TERRESTRIAL ECOLOGICAL HABITAT INTEGRITY INVESTIGATION AS PART OF THE WASTE MANAGEMENT LICENSE APPLICATION (EIA) FOR THE TSHIPI WASTE ROCK DUMP AND EMP AMENDMENT, HOTAZEL, NORTHERN CAPE

Prepared for

SLR Consulting (Africa) (Pty) Ltd

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Prepared by: **Scientific Terrestrial Services**
Report author: **C. Hooton**
Report reviewer: **E. van der Westhuizen**
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Scientific Terrestrial Services CC
CC Reg No 2005/122329/23
PO Box 751779
Gardenview
2047
Tel: 011 616 7893
Fax: 086 724 3132
E-mail: admin@sasenvgroup.co.za

EXECUTIVE SUMMARY

Based on the findings of the assessment, it is the opinion of the ecologists that from an ecological perspective, the proposed project be considered favorably. However, all essential mitigation measures and recommendations presented in this report should be adhered to as to ensure that the impact on the receiving environment is minimized.

Scientific Terrestrial Services (STS) was appointed to conduct an investigation into the terrestrial faunal and floral ecology as part of the Waste Management License Application and EMP Amendment process for the following proposed construction activities at the Tshipi Borwa Mine, near Hotazel, Northern Cape Province:

- The extension of the existing East Waste Rock Dump (WRD) to the mining right boundary and towards the Mamatwan WRD and eventually filling the void between these dumps, to provide additional overburden storage capacity;
- The extension of the existing West WRD onto the remaining extent of Portion 8 of the farm Mamatwan 331, thereby including the remaining extent of Portion 8 into the mine's surface use area;
- The erection of an 11kV overhead powerline and associated sub-station along the Portion 8 boundary onto the existing mining right area; and
- The construction of an overland conveyor system from the existing secondary crushing and screening plant to the existing manganese ore product stockpiles.

Specific outcomes required from this report include the following:

- To define the Present Ecological State (PES) of the terrestrial ecological resources in the vicinity of the study area;
- To conduct a faunal and floral Species of Conservation Concern (SCC) assessment, including potential for such species to occur or to have occurred within the study area;
- To identify and consider all sensitive landscapes including rocky ridges, natural grasslands, wetlands and any other ecologically important features; and
- To determine the environmental impacts that the construction of the study area might have on the terrestrial ecology associated with the footprint area, and to develop mitigation and management measures for all phases of the development.

TERRESTRIAL RESULTS

- Two habitat units were identified during the field assessment, namely Kathu Thornveld and Disturbed Habitat;
- The Kathu Thornveld habitat unit is considered to be in a good and overall intact state, with very limited impacts evident resulting from land use and mining activities;
- The Disturbed habitat unit is associated with the current mining and infrastructure areas, with characteristic habitat degradation from edge effects, vegetation clearing and alien plant proliferation;
- Two tree species, *Vachellia erioloba* and *Vachellia haematoxylon*, which are listed as Protected in Section 15 (1) of the National Forest Act (1998, as amended in September 2011) were observed within the study area. All relevant permits pertaining to these species are to be acquired prior to vegetation clearing activities;
- *Harpagophytum procumbens* as listed in both the TOPS (NEMBA, 2015) and the NCNCA (Act No 9 of 2009) plants list for threatened and protected floral species may occur within the study area. As such it is recommended that a walkdown of the footprint areas be conducted before operational activities commence. Should any individuals be located, permits are required from the relevant authorities pertaining to the removal/ relocation or destruction of this species;
- The study area was predominantly inhabited by faunal species common to the region, that are widely distributed throughout the surrounding habitat;
- No faunal SCC were observed, however there is an increased probability that species such as *Otocyon megalotis* (Bat-eared fox), *Vulpes chama* (Cape fox), *Ardeotis kori* (Kori Bustard),

Neotis ludwigii (Ludwig's Bustard), *Python natalensis* (African Rock Python), species of the Genus: *Ceratogyrus, Harpactira* and *Pterinochilus* (Baboon Spiders), *Mellivora capensis* (Honey Badger) and *Atelerix frontalis* (South African Hedgehog) may utilise the western and northern portions of the Kathu Thornveld habitat unit;

- Should any of these species be observed, a relevant specialist is to be contacted in order to recommend the best way forward, and to determine if rescue and relocation actions will be necessary; and
- Provided that all mitigation measures are adhered to and that the necessary permitting systems are followed, it is deemed that the proposed mine infrastructure developments be considered favorable.

TERRESTRIAL IMPACT ASSESSMENT

The tables below summarise the findings indicating the significance of the impacts before mitigation takes place and the likely impact if management and mitigation takes place. In the consideration of mitigation measures it is assumed that a high level of mitigation takes place, but which does not lead to prohibitive costs. The Impacts have been assessed according to the loss of the Kathu Thornveld habitat unit, as this is the habitat that will be impacted upon as a result of the mines proposed infrastructure plans. The disturbed habitat has already been impacted upon and constitutes part of the existing mining area, and as such would reflect a very low/ negligible impact scoring if assessed.

From the table, it is evident that prior to mitigation the impacts are of medium-high significance. If mitigation takes place all impacts can be further reduced.

A summary of the impact significance of the construction/operational phase.

Impact	Unmanaged	Managed
1: Impact on Terrestrial habitat	Medium-High	Medium-Low
2: Impact on Faunal and Floral SCC	Medium-High	Medium-Low

A summary of the impact significance of the Decommissioning phase.

Impact	Unmanaged	Managed
1: Impact on Terrestrial habitat	Medium-High	Low
2: Impact on Faunal and Floral SCC	Medium-High	Low

SENSITIVITY

From an ecological perspective, habitat sensitivity is considered to be of a moderately high level. The table below indicates the sensitivity of the habitat units along with an associated conservation objective and implications for development.

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Kathu Thornveld	Moderately High	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance	Development activities in this area are likely to have an impact on the receiving environment. All mitigation measures provided need to be adhered to, and the development footprint is to be kept as small as possible. Where feasible, enough habitat is to be retained surrounding and within the mine so as to minimise total species displacement. A site walkdown is to be conducted prior to the commencement of infrastructure to accurately mark and protected species in order for permit applications to move forward.
Disturbed Habitat	Moderately Low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	This habitat comprises the existing mining area and open spaces adjacent to and there-in, as well as the larger road networks. The habitat has already been degraded due to edge effects and mining activities. Alien plant proliferation is evident throughout this habitat. Continued activities including new development and operational activities in this habitat unit will have limited ecological implications, provided that mitigation measures are implemented, and alien plants controlled.

The sensitivity of the Kathu Thornveld is largely attributable to the intact habitat present and current low levels of disturbance. The presence of both *Vachellia erioloba* and *Vachellia haematoxylon* further increase the habitat sensitivity. Currently the study area provides suitable habitat and resources to a diversity of species and probable SCC, notably in a region where habitat disturbance is common place.

It is the opinion of the ecologists that, from a terrestrial ecological perspective, the proposed development be considered favorably, provided that the recommended mitigation measures for the identified impacts are adhered to fully and the project footprint be kept as small as possible. Best practice methods must be implemented, all permits for protected species acquired and where feasible protected floral and faunal species relocated. Following the cessation of mining activities, suitable rehabilitation of all disturbed areas must take place.

DOCUMENT GUIDE

The table below provides the NEMA (2017) Requirements for Biodiversity Assessments and also the relevant sections in the reports where these requirements are addressed.

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Appendix H
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Appendix H
b)	A declaration that the specialist is independent	Appendix H
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1.2
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 6
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1.3
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Appendix 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 5
g)	An identification of any areas to be avoided, including buffers	Section 5
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 5
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 1.3
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 4 and 6
k)	Any mitigation measures for inclusion in the EMPr	Section 6.4
l)	Any conditions for inclusion in the environmental authorisation	Section 6.6
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 6.4
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Section 7
(iA)	Regarding the acceptability of the proposed activity or activities	Section 7
(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 7
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	Appendix H
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Appendix H, no comments received.
q)	Any other information requested by the competent authority	None as yet

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GLOSSARY OF TERMS

Alien vegetation	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Biome	A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.
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	Vegetation occurring naturally within a defined area.
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 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
CR	Critically Endangered
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EN	Endangered
EW	Extinct in the Wild
GIS	Geographic Information System
GPS	Global Positioning System
IBA	Important Bird Area
IUCN	International Union for the Conservation of Nature
MAP	Mean Annual Precipitation
MAPE	Mean Annual Potential for Evaporation
MASMS	Mean Annual Soil Moisture Stress
MAT	Mean Annual Temperature
MFD	Mean Frost Days
NBA	National Biodiversity Assessment (2011)
NEMA	National Environmental Management Act (Act 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NEMWA	National Environmental Management: Waste Act
NT	Near Threatened
PES	Present Ecological State
POC	Probability of Occurrence
POSA	Plants of Southern Africa
PRECIS	Pretoria Computer Information Systems
QDS	Quarter Degree Square (1:50,000 topographical mapping references)
RDL	Red Data List
RE	Regionally Extinct
SABAP 2	Southern African Bird Atlas 2
SACAD	South Africa Conservation Areas Database
SANBI	South African National Biodiversity Institute
SAPAD	South Africa Protected Area Database
SCC	Species of Conservation Concern
STS	Scientific Terrestrial Services CC
TOPS	Threatened or Protected Species
TSP	Threatened Species Programme
VU	Vulnerable

1. INTRODUCTION

1.1 Background

Scientific Terrestrial Services (STS) was appointed to conduct an investigation into the terrestrial faunal and floral ecology as part of the Waste Management License Application and EMP Amendment process for the following proposed construction activities at the Tshipi Borwa Mine, near Hotazel, Northern Cape Province:

- The extension of the existing East Waste Rock Dump (WRD) to the mining right boundary and towards the Mamatwan WRD and eventually filling the void between these dumps, to provide additional overburden storage capacity;
- The extension of the existing West WRD onto the remaining extent of Portion 8 of the farm Mamatwan 331, thereby including the remaining extent of Portion 8 into the mine's surface use area;
- The erection of an 11kV overhead powerline and associated sub-station along the Portion 8 boundary onto the existing mining right area; and
- The construction of an overland conveyor system from the existing secondary crushing and screening plant to the existing manganese ore product stockpiles.

The study area is located approximately 13.8 km south of the R31 Highway, and 27 km north of the N14 Highway. The town of Hotazel is located approximately 17 km north and Kuruman 44 km southeast of the study area. The study area forms part of the John Taolo Gaetsewe District Municipality.

This report, after consideration and the description of the ecological integrity of the study area, must guide the Environmental Assessment Practitioner (EAP), regulatory authorities and developing proponent, by means of the presentation of results and recommendations, as to the ecological viability of the proposed development activities.

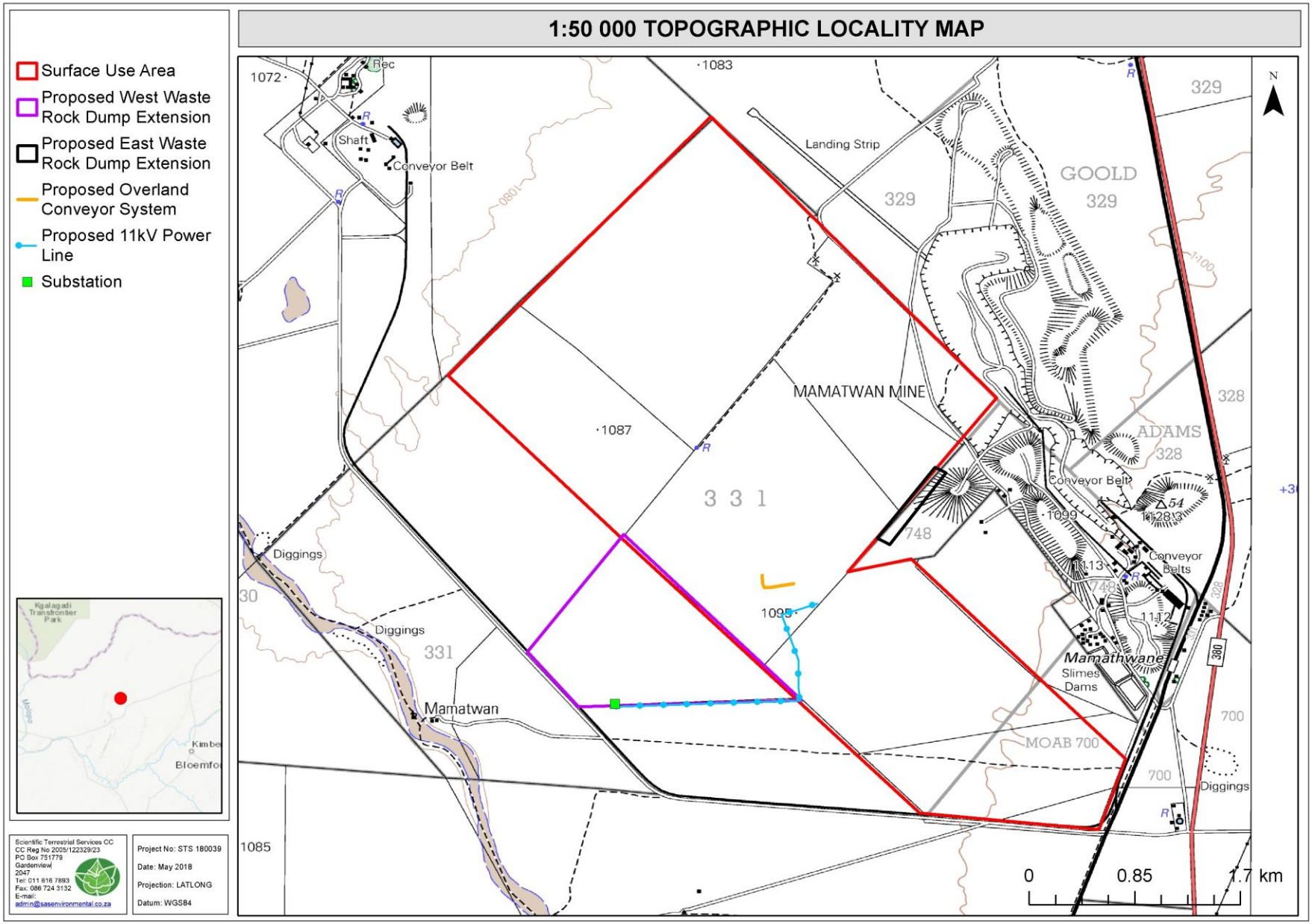


Figure 1: The study area depicted on a 1:50 000 topographical map in relation to the surrounding area.

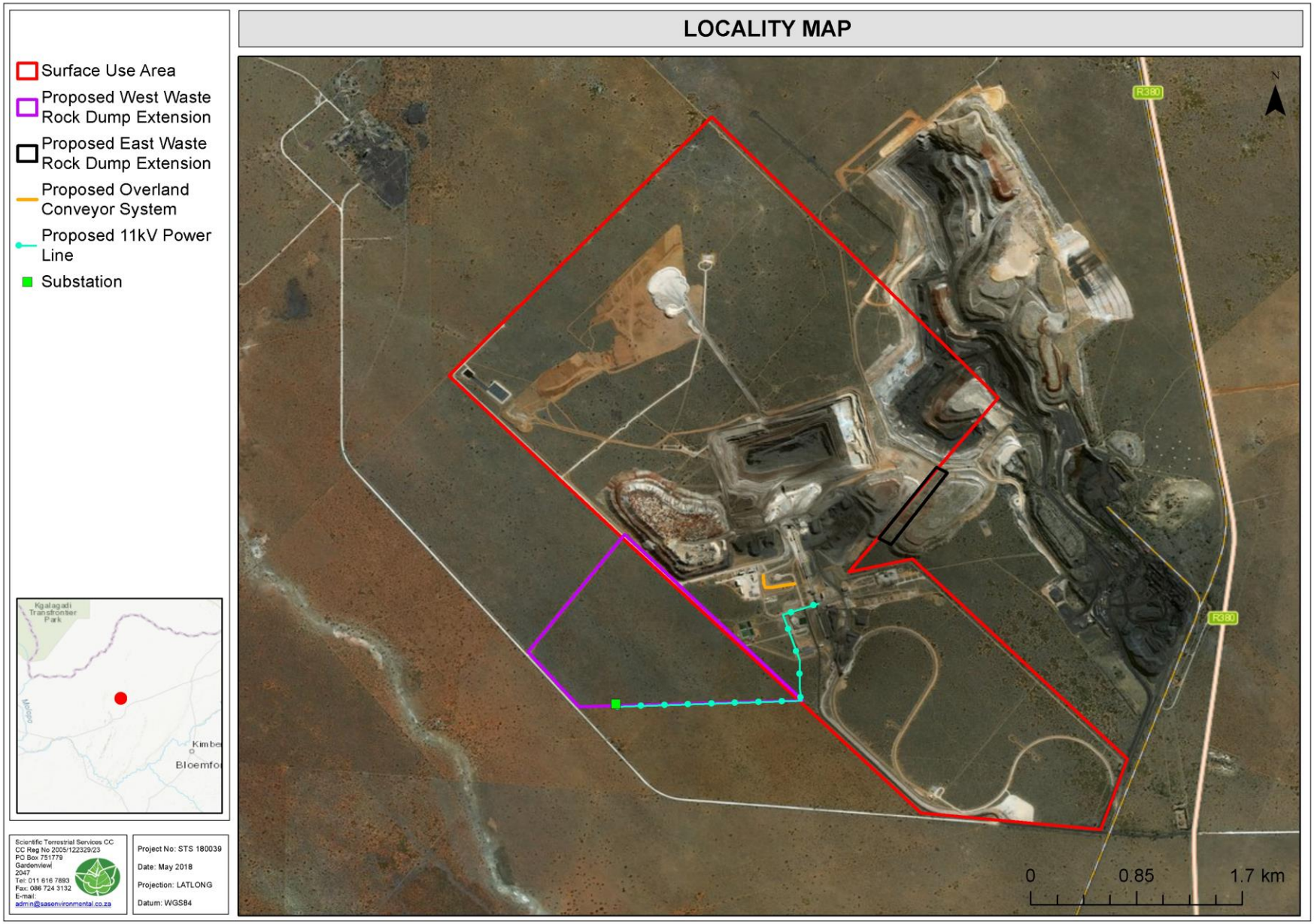


Figure 2: Digital Satellite image depicting the location of the study area in relation to surrounding areas.

1.2 Project Scope

Specific outcomes in terms of this report are outlined below:

- To define the Present Ecological State (PES) of the terrestrial ecological resources associated with the study area;
- To determine and describe habitats, communities and the ecological state of the study area;
- To conduct a faunal and floral Species of Conservation Concern (SCC) assessment, including potential for such species to occur within the study area;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and any other ecologically important features, if present; and
- To determine the environmental impacts that the construction of the proposed development might have on the terrestrial ecology associated with the study area, as well as potential impacts on the ecology due to activities related to the proposed development and to develop mitigation and management measures for all phases of the development.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The ecological 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;
- 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 and faunal communities have been accurately assessed and considered;
- Due to the nature and habits of most faunal taxa, the high level of surrounding anthropogenic activities and the time (season) of the assessment, 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 have been missed during the assessment; and
- The data presented in this report are based on two, two-day site visits, undertaken in the middle of May 2017 (moving into the winter season), and again in the middle of November 2017 (spring). 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 and previous studies. As such

the findings of this assessment are considered to be an accurate reflection of the current ecological characteristics of the study area.

1.4 Legislative Requirements

The following legislative requirements were considered during the assessment:

- National Environmental Management Act (NEMA) (Act 107 of 1998);
- National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004);
- National Environmental Management: Waste Act, (NEMWA; Act 59 of 2008),
- Conservation of Agricultural Resources Act (CARA, Act 43 of 1983); and
- The Northern Cape Nature Conservation Act (NCNCA, Act No 9 of 2009);
- The National Forest Act (1998, as amended in September 2011).

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

2. ASSESSMENT APPROACH

2.1 General Approach

In order to accurately determine the PES of the study area and capture comprehensive data with respect to the terrestrial ecology, the following methodology was used:

- Maps, aerial photographs and digital satellite images were consulted prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. The results of this analyses were then used to focus the field work on specific areas of concern and to identify areas where target specific investigations were required;
- A literature review with respect to previous studies, habitats, vegetation types and species distribution was conducted;
- Relevant databases considered during the assessment of the study area included the South African National Biodiversity Institute (SANBI) Threatened Species Programme (TSP), the Northern Cape Spatial Development Framework (2012), Mucina and Rutherford (2006), National Biodiversity Assessment, Important Bird Areas in conjunction with the South African Bird Atlas Project (SABAP2), International Union for Conservation of Nature (IUCN), and Pretoria Computer Information Systems (PRECIS);
- A visual on-site assessment of the study area was conducted during May and November 2017 in order to confirm the assumptions made during consultation of the

maps and to determine the ecological status of the study area. A thorough 'walk through' on foot was undertaken in order to identify the occurrence of the dominant floral species and faunal and floral habitat diversities;

- Specific methodologies for the assessment, in terms of field work and data analysis of faunal and floral ecological assemblages will be presented in Appendices B; and
- For the methodologies relating to the impact assessment and development of the mitigation measure, please refer to Appendix C of this report.

2.2 Sensitivity Mapping

All the ecological features of the study area were considered and sensitive areas were delineated with the use of a Global Positioning System (GPS). In addition, identified locations of SCC and SANBI protected species were also marked by means of GPS. A Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps.

3. RESULTS OF THE DESKTOP ANALYSIS

3.1 Conservation Characteristics of the Study area

The following table contains data accessed as part of the desktop assessment. It is important to note, that although all data sources used provide useful and often verifiable high-quality data, the various databases do not always provide an entirely accurate indication of the study areas actual biodiversity characteristics.

Table 1: Summary of the conservation characteristics for the study area.

Details of the study area in terms of Mucina & Rutherford (2006)	
Biome	The study area is situated within the **Savanna Biome.**
Bioregion	The study area is located within the **Eastern Kalahari Bushveld Bioregion**
Vegetation Type	The study area is situated within the **Kathu Bushveld**
Conservation details pertaining to the study area (Various databases)	
NBA (2011)	The study area falls within an area that is currently not protected
National Threatened Ecosystems (2011)	The study area falls within an area that is least threatened.
NPAES (2009), SACAD (2017) and SAPAD (2017)	The study area is not located within or near any protected or conservation areas (within a 10km radius)
IBA (2015)	Not located within or near an IBA (within 10 km)
Mining and Biodiversity Guidelines (2013)	
According to the Mining and Biodiversity guidelines, the study area is not ranked as a priority area, nor is it located near (within 10km) an area considered to be of biodiversity importance.	
Northern Cape Critical Biodiversity Areas (2016) (Figure 3)	
The majority of the study area falls within an area considered to be other natural areas. According to the Technical Guidelines for CBA Maps document ONA consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs (SANBI, 2017).	
Northern Cape Provincial Spatial Development Framework (NPSDF, 2012)	
• The proposed study area is situated within the Griqualand West Centre of Endemism) (Figure 4). Please refer to Appendix D for further detail; and • The proposed study area is situated within the Gamagara Corridor. The corridor focuses on the mining of iron and manganese (Figure 5).	

Description of the vegetation type(s) relevant to the study area (Mucina & Rutherford 2006)	
Vegetation Type	Kathu Bushveld
Climate	Summer and autumn rainfall, very dry winters
Altitude (m)	960 - 1300
MAP* (mm)	300
MAT* (°C)	18.5
MFD* (Days)	27
MAPE* (mm)	2883
MASMS* (%)	85
Distribution	Northern Cape Province
Geology & Soils	Aeolian red sand and surface calcrete, deep (>1.2m) sandu soils of Hutton and Clovelly soil forms.
Conservation	Least threatened. Target 16%. None conserved.in statutory
Vegetation & landscape features (Dominant Floral Taxa in Appendix F)	Medium-tall tree layer with *Vachellia erioloba* in places, but mostly open and including *Boscia albitrynca* as the prominent trees. Shrub layer generally most important with for example *Acacia mellifera, Diospyros lycioides* and *Lycium hirsutum*. Grass layer variable in cover.
Tall Tree	*Vachellia erioloba* (d)
Small Trees	*Senegalia mellifera* subsp. *detinens* (d), *Vachellia. leudertzii* var. *leudertzii* (k), *Boscia albitrunca* (d), *Terminalia sericea,*
Tall Shrubs	*Diospyros lycioides* subsp. *lycioides* (d), *Dichrostachys cinereal, Grewia flava, Gymnosporia buxifolia, Rhigozum brevispinosum*
Low Shrubs	*Aptosimum decumbens, Grewia retinervis, Nolletia arenosa, Sida cordifolia, Tragia dioica,*
Graminoids	*Aristida meridionalis* (d), *Brachiaria nigropedata* (d), *Centropedia glauca* (d), *Eragrostis lehmanniana* (d), *Schmidtia pappophoroides* (d), *Stipagrostis uniplumis, Tragus berteronianus, Anthephora argentea* (k), *Megaloprotachne albescens* (k), *Panicum kalaharense* (k)
Herbs	*Acrotome inflate, Erlangea misera, Gisekia Africana, Heliotropium cillatum, Hermbstaedtia fleckii, H. odorata, Limeum fenestratum, L. viscosum, Lotononis platycarpa, Senna italic* subsp. *arachoides, Tribulus* terrestris, *Neuradopsis bechuanensis* (k)

NBA = National Biodiversity Assessment; NPAES = National Protected Areas Expansion Strategy; SAPAD = South African Protected Areas Database; IBA = Important Bird Area; MAP – Mean annual precipitation; MAT – Mean annual temperature; MAPE – Mean annual potential evaporation; MFD = Mean Frost Days; MASMS – Mean annual soil moisture stress (% of days when evaporative demand was more than double the soil moisture supply), (d) = dominant species; (k) Kalahari endemic

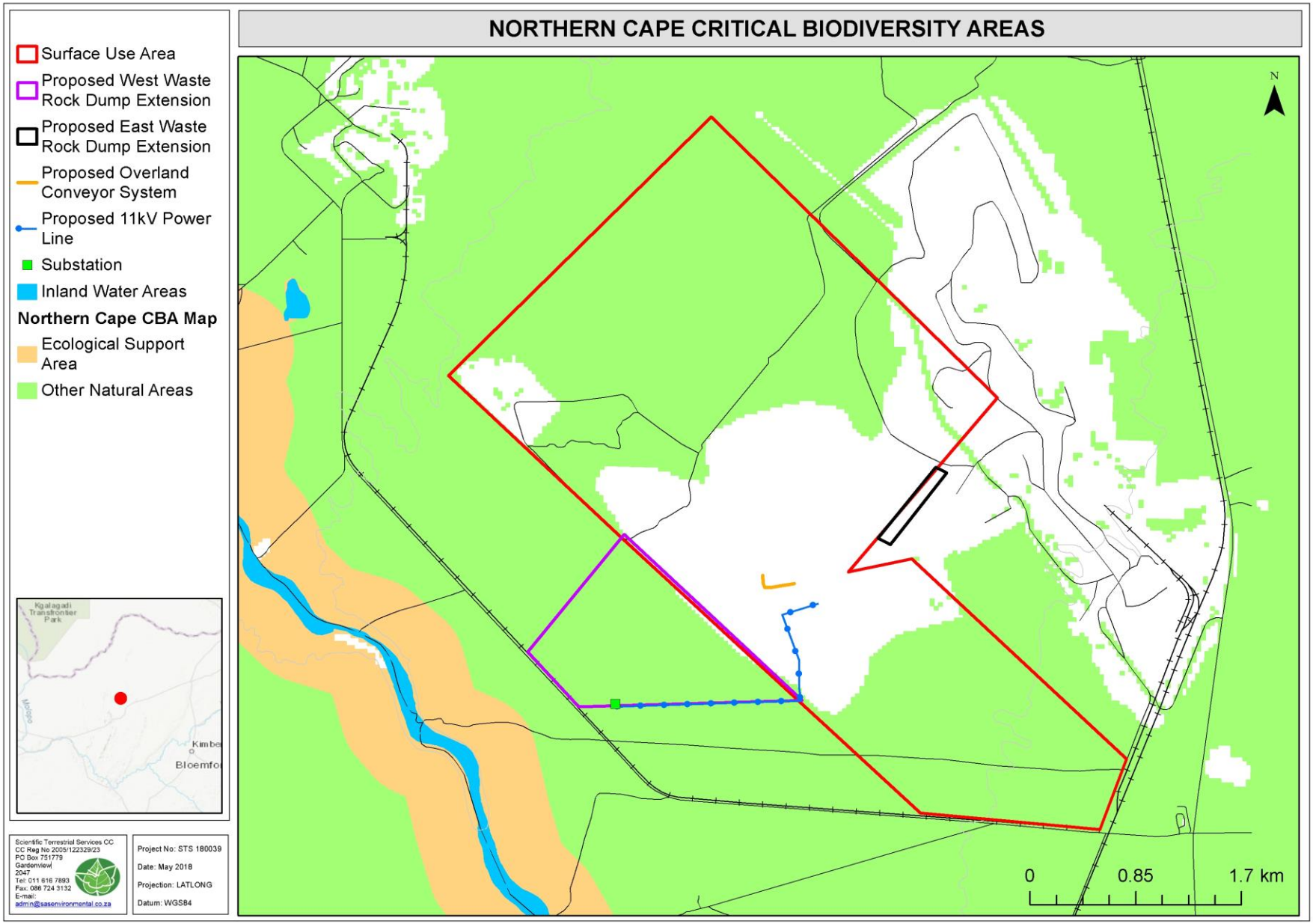


Figure 3: The study area falling within an Other Natural Area (Northern Cape CBA Map, 2016)

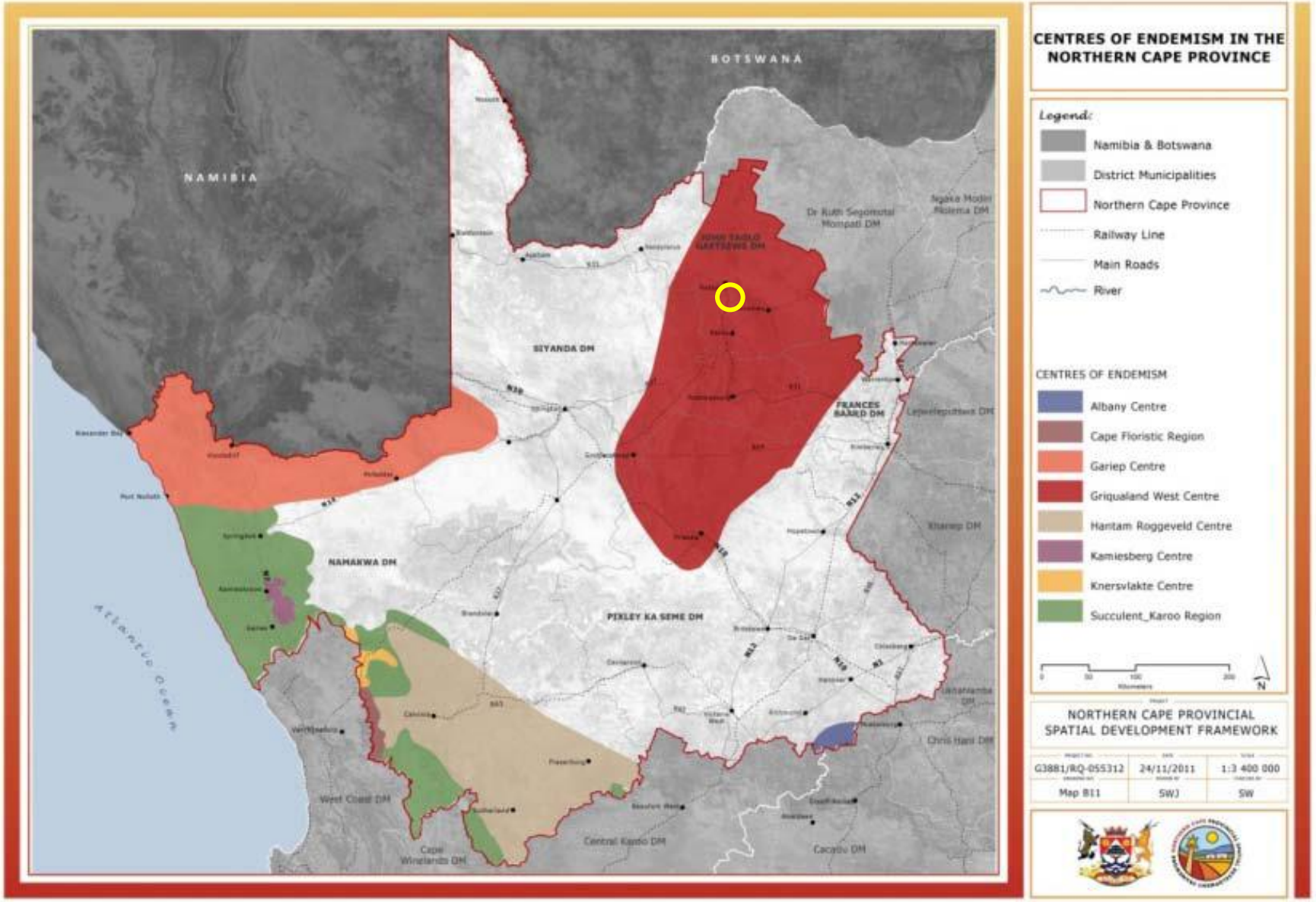


Figure 4: Centers of endemism of the Northern Cape Province: the MRA indicated by a yellow circle (Northern Cape Provincial Spatial Development Framework, 2012).

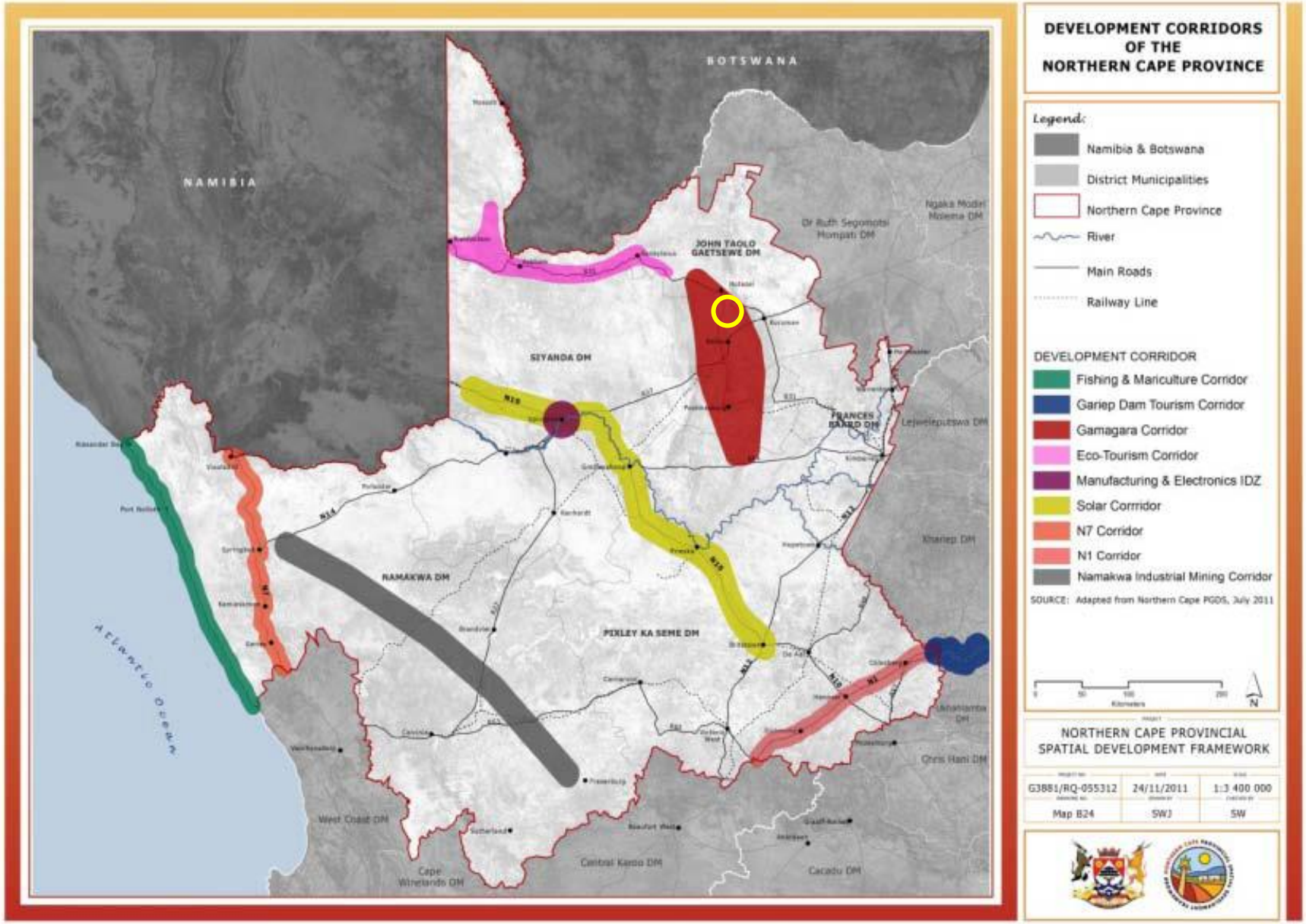


Figure 5: Development regions and corridors of the Northern Cape: the MRA indicated by the yellow circle (NPSDF, 2012).

4. TERRESTRIAL ECOLOGICAL ASSESSMENT RESULTS

4.1 Terrestrial Habitat Units

Following the assessment of the study area and the associated habitat, it has been concluded that a single habitat unit will be impacted upon. The habitat unit is described below:

Kathu Thornveld Habitat Unit

The Kathu Thornveld habitat unit within the study area is characterised by a well-developed herbaceous layer interspersed with woody species, notably that of *Grewia flava, Vachellia erioloba* and *Vachellia haematoxylon*, which are characteristic for the region. This habitat unit encompasses much of the current mining area, with a number of dirt roads noted traversing the habitat unit, although these do not appear to carry heavy traffic loads. A number of small mammal species, invertebrates and avifauna where observed, evident that anthropogenic activities in this habitat unit are low and have had a minimal impact on the overall habitat utilization and behavior of species. Overall, the habitat is considered to be in a good condition and is populated by a high number of the protected tree species *Vachellia erioloba* and *Vachellia haematoxylon*, listed in the National Forest Act (1998, as amended in September 2011).

Disturbed Habitat Unit

This habitat unit comprises the mining infrastructure areas, and the small pockets of vegetation remaining therein, or directly adjacent to the mining infrastructure. This habitat unit, as a result of the development and daily functioning of the mine, has been subjected to increased levels of dust, vegetation clearing activities, dumping of excavated material and clearing of new roads. As a result, the natural vegetation has decreased, creating an ideal environment for the proliferation of alien and invasive plant species. Although habitat degradation has occurred, there were still a number of *Vachellia erioloba* and *Vachellia haematoxylon*, listed in the National Forest Act (1998, as amended in September 2011) observed.

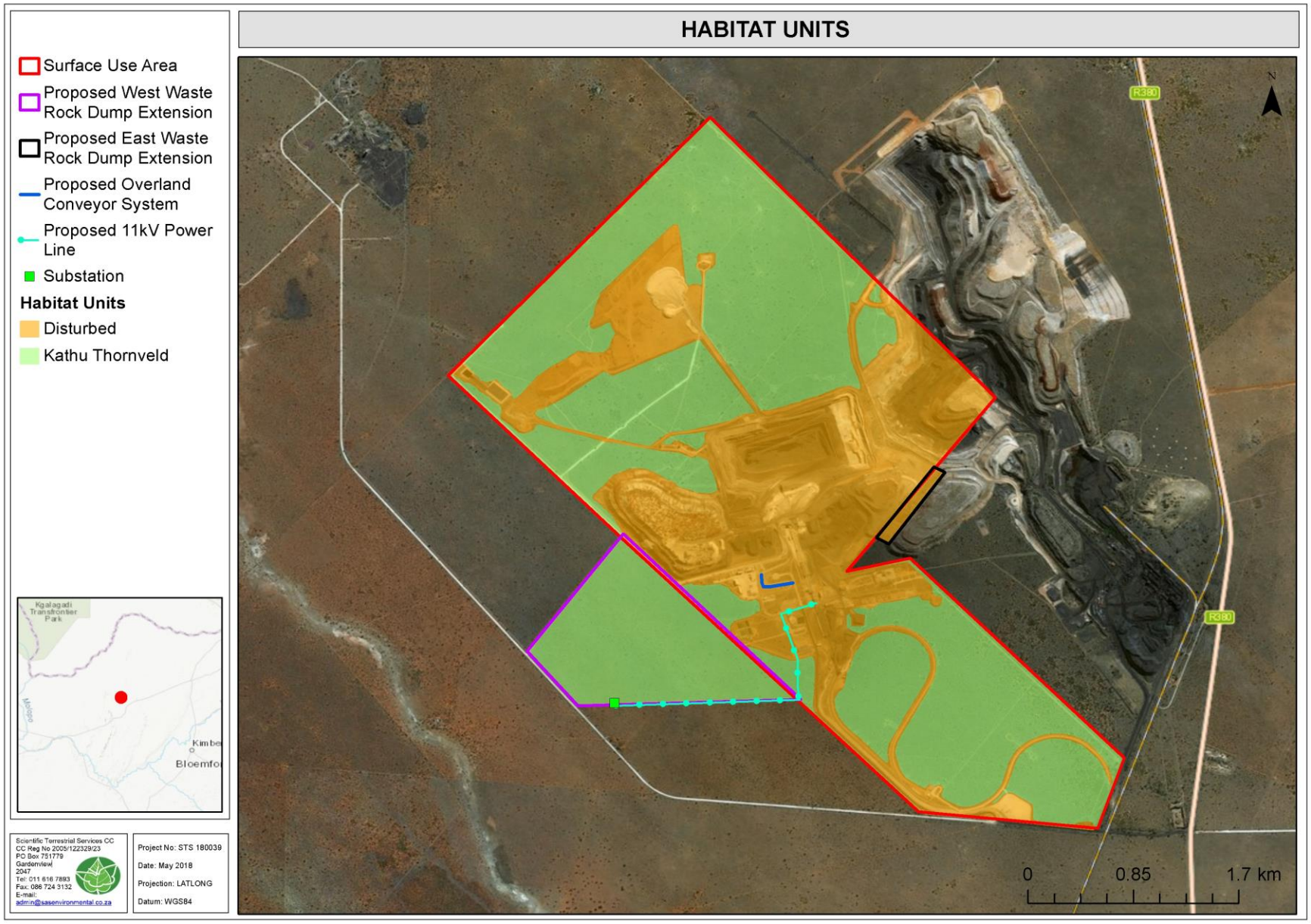
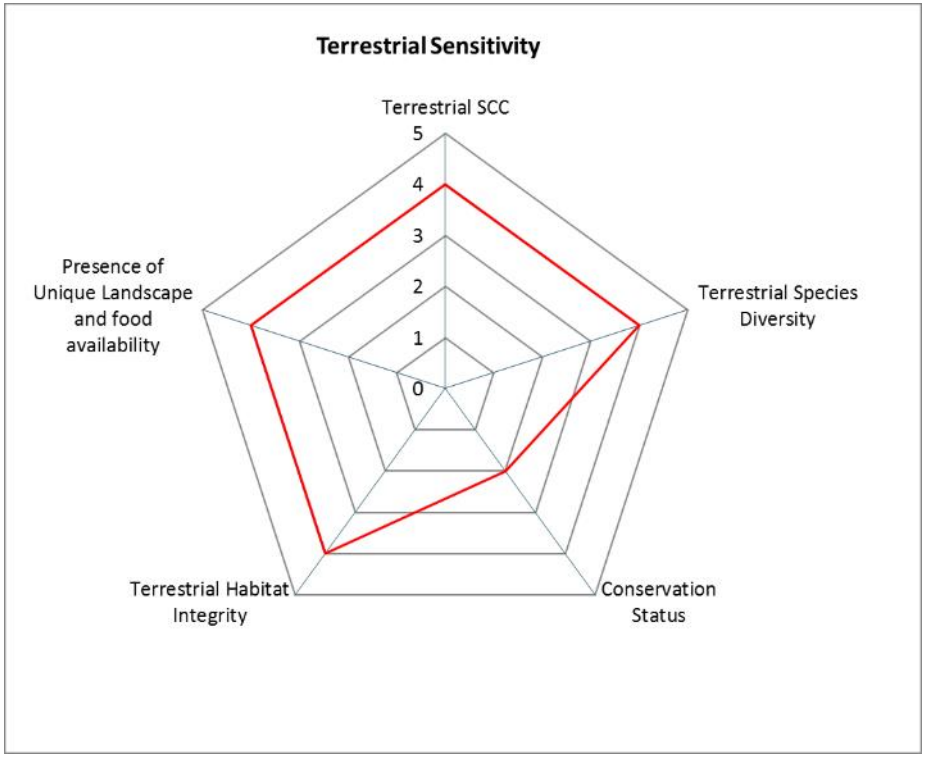


Figure 6: Habitat units encountered within the study area.

Table 2: Summary of results for the Kathu Thornveld Habitat Unit.

Kathu Thornveld Habitat Unit	Terrestrial Sensitivity	Moderately High
	Notes on Photograph: Images depicting the Kathu Thornveld observed within the study area. Some areas presented more open veld with a strong herbaceous layer, whilst other areas had an increase woody density, as is typical with this region.	

Terrestrial Sensitivity Graph:



Species of Conservation Concern (SCC)	Two floral SCC were observed within this habitat unit, namely *Vachellia erioloba* and *Vachellia haematoxylon* of which both are listed as protected in the National Forest Act (1998, as amended in September 2011). The relevant permits will be required for the removal or destruction of individual trees, should they be located in areas earmarked for construction/clearing. It is recommended that where possible trees be relocated to similar habitat close to the study area but outside of the development footprint. Furthermore, species such as *Harpagophytum procumbens, Mellivora capensis* (Honey Badger) *and Atelerix frontalis* (South African Hedgehog) listed as specially protected in the Northern Cape Nature Conservation Act (No.9 of 2009), *Neotis ludwigii* (Ludwig's Bustard) and *Ardeotis kori* (Kori Bustard) (TOPS) have an increased likelihood of occurring within this habitat unit, notably in the western portions of the study area.
Terrestrial Species Diversity	Terrestrial species diversity of the study area is considered to be moderately high. The floral diversity of the study area was characteristic of the Kathu Thornveld, and as a result of the mine has not been subjected to overgrazing, commonly found in other areas of this vegetation type. The faunal diversity was mixed, with a good representation of insects, avifauna and small to medium sized mammals, notably species such as *Lepus saxatilis* (Scrub Hare); *Raphicerus campestris* (Steenbok), *Sylvicapra grimmia* (Common Duiker) and *Cynictis penicillata* (Yellow Mongoose), all of which appeared to be well adapted to the presence and activities of the mine. This is most likely attributable to that fact that outside of the direct mining areas, no human presence or other activities occur, leaving the natural veld areas for largely exclusive use by the local fauna.
Presence of Unique Landscapes and Food Availability	Although this vegetation type is widespread in the region, it is not common to find this vegetation type in an undisturbed state. Furthermore, due to the low levels of disturbance and good vegetation cover, the study area is capable of providing habitat and resources to a diversity of species, as noted by the faunal species diversity and abundance.
Conservation Status	The study area falls within the Kathu Bushveld vegetation type, which is listed as Least Threatened. Increased mining activities and improper veld management practices by farmers has largely impacted upon this vegetation type, and in time may result in the necessary adjusting of the current conservation status.

Terrestrial Habitat Integrity

Habitat integrity is deemed to be medium-high. Although mining activities are currently taking place, the remaining open veld areas are still in a good condition, with minimal edge effect degradation, evident by the intact woody and herbaceous layers present. Habitat utilisation by faunal species was high, attributable to the levels of available habitat and limited barriers of movement. Although the overall study area is fenced-in, the fence does not restrict the movement of faunal species, notably in the northern and north-western areas. A single alien invasive plant species, namely *Prosopis glandulosa* (Glandular Mesquite) was observed within the study area, indicating the very low level of alien plant impacts within the study area.

General comments:

Current edge effects from the adjacent mining activities were observed to be minimal and well controlled, allowing for the ongoing natural functioning of habitat unit, as evident by the current level of habit utilisation observed from faunal species. The habitat unit provides refuge and suitable resources for many species that were likely displaced when the mining activities started. Although none were found in the study area, the possibility remains that *Harpagophytum procumbens* may be located within the study area. This species is protected under the Northern Cape Nature Conservation Act (No9 of 2009), and as such will require permits for the removal or destruction thereof. *Vachellia erioloba* and *Vachellia haematoxylon* of which both are listed as protected in the National Forest Act (1998, as amended in September 2011) which were observed will also require permit for the removal or destruction of individual trees.

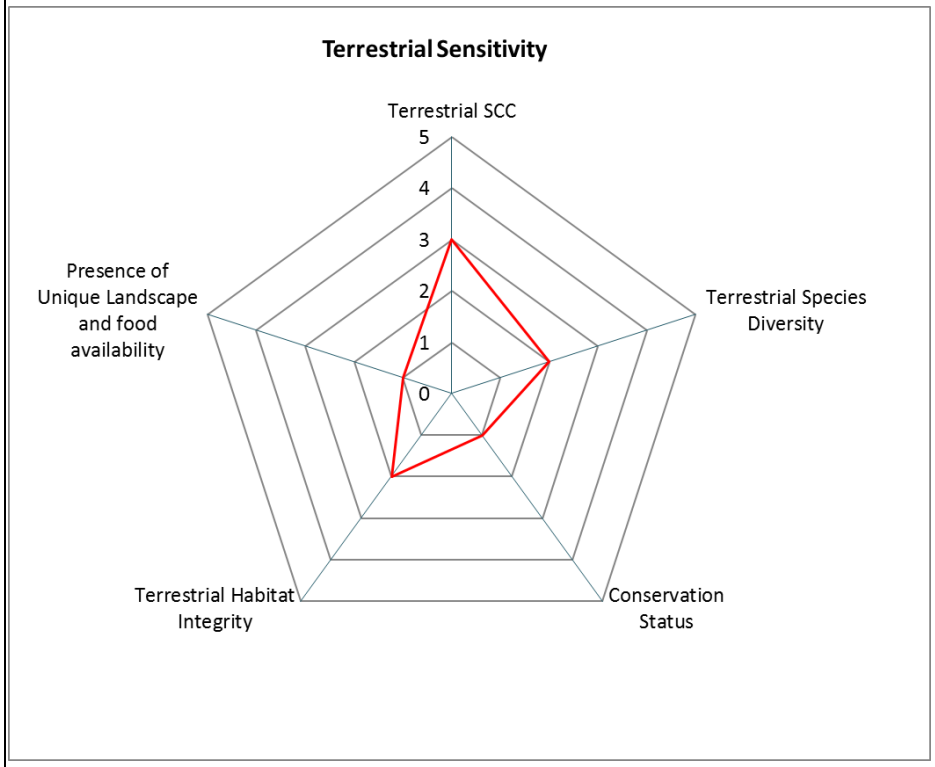
Business Case, Conclusion and Mitigation Requirements:

This habitat unit is considered to be of medium-high sensitivity. Construction of the proposed mining related infrastructure will result in the loss of habitat for several faunal and floral species, as well as the loss of a high number of protected tree species, notably *Vachellia erioloba* and *Vachellia haematoxylon*. Protected plant species, where possible, are to be relocated to suitable habitat in the area. Permits for the removal/ destruction of protected plants are to be obtained from the relevant authorities prior to the commencement of vegetation clearing activities and the construction of new infrastructure. Furthermore, during construction activities, all mitigation measures are to be strictly enforced so as to ensure that the surrounding environment is not impacted upon through edge effects or careless veld clearing and waste disposal activities. The construction of the proposed 11kV powerline will likely result in the necessary removal of protected floral species. It is recommended that a walk down of the tower footprint areas be conducted in order to ascertain the location and number of species that will be lost, in order to apply for the relevant permits.

Table 3: Summary of results for the Disturbed Habitat Unit.

Disturbed Habitat Unit	Terrestrial Sensitivity	Moderately low
	Notes on Photograph: Disturbed habitat within the mining operation, soil disturbances, alien plant proliferation and vegetation clearing have resulted in a decreased habitat sensitivity.	

Terrestrial Sensitivity Graph:



Species of Conservation Concern (SCC)	Two floral SCC were observed within this habitat unit, namely *Vachellia erioloba* and *Vachellia haematoxylon* of which both are listed as protected in the National Forest Act (1998, as amended in September 2011). Where applicable the relevant permits will be required for the removal or destruction of individual trees. However, it is recommended that as far as possible such trees be relocated to similar suitable habitat close to the study area but outside of the development footprint.	**Terrestrial Habitat Integrity**	
		Habitat integrity is deemed to be moderately low. Although habitat degradation and alien plant proliferation has occurred, the remaining open areas still provide limited habitat to faunal and floral species. Open areas that have not been cleared as of yet still contained a number of *Vachellia erioloba* and *Vachellia haematoxylon* trees, which were still being utilised by some avifaunal species. This habitat unit acts as a buffer between the mining areas and the remaining Kathu Thornveld habitat, and as such, has an increased level of ecological functioning in the greater system.	
Terrestrial Species Diversity	The overall species diversity of this habitat unit is moderately low, comprising of common faunal and floral species, with an increased number of alien plant species. Alien species observed include *Argemone Mexicana, Argemone ochroleuca, Atriplex nummularia, Achyranthes aspera* and *Xanthium spinosum*. These species occurred primarily in the open space areas within the current mining infrastructure. Edge effects and earth moving activities are the key drivers to the proliferation of these species	**General comments:** The disturbed habitat comprising all the mining areas, pockets of habitat there-in as well as a number of large roads observed in the mining area. These mining, mining related activities and edge effects have resulted in the degradation of the terrestrial habitat. Although degradation of the terrestrial habitat has occurred, protected species such as *Vachellia erioloba* and *Vachellia haematoxylon* of which both are listed as protected in the National Forest Act (1998, as amended in September 2011) were still observed.	**Business Case, Conclusion and Mitigation Requirements:** This habitat unit is considered to be of moderately low sensitivity, only due to the remaining presence of the protected tree species *Vachellia erioloba* and *Vachellia haematoxylon*. Permits for the removal/ destruction of these protected plants are to be obtained from the relevant authorities prior to the commencement of vegetation activities. Furthermore, during construction activities, all mitigation measures are to be strictly enforced so as to ensure that the surrounding environment is not impacted upon and that the necessary alien plant control measures are put into place. The extension of the East WRD and the construction of the overland conveyor system are unlikely to have a significant impact of the terrestrial ecology as these proposed developments are located within already disturbed areas. Should any floral SCC be located within these proposed areas, the relevant permits for the removal or destruction of these species is to be obtained from the pertinent authorities.
Presence of Unique Landscapes and Food Availability	This habitat unit is not considered to possess any landscape uniqueness, has been degraded and infested with alien plant growth. The only notable feature remaining of this habitat unit were a number of *Vachellia erioloba* and *Vachellia haematoxylon* trees remaining in areas that have not been cleared.		
Conservation Status	The study area falls within the Kathu Bushveld vegetation type, which is listed as Least Threatened. The habitat unit has been degraded and transformed due to mining activities, and as such does not warrant any levels or concerns pertaining to habitat conservation, with the exception of alien plant control.		

4.2 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. According to the SANBI PRECIS Red Data Lists there are no floral SCC within the QDS 2722BD. The NCNCA (Act 9 of 2009) and TOPS (NEMBA, 2015) floral species list were taken into consideration, as was the protected tree species listed within Section 15 (1) of the National Forest Act (1998, as amended in September 2011).

An assessment considering the presence of any plant species of concern, as well as suitable habitat to support any such species was undertaken.

The following protected species were observed within the study are at the time of assessment:

- *Vachellia erioloba; and*
- *Vachellia haematoxylon*.

The study area was observed to contain a large and healthy population of *Vachellia erioloba* and *Vachellia haematoxylon* trees, with individuals ranging from 1m to larger than 4m. The removal, relocation or destruction of these species will require permits as stipulated within the National Forest Act (1998, as amended in September 2011), and as such development activities cannot commence until such permits are in place. As a first priority, attempts should be made to preserve selected existing larger trees (height of more than 2.5m), and if this cannot be achieved, where feasible selected individuals should be relocated to suitable similar habitat in the vicinity. The number of trees to be relocated is to be agreed upon with a qualified specialist. *Harpagophytum procumbens* is listed as specially protected in the NCNCA (Act 9 of 2009) and in TOPS (Notice 389 of 2013), and as such will require permits should the removal or destruction of this species in the study area be necessary. Should any *Harpagophytum procumbens* be located within areas earmarked for development, these individuals are to be relocated to suitable habitat in the surrounding area by a specialist. Once the development plans have been finalised, a walkdown of the site should be conducted in order to mark and ascertain the presence of all floral and faunal SCC occurring within the

construction footprint site, in order to apply for the necessary permits needed for removal or relocation where/ if necessary.

4.3 Faunal Species of Conservation Concern Assessment

During field assessments, it is not always feasible to identify or observe all species within an area, largely due to the secretive nature of many faunal species, possible low population numbers or varying habits of species. As such, and 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 H whose known distribution ranges and habitat preferences include the study area were taken into consideration.

The species listed below are considered to have an increased probability of occurring (POC) within the study area:

Table 4: Faunal SCC considered likely to occur in the Kathu Thornveld of the Study area

Scientific Name	Common Name	POC %
Otocyon megalotis	Bat-eared fox	70%
Vulpes chama	Cape fox	60%
Ardeotis kori	Kori Bustard	70%
Neotis ludwigii	Ludwig's Bustard	60%
Python natalensis	African Rock Python	60%
Mellivora capensis	Honey Badger	70%
Atelerix frontalis	South African Hedgehog	70%
Genus: *Ceratogyrus, Harpactira* and *Pterinochilus*	Baboon Spiders	80%

Although none of these faunal species were observed within the study area, they are known to occur within the region, favouring the Kathu Thornveld habitat that is presented within the study area. This habitat unit provides suitable breeding and foraging resources for these species, and as such the loss of habitat within the study area my result in a disruption of breeding activities with the net result being a possible decrease in population numbers. Currently there is similar suitable habitat in the areas surrounding the study area, which may provide viable alternative foraging and breeding sites, but possibly not at the same protection level currently afforded by the study area (Fenced and largely protected from habitat degradation associated with grazing activities). Overall, the proposed Western WRD and other mine related construction activities will result in the loss of habitat and emigration of faunal SCC from the study area, with knock on ecological effects such as increased resource stress in the remaining and neighbouring natural areas due to more concentrated species numbers, or in the unfortunate cases, increased mortality rates. It is recommended that prior to mining and vegetation clearing activities, a thorough walk down of the proposed sites be undertaken,

in an attempt to locate such species, and/or their nests/burrows. Where these are located within the constrcution footprint areas, it is recommended that following the receiving of the relevant permits as per the NCNCA (Act 9 of 2009), a rescue and relocation plan be implemented and overseen by a specialist.

4.4 Alien and Invasive Plant Species

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

Table 5: Dominant alien vegetation species identified during the field assessment.

Alien and Invasive Floral Species		
Scientific Name	**Common Name**	**NEMBA Category**
Prosopis glandulosa	Glandular Mesquite	**2**
Argemone mexicana	Yellow-flowered Mexican Poppy	**1b**
Achyranthes aspera	Burweed	**NA**
Xanthium spinosum	Spiny Cocklebur	**1b**
Argemone ochroleuca	White-flowered Mexican Poppy	**1b**
Opuntia humifusa	Large flowered prickly pear	**1b**
Atriplex nummularia	Old Man Salt Bush	**2**
Pennisetum setaceum	Fountain grass	**1b**

N/L = Not Listed and not categorised
*** National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, GN R586 of 2016**
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.
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).

Several alien and invasive plant species was observed within the study area at the time of assessment. However, due to the ongoing impacts and edge effects from the mining activities, there is an increased risk that further alien plant proliferation in disturbed area may occur. As such, in accordance with the National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, GN R586 of 2016, all listed alien invasive plant species need to be controlled and removed during operational and rehabilitation activities. For further information and control methodologies for the species, please refer to the Alien and Invasive plant control plan for the Tshipi Borwa Manganese Mine (STS 2017)

5. SENSITIVITY MAPPING

The figure below conceptually illustrates the areas considered to be of increased ecological sensitivity. The areas are depicted according to their sensitivity in terms of the presence or potential for floral and faunal 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 6: A summary of sensitivity of each habitat unit and implications for development.

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Kathu Thornveld	Moderately High	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance	Development activities in this area are likely to have an impact on the receiving environment. All mitigation measures provided need to be adhered to, and the development footprint is to be kept as small as possible. Where feasible, enough habitat is to be retained within and surrounding the mine area so as to minimise total species displacement. A site walkdown is to be conducted prior to the commencement of infrastructure development to accurately mark and protected species in order for permit applications to move forward.
Disturbed Habitat	Moderately Low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	This habitat comprises the existing mining area and open spaces adjacent to and there-in, as well as the larger road networks. The habitat has already been degraded due to edge effects and mining activities. Alien plant proliferation is evident throughout this habitat. Continued activities including new development and operational activities in this habitat unit will have limited ecological implications, provided that mitigation measures are implemented, and alien plants controlled.

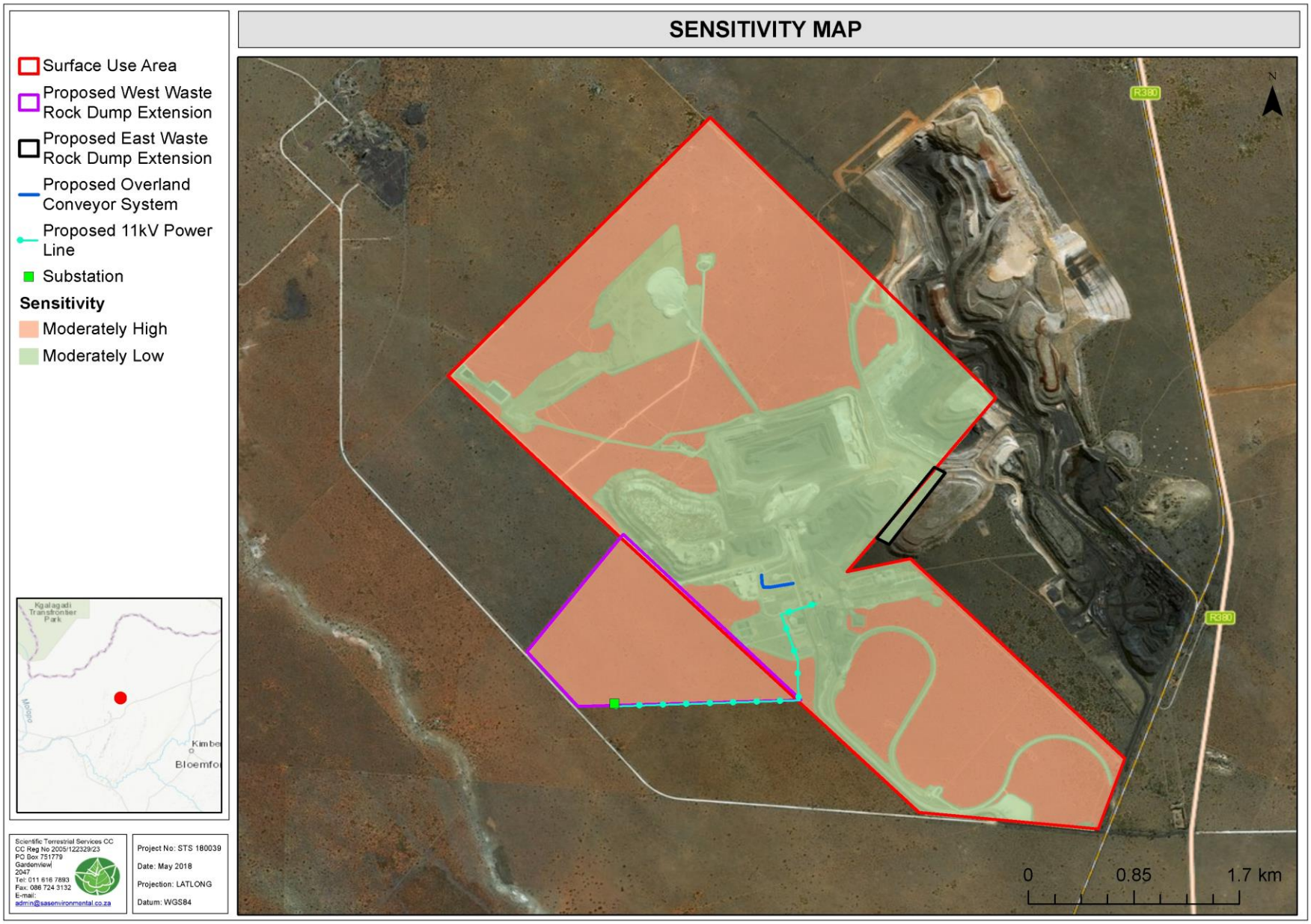


Figure 7: Sensitivity map of the study area.

6. IMPACT ASSESSMENT

The tables below serve to summarise the significance of perceived impacts on the terrestrial ecology and SCC of the study area, with each individual impact identified presented in Section 6.1 and 6.2 of this report. A summary of all potential pre-construction, construction and decommissioning impacts is provided in Section 6.3.

The tables below present the impact assessment according to the method described in Appendix D. 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 Section 6.3.

The Impacts have been assessed according to the loss of the Kathu Thornveld habitat unit, as this is the habitat that will be impacted upon as a result of the mines new proposed infrastructure plans. The disturbed habitat has already been impacted upon and constitutes part of the existing mining area, and as such would reflect a very low/ negligible impact scoring if assessed.

6.1 IMPACT 1: Impact on Terrestrial Habitat

Activities and aspects register

Pre-Construction	Construction/Operational	Decommissioning
Possible insufficient planning of infrastructure placement and design leading to habitat loss	Vegetation clearing resulting in permanent terrestrial habitat loss	Continued proliferation of alien plant species and further transformation of natural habitat due to inadequate rehabilitation
	Introduction and proliferation of alien plant species and further transformation of natural habitat	Possible further loss of faunal and floral habitat in and around the study area
	Dumping of material outside designated areas leading to loss of terrestrial habitat	Continued loss of faunal and floral species due to habitat loss
	Risk of increased fire frequency, as well as uncontrolled fires due to increased human activity will impact on plant communities	Failure to revegetate WRD should they not be removed during the closure of the mine
	Unregulated movement of mine vehicles through the study area	
	Increased risk of poaching due to increased personal movement in the study area	

The proposed infrastructure will result in a significant loss of terrestrial habitat within proposed Western WRD area, however the proposed Eastern WRD and Conveyor will result in lower levels of habitat loss as these are located in already disturbed areas. The construction of the 11kV powerline will result in the loss of habitat in the areas associated with the powerline pylon footprints. Vegetation clearing activities, increased number of vehicles moving in the study area, as well as increased edge effects will create an ideal scenario for the proliferation of alien invasive plant species, which will result in a further disturbance of terrestrial habitat. The proposed WRD may remain in perpetuity, and as such suitable rehabilitation and revegetation of the WRD should be carried out in order to mitigate further disturbances ensuring that alien plant species are controlled. Prior to the implementation of mitigation measures, impacts are expected to be of a medium-high significance during the construction/operational and rehabilitation phases, decreasing to a medium-low and low significance impact with the implementation of mitigation measures.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction /Operational phase	5	4	4	3	4	9	11	99 (Medium-high)
Decommissioning phase	4	4	4	3	5	8	12	96 (Medium-high)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction /Operational phase	4	4	3	2	4	8	9	72 (Medium low)
Decommissioning phase	2	4	2	2	3	6	7	42 (Low)

6.2 IMPACT 2: Impact on Faunal and Floral SCC

Activities and aspects register

Pre-Construction	Construction/Operational	Decommissioning
Possible insufficient planning of infrastructure placement and design leading to SCC and habitat loss	Dumping of material outside designated areas leading to loss of SCC habitat	Continued proliferation of alien plant species and further transformation of natural habitat due to inadequate rehabilitation
Failure to apply for permits pertaining to the removal/destruction of protected species	Risk of increased fire frequency, as well as uncontrolled fires due to increased human activity, impacting on plant and SCC communities	Further loss of faunal and floral SCC
Failure to conduct a walkdown prior to construction activities to mark and relocate SCC where necessary	Increased SCC mortality rates due to collision with increased number of mine vehicles	Permanent loss of SCC habitat within the study area
	Increased risk of poaching due to increased personal movement in the study area	
	Permanent loss of SCC foraging and breeding habitat	

The proposed infrastructure areas and continued operation of the mine will result in a loss of SCC and SCC habitat, notably *Vachellia erioloba* and *Vachellia haematoxylon* as well as several other faunal and floral SCC as listed in Section 4.2 and 4.3. The removal, relocation or destruction of floral SCC will require permits as stipulated within the National Forest Act (1998, as amended in September 2011) and the NCNCA (Act 9 of 2009), and as such vegetation clearing/construction activities cannot commence until such permits are in place. Where feasible, floral SCC should be left in their current positions or relocated to suitable habitat in the surrounding area. Faunal SCC are likely to relocate in their own capacity, however where this is not possible, species relocation will have to be undertaken, provided that all the relevant permits have been attained from the relevant authorities. It is unlikely that any floral or faunal SCC will occur within the proposed Eastern WRD extension nor the conveyor route, however should any species be observed within these areas the above-mentioned processes for SCC are to be adhered to.

Prior to the implementation of mitigation measures, impacts are expected to be of a medium-high significance throughout all phases, decreasing to a medium-low and low significance impact with the implementation of mitigation measures.

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction /Operational phase	5	4	3	2	5	9	10	90 (Medium-high)
Decommissioning phase	5	4	4	2	5	9	11	99 (Medium-high)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction /Operational phase	4	4	2	2	4	8	8	64 (Medium low)
Decommissioning phase	2	4	2	2	3	6	7	42 (Low)

6.3 Assessment Summary

The tables below serve to summarise the findings indicating the significance of the impact before mitigation takes place and the likely impact if management and mitigation takes place. In the consideration of impact mitigation, it is assumed that a high level of mitigation takes place, but which does not lead to prohibitive costs. From the tables below, it is evident that prior to mitigation the impacts on terrestrial habitat and SCC are of a medium high significance. If effective mitigation takes place, all impacts may be reduced to medium low significance impacts.

Table 7: A summary of the impact significance of the Construction/Operational phase.

Impact	Unmanaged	Managed
1: Impact on Terrestrial habitat	Medium-High	Medium-Low
2: Impact on Faunal and Floral SCC	Medium-High	Medium-Low

Table 8: A summary of the impact significance of the Decommissioning phase.

Impact	Unmanaged	Managed
1: Impact on Terrestrial habitat	Medium-High	Low
2: Impact on Faunal and Floral SCC	Medium-High	Low

6.4 Integrated Impact Mitigation

Mitigation Measures

- If not already done, a walkdown of the proposed new infrastructure areas should be undertaken prior to the commencement of construction/ operational activities in order to assess the site for the presence of *Harpagophytum procumbens* and other faunal SCC, as well as to mark individual *Vachellia erioloba* and *Vachellia haematoxylon* for permitting purposes;
- As a first priority, attempts should be made to preserve selected existing larger trees (height of more than 2.5m), and if this cannot be achieved, where feasible selected individuals will be relocated to suitable similar habitat in the vicinity. The number of trees to be relocated will be agreed upon with a qualified specialist;
- The necessary permits need to be acquired pertaining to the removal of floral and faunal SCC that are located within the study area, and the following should be ensured:
  - Where feasible, effective relocation of individuals to suitable similar habitat in the vicinity of the study area;
  - All rescue and relocation plans should be overseen by a suitably qualified specialist;
- Faunal SCC encountered within the study area are to be relocated by a suitably qualified specialist to suitable habitat in the vicinity of the study area following the application of all the relevant permits;
- It is recommended that vegetation clearing and other mine related operational activities take place in a phased manner, in a uniform direction from one side to the other of the mine footprint so as to ensure that as far as possible faunal species can naturally disperse out of the area ahead of activities;
- The operational footprint must be kept as small as possible in order to minimise impact on the surrounding environment;
- Edge effects of operational activities need to be actively managed to minimise further impacts to the receiving environment, with specific consideration to erosion control and alien floral species management;
- Restrict vehicles to travelling only on designated roadways to limit the ecological footprint;
- No uncontrolled fires whatsoever should be allowed;
- No dumping of waste should take place. If any spills occur, they should be immediately cleaned up;

- In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced preventing the ingress of hydrocarbons into the topsoil;
- No trapping or hunting of any faunal species is to take place;
- Alien vegetation must be removed from the study area during both the construction and operational phases, in line with the NEMBA Alien and Invasive Species Regulations (2016); and

Rehabilitation Plan:

- Disturbed and cleared areas need to be revegetated with indigenous grass species to help stabilise the soil surface
- All alien plants within the study area should be cleared, with follow up activities running concurrently for one year; and
- Soils that has been compacted must be ripped and profiled in line with the surrounding area.

Possible latent impacts:

- Loss of floral and faunal habitat;
- Permanent loss of and altered floral and faunal species diversity;
- Loss of floral and faunal SCC;
- Alien floral invasion;
- Disturbed areas are unlikely to be rehabilitated to pre-development conditions of ecological functioning and as such loss of faunal habitat and species diversity will most likely be permanent.

Cumulative impacts:

The extension of the proposed Eastern WRD and construction of the Conveyor system is unlikely to significantly add to the current environmental impact levels of the mine, as the infrastructure areas are located in already disturbed habitat. The proposed Western WRD and the 11kV powerline will however add to the overall cumulative impact of the mine, as these developments will result in the further loss of terrestrial habitat, increase the mine footprint and result in further edge effects on the surrounding environment.

7. CONCLUSION

Scientific Terrestrial Services (STS) was appointed to conduct an investigation into the terrestrial faunal and floral ecology as part of the Waste Management License Application and

EMP Amendment process for the Tshipi Waste Rock Dump at the Tshipi é Ntle Open Pit Manganese Mine, near Hotazel, Northern Cape Province.

The objective of this study was to provide sufficient information on the terrestrial ecology of the area, together with other studies on the physical and socio-cultural environment, in order for the relevant proponents 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. It is recommended that, from a terrestrial ecological perspective, the proposed development be considered favorably provided that the recommended mitigation measures for the identified impacts (as outlined in Section 6.4) are adhered to.

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APPENDIX A – Legislative Requirements and Indemnity

National Environmental Management Act, 1998

- 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.

National Environmental Management Biodiversity Act (NEMBA, Act No. 10 of 2004)

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.

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

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.

National Environmental Management: Waste Act, (NEMWA; Act 59 of 2008),

NEMWA which reforms the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution; provides for national norms and standards for regulating the management of waste by all spheres of government; and provides for the licensing and control of waste management activities

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APPENDIX B - Method of assessment

B1: Floral Method of assessment

Floral Species of Conservation 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%

Vegetation Surveys

Vegetation surveys were undertaken by first identifying different habitat units and then analysing the floral species composition that was recorded during detailed floral assessments using the step point vegetation assessment methodology. Different transect lines were chosen throughout the entire study area within areas that were perceived to best represent the various plant communities. Floral species were recorded and a species list was compiled for each habitat unit. These species lists were also compared with the vegetation expected to be found within the relevant vegetation types as described in Section 4, which serves to provide an accurate indication of the ecological integrity and conservation value of each habitat unit (Evans & Love, 1957; Owensby, 1973).

B2: 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

Small mammals are notoriously hard to observe, as such, signs thereof (burrows, spoor and scat) were also utilised in order to determine small mammal presence. Medium to large mammal species were recorded during the field assessment with the use of visual identification, spoor, call and dung. Specific attention was given to mammal SCC listed on a regional and national level, as well as those identified 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 International Union for the Conservation of Nature (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 International Union for the Conservation of Nature (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 International Union for the Conservation of Nature (IUCN).

Invertebrates

Whilst conducting transects through the study area, all insect species visually observed were identified, and where possible photographs taken.

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 the International Union for the Conservation of Nature (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 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 scorpions within the study area.

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%

B3: Habitat Sensitivity

The habitat sensitivity of each habitat unit was determined by calculating the mean of five different parameters which influence floral and faunal communities and provide an indication of the overall terrestrial 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):

- **Terrestrial SCC:** The confirmed presence or potential for floral and/or faunal SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Unique Landscapes and Food Availability:** The presence of unique landscapes or the presence of an ecologically intact habitat unit in a transformed region, as well as the availability of food within the habitat unit for faunal species;
- **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;
- **Terrestrial Diversity:** The recorded floral and faunal diversity compared to a suitable reference condition such as surrounding natural areas or available floral and faunal 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 terrestrial 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 terrestrial ecology for each vegetation type. The different classes and land-use objectives are presented in the table below:

Table B1: Terrestrial habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1> and <2	Low	Optimise development potential.
2> and <3	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
3> and <4	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
4> and <5	Moderately high	Preserve and enhance the biodiversity of the habitat unit limit development and disturbance.
5	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX C - Impact Assessment Methodology

Ecological Impact Assessment Method

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

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

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[1]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to the Table C1. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance-rating matrix and are used to determine whether mitigation is necessary[2].

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

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

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

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

Table C1: Criteria for assessing significance of impacts

LIKELIHOOD DESCRIPTORS

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

CONSEQUENCE DESCRIPTORS

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

Table C2: Significance Rating Matrix.

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

Table C3: Positive/Negative Mitigation Ratings.

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Critically consider the viability of proposed projects Improve current management of existing projects significantly and immediately	Maintain current management
High	101-125	Comprehensively consider the viability of proposed projects Improve current management of existing projects significantly	Maintain current management
Medium-high	76-100	Consider the viability of proposed projects Improve current management of existing projects	Maintain current management
Medium-low	51-75	Actively seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Low	26-50	Where deemed necessary seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Very low	1-25	Maintain current management and/or proposed project criteria and strive for continuous improvement	Maintain current management and/or proposed project criteria and strive for continuous improvement

The following points were considered when undertaking the assessment:

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

Mitigation measure development

According to the DEA *et al.,* (2013) "Rich biodiversity underpins the diverse ecosystems that deliver ecosystem services that are of benefit to people, including the provision of basic services and goods such as clean air, water, food, medicine and fibre; as well as more complex services that regulate and mitigate our climate, protect people and other life forms from natural disaster and provide people with a rich heritage of nature-based cultural traditions. Intact ecological infrastructure contributes significant savings through, for example, the regulation of natural hazards such as storm surges and flooding by which is attenuated by wetlands".

According to the DEA *et al.,* (2013) Ecosystem services can be divided into 4 main categories:

- Provisioning services are the harvestable goods or products obtained from ecosystems such as food, timber, fibre, medicine, and fresh water;
- Cultural services are the non-material benefits such as heritage landscapes and seascapes, recreation, ecotourism, spiritual values and aesthetic enjoyment;
- Regulating services are the benefits obtained from an ecosystem's control of natural processes, such as climate, disease, erosion, water flows, and pollination, as well as protection from natural hazards; and
- Supporting services are the natural processes such as nutrient cycling, soil formation and primary production that maintain the other services.
-

Loss of biodiversity puts aspects of the economy, wellbeing and quality of life at risk, and reduces socio-economic options for future generations. This is of particular concern for the poor in rural areas who have limited assets and are more dependent on common property resources for their livelihoods. The importance of maintaining biodiversity and intact ecosystems for ensuring on-going provision of ecosystem services, and the consequences of ecosystem change for human well-being, were detailed in a global assessment entitled the Millennium Ecosystem Assessment (MEA, 2005), which established a scientific basis for the need for action to enhance management and conservation of biodiversity.

Sustainable development is enshrined in South Africa's Constitution and laws. The need to sustain biodiversity is directly or indirectly referred to in a number of Acts, not least the National Environmental Management: Biodiversity Act (No. 10 of 2004) (hereafter referred to as the Biodiversity Act), and is fundamental to the notion of sustainable development. In addition, International guidelines and commitments as well as national policies and strategies are important in creating a shared vision for sustainable development in South Africa (DEA *et al.,* 2013).

The primary environmental objective of the Mineral and Petroleum Resources Development Act (MPRDA) is to give effect to the environmental right contained in the South African Constitution. Furthermore, Section 37(2) of the MPRDA states that "any prospecting or mining operation must be conducted in accordance with generally accepted principles of sustainable development by integrating social, economic and environmental factors into the planning and implementation of prospecting and mining projects in order to ensure that exploitation of mineral resources serves present and future generations".

Pressures on biodiversity are numerous and increasing. According to the DEA *et al.,* (2013) Loss of natural habitat is the single biggest cause of biodiversity loss in South Africa and much of the world. The most severe transformation of habitat arises from the direct conversion of natural habitat for human requirements, including[3]:

- Cultivation and grazing activities;
- Rural and urban development;
- Industrial and mining activities, and
- Infrastructure development.

Impacts on biodiversity can largely take place in four ways (DEA *et al.,* 2013):

- **Direct impacts:** are impacts directly related to the project including project aspects such as site clearing, water abstraction and discharge of water from riverine resources;

[3] Limpopo Province Environment Outlook. A Report on the State of the Environment, 2002. Chapter 4.

- **Indirect impacts:** are impacts associated with a project that may occur within the zone of influence in a project such as surrounding terrestrial areas and downstream areas on water courses;
- **Induced impacts:** are impacts directly attributable to the project but are expected to occur due to the activities of the project. Factors included here are urban sprawl and the development of associated industries; and
- **Cumulative impacts:** can be defined as the sum of the impact of a project as well as the impacts from past, existing and reasonably foreseeable future projects that would affect the same biodiversity resources. Examples include numerous mining operations within the same drainage catchment or numerous residential developments within the same habitat for faunal or floral species.

Given the limited resources available for biodiversity management and conservation, as well as the need for development, efforts to conserve biodiversity need to be strategic, focused and supportive of sustainable development. This is a fundamental principle underpinning South Africa's approach to the management and conservation of its biodiversity and has resulted the definition of a clear mitigation strategy for biodiversity impacts.
'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 as a result 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 to be 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 (DEA *et al.,* 2013):

- **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 impact:** can be done through utilisation of alternatives that will ensure that impacts on biodiversity and ecoservices provision are reduced. Impact minimisation is considered an essential part of any development project;
- **Rehabilitate 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 tool 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 study area 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** which 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 post closure land use; and
  - **Species reinstatement** which 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 to be 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 to be a last resort to compensate for residual negative impacts on biodiversity.

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.[4]

In light of the above discussion the following points present the key concepts considered in the development of mitigation measures for the proposed development.

- Mitigation and performance improvement measures and actions that address the risks and impacts[5] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation.
- Desired outcomes are defined, and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, with estimates of the resources (including human resource and training requirements) and responsibilities for implementation wherever possible.

Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to construction and operation.

[4] Provincial Guideline on Biodiversity Offsets, Western Cape, 2007.

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

APPENDIX D – Northern Cape Provincial Spatial Development Framework (NPSDF, 2012)

The study area falls within the Griqualand West Centre of Endemism (GWC). According to van Wyk and Smith (2001), the GWC coincides with the surface outcrops of the Ghaap Group (previously Griqualand West Sequence) and Olifantshoek Supergroup (previously Sequence). However, in floristic terms the outer boundaries of the centre are rather diffuse, as several of the GWC floristic elements spill over onto related substrates, especially alkaline substrates rich in calcium.

The Kalahari Mountain Bushveld covers the mountainous western parts of the GWC, and, both endemic to the centre, covers the eastern plateau area. *Tarchonanthus camphorates* is a particularly common woody species in these two bushveld types. Typical mountain species include *Searsia tridactyla* (formally known as *Rhus tridactyla*), *Croton gratissimus* and *Buddleja saligna*. Pockets of Karoo-type vegetation increase towards the south and west, especially in heavily overgrazed areas.

The vegetation of the GWC is still intact, although extremely poorly conserved. Apparently, the Kalahari Plateau Bushveld is the only Savanna Biome vegetation type, which is not represented in any sizable nature reserve. Bush encroachment by e.g. the indigenous *Senegalia mellifera* (formally known as *Acacia mellifera*), which is due to inappropriate veld management practices (mainly overgrazing by domestic livestock), is a major problem in many parts of the region.

APPENDIX E- Species List

Table F1: Dominant floral species encountered in the three route alternatives. Alien species are indicated with an asterisk (*). Also indicated are species falling within an alien invasive category as per the National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, 2016.

Grass species	Forb species	Tree/Shrub Species
Stipagrostis amabilis	*Ammocharis coranica*	*Vacehllia hebeclada*
Stipagrostis uniplumis	*Aptosimum elongatum*	*Lycium hirsutum*
Eragrostis pallens	*Chrycosoma ciliata*	*Asparagus laricinus*
Eragrostis trichophora	*Dimorphotheca sp.*	*Grewia flava*
Melenis repens	*Felicia muricata*	*Senegalia mellifera subsp. detinens*
Anthephora pubescens	*Gnidia polycephala*	***Vachellia erioloba***
Pogonarthria squarrosa	*Helichrysum cerastioides*	***Vachellia haematoxylon***
Cynodon dactylon	*Melolobium candicans*	*Ziziphus micronata*
Aristida meridionalis	*Nolletia arenosa*	**Prosopis glandulosa var. torreyana**
Cenchrus ciliaris	*Pentzia globosa*	
Aristida congesta	*Pollicha campestris*	
Enneapogon cenchroides	*Pteronia glauca*	
Eragrostis lehmanniana	*Senna italica* subsp. *arachoides*	
Hyparrhenia hirta	*Tribulus zeyheri*	
Brachiaria nigropedata	*Lophiocarpus polystachyus*	
Centropedia glauca	*Elephantorrhiza elephantina*	
Schmidtia pappophoroides		

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).

Mammal species observed

Scientific name	Common Name	IUCN Red List Status
Sylvicapra grimmia	Common Duiker	LC
Galerella sanguinea	Slender Mongoose	LC
Hystrix africaeaustralis	African Porcupine	LC
Lepus saxatilis	Scrub Hare	LC
Galerella sanguinea	Slender Mongoose	LC
Cryptomys hottentotus	Common Mole-rat	LC
Tragelaphus strepsiceros	Kudu	LC
Phacochoerus africanus	Warthog	LC
Raphicerus campestris	Steenbok	LC

LC = Least Concern, NT = Near Threatened

Avifaunal species observed

Streptopelia capicola	Cape turtle-dove	LC
Pycnonotus nigricans	Red-eyed Bulbul	LC
Serinus flaviventris	Yellow Canary	LC
Passer melanurus	Cape Sparrow	LC
Streptopelia capicola	Cape Turtle-Dove	LC
Sporopipes squamifrons	Scaly-feathered Finch	LC
Spreo bicolor	Pied Starling	LC
Saxicola torquata	African Stonechat	LC
Anthus cinnamomeus	African Pipit	LC
Cisticola fulvicapillus	Neddicky	LC
Elanus caeruleus	Black-shouldered Kite	LC
Tockus nasutus	African Grey Hornbill	LC
Dicrurus adsimilis	Fork-tailed Drongo	LC
Hirundo fuligula	Rock Martin	LC
Parus cinerascens	Ashy Tit	LC
Batis pririt	Pririt Batis	LC
Sigelus silens	Fiscal Flycatcher	LC
Emberiza flaviventris	Golden-breasted Bunting	LC
Parisoma subcaeruleum	Chestnut-vented Titbabbler	LC

LC = Least concerned. NT = Near Threatened, NYBA = Not yet been assessed by the IUCN.

Insect species observed

Scientific Name	Common Name	IUCN 2015 Status
Junonia hierta	Yellow Pansy	LC
Calidea dregii	Rainbow Shield Bug	NYBA
Catopsilia florella	African Migrant	NYBA
Belenois aurota	Brown-veined White	NYBA
Junonia orithya	Eyed Pansy	NYBA
Danaus chrysippus	African Monarch	NYBA
Colotis euippe	Smokey Orange Tip	NYBA
Eurema brigitta	Broad-bordered Grass Yellow	NYBA
Spalia sp	Sandman	NYBA
Loxostege frustalis	Karoo Moth	NYBA
Conistica saucia	Rock Grasshopper	NYBA
Sphingonotus scabriculus	Blue-wing	NYBA
Acanthacris ruficornis	Garden Locust	NYBA
Gastrimargus sp.	N/A	NYBA
Rhachitopis sp	N/A	NYBA
Systophlochius palochius	Orange wing	NYBA
Anterhynchium fallax	N/A	NYBA
Camponotus fulvopilosus	Bal-byter	NYBA
Crematogaster peringueyi	Cocktail Ant	NYBA
Pantala flavescens	Wandering Glider	LC
Mylabris oculata	CMR Bean Beetle	NYBA

NYBA = Not Yet Been Assessed, LC = Least Concern

APPENDIX F – Floral SCC

Table F1: TOPS plant list for the floral species expected to occur within the Northern Cape.

Family	Scientific Name	Habitat	Growth Form	Threat Status
Aizoaceae	*Cheiridopsis peculiaris*	Gravels and shale derived from metamorphic rocks of the Namaqualand Complex	Succulent	CR
Aizoaceae	*Conophytum herreanthus subsp. Herreanthus*	Quartz patches	Succulent	CR
Asphodelaceae	*Aloidendron pillansii*	Succulent Karoo shrubland on dry, rocky dolomite and gneiss hillsides.	Succulent, Tree	EN
Amaryllidaceae	*Haemanthus granitcus*	Namaqualand Klipkoppe Shrubland or Namaqualand Granite Renosterveld.	Geophyte	EN
Aizoaceae	*Lithops dorotheae*	Fine-grained, sheared, feldspathic quartzite	Succulent	EN
Asphodelaceae	*Aloidendron dichotomum*	On north-facing rocky slopes (particularly dolomite) in the south of its range. Any slopes and sandy flats in the central and northern parts of range.	Succulent, Tree	VU
Amaryllidaceae	*Brunsvigia herrei*	Succulent Karoo Shrubland, granitic soils on flats and sometimes in deposits of fairly large stones.	Geophyte	VU
Aizoaceae	*Conophytum bachelorum*	Rocky outcrops	Succulent	VU
Aizoaceae	*Conophytum ratum*	Spongy quartz soil.	Succulent	VU
Amaryllidaceae	*Gethyllis grandiflora*	Sandy and or stony soils in arid karroid shrubland.	Geophyte	VU
Amaryllidaceae	*Gethyllis namaquensis*	Coastal dunes and gravelly mountain slopes in succulent karoo shrubland.	Geophyte	VU
Amaryllidaceae	*Brunsvigia josephinae*	Heavy clay soils.	Geophyte	VU
Asphodelaceae	*Aloe krapohliana*	Occurs in the extremely arid northern regions of the Succulent Karoo, on clay, stony (mostly quarzitic) and sandy soils on flats and slopes.	Herb, Succulent	P
Amaryllidaceae	*Cyrtanthus herrei*	Deeply shaded rock ledges on south-facing rocky slopes.	Bulb	P
Aizoaceae	*Sceletium tortuosum*	Quartz patches and is usually found growing under shrubs in partial shade.	Succulent	P
Pedaliaceae	*Harpagophytum procumbens*	Well drained sandy habitats in open savanna and woodlands.	Herb	P

CR= Critically Endangered, EN= Endangered, VU= Vulnerable, P= Protected

APPENDIX G – Faunal SCC

Table G1: TOPS list of faunal species expected to occur within the Northern Cape.

Scientific Name	Common Name	Threat Status
Chrysoritis thysbe schloszae	Schlosz's Opal Butterfly	CR
Trimenia malagrida	Scarce Mountain Copper Butterfly	CR
Trimenia wallengrenii	Wallengren's Silver-spotted Copper Butterfly	CR
Bitis schneideri	Namaqua Dwarf Adder	P
Bitis xeropaga	Desert Mountain Adder	P
Bitis caudalis	Horned Adder	P
Lamprophis fiski	Fisk's House Snake	P
Neophron percnopterus	Egyptian Vulture	CR
Neotis ludwigii	Ludwig's Bustard	EN
Ardeotis kori	Kori Bustard	P
Bunolagus monticularis	Riverine Rabbit	CR
Pelea capreolus	Grey Rhebok	P

CR= Critically Endangered, EN=Endangered, P=Protected

South African Bird Atlas Project 2 list for quadrant 2722BD

Avifaunal Species for the pentads 2720_2255 within the QD2722BD

http://sabap2.adu.org.za/pentad_info.php?pentad=2720_2255#menu_top

APPENDIX H – IAP Comments

No biodiversity related IAP comments have been received to date with regards to the proposed additional infrastructure developments at the Tshipi Borwa Mine. Should any comments be received at a later date, these will be addressed and included in this section.

APPENDIX I – Declaration and Specialists CV's

Declaration

Declaration that the specialist is independent in a form as may be specified by the competent authority

I, Emile van der Westhuizen, 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

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION
CURRICULUM VITAE OF EMILE BASSON VAN DER WESTHUIZEN

PERSONAL DETAILS

Position in Company	Ecologist, Botanist
Date of Birth	30 May 1984
Nationality	South African
Languages	English, Afrikaans
Joined STS	2008

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Council for Natural Scientific Professions (SACNASP) (Reg. Number 100008/15).

EDUCATION

Qualifications

BSc (Hons) Plant Science (University of Pretoria)	2012
B.Sc. Botany and Environmental Management (University of South Africa)	2010

Short Courses

Grass Identification – Africa Land Use Training	2009
Wild Flower Identification – Africa Land Use Training	2009

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Free State, Eastern Cape.
Mozambique (Tete, Sofala and Manica Provinces)
Democratic Republic of the Congo (Katanga and Kivu Provinces)
Ghana (Western and Greater Accra Provinces)
Sierra Leone
Angola
Cabinda

SELECTED PROJECT EXAMPLES

Floral Assessments

- Floral assessment for the proposed Modikwa Platinum Mine South 2 Shaft Project, Burgersfort, Limpopo Province.
- Floral assessment for the proposed New Clydesdale Colliery Stoping Project, Vandyksdrift, Mpumalanga Province.
- Floral assessment as part of the EIA process for the proposed Harriet's Wish PGM Project, Limpopo Province.
- Floral assessment as part of the environmental authorisation process for the proposed Shanduka Coal Argent Colliery in the vicinity of Argent, Mpumalanga.
- Floral assessment for the Auroch Resources Manica Gold Mining Project, Manica, Mozambique.
- Floral assessment for the Namoya Gold Mine project in Namoya, Democratic Republic of Congo.
- High level floral risk assessment and alternatives analysis for the proposed new Tete Airport, Tete, Mozambique.
- Floral assessment for the proposed Richardsbay Harbour Compactor Slab development, Richardsbay, Kwa-Zulu-Natal Province.
- Site walkdown and floral ecological input prior to the construction of the proposed 180km Mfolozi-Mbewu powerline, Richardsbay, Kwa-Zulu-Natal Province.
- Floral assessment as part of the EIA process for the proposed Peerboom Colliery, Lephalale, Limpopo Province.
- Floral assessment as part of the EIA process for the proposed Overvaal Underground Coal Mine Project, Ermelo, Mpumalanga Province.

- Floral assessment as part of the EIA process for the proposed King's City Takoradi 3000 hectare development, Takoradi, Ghana
- Floral assessment as part of the EIA process for the proposed Aquarius Platinum Fairway Platinum Mine, Steelpoort, Mpumalanga Province.
- Floral assessment as part of the EIA process for the proposed Geniland Lubumbashi City 4000 hectare development, Likasi, Katanga Province, Democratic Republic of Congo.
- Floral, faunal, aquatic and wetland assessment as part of the EIA process for the proposed Appollonia City Accra 3000 hectare development, Accra, Ghana.
- Floral assessment as part of the EIA process for the proposed Leeuw Colliery, Utrecht, Kwa-Zulu Natal Province.
- Floral assessment as part of the EIA process for the proposed Lubembe Coppermine Project, Lubumbashi, Katanga Province, Democratic Republic of Congo.
- Floral assessment as part of the EIA process for the proposed Kinsenda Coppermine Project, Lubumbashi, Katanga Province, Democratic Republic of Congo.
- Floral assessment as part of the EIA process for the proposed Lonshi Coppermine Project, Lubumbashi, Katanga Province, Democratic Republic of Congo.
- Floral assessment as part of the EIA process for the proposed Jozini Shopping Mall, Jozini, Kwa-Zulu Natal Province.
- Floral assessment as part of the Biodiversity Action Plan for the Assmang Chrome Dwarsrivier Mine, Steelpoort, Mpumalanga Province.

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 STS	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.