removal of dead animal and plant material and clearing of dung and scat. Insect species also serve as a vital food resource for many of the other faunal species. As such the loss of insect abundance and diversity will have a significant knock on effect on other faunal species in the study area. Impacts to insect species within the study area will result in the localised loss of habitat, species diversity and abundance, whilst edge effects such as additional lighting, dust and footprint creep will impact on insect species in the immediate vicinity of the mine. Where the proposed activities are to proceed, the following recommendations are made to minimise the impact to insect species within the study area: • Downlighting and as few external lights as needed are to be used for all lighting requirements at night. Additionally, yellow lights of lower frequencies are to be used in order to limit insect attraction; • As far as possible and where feasible pockets of natural vegetation between buildings and mine infrastructure must be left intact and not cleared, and • The footprint areas of all surface infrastructure must be minimised to what is absolutely essential.

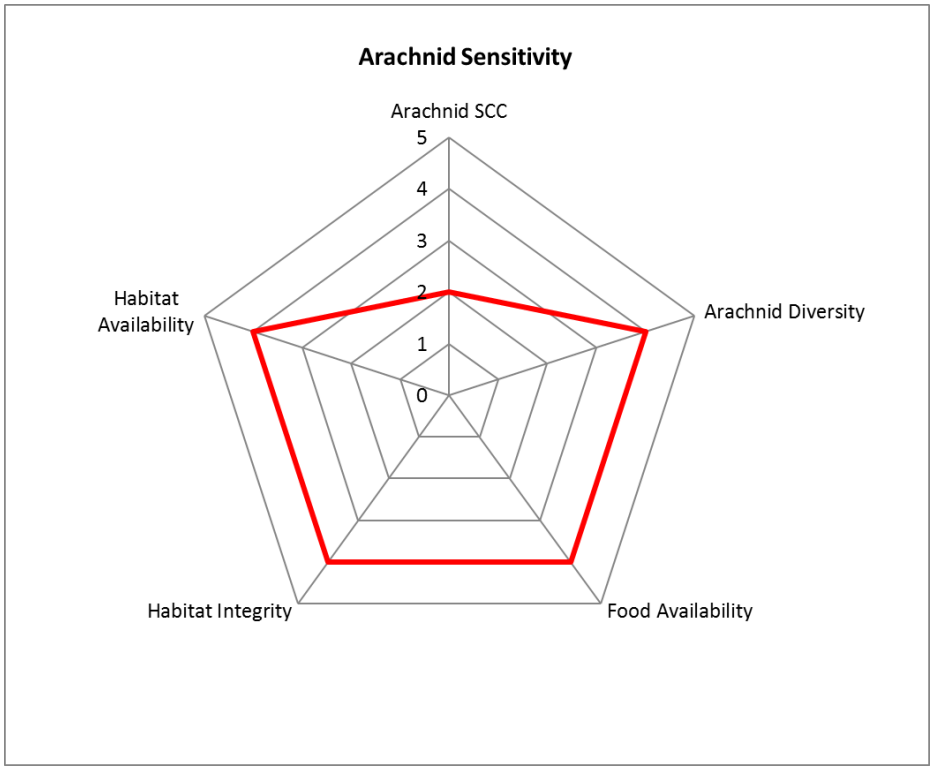
4.7 Arachnids

Table 6: Field assessment results pertaining to arachnid species within the study area

Arachnid Habitat Sensitivity	Moderately High	Photographs:

Photograph Notes:
Top: Family Lycosidae (Wolf Spiders) left and Family Eresidae (Velvet Spiders) right; and
Bottom: *Argiope lobata* (Black-lobed Garden Orb-web Spider).

Arachnid Sensitivity Graph:



Faunal Species of Conservation Concern (SCC)	The Limpopo SoER (2004) makes no provision for arachnid species. As such alternative databases such as the NEBA TOPS list as well as the IUCN were used in order to ascertain the likelihood of arachnid SCC occuring wihtin the study area. Following the analysis of these databases as well as the site assessment and identification of observed arachnid species it has been concluded that arachnids listed as SCC nationally are unlikely to occur within the study area.
Faunal Diversity	Arachnid species are notoriously hard to detect over a relatively short period of time, which can often lead to the under estimation of diversity and abundance. Taking this into consideration, habitat conditions for arachnids as well as available desktop resources were analysed, including information on arachnid occurrences and species diversity for the QDS was collected from databases such as iNaturalist and the Animal Demography Unit (ADU). Taking into consideration the species observed whilst on site, plus the additional species recording as per the information presented in the various databases, it can be assumed that the overall arachnid diversity of the study area will be moderately high. Scorpions species, although not observed during the field investigation are likely to be prolific within the study area, often favouring areas where they can seek refuge under fallen trees / dead logs or dense shrubs. The following arachnid species have been recorded in the region and may occur within the study area, namely *Parabuthus mosambicensis, Parabuthus transvaalicus, Opistophthalmus glabrifrons, Opisthacanthus asper, Hadogenes troglodytes, Pterinochilus lapalala, Idiothele nigrofulva, Ceratogyrus darlingi, Augacephalus junodi* and *Uroplectes flavoviridis* amongst others.
Habitat integrity	Habitat integrity of the study area with regards to arachnid species is considered to be moderately high. Arachnids are capable of surviving in areas of extreme aridity, whilst also showing an inherent resilience to habitat degradation. As the study area shows limited areas of disturbance/transformation it enables for a greater diversity and abundance of arachnid species to exist. Increased food resources combined with intact habitat contribute to the moderately high habitat integrity associated with the study area.

Habitat Availability	**Food Availability**
Many arachnid species only venture out during the safety of night, opting to seek refuge under rocks, bark and dead trees during the day. Areas of refuge such as within the study area were provided under dense shrubs as well as fallen trees and logs. The woody layer within the study area provides ample areas for web building spiders to construct their webs, whilst the sandy soils provide an ideal substrate in which burrowing species can dig into and construct burrows. The sandy areas between grass tufts in addition provide ideal hunting grounds for arachnids that actively hunt their prey, such as species in the Family Lycosidae (Wolf Spiders).	Arachnid species are predatory, preying predominantly on invertebrates and in some instances small reptiles. As these prey species appear to be well represented within the study area and in high abundance, it can be inferred that arachnid species have sufficient suitable food resources available to them in order to ensure their continued survival within the study area.

Business Case, Conclusion and Mitigation Requirements:	Overall the arachnid sensitivity associated with the study area is considered to be moderately high, with a moderately high diversity of species expected The proposed mining activities and associated infrastructure will lead to the loss of habitat and food resources which may lead to a decreased diversity and abundance of arachnid species. Although not formally protected, the threat to scorpion and spider species that seek refuge in subsurface burrows must be highlighted. Vegetation clearing and the removal of topsoil will directly threaten these individuals and concurrently the diversity of such arachnids in the study area. Should the proposed activities proceed, the following recommendations are made to minimise (although not prevent) the impact to arachnid species within the study area: • Personnel working at the mine are to be educated and made aware about the larger scorpions and spiders in the area, and that they are not to be harmed; • Mine workers are to be educated on how to safely and carefully capture and relocate such species should they be found within mine buildings / offices; • As far as possible natural vegetation between buildings must be left intact and not cleared; • Prior to the clearing of vegetation footprint specific assessments are to be undertaken in order to mark the locations of baboon spider burrows. Once marked, the spiders should be carefully excavated and relocated to similar habitat in the vicinity of the mine, but outside of the development footprint. All relocations are to be overseen by a suitably qualified specialist; and • The footprint areas of all surface infrastructure must be minimised to what is absolutely essential.

4.8 Faunal Species of Conservational Concern Assessment

During the field assessment, it is not always feasible to identify or observe all species within the study area, largely due to the secretive nature of many faunal species, possible low population numbers or varying habits of species. As such, to specifically assess an area for faunal SCC, a Probability of Occurrence (POC) matrix is used, utilising a number of factors to determine the probability of faunal SCC occurrence within the study area. Species listed in Appendix C whose known distribution ranges and habitat preferences include the focus area were taken into consideration. The species listed below are considered to have a significant probability of occurring within the focus area.

Table 7: Faunal SCC Probability of Occurrence Score (POC) for the focus area.

Scientific name	Common Name	Conservation listing	POC %
Mammals			
Panthera pardus	Leopard	VU	100%
Felis lybica	African Wild Cat,	VU	100%
Acinonyx jubatus	Cheetah	VU	100%
Oryx gazelle	Gemsbok	NEMBA TOPS	100%
Hyaena brunnea	Brown Hyaena	NT	80%
Hippotragus niger	Sable	VU	100%
Orycteropus afer	Aardvark	NEMBA TOPS	100%
Avifauna			
Gyps africanus	White Backed Vulture	CR	80%
Ardeotis kori	Kori Bustard	NT	90%
Torgos tracheliotos	Lappet-faced Vulture	EN	80%
Buphagus erythrorhynchus	Red-billed Oxpecker	T	80%
Polemaetus bellicosus	Martial Eagle	VU	80%
Aquila rapax	Tawny Eagle	VU	80%
Gyps coprotheres	Cape Vulture	EN	80%
Reptiles			
Python natalensis	African Python	VU	90%

*LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN. T = listed as threatened but with no specific status for the Limpopo Province

As can be seen from the table above, the study area is expected to provide suitable habitat and food resources for a number of faunal SCC. It must be noted however that species such as *Hyaena brunnea, Panthera pardus, Acinonyx jubatus, Gyps africanus* and *Gyps coprotheres* as well as some of the other large raptors may only utilise the study area for foraging purposes, as no direct evidence was available at the time of assessment that indicated the permanent presence of these species in the study area. The remaining SCC identified above all have an increased likelihood of inhabiting and breeding within the study area. Habitat loss and transformation, loss of habitat connectivity and artificial water resources, edge effects as well as increased levels of persecution and vehicle related collisions will result in a decrease in SCC numbers and diversity. Such losses will further strain current conservation efforts in the region, placing increased pressure on the surrounding areas and remaining populations.

5 SENSITIVITY MAPPING

Figure 5 below conceptually illustrates the areas considered to be of increased faunal ecological sensitivity. The areas are depicted according to their sensitivity in terms of the presence or potential for faunal SCC, habitat integrity, levels of disturbance and overall levels of diversity. The table below presents the sensitivity of each area along with an associated conservation objective and implications for development.

Table 8: A summary of the sensitivity of each habitat unit and implications for the proposed development.

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Sweet Bushveld A	Moderately High	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.	The majority of this habitat unit is excluded from the proposed mining footprint area, however the open cast pits, overburden dump and parts of the discard dump are located in this habitat unit and as such will result in the loss of habitat and disturbance of faunal species and possibly SCC. As such, it is imperative that all mitigation measures as stipulated in this report are implemented so as to minimise additional unnecessary habitat loss and thus the impact to the receiving environment.
Sweet Bushveld B	Moderately High	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.	The current proposed mine layout will result in a significant loss of habitat within this habitat unit even with stringent implementation of mitigation measures it is unlikely that the significance of habitat loss in this habitat can be mitigated. The loss of habitat herein will have a significant impact on species abundance and diversity in this habitat unit. All mitigation measures as stipulated in this report must be implemented so as to minimise additional unnecessary habitat loss as a result of footprint creep and the proliferation of AIP species.
Degraded Areas	Moderately Low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	Development within this habitat unit is unlikely to result in significant loss of habitat for faunal species, however the open cast pit and discard dump will lead to the loss of important water points, albeit artificial water points. The loss of the water points will lead to altered faunal area use. Provided that the remaining water points in the northern portion of the study area remain active the loss of the water points in the south is unlikely to have a significant impact to faunal species.

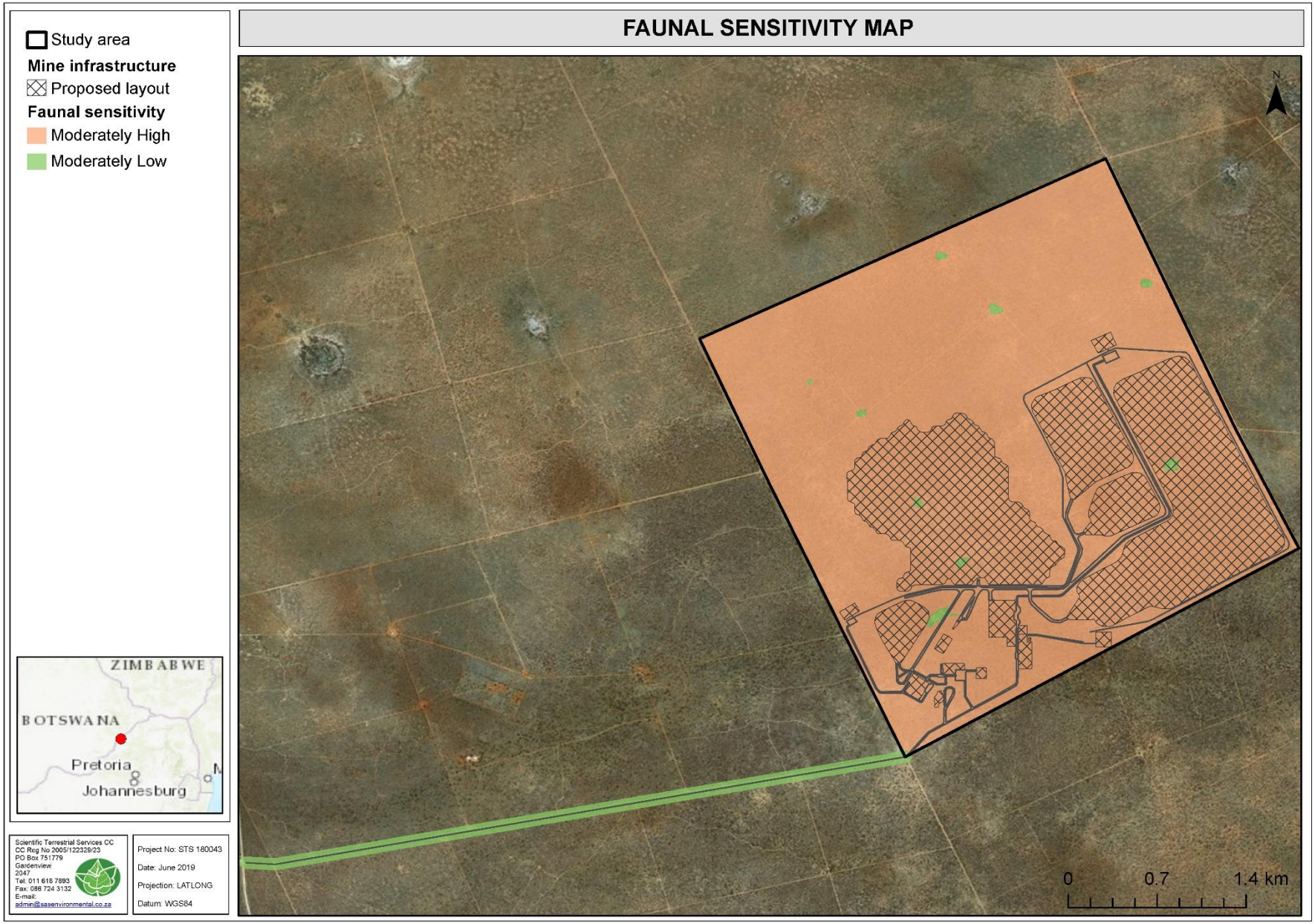


Figure 4: Sensitivity map for the study area with the proposed infrastructure areas.

6 FAUNAL IMPACT ASSESSMENT

The sections below serve to summarise the significance of perceived impacts on the faunal ecology of the study area, with impacts identified presented in Section 6.2 of this report.

Table 9 in Section 6.2 below presents the impact assessment according to the method described in Appendix B of this report. All impacts are considered without mitigation taking place as well as with mitigation fully implemented. All the required mitigatory measures needed to minimise the impact is presented in Table 6 with a short summary the possible latent impacts presented in Section 6.3.

6.1 Impact Discussion

The proposed mining infrastructure will negatively impact on the faunal habitat and communities therein of the study area, whilst also impacting on species that range outside of the study area. The current layout plans will result in an extensive loss of habitat, faunal diversity and abundance in the southern portion of the study area, whilst impacts can be considered limited within the northern portion. Mining activities are likely to lead to a loss of habitat connectivity not just within the study area but also impact upon such connectivity on a local scale, with faunal species having to now circumnavigate the mining activities. This is of particular concern for migratory species (some avifauna) and larger mammals that have home ranges that extend beyond that of the study area. Although these species can move around the mine footprint, they will now encounter additional risks in the form of increased vehicle movement, personnel (snares and poaching) as well as overhead transmission lines (avifauna). Additionally, the proposed activities will result in the displacement of faunal species, pushing them into the surrounding habitats. This will inevitably lead to an increase in inter and intraspecific competition for habitat and resources. The increased competition rates may lead to increased mortality rates and lower breeding potential as well as further dispersal of species from the areas immediately surrounding the study area, with knock on effects being experienced beyond that of the study area. Such impacts and eventualities will lead to a lower species diversity and abundance in the study area.

In addition to the loss of habitat, it is likely that the proposed mining plans will negatively impact upon several faunal SCC species, predominantly as a result of the loss of foraging grounds and habitat. Many of the faunal SCC expected to occur within the study area are far ranging species which require large areas of natural habitat in order to survive. The loss of habitat,

lower food resources and decreased habitat connectivity will force many of the SCC to inhabit and forage in the surrounding areas, which may expose them up to increased levels of persecution and resource competition.

Activities which are likely to negatively impact faunal species within the study area include, but are not limited to, the following:

- Placement of mining infrastructure within sensitive faunal habitat;
- Clearing of vegetation during construction and operational activities;
- Alien and invasive plant proliferation and erosion in disturbed areas;
- Increased possibility of hunting/poaching of faunal species;
- Increased possibility of faunal species being struck by moving vehicles and of bird strikes with overhead transmission lines; and
- Edge effects compromising habitat integrity as a result of alien plant proliferation, decreased habitat connectivity and an increase in the extent of degraded habitat with little chance of habitat restoration to pre-mining conditions.

Section 6.2 provides an indication of the anticipated impact significance pre- and post-mitigation for all phases of the project as well as recommended mitigation measures.

6.2 Results of the Impact Assessment

The impact significance of the proposed mining plans associated with the loss of faunal species and habitat is considered to be medium-high to high prior to the implementation of mitigation measures. Following the implementation of mitigation measures, although the habitat lost as a direct result of the mining activities is considered to remain a medium to high impact, other, indirect impacts can be suitably mitigated and managed to a medium-low to low significance level.

The following table provide an indication of the anticipated impact significance pre- and post-mitigation during all phases of the mining project.

Table 9: Summary of the Impact Assessment of the proposed Gruisfontein Coal Mine on the Faunal ecology of the study area.

ID	Environmental Aspect	Potential Impact	Nature of Impact	Duration	Extent	Probability	Intensity	Weighting factor	Impact Significance	Significant Points	Proposed Mitigation measures	Mitigation Efficiency	Impact Significance
Pre-Construction Phase													
1	Current planned layout of the proposed infrastructure, opencast pits and waste rock dumps within study area.	Extensive loss of faunal habitat, leading to a decline in faunal diversity, including a decline of potential faunal SCC (Species of Conservation Concern) within the study area, including potential niche breeding areas (large trees for avifaunal SCC).	Negative	Permanent	Regional	Definite	High	Medium to High	Medium to High	72	*Minimise loss of indigenous vegetation where possible through planning and suitable layout designs; *The footprint area of all proposed infrastructure should be limited to what is absolutely necessary as the majority of the study area is considered to be of increased sensitivity. Disturbance to the surrounding natural habitat should be kept to a minimal; *Access roads should be kept to existing roads so to reduce fragmentation of existing natural habitat; and *Prior to the clearance of any vegetation or commencement of construction activities a walkdown of the proposed footprints should be undertaken in order to identify and mark SCC encountered, notably that of nesting avifaunal SCC. Should such species be observed a suitably qualified specialist is to be consulted so as to determine the best way forward.	Not Efficient	Medium to High
2	*Potential failure to develop and implement the required mitigation measures before and at commencement of construction activities; * Potential failure to develop an Erosion Control Plan; * Potential failure to develop a Rehabilitation Plan developed before commencement of mining activities; and * Potential failure to develop an Alien and Invasive Plant (AIP) Management/Control Plan prior to the commencement of construction activities and vegetation clearing.	*Extensive and unnecessary loss of faunal habitat outside of the mining footprint, leading to the further decline in faunal diversity, including a decline in faunal SCC numbers within the study area; *Inability of vegetation to recover due to a lack of, or untimely, implementation of a well-conceived rehabilitation plan leading to long term loss of habitat and species abundance; and *Proliferation of AIPs within the study area and the surrounding areas due to a failure to implement AIP Control Plan during the pre-construction phase. If AIPs are not managed before construction activities, AIP seeds will end up in topsoil stockpiles and will be reintroduced during the rehabilitation phase.	Cumulative Negative	Permanent	District	Probable	High	MediumtoHigh	Medium to High	60	*Ensure that sound environmental management is in place during the planning phase; *It is recommended that prior to the commencement of construction activities that the entire construction footprint, including lay down areas and stock pile areas etc., be clearly demarcated; *Prior to the commencement of construction activities on site an AIP Management/Control Plan should be compiled for implementation throughout the construction and operational phases; and *Prior to the commencement of construction activities on site, a rehabilitation plan should be developed for implementation throughout the development phases.	Medium	Low to Medium
Construction Phase													

3	Site preparation and clearing of vegetation for mine related infrastructure: -Open Pit (135ha), including box-cut; -Discard Dump (154ha), soft overburden (18.3ha) and hard overburden (40.1ha) stockpiles; -3-year Temporary Discard Dump (12ha); -Workshop and washbay (6.12ha); -Office, Training & Parking (2.52ha); -Explosives Magazine (1.37ha); -RoM Stockpile (1ha) and RoM Tip (0.12ha); -CHPP Plant (2.1ha) and Plant Infrastructure Area (1.16ha); -PCD's (1.67ha + 0.94); -Product Stockpile (0.58); -Electrical Substation (0.63ha); and -Bulk Water Supply Reservoirs (329m2 + 224m2). Continuous stretches of vegetation cleared along proposed linear developments: -29.11 km of road (only 4.81km placed on existing road); and -approximately 9.8 km of trenches for water management.	*Loss of faunal habitat through vegetation clearance activities; *Loss of faunal species diversity; *Decreased faunal species habitat connectivity; *Loss of faunal food resources, artificial water points and potential breeding habitat; and *Proliferation of alien and invasive plant species in the disturbed areas.	Negative	Long Term	Regional	Highly Probable	High	High	High	80	*It is recommended that all construction personnel be educated in environmental awareness, notably with regards to dangerous faunal species and faunal SCC; *Clearing of vegetation should take place in a phased manner to enable faunal species to move of on their own, whilst keeping bare soil areas at a minimum and to limit the erosion potential; *Only vegetation within the footprint areas is to be cleared; *Suitably qualified and nominated mining/construction personnel should undergo a snake handling course in order to safely remove any snakes that are encountered during construction activities; *Planning of temporary roads and access routes should take the site sensitivity map into consideration. If possible, such roads should be constructed along existing roads and planned in such a manner that the habitat does not unnecessarily get fragmented; *Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the construction activities; *All areas of increased ecological sensitivity, outside of the mining footprint should be designated as No-Go areas and be off-limits to all unauthorised construction vehicles and personnel; *Edge effects stemming from construction activities, which may affect faunal habitat in the surrounding areas, are to be strictly managed, e.g. implement an alien and invasive plant control plan, manage soil erosion, restrict personnel and vehicles movement to the footprint areas and ensure that sufficient dust suppress is taking place during the construction and operational phases; and *A rehabilitation plan must be in place and implemented in disturbed areas where work has been completed.	Low to Medium	Medium to High

		*Potential loss of faunal SCC species; *Loss of faunal SCC breeding habitat including the removal of large trees utilised by raptors and vultures for nesting; and *Potential increased mortality rate due to bird strikes with overhead powerlines and infrastructure.	Negative	Long Term	District	Highly Probable	Medium	MediumtoHigh	Medium	56	*The construction footprint must be kept as small as possible in order to minimise impact on the surrounding environment and vegetation clearing should be limited to what is absolutely essential; *Prior to vegetation clearance activities a site inspection/walkdown of the footprint area is to be undertaken and the occurrence of SCC is to be marked. This is particularly important in terms of nesting avifauna, where large trees with active nests are to be marked and recorded; *Where large nests are located within tall trees, if active, they are to not be disturbed and a suitably qualified avifaunal specialist is to be consulted as to the best way forward; *Where slow moving terrestrial species are located, if they are threatened by construction activities or vegetation clearance, they are to be carefully relocated to similar habitat in the study area by a suitably qualified specialist. Such location and removal activities are particularly important to slow moving reptile species and arachnids; and *All areas of increased ecological sensitivity, outside of the mining footprint should be designated as No-Go areas and be off-limits to all unauthorised construction vehicles and personnel.	Medium	Low to Medium
		Hunting/ collection of common faunal species and that of SCC.	Negative	Long Term	Local	Probable	High	MediumtoHigh	Medium	52	*No hunting or trapping of faunal species or SCC is to be allowed. Access control to the property must be implemented and perimeter fences are to be regularly inspected for signs of damage by poachers; and *Well used game paths, roadsides and if applicable burrows under fences used by fauna are to be inspected for snares, which if found are to be removed and destroyed.	High	Low
		Soil compaction and erosion as a result of development activities and storm water runoff leading to a loss of faunal habitat and consequently a further loss of species diversity.	Negative	Long Term	Local	Probable	Medium	Medium	Low to Medium	36	*All soils compacted as a result of construction activities falling outside of the proposed infrastructure areas should be ripped and profiled. Special attention should be paid to alien and invasive plant control within these areas; and *Disturbed areas that will not form part of the future mining footprint are to be immediately rehabilitated as per the rehabilitation plan.	Medium to High	Low
4	Disposal of construction related material in the surrounding habitat.	Disposal of construction waste material in the surrounding natural areas will lead to disturbance of natural vegetation and subsequently faunal species diversity and abundance.	Negative	Short Term	Local	Probable	Low	Medium	Low to Medium	27	*All construction related waste and material is to be disposed of at a registered waste facility; and *No waste or construction rubble is to be disposed of in the surrounding natural habitats.	High	Low

5	Increased personnel on site and potentially moving through the study area.	*Possible increased fire frequency and intensity, as well as uncontrolled fires due to increased human activity may impact on the faunal habitat and species diversity. Fires may also impact upon faunal SCC in the study area should they not be able to move out the area in time; and *Indiscriminate movement of vehicles through veld will impact on the faunal habitat and increase the possibility of vehicle and faunal collisions.	Negative	Long Term	Local	Probable	High	Medium	Low to Medium	39	*No illicit/unsupervised fires must be allowed during any phases of the proposed mining development. A Fire Management Plan (FMP) should be set in place to ensure that any fires occurring within the study area can be managed and / or stopped before significant damage to the environment occurs; and *No indiscriminate movement of vehicles through the veld is allowed. As far as possible vehicles are to utilise the existing roads. Where this is not feasible, new roads are to be located in areas of existing disturbance, and not encroach upon sensitive habitats.	Medium	Low to Medium
Operational Phase													
6	Blasting and removal of material from opencast pits during the operation of the mine.	*Dust and sediment from active mining areas may lead to the smothering of surrounding plants, impacting of food resources for herbivorous species; and *Disturbance of faunal species in the vicinity of the mine leading to faunal species movement out of the study area as well as decreased breeding rates which will impact upon faunal diversity and abundance.	Negative	Long Term	District	Definite	High	MediumtoHigh	Medium to High	64	*Ecological footprint of open cast pits is to remain as small as possible whilst allowing for economical and optimal extraction of the material; *Blasting should ideally be done during mid-afternoon and not early mornings or late afternoon/ evenings when faunal species are most active; *Edge effects must be suitably managed to ensure that the surrounding habitat is not impacted upon; and *Innovative blasting techniques are to be employed in order to minimise ground and air vibrations and disturbances so as to minimise the impacts on surrounding faunal species.	Medium	Low to Medium
7	Continued expansion of stockpiles and discard dumps during the operational phase of the mine as material is removed from the open cast pits.	*Loss of faunal habitat as a result of vegetation clearing related to the expansion of the Discard Dump (154ha), soft overburden (18.3ha) and hard overburden (40.1ha) stockpiles, the 3-year Temporary Discard Dump (12ha), RoM Stockpile (1ha), Product Stockpile (0.58) and PCD's (1.67ha + 0.94); and *Loss of faunal diversity and species abundance due to long-term habitat loss and disturbances associated with the above-mentioned mining activities.	Negative	Long Term	Local	Definite	High	MediumtoHigh	Medium to High	60	*Stockpiles, discard dumps and PCD positions, and their expansion as material is deposited, should be kept as small as possible to limit unnecessary habitat loss and may not exceed the area as demarcated in this assessment; *Where vegetation clearance activities are undertaken as part of the expansion process, these clearance activities are to be done in a phased manner so as to allow for faunal species to naturally relocate outside of the disturbance footprint; and *All sites should be inspected for small and slow moving faunal as well as SCC prior to vegetation clearance activities.	Medium	Low to Medium

8	Movement of operational vehicles within and without the active mining areas.	*Increased risk of faunal mortality rates due to collisions with mine vehicles; and *Risk of SCC mortalities due to collisions with mine vehicles.	Negative	Long Term	Local	Highly Probable	Medium	Medium	Low to Medium	39	*No indiscriminate driving through the veld is allowed. As far as possible vehicles are to utilise the existing roads. Where this is not feasible, new roads are to be located in areas of existing high disturbance, and not encroach upon sensitive habitats; *Speed restrictions to be placed on all vehicles within the study area to limit faunal and vehicle collisions; and *Drivers to be educated about the presence and importance of faunal species and instructed to actively avoid collisions with faunal species, regardless of size. In particular drivers are to be aware of the increased risk of possible vehicle collisions with smaller slower moving species that may cross the roads as well as faunal SCC that are likely to be more active during dusk and dawn.	Medium	Low to Medium
9	Increased personnel on site as well as increased human populations within the surrounding area.	Increased human populations in the area as well as personnel onsite may lead to the following: *Risk of uncontrolled fires leading to habitat modification, loss of faunal species as well as impacting upon SCC; *Hunting and trapping of faunal species; and *Increased risk of AIP proliferation in the study area.	Negative	Long Term	Local	Probable	Medium	Medium	Low to Medium	36	*Ensure strict access control and patrol boundary fences to ensure perimeter fences are in good stead whilst removing any poachers snares encountered in the study area; *Educate mine personnel on the biodiversity of the study area and highlight the damaging effects of uncontrolled hunting/poaching to species diversity and abundance; *No uncontrolled or unsanctioned fires are allowed. A Fire Management Plan should be in place; and *Implement an AIP Management / Control Plan that includes ongoing monitoring and control of the presence and/or re-emergence of such species.	Medium to High	Low
10	Increased ambient lighting at night as part of the operational and health and safety requirements of the mine.	Increased lighting will result in the attraction of insects, which will inevitably attract a number of insectivorous predators. This may result in increased risk of injury or mortality to such predatory species either from collision with operational machinery and vehicles, or as a result of direct human conflict.	Negative	Long Term	Local	Highly Probable	High	MediumtoHigh	Medium	56	*Lighting pollution and its effect on fauna (with special mention of invertebrates, bats and avifauna) must be effectively mitigated with the following guidelines in mind with due cognizance take of health and safety requirements: • Downward facing lights must be installed and limited to absolutely essential areas; • Covers/light diffusers must be installed to lessen the intensity of illumination where possible; and *Outside lights are to utilise bulbs of varying wave lengths that do not attract insects.	Medium	Low to Medium

11	Collision of avifauna with overhead transmission lines and raptors with moving vehicles notably along dirt roads entering and exiting the study area.	Potential loss of common avifaunal and notably avifaunal SCC due to collisions with the overhead transmission lines and mining vehicles both within and around the mining footprint area.	Negative	Long Term	Local	Probable	High	MediumtoHigh	Medium	52	*Bird flappers and diverters are to be placed on all overhead powerlines in order to increase their visibility; *Powerlines should ideally not be placed in areas of high avifaunal use or along known large raptor flight paths; *Prior to any vegetation clearance activities, a walkdown/site specific assessment should be undertaken in order to mark/assess all possible nesting locations for large raptors in the mining footprint areas. Should active nests be located, an avifaunal specialist should be consulted as to determine the best way forward. At no time are any breeding/nesting species to be disturbed or trees removed that contain active nests; *The use of ultraviolet (UV) lights should be investigated to help avoid night-time bird collisions with tall structures and powerlines. Such lights have proven to be effective in mitigating bird strikes with powerlines for cranes and storks in Europe (Dwyer. J *et al.,* 2019); *Anti-nesting and roosting devices should be installed on all powerlines poles to avoid electrocution of avifauna; Artificial nesting stations should be constructed in the northern portion of the study area to offset any nesting locations lost as a result of the removal of large trees in the mining footprint. A suitably qualified faunal specialist should be consulted with regards to their design and placement; *All vehicle operators and mining personnel are to be educated about the presence of avifaunal SCC within and outside of the study area and made aware of the threat that vehicles pose to these species; and *A specialist avifaunal study should be undertaken and incorporated into the mining Biodiversity Action Plan.	Medium to High	Low to Medium
12	Operational phase related edge effects.	*On-going disturbance of soils including erosion and sedimentation due to operational activities leading to altered faunal habitat and species diversity; and *Dust generation during operational activities leading to dust pollution, habitat disturbance and decreased species diversity.	Negative	Long Term	Local	Probable	High	MediumtoHigh	Medium	52	* All soils compacted as a result of operational activities falling outside of the proposed infrastructure areas should be ripped and profiled. Special attention should be paid to alien and invasive plant control within these areas; and * An effective dust management plan must be designed and implemented in order to mitigate the impact of dust on floral species throughout the operational phase.	Medium to High	Low to Medium

Decommissioning Phase												
13	Decommissioning/ removal of surface infrastructure: -Failure to implement and manage biodiversity action plan, rehabilitation plan, alien and invasive control plan; -Compacted soils limiting the re-establishment of natural vegetation; -Increased risk of erosion in disturbed areas; -Improper rehabilitation of disturbed areas leading to permanent faunal habitat loss.	*Highly compacted soils limiting the re-establishment of natural vegetation; *Increased risk of erosion in disturbed areas; *Proliferation of alien and invasive plant species; and *Inadequate rehabilitation of open pit mining blocks and disturbed areas leading to permanent faunal habitat loss.	Cumulative Negative	Permanent	Local	Probable	High	High	Medium to High	70	*Ensure sound implementation of AIP Management / Control Plan; *Where soils have been compacted, they are to be ripped and where necessary reprofiled; *Indigenous grass species are to be used for revegetation of disturbed areas; and *All surface infrastructure is to be removed and waste material disposed of at a registered disposal site. Waste and remnant mine related material is not to be dumped or left within the study area.	Medium to High	Low to Medium
14	Ineffective rehabilitation and revegetation of the study area post-mine closure	*Ongoing erosion, habitat loss, alien plant proliferation and the loss of faunal species diversity; and *Potential permanent transformation of the faunal habitat leading to a long term and significant cumulative loss of natural habitat and species in the region.	Cumulative Negative	Permanent	Local	Probable	High	High	Medium to High	70	*Implement all recommendations as per the mine closure plan; and *Continue monitoring of rehabilitation activities for a minimum period of 5 years following the mine closure or until an acceptable level of habitat and biodiversity re-instatement has occurred, in such a way as to ensure that natural processes and veld succession will lead to the re-establishment of the natural wilderness conditions which are analogous to the pre-mining conditions of the area.	Medium to High	Low to Medium

6.3 Probable Latent Impacts

Even with extensive mitigation, significant latent impacts on the receiving faunal ecological environment are deemed highly likely. The following points highlight the key latent impacts that have been identified:

- Permanent loss of ecologically intact faunal habitat in the footprint areas;
- Continued loss of and altered faunal species diversity;
- Continued loss of faunal SCC and suitable habitat; and
- Disturbed areas are unlikely to be rehabilitated to baseline levels of ecological functioning and loss of faunal habitat, species diversity and faunal SCC will most likely be permanent.

6.4 Faunal Monitoring

A faunal monitoring plan must be designed and implemented throughout all phases of the mining development, should it be approved. The following points aim to guide the design of the monitoring plan, and it must be noted that the monitoring plan must be continually updated and refined for site-specific requirements:

- Permanent monitoring points must be established in areas surrounding the surface infrastructure. These points must be designed to accurately monitor the following parameters:
  - Species diversity (mammal, invertebrate, amphibian, reptile, arachnid and avifaunal);
  - Species abundance; and
  - Faunal community structure including species composition and diversity, which should be compared to pre-development conditions;
- The following methods aim to guide the monitoring plan, although more detailed, site specific methods must be employed during the development and implementation of the monitoring plan:
  - Monitoring activities must take place on a bi-annual basis (winter and summer) as a minimum;
  - Sherman and camera traps can be used to monitor mammal diversity and occurrence; and
  - Pitfall traps with drift fences can be used to monitor ground invertebrate species, and in some instances small reptile occurrence;
- The following criteria must be used with regards to the avifaunal monitoring:

- Fixed and random points for bird counts to determine species composition and diversity trends. At these points, the observer must record all avifaunal species and total of species observed at the point. A Bird Lasser app that can be downloaded onto a smartphone can assist with record keeping of all necessary information;
- A walkdown of the overhead transmission lines should be undertaken on a monthly basis in order to ascertain the rate of bird strikes occurring in order to better inform the required levels of management and mitigations; and
- Proposed avifaunal fixed-point monitoring must be monitored bi-annually (July and February) in order to record summer as well as winter avifaunal species utilising the area;

➢ The results of the monitoring activities must be taken into account during all phases of the proposed mining development within all seasons and action must be taken to mitigate impacts as soon as the negative effects from mining related activities become apparent; and

➢ The method of monitoring must be designed to be subjective and repeatable in order to ensure consistent results.

7 CONCLUSION

Scientific Terrestrial Services (STS) was appointed to conduct a faunal and floral ecological assessment as part of the Environmental Impact Assessment (EIA) process for the proposed Gruisfontein coal mine project within the Limpopo Province.

Three habitats namely, Sweet Bushveld A, Sweet Bushveld B and Degraded Habitat are associated with the study area. With the exception of the Degraded Habitat unit, the habitat units were noted to be relatively intact, with high levels of habitat connectivity and currently sustaining a moderately high diversity of faunal species. Following the assessments, it can be concluded that the ecological sensitivity of the habitat units is moderately high (Sweet Bushveld A and Sweet Bushveld B) and moderately low (Degraded Habitat). However, the degraded habitat cannot be overlooked in terms of faunal importance as this habitat unit is associated with the current artificial water points which are considered important for all species in the study area. The site assessment further indicated that several faunal SCC are likely to make use of the study area, either permanently or on a periodic basis whilst foraging. The presence of faunal SCC as well as the moderately high abundance and diversity of common faunal species from all classes further indicates that the overall importance of the study area and the habitat therein.

The perceived impact significance of the proposed mining activities prior to mitigation affecting faunal habitat, diversity and SCC are predominantly of medium to high significance impacts. If effective mitigation takes place, many of the impacts may be reduced to a low to medium, however it must be noted that even with mitigation the loss of habitat through vegetation clearance will still be medium-high, as habitat will still be permanently lost. It is thus deemed essential that a cogently developed, documented and managed biodiversity management plan be implemented and maintained throughout the life of the proposed Gruisfontein coal mine.

The objective of this study was to provide sufficient information on the faunal ecology of the area, together with other studies on the physical and socio-cultural environment, in order for the Environmental Assessment Practitioner (EAP) and the relevant authorities to apply the principles of Integrated Environmental Management (IEM) and the concept of sustainable development. It is the opinion of the ecologists that this study provides the relevant information required in order to implement IEM and to ensure that the best long-term use of the ecological resources in the study area will be made in support of the principle of sustainable development.

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APPENDIX A: Faunal Method of Assessment

It is important to note that due to the nature and habits of fauna, varied stages of life cycles, seasonal and temporal fluctuations along with other external factors, it is unlikely that all faunal species will have been recorded during the site assessment. The presence of human habitation nearby the study area and the associated anthropogenic activities may have an impact on faunal behaviour and in turn the rate of observations. In order to increase overall observation time within the study area, as well as increasing the likelihood of observing shy and hesitant species, camera traps were strategically placed within the study area. Sherman traps were also used to increase the likelihood of capturing and observing small mammal species, notably small nocturnal mammals.

Mammals

Mammal species were recorded during the field assessment with the use of visual identification, spoor, call and dung. Sherman traps and camera traps were placed in the study area in order to increase the detection rate of species, notably small mammals and mammals that are nocturnal and/or secretive. Specific attention was paid to mammal SCC as listed by the International Union for the Conservation of Nature (IUCN).

Avifauna

The Southern African Bird Atlas Project 2 database (http://sabap2.adu.org.za/) was compared with the recent field survey of avifaunal species identified on the study area. Field surveys were undertaken utilising a pair of Bushnell 10x50 binoculars and bird call identification techniques were utilised during the assessment in order to accurately identify avifaunal species. Specific attention was given to avifaunal SCC listed on a regional and national level, as well as those identified by the IUCN.

Reptiles

Reptiles were identified during the field survey. Suitable applicable habitat areas (rocky outcrops and fallen dead trees) were inspected and all reptiles encountered were identified. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which reptile species are likely to occur on the study area. Specific attention was given to reptile SCC listed on a regional and national level, as well as those identified by the IUCN.

Amphibians

Identifying amphibian species is done by the use of direct visual identification along with call identification technique. Amphibian species flourish in and around wetland, riparian and moist grassland areas. It is unlikely that all amphibian species will have been recorded during the site assessment, due to their cryptic nature and habits, varied stages of life cycles and seasonal and temporal fluctuations within the environment. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which amphibian species are likely to occur within the study area as well as the surrounding area. Specific attention was given to amphibian SCC listed on a regional and national level, as well as those identified by the IUCN.

Invertebrates

Whilst conducting transects through the study area, all insect species visually observed were identified, and where possible photographs taken. Furthermore, at suitable and open sites within the study area, sweep netting was conducted, and all the insects captured identified. In addition, pitfall traps with drift fences were placed in the study area in order to increase the detection rate of terrestrial invertebrate species. It must be noted however that due to the cryptic nature and habits of insects, varied stages of life cycles and seasonal and temporal fluctuations within the environment, it is unlikely that all insect species will have been recorded during the site assessment period. Nevertheless, the data gathered during the assessment along with the habitat analysis provided an accurate indication of which species are likely to occur in the study area at the time of survey. Specific attention was given to insect SCC listed on a regional and national level, as well as those identified by IUCN.

Arachnids

Suitable applicable habitat areas (rocky outcrops, sandy areas and fallen dead trees) where spiders and scorpions are likely to reside were searched. Rocks and old tree logs were overturned and inspected for signs of these species. Specific attention was paid to searching for Mygalomorphae arachnids (Trapdoor and Baboon spiders) as well as potential SCC species.

Faunal Species of Conservational Concern Assessment

The Probability of Occurrence (POC) for each faunal SCC was determined using the following four parameters:

- Species distribution;
- Habitat availability;
- Food availability; and
- Habitat disturbance.

The accuracy of the calculation is based on the available knowledge about the species in question. Therefore, it is important that the literature available is also considered during the calculation.
Each factor contributes an equal value to the calculation.

Scoring Guideline				
Habitat availability				
No Habitat	**Very low**	**Low**	**Moderate**	**High**
1	2	3	4	5
Food availability				
No food available	**Very low**	**Low**	**Moderate**	**High**
1	2	3	4	5
Habitat disturbance				
Very High	**High**	**Moderate**	**Low**	**Very Low**
1	2	3	4	5
Distribution/Range				
Not Recorded		**Historically Recorded**		**Recently Recorded**
1		3		5

[Habitat availability + Food availability + Habitat disturbance + Distribution/Range] / 20 x 100 = POC%

Faunal Habitat Sensitivity

The sensitivity of the study area for each faunal class (i.e. mammals, birds, reptiles, amphibians and invertebrates) was determined by calculating the mean of five different parameters which influence each faunal class and provide an indication of the overall faunal ecological integrity, importance and sensitivity of the study area for each class. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Faunal SCC:** The confirmed presence or potential for faunal SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Habitat Availability:** The presence of suitable habitat for each class;
- **Food Availability:** The availability of food within the study area for each faunal class;
- **Faunal Diversity:** The recorded faunal diversity compared to a suitable reference condition such as surrounding natural areas or available faunal databases; and
- **Habitat Integrity:** The degree to which the habitat is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the suitability and sensitivity of the study area for each faunal class. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the study area in relation to each faunal class. The different classes and land-use objectives are presented in the table below:

Table A1: Faunal habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1 < 1.5	Low	Optimise development potential.
≥1.5 <2.5	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
≥2.5 <3.5	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
≥3.5<4.5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, li development and disturbance.
≥4.5 ≤5.0	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX B: Impact Assessment Methodology

Impact Significance

Nature and Status

The 'nature' of the impact describes what is being affected and how. The 'status' is based on whether the impact is positive, negative or neutral.

Spatial Extent

'Spatial Extent' defines the spatial or geographical scale of the impact.

Category	Rate	Descriptor
Site	1	Site of the proposed development
Local	2	Limited to site and/or immediate surrounds
District	3	Lephalale Local Municipal Area
Region	4	Waterberg District Municipal Area
Provincial	5	Limpopo Province
National	6	South Africa
International	7	Beyond South African borders

Duration

'Duration' gives the temporal scale of the impact.

Category	Rate	Descriptor
Temporary	1	0 – 1 years
Short term	2	1 – 5 years
Medium term	3	5 – 15 years
Long term	4	Where the impact will cease after the operational life of the activity either because of natural process or by human intervention
Permanent	5	Where mitigation either by natural processes or by human intervention will not occur in such a way or in such a time span that the impact can be considered as transient

Probability

The 'probability' describes the likelihood of the impact actually occurring.

Category	Rate	Descriptor
Rare	1	Where the impact may occur in exceptional circumstances only
Improbable	2	Where the possibility of the impact materialising is very low either because of design or historic experience
Probable	3	Where there is a distinct possibility that the impact will occur
Highly probable	4	Where it is most likely that the impact will occur
Definite	5	Where the impact will occur regardless of any prevention measures

Intensity

'Intensity' defines whether the impact is destructive or benign, in other words the level of impact on the environment.

Category	Rate	Descriptor
Insignificant	1	Where the impact affects the environment is such a way that natural, cultural and social functions and processes are not affected. Localised impact and a small percentage of the population is affected
Low	2	Where the impact affects the environment is such a way that natural, cultural and social functions and processes are affected to a limited extent
Medium	3	Where the affected environment is altered in terms of natural, cultural and social functions and processes continue albeit in a modified way
High	4	Where natural, cultural or social functions or processes are altered to the extent that they will temporarily or permanently cease
Very High	5	Where natural, cultural or social functions or processes are altered to the extent that they will permanently cease, and it is not possible to mitigate or remedy the impact

Ranking, Weighting and Scaling

The weight of significance defines the level or limit at which point an impact changes from low to medium significance, or medium to high significance. The purpose of assigning such weights serves to highlight those aspects that are considered the most critical to the various stakeholders and ensure that the element of bias is taken into account. These weights are often determined by current societal values or alternatively by scientific evidence (norms, etc.) that define what would be acceptable or unacceptable to society and may be expressed in the form of legislated standards, guidelines or objectives.

The weighting factor provides a means whereby the impact assessor can successfully deal with the complexities that exist between the different impacts and associated aspect criteria.

Spatial Extent	Duration	Intensity / Severity	Probability	Weighting factor	Significance Rating (SR - WOM) Premitigation	Mitigation Efficiency (ME)	Significance Rating (SRWM) Post Mitigation
Site (1)	Short term (1)	Insignificant (1)	Rare (1)	Low (1)	Low (0 – 19)	High (0.2)	Low (0 – 19)
Local (2)	Short to Medium term (2)	Minor (2)	Unlikely (2)	Low to Medium (2)	Low to Medium (20 – 39)	Medium to High (0.4)	Low to Medium (20 – 39)
District (3)							
Regional (4)	Medium term (3)	Medium (3)	Possible (3)	Medium (3)	Medium (40 – 59)	Medium (0.6)	Medium (40 – 59)
Provincial (5)	Long term (4)	High (4)	Likely (4)	Medium to High (4)	Medium to High (60 – 79)	Low to Medium (0.8)	Medium to High (60 – 79)
National (6)							
International (7)	Permanent (5)	Very high (5)	Almost certain (5)	High (5)	High (80 – 110)	Low (1.0)	High (80 – 110)

Impact significance without mitigation (WOM)

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned weightings, resulting in a value for each impact (prior to the implementation of mitigation measures).

Equation 1:

Significance Rating (WOM) = (Extent + Intensity + Duration + Probability) x Weighting Factor

Effect of Significance on Decision-makings

Significance is determined through a synthesis of impact characteristics as described in the above paragraphs. It provides an indication of the importance of the impact in terms of both tangible and intangible characteristics. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required.

Rating	Rate	Descriptor
Negligible	0	The impact is non-existent or insignificant, is of no or little importance to decision making.
Low	1-19	The impact is limited in extent, even if the intensity is major; the probability of occurrence is low and the impact will not have a significant influence on decision-making and is unlikely to require management intervention bearing significant costs.
Low to Medium	20 – 39	The impact is of importance, however, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels. The impact and proposed mitigation measures can be considered in the decision-making process
Medium	40 – 59	The impact is significant to one or more affected stakeholder, and its intensity will be medium or high; but can be avoided or mitigated and therefore reduced to acceptable levels. The impact and mitigation proposed should have an influence on the decision.
Medium to High	60 -79	The impact is of major importance but through the implementation of the correct mitigation measures, the negative impacts will be reduced to acceptable levels.
High	80 – 110	The impact could render development options controversial or the entire project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor and must influence decision making.

Mitigation

"Mitigation" is a broad term that covers all components of the 'mitigation hierarchy' defined hereunder. It involves selecting and implementing measures, amongst others, to conserve biodiversity and to protect, the users of biodiversity and other affected stakeholders from potentially adverse impacts because of mining or any other land use. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level. Offsetting of impacts is considered the last option in the mitigation hierarchy for any project.

The mitigation hierarchy in general consists of the following in order of which impacts should be mitigated:

- Avoid/prevent impact: can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases, if impacts are expected to be too high, the "no project" option should also be considered, especially where it is expected that the lower levels of mitigation will not be adequate to limit environmental damage and eco-service provision to suitable levels.
- Minimise (reduce) impact: can be done through utilisation of alternatives that will ensure that impacts on biodiversity and eco-services provision are reduced. Impact minimisation is considered an essential part of any development project.
- Rehabilitate (restore) impact is applicable to areas where impact avoidance and minimisation are unavoidable where an attempt to re-instate impacted areas and return them to conditions which are ecologically similar to the pre-project condition or an agreed post project land use, for example arable land. Rehabilitation can however not be considered as the primary mitigation toll as even with significant resources and effort rehabilitation that usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation should consist of the following phases in best practice:
    - Structural rehabilitation which includes physical rehabilitation of areas by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long terms sustainable ecological structure;
    - Functional rehabilitation, which focuses on ensuring that the ecological functionality of the ecological resources on the subject property supports the intended post-closure land use. In this regard, special mention is made of the need to ensure the continued functioning and integrity of wetland and riverine areas throughout and after the rehabilitation phase;
    - Biodiversity reinstatement that focuses on ensuring that a reasonable level of biodiversity is re-instated to a level that supports the local post-closure land uses. In this regard,

special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community of community suitable for supporting the intended postclosure land use; and

- Species reinstatement that focuses on the re-introduction of any ecologically important species, which may be important for socio-cultural reasons, ecosystem functioning reasons and for conservation reasons. Species re-instatement need only occur if deemed necessary.

➢ Offset impact: refers to compensating for latent or unavoidable negative impacts on biodiversity. Offsetting should take place to address any impacts deemed unacceptable which cannot be mitigated through the other mechanisms in the mitigation hierarchy. The objective of biodiversity offsets should be to ensure no net loss of biodiversity. Biodiversity offsets can be considered a last resort to compensate for residual negative impacts on biodiversity.

According to the DMR (2013) "Closure" refers to the process for ensuring that mining operations are closed in an environmentally responsible manner, usually with the dual objectives of ensuring sustainable post-mining land uses and remedying negative impacts on biodiversity and ecosystem services.
The significance of residual impacts should be identified on a regional as well as national scale when considering biodiversity conservation initiatives. If the residual impacts lead to irreversible loss or irreplaceable biodiversity, the residual impacts should be considered to be of very high significance and when residual impacts are considered to be of very high significance, offset initiatives are not considered an appropriate way to deal with the magnitude and/or significance of the biodiversity loss. In the case of residual impacts determined to have medium to high significance, an offset initiative may be investigated. If the residual biodiversity impacts are considered of low significance, no biodiversity offset is required.

Impact significance with mitigation measures (WM)

In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it is necessary to re-evaluate the impact.

Mitigation Efficiency (ME)

The most effective means of deriving a quantitative value of mitigated impacts is to assign each significance rating value (WOM) a mitigation effectiveness (ME) rating. The allocation of such a rating is a measure of the efficiency and effectiveness, as identified through professional experience and empirical evidence of how effectively the proposed mitigation measures will manage the impact. Thus, the lower the assigned value the greater the effectiveness of the proposed mitigation measures and subsequently, the lower the impacts with mitigation.

Equation 2: Significance Rating (WM) = Significance Rating (WOM) x Mitigation Efficiency (ME)

Mitigation Efficiency is rated out of 1 as follows:

Category	Rate	Descriptor
Not Efficient (Low)	1	Mitigation cannot make a difference to the impact
Low to Medium	0.8	Mitigation will minimize impact slightly
Medium	0.6	Mitigation will minimize impact to such an extent that it becomes within acceptable standards
Medium to High	0.4	Mitigation will minimize impact to such an extent that it is below acceptable standards
High	0.2	Mitigation will minimize impact to such an extent that it becomes insignificant

Significance Following Mitigation (SFM)

The significance of the impact after the mitigation measures are taken into consideration. The efficiency of the mitigation measure determines the significance of the impact. The level of impact is therefore seen in its entirety with all considerations taken into account.

APPENDIX C: Faunal SCC

Faunal Species of Conservation Concern

Table C1: Red Data Mammal species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status
Diceros bicornis	Black Rhinoceros	CR	CR
Neamblysomus julianae	Juliana's golden mole	CR	VU
Loxodonta africana	African elephant	VU	VU
Lycaon pictus	African wild dog	EN	EN
Amblysomus gunningi	Gunning's golden mole	VU	EN
Lutra maculicollis	Spotted-necked otter	VU	LC
Acinonyx jubatus	Cheetah	VU	VU
Felis lybica	African Wild Cat	VU	NYBA
Panthera leo	Lion	VU	VU
Ceratotherium simum	White rhinoceros	NT	NT

LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN.

Table C2: Red Data Bird species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status
Gyps coprotheres	Cape Vulture	T	VU
Ciconia nigra	Black Stork	T	LC
Falco naumanni	Lesser Kestrel	T	LC
Certhilauda chuana	Short-clawed Lark	T	LC
Pterocles gutturalis	Yellow throated Sandgrouse	T	LC
Anthropoides paradiseus	Blue Crane	T	VU
Gyps africanus	White backed Vultures	T	EN
Ardeotis kori	Kori Bustard	T	LC
Scotopelia peli	Pel's Fishing Owl	T	LC
Bucorvus leadbeateri	Southern Ground Hornbill	T	VU
Buphagus erythrorhynchus	Red-billed Oxpecker	T	LC
Terathopius ecaudatus	Bateleur	T	NT
Polemaetus bellicosus	Martial Eagle	T	NT
Aquila rapax	Tawny Eagle	T	LC
Torgos tracheliotos	Lappet faced Vulture	T	VU
Trigonoceps occipitalis	White headed Vulture	T	VU
Buphagus africanus	Yellow billed Oxpecker	T	LC
Stephanoaetus coronatus	Crowned hawk Eagle	T	NT

LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN. T = listed as threatened but with no specific status for the Limpopo Province

Table C3: Red Data Amphibian species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status
Breviceps sylvestris	Transvaal forest rain frog	VU	EN
Ptychadena uzungwensis		P	LC
Leptopelis bocagii		P	LC
Hemisus guineensis	Guinea Snout-burrower	P	LC

LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, P = Peripheral. NYBA = Not yet been assessed by the IUCN.

Table C4: Red Data Reptile species listed in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status
Homoroselaps dorsalis	Striped Harlequin snake	R	NT
Xenocalamus transvaalensis	Transvaal Quill-snout snake	R	DD
Lamprophis swazicus	Swazi Rock Snake	R	NT
Python natalensis	African Python	VU	NYBA
Lygodactylus methueni	Methuen's Dwarf Gecko	VU	VU
Crocodylus niloticus	Nile Crocodile	VU	LC
Lycophidion variegatum	Variegated Wolf snake	P	NYBA
Psammophis jallae	Jalla's Sand snake	P	NYBA

R = Rare, DD = Data Deficient, LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, P = Peripheral. NYBA = Not yet been assessed by the IUCN.

Table C5: Red Data Invertebrates species mentioned in the Limpopo SoER 2004 report including IUCN status.

Scientific name	Common Name	Limpopo SoER 2004 Status	IUCN Red List Status
Taurhina splendens	Splendid fruit chafer *	T	NYBA
Charaxes marieps	Marieps Charaxes butterfly *	T	NYBA
Trichostetha fasicularis	Protea beetle *	T	NYBA
Ischnestoma ficqui	Fruit eating beetles *	T	NYBA

R = Rare, DD = Data Deficient, LC = Least concerned, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN. T = listed as threatened but with no specific status for the Limpopo Province. * Very little detailed or general information exists on terrestrial invertebrates in the Limpopo Province, thus in general there is very little consolidated information regarding invertebrates (Limpopo SOER, 2004).

South African Bird Atlas Project 2 list

Table C6: Avifaunal Species for the pentads 2330_2715 and **2335_2715 within the QDS 2327CB.**

Pentads	Link to pentad summary on the South African Bird Atlas Project 2 web page
2330_2715	http://sabap2.adu.org.za/coverage/pentad/2330_2715
2335_2715	http://sabap2.adu.org.za/coverage/pentad/2335_2715

APPENDIX D: Faunal Species List

Table D1: Mammal species recorded during the field assessment. Species marked with an asterix (*) were observed by other specialists and the land manager.

Scientific Name	Common Name	Conservation Status
**Canis mesomelas*	Black-backed Jackal	LC
Lepus saxatilis	Scrub hare	LC
**Otocyon megalotis*	Bat-eared Fox	LC
Sylvicapra grimmia	Common Duiker	LC
Raphicerus campestris	Steenbok	LC
Aepyceros melampus	Impala	LC
Tragelaphus strepsiceros	Kudu	LC
Hystrix africaeaustralis	Cape Porcupine	LC
**Papio ursinus*	Chacma Baboon	LC
**Panthera pardus*	Leopard	VU
**Hippotragus niger*	Sable	VU
**Chlorocebus pygerythrus*	Vervet Monkey	LC
Phacochoerus aethiopicus	Warthog	LC
Felis lybica	African Wild Cat	VU
**Mungos mungo*	Banded Mongoose	LC
Galerella sanguinea	Slender Mongoose	LC
Oryx gazella	Gemsbok	LC, TOPS Listed
**Tragelaphus angasii*	Nyala	LC
Parahyaena brunnea	Brown Hyaena	NT
**Acinonyx jubatus*	Cheetah	VU
**Civettictis civetta*	Civet	LC
Alcelaphus buselaphus	Red Hartebeest	LC
Paraxerus cepapi	Tree Squirrel	LC
Cryptomys hottentotus	Common Mole-rat	LC
**Genetta*	Small Spotted Genet	LC
**Genetta maculata*	Large Spotted Genet	LC
Orycteropus afer	Aardvark	LC, TOPS Listed

LC = Least Concern, VU = Vulnerable, NT = Near Threatened

Table D2: Avifaunal species recorded during the field assessment.

Scientific name	English name	Conservation Status
Upupa africana	African Hoopoe	LC
Coracias caudatus	Lilac-breasted Roller	LC
Batis molitor	Chinspot Batis	LC
Vidua paradisaea	Long-tailed Paradise-whydah	LC
Lamprotornis nitens	Cape Glossy Starling	LC
Tchagra australis	Brown-crowned Tchagra	LC
Parus niger	Southern Black Tit	LC
Granatina	Violet-eared Waxbill	LC
Uraeginthus angolensis	Blue Waxbill	LC
Cercotrichas leucophrys	White-browed Scrub-robin	LC
Passer melanurus	Cape Sparrow	LC

Scientific name	English name	Conservation Status
Streptopelia capicola	Cape Turtle Dove	LC
Motacilla capensis	Cape Wagtail	LC
Lanius collaris	Common Fiscal	LC
Turtur chalcospilos	Emerald-spotted Wood-dove	LC
Circaetus pectoralis	Black-breasted Sake Eagle	LC
Pycnonotus nigricans	African Red-eyed Bulbul	LC
Cercotrichas leucophrys	White-browed Scrub-robin	LC
Tchagra senegalus	Black-crowned Tchagra	LC
Numida meleagris	Helmeted Guineafowl	LC
Streptopelia senegalensis	Laughing Dove	LC
Cinnyricinclus leucogaster	Violet-backed Starling	LC
Emberiza flaviventris	Golden-breasted Bunting	LC
Cisticola fulvicapilla	Neddicky	LC
Batis molitor	Chinspot Batis	LC
Dicrurus adsimilis	Fork-tailed Drongo	LC
Lanius collurio	Red-backed Shrike	LC
Plocepasser mahali	White-browed Sparrow-weaver	LC
Tockus nasutus	African Grey Hornbill	LC
Corvus albus	Pied Crow	LC
Elanus caeruleus	Black-shouldered Kite	LC
Oena capensis	Namaqua Dove	LC
Sporopipes squamifrons	Scaly-feathered Finch	LC
Turdoides bicolor	Southern Pied Babler	LC
Turdoides jardineii	Arrow-marked Babler	LC
Quelea	Red-billed Quelea	LC
Laniarius atrococcineus	Crimson-breasted Shrike	LC
Urocolius indicus	Red-faced Mousebird	LC
Vidua paradisea	Paradise Whydah	LC
Prinia flavicans	Black-chested Prinia	LC
Corythaixoides concolor	Grey Go-away-bird	LC
Pternistis natalensis	Natal Spurfowl	LC

LC = Least Concern, NT = Near Threatened, NYBA = Not Yet Been Assessed

Table D3: Reptile species recorded during the field assessment. Species marked with an asterix (*) were observed by other specialists and the land manager.

Scientific name	Common Name	Conservation Status
Trachylepis striata	Striped Skink	LC
Acanthocercus atricollis atricollis	Southern Tree Agama	LC
**Chamaeleo dilepis*	Flap-neck Chameleon	LC
Stigmochelys pardalis	Leopard Tortoise	LC
Heliobolus lugubris	Bushveld Lizard)	LC

LC = Least Concern, VU = Vulnerable, NYBA = Not Yet Been Assessed

Table D4: General invertebrate species recorded during the field assessment.

Scientific Name	Common Name	Conservation Status
Eurema brigitta	Broad-bordered Grass Yellow	NYBA
Belenois aurota	Brown-veined White	NYBA
Junonia hierta	Yellow Pansy	LC
Musca domestica	House Fly	NYBA
Pinacopteryx eriphia	Zebra White	LC
Rhachitopis sp	N/A	NYBA
Acrotylus sp	Burrowing Grasshoppers	NYBA
Genus *Platypleura*	Cicada	NYBA
Family Psychidae	Bagworm	NYBA
Pachylomera femoralis	Flattened Giant Dung Beetle	NYBA
Cupidopsis jobates jobates	Tailed Meadow Blue	LC
Acrea axina	Little Acrea	LC
Trithemis kirbyi	Kirby's Dropwing	LC
Garreta sp	Dung Beetle	NYBA
Manticora sp	Monster Tiger Beetles	NYBA
Cynthia cardui	Painted Lady	LC
Phalanta phalanta	Common Leopard	LC
Byblia ilythia	Spotted Joker	LC
Papilio demodocus	Citrus Swallowtail	LC
Cypholoba macilenta	N/A	NYBA
Passalidus fortipes	Burrowing Ground Beetle	NYBA
Acrea natalica	Natal Acrea	LC
Melanitis leda	Twilight Brown	LC
Danaus chrysippus	African Monarch	LC
Spalia sp	Sandman	LC
Cyligramma latona	Cream-striped Owl	LC
Eupezus natalensis	Tree Darkling Beetle	NYBA
Dichthaincantatoris	White-legged Toktokkie	NYBA
Kheper nigroaeneus	Large Copper Dung Beetle	NYBA
Protostrophus sp	Bearded Weevils	NYBA
Thermophilum homoplatum	Two-spotted Ground Beetle	NYBA
Macrotoma palmata	Large Brown Longhorn	NYBA
Papilio nireus	Green-banded Swallowtail	LC
Acanthacaris ruficornis	Garden Locust	NYBA
Hamanumida Daedalus	Guinea Fowl	LC
Hypolimnas misippus	Diadem	LC
Bactrododema tiaratum	Giant Stick Insect	NYBA
Maransis rufolineatus	Grass Stick Insect	NYBA
Oedaleus sp	Yellow Wings	NYBA
Eyprepocnemis plorans	N/A	NYBA
Gastrimargus sp	N/A	NYBA
Cyrtacanthacris aeruginosa	Green Tree Locust	NYBA
Truxaloides sp	N/A	NYBA
Phaneroptera sp	Leaf Katydid	NYBA
Apis mellifera	Western Honeybee	DD
Pantala flavescens	Wandering Glider	LC
Junonia octavia	Gaudy Commodore	LC

Scientific Name	Common Name	Conservation Status
Colotis danae	Scarlet Tip	LC
Colotis euippe	Smokey Orange Tip	LC
Catopsilla florella	African Migrant	LC
Pontia helice	Meadow White	LC
Anoplolepis custodiens	Pugnacious Ant	NYBA
Subfamily *Entiminae*	Broad-nosed Weevils	NYBA
Cheilomenes lunata	Lunate Ladybird	NYBA
Lestes pallidus	Pale Spreadwing	LC

LC = Least Concern, NYBA = Not yet been assessed by the IUCN

Table D5: Arachnid species recorded during the site assessment.

Scientific Name	Common Name	Conservation Status
Argiope lobata	Black-lobed Garden Orb-web Spider	NYBA
Family Eresidae	Velvet Spiders	NYBA
Family Lycosidae	Wolf Spiders	NYBA

LC = Least Concern, NYBA = Not Yet Been Assessed