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Applying science to the real world

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Date: 05 October 2021
Ref: SAS 219162

TECHNICAL MEMORANDUM

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WETLAND VERIFICATION AS PART OF THE WATER USE AUTHORISATION PROCESS FOR THE PROPOSED MAMATWAN MINE PROJECT NEAR KATHU, NORTHERN CAPE PROVINCE.

INTRODUCTION

Scientific Aquatic Services (SAS) was appointed by SLR Consulting (Africa) (Pty) Ltd to consider the characteristics of a watercourse associated with the proposed Mamatwan mine project hereafter referred to as the 'Mamatwan Expansion activities' near Kathu, Northern Cape Province, South Africa.

In order to ensure that the assessment was undertaken fully in compliance with the requirements of Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998), all watercourses within 500m of the proposed Mamatwan Expansion activities were considered. To ensure that known features were considered a detailed analysis of National and Provincial Legislation, Policies, Guidelines and Databases was undertaken. Refer to Appendix B.

OUTCOME OF DESKTOP ASSESSMENT

Use was made of aerial photography, digital satellite imagery, and available provincial and national freshwater resource management databases to identify points of interest prior to the field survey. A desktop study was undertaken during which the relevant national and provincial databases were consulted to determine the location of any watercourses in the vicinity of the proposed infrastructure. In addition, digital satellite imagery was used to identify any watercourses present within 500m of the proposed

Mamatwan Expansion activities. The outcome of the desktop assessment is provided in Appendix B. Based on the outcome of the background database study no wetlands nor rivers were identified by the National Freshwater Ecosystem Priority Areas (NFEPA, 2011) database within the proposed Mamatwan expansion activities and investigation area, nor are any watercourses indicated by the topographic data for the area. The proposed Mamatwan expansion activities are situated within the Eastern Kalahari Bushveld Group 1 wetland vegetation type considered Least Threatened (LT) according to Mbona *et al.* (2014).

The identification of watercourses through the use of desktop assessment methods is based on identifying features displaying a diversity of digital signatures. In this regard, specific mention is made of the following:

- Vegetation associated with watercourses: a distinct increase in density as well as shrub size near flow paths;
- Hue: with water flow paths often shown as white/grey or black. Outcrops or bare soils display varying chroma created by varying vegetation cover, geology and soil conditions; and
- Texture: with areas displaying various textures, created by varying vegetation cover and soil conditions.

ASSUMPTIONS AND LIMITATIONS

- Delineation and assessment of the watercourse is confined to the proposed Mamatwan expansion activities and investigation areas as depicted in Appendix A - Figure A1 and Figure A2, and does not include the neighbouring and adjacent properties, although land uses and possible catchment impacts occurring on surrounding properties were taken into consideration;
- A site visit was conducted on the 7th November 2019 to observe and delineate watercourses within the Mamatwan activities and investigation area. Due to the nature of impacts within the investigation area, the applicability of the use of soil indicators was limited as the dominant soils in the area can be considered anthrosols (soils that have been modified profoundly by human activities);
- Similarly, as a result of the land use within the investigation area much of the vegetation has already been cleared thus limiting the usefulness of vegetation as an indicator;
- Infrastructure in the area has severely affected runoff patterns due to increased extent of impermeable surfaces which has affected natural hydrological processes; and
- Given the prevailing conditions on site at the time of the field assessment, the precautionary principle was applied when verifying the existence of a watercourse and data obtained in the field was compared to digital signatures in digital satellite imagery.

DEFINITIONS

As part of this memorandum, the following definitions as per the National Water Act, 1998 (Act No. 36 of 1998) (NWA) are of relevance:

Watercourse means-

(a) A river or spring;
(b) A natural channel in which water flows regularly or intermittently;
(c) A wetland, lake or dam into which, or from which water flows; and
(d) Any collection of water, which the Minister may, by notice of the Gazette, declare a watercourse.

Wetland means-

"Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

Riparian habitat includes-

"The physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas".

Regulated Area of a Watercourse means-

(a) The outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
(b) In the absence of a determined 1 in 100-year flood line or riparian area, the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or
(c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

In terms of Section 21 of the National Water Act, 1998 (Act No. 36 of 1998) which provides the water uses that would trigger the need for a water Use Authorisation, the following are applicable to this project:

Section 21(c) of the National Water Act, 1998 (Act No. 36 of 1998) – impeding or diverting the flow of water in a watercourse.
Section 21(i) of the National Water Act, 1998 (Act No. 36 of 1998) – altering the beds, banks, course or characteristics of a watercourse.

KEY OBSERVATIONS OF THE SITE VERIFICATION

Terrestrial soil characterised by yellow brown (high chroma) coloured soils were found within the undisturbed areas of the proposed Mamatwan expansion activities. Due to the physical properties (i.e. well-drained and single soil structure) of these soils no signs of wetness (iron (Fe) and manganese (Mn) oxides) were observed and further confirm the absence of wetland conditions. Upon investigation of these soils, by means of hand auguring within 50cm of the soil surface within the Mamatwan expansion activities, wetland indicators such as mottling, gleying or other redoximorphic characteristics were not present (Figure 1).

Figure 1: (left) Runoff associated with mine operations and (right) soils within the proposed Mamatwan expansion activities showing no signs of wetness within the first 50cm.

Using digital satellite imagery, it was observed that the robust vegetation response within the upgradient portion of Adams pit, within the investigation area is as a result of the mining activities taking place in the area. Prior to these activities no wetness signatures are observable in the satellite imagery. It therefore evident that as a result of altered natural flow patterns linked to the activities within the investigation area, the wet response is artificial and is entirely driven by regular water inflow into the upgradient portion of the Adams pit. This portion of Adams pit receives surplus water from the mine storage dams and from the ore processing plant regularly. Furthermore, the Adams pit is used as a stormwater storage dam as part of the mine stormwater management system.

Figure 2: Artificially driven freshwater feature identified within the Mamatwan expansion activities.

Therefore, this artificial wet response is unlikely to persist under "normal circumstances" in accordance with the definition provided by the National Water Act, 1998 (Act No. 36 of 1998) as when the mining activities cease, the hydrological driver of this anthropogenically derived freshwater feature will cease.

CONCLUSION OF FINDINGS AND SPECIALIST OPINION

In consideration of the findings during the watercourse verification within the Mamatwan expansion activities, the following can be concluded:

- No true watercourses as defined by the National Water Act, 1998 (Act No. 36 of 1998) were observed within the proposed Mamatwan expansion and investigation area.
- It is therefore the opinion of the freshwater ecologist that the artificial freshwater feature with associated hydrophytic vegetation cannot be deemed a watercourse given that under normal circumstances it would not persist. In addition, the Zones of Regulation advocated by the National Water Act, 1998 (Act No.36 of 1998) and the National Environmental Management Act 1998 (Act No.107 of 1998), are not applicable in protection of the artificial feature identified.

Yours Faithfully,

Digital Documentation Not Signed for Security Purpose

Stephen van Staden

Pri. Sci. Nat

APPENDIX A

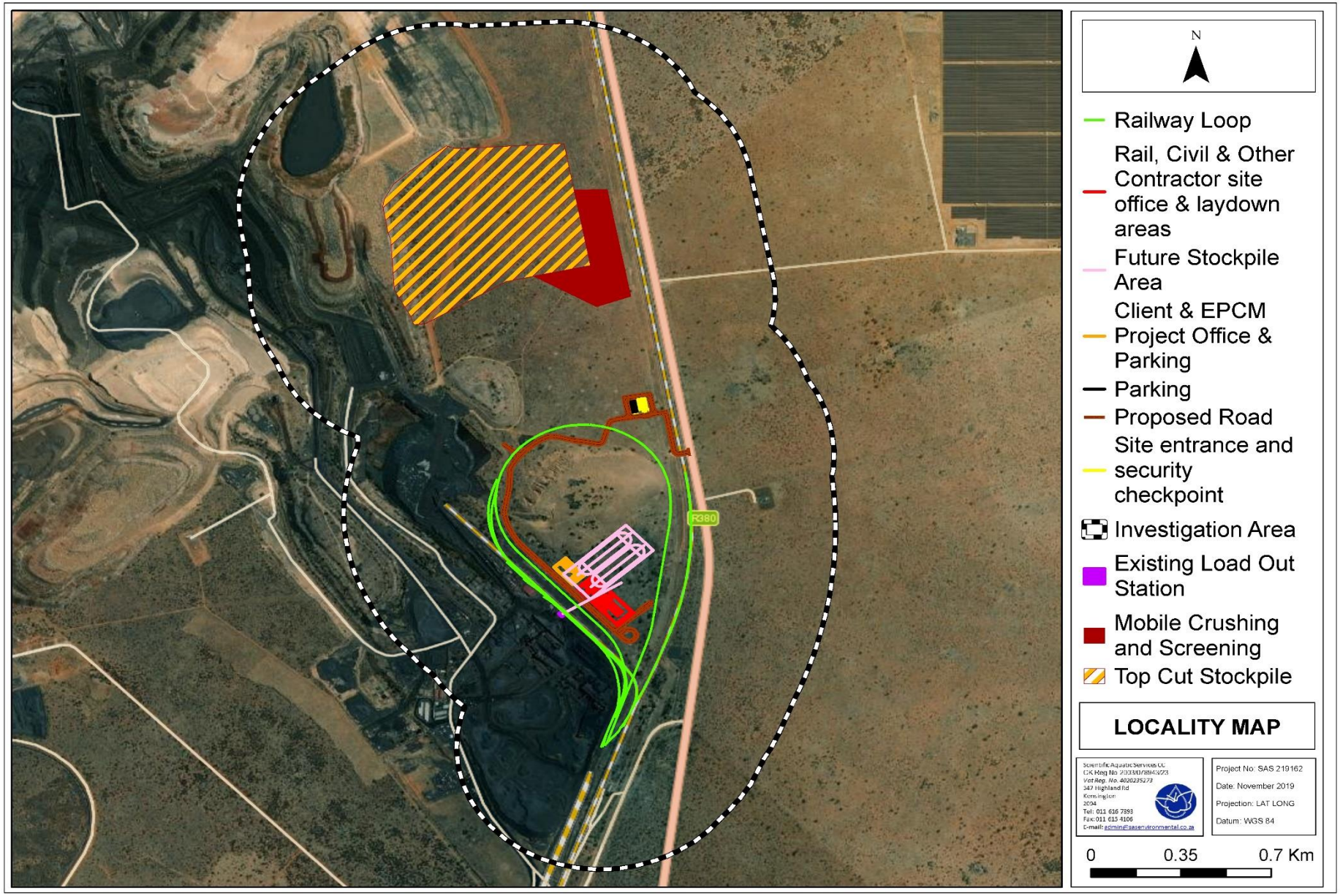

Figure A1: Location of the proposed infrastructure and investigation area in relation to the surrounds, depicted on digital satellite imagery.

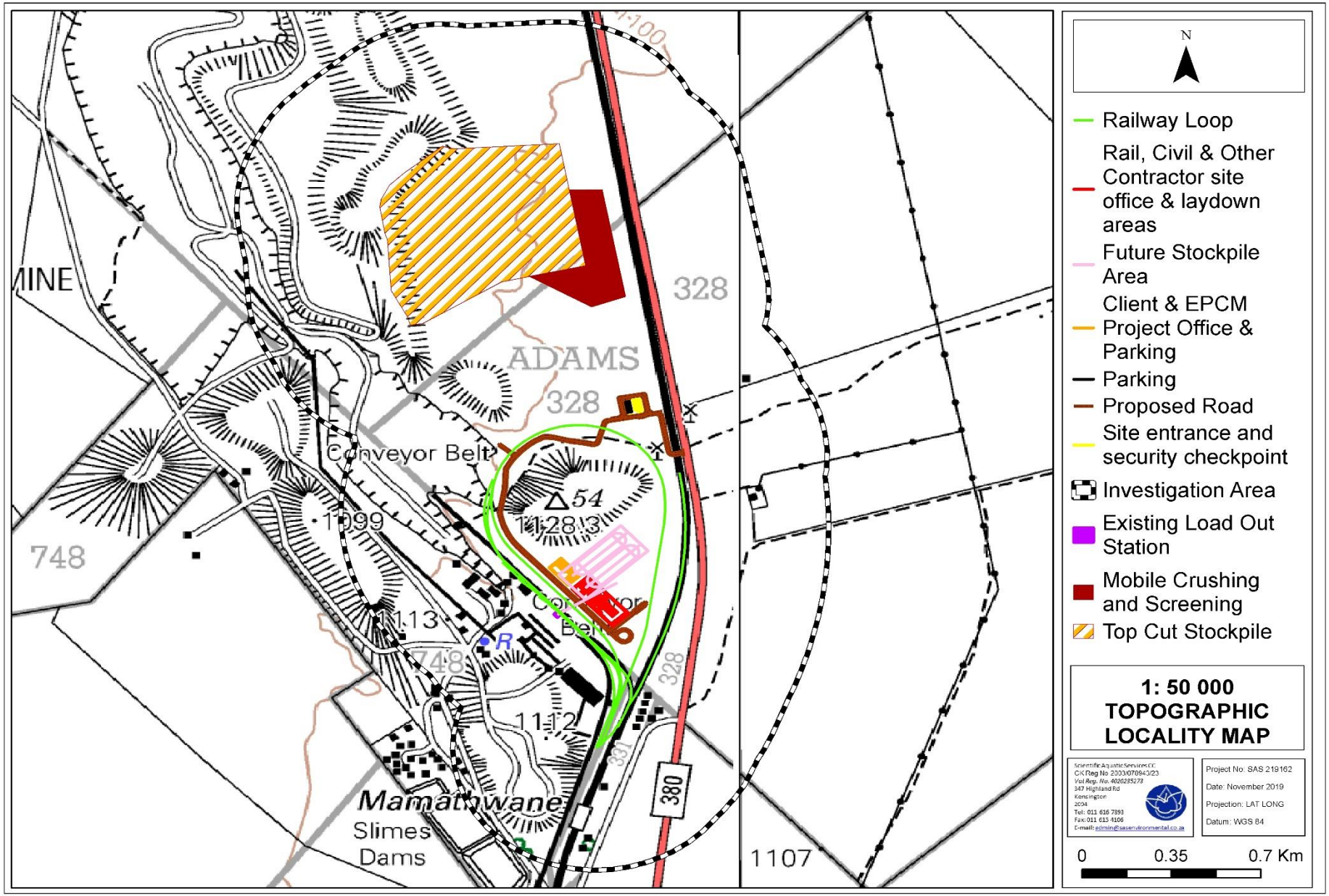

Figure A2: The location of the proposed infrastructure and investigation area depicted on a 1: 50 000 topographic map.

APPENDIX 2

Table 1: Desktop data relating to the character of watercourses associated with the proposed Mamatwan Expansion activities and surrounding region.

Aquatic ecoregion and sub-regions in which the Mamatwan Expansion Activities is located	
Ecoregion	Southern Kalahari
Catchment	Orange
Quaternary Catchment	D41K
WMA	Lower Vaal
subWMA	Molopo
Dominant characteristics of the Southern Kalahari (29.01) Aquatic Ecoregion Level 2 (Kleynhans *et al.*, 2007)	
Dominant primary terrain morphology	Plains; moderate relief, Closed Hills, mountains; moderate and high relief.
Dominant primary vegetation types	Karroid Kalahari Bushveld, Kalahari Mountain Bushveld, Kalahari Plateau Bushveld
Altitude (m a.m.s.l)	700 - 1500
MAP (mm)	0 - 500
The coefficient of Variation (% of the MAP)	30 - 40
Rainfall concentration index	60 - >65
Rainfall seasonality	Late Summer
Mean annual temp. (°C)	16 - 22
Winter temperature (July)	0 - 22
Summer temperature (Feb)	16 - >32
Median annual simulated runoff (mm)	<5 – 40
National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE)	
According to the NBA (2018): SAIIAE there are no wetland features or rivers associated with the Mamatwan Expansion Activities nor the investigation area, thus corresponding with the NFEPA Database (2011).	

Detail of the Mamatwan Expansion Activities in terms of the National Freshwater Ecosystem Priority Area (NFEPA, 2011) database	
FEPACODE	The Mamatwan Expansion Activities is situated in an area defined as an upstream management catchment (FEPACODE 4). Upstream management catchments are required to prevent the downstream degradation of Freshwater Ecosystem Priority Areas (FEPAs) and Fish Support Areas (FSAs).
NFEPA Wetlands	According to the NFEPA database (2011) no wetlands are located within the Mamatwan Expansion Activities or investigation areas. An artificial unchannelled valley bottom wetland is indicated approximately 1.7 km south of the Mamatwan Expansion Activities. This wetland is indicated to be heavily to critically modified (Class Z3).
Wetland Vegetation Type	The Mamatwan Expansion Activities are situated within the Eastern Kalahari Bushveld Group 1 Wetland Vegetation Type considered Least Threatened according to SANBI, 2012 and Mbona *et al.* (2014),
NFEPA Rivers	According to the NFEPA Database there are no rivers associated with the Mamatwan Expansion Activities nor with the investigation area. The Vlermuisleegte River is situated approximately 5km south west of the Mamatwan Expansion Activities.
Detail of the Mamatwan Expansion Activities in terms of the Northern Cape Critical Biodiversity Areas (2016) (Figure 5)	
The majority of the Mamatwan Expansion Activities are defined as “Other Natural Areas” (ONA). According to the Technical Guidelines for CBA, Maps document, ONA’s consist of all 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).	

CBA = Critical Biodiversity Area; DWS = Department of Water and Sanitation; EI = Ecological Importance; ES = Ecological Sensitivity; ESA = Ecological Support Area; m.a.m.s.l = Metres Above Mean Sea Level; MAP = Mean Annual Precipitation; NBA = National Biodiversity Assessment; NFEPA = National Freshwater Ecosystem Priority Areas; PES = Present Ecological State; SAIIAE = South African Inventory of Inland Aquatic Ecosystems; WMA = Water Management Area


N
Railway Loop
Rail, Civil & Other Contractor site office & laydown areas
Future Stockpile Area
Client & EPCM Project Office & Parking
Parking
Proposed Road
Site entrance and security checkpoint
Investigation Area
Existing Load Out Station
Mobile Crushing and Screening
Top Cut Stockpile
Northern Cape CBA Map
Other Natural Areas
NORTHERN CAPE CBA MAP
Scientific Aquatic Services CC
CK Reg No 2003/078943/23
Vat Reg. No. 4020235273
347 Highland Rd
Kensington
2094
Tel: 011 616 7893
Fax: 011 615 4105
E-mail: admin@sasenvironmental.co.za
Project No: SAS 219162
Date: November 2019
Projection: LAT LONG
Datum: WGS 84
0
0.35
0.7 Km

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BIODIVERSITY ASSESSMENT AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED EXPANSION ACTIVITIES AT THE MAMATWAN MINE, NEAR HOTAZEL, NORTHERN CAPE PROVINCE

Prepared for

SLR Consulting (South Africa) (Pty) Ltd

May 2020

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Date May 2020

EXECUTIVE SUMMARY

Scientific Terrestrial Services (STS) was appointed to conduct a Biodiversity Assessment for the proposed expansion activities at the Mamatwan Mine. The biodiversity assessment revealed that the study area comprises of three habitat units, namely the Kathu Bushveld, Degraded Bushveld and Transformed Habitat, ranging in sensitivity from intermediate (Kathu Bushveld), moderately low (Degraded Bushveld) to low (Transformed habitat). The Kathu Bushveld was degraded as a result of edge effects related to mining activities which have resulted in bush encroachment and Alien Invasive Plant (AIP) establishment in areas. This habitat unit did however provide habitat for a number of protected floral species and can be considered representative of the Kathu Bushveld vegetation type, a Least Threatened Vegetation type as per the National Biodiversity Assessment (2018). The Degraded Bushveld was severely altered from the reference Kathu Bushveld as a result of historic and ongoing mining activities and cannot be considered representative of the Kathu Bushveld. The transformed habitat has been completely transformed comprising of no vegetation, or where vegetation was observed was limited to AIPs.

A number of protected floral species was observed and include the National Forest Act, 1998, (Act 84 of 1998, amended in September 2011) (NFA) protected trees *Vachellia erioloba* and *V. haematoxylon*. Also observed were a number of Northern Cape Nature Conservation Act, 2009 (Act 9 of 2009) (NCNCA) protected species, namely *Boophone disticha* (Poison Bulb) , *Harpagophytum procumbens* (Devil's Claw), and *Tridentea sp. H. procumbens* is also considered a protected species in terms of the National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004) Threatened or Protected Species (TOPS).

It is recommended that a walkdown of the final development footprint be undertaken during the flowering season (preferably between January and May), and after sufficient rainfall events whereby all floral SCC are marked by means of GPS. Permits will have to be obtained from the Department of Environment, Forestry and Fisheries (DEFF) and Northern Cape Department Environment and Nature Conservation (NCDENC) for all protected species individuals to be disturbed prior to commencement of expansion activities. All herbaceous protected floral individuals should be rescued and relocated by a suitably qualified contractor.

A single Species of Conservation Concern (SCC) was directly observed within the study area, *Orycteropus afer* (Aardvark) and likely utilises much of the Kathu Bushveld for foraging while breeding is likely to occur off-site. There is a high likelihood for a further five SCC to occur on the site. *Opistophthalmus ater* (Steinkopf Burrowing Scorpion) which is Critically Endangered is considered a protected species within the National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004) Threatened or Protected Species (TOPS), a further two burrowing scorpions *Opistophthalmus wahlbergii* and *Opistophthalmus carinatus* all protected by the Northern Cape Nature Conservation Act, 2009 (Act 9 of 2009) (NCNCA) are likely to occur in the Kathu and Degraded Bushveld. Two avian species: *Aquila verreauxii* (Verreaux's Eagle) and *Anthus crenatus* (African Rock Pipit) have been observed in the vicinity and although they were not observed during the field assessment the habitat created by the mine provides habitat which is suitable for their presence. Verreaux's eagle only utilises the site for foraging while the African Rock Pipit potentially breeds within the larger mining right area on the hillslopes within Degraded bushveld and Transformed areas.

Following the biodiversity assessment within the study area, the impacts associated with the proposed development activities were determined. The impacts arising from the proposed development will range from very low to high for floral and faunal habitat, diversity and SCC for the various expansion related activities. The most significant impacts are expected to arise from the development of the top-cut stockpile and Manganese Railway Line due to the extent of vegetation clearance, loss of protected floral species and faunal SCC habitat that will result from the development of these infrastructure. With mitigation measures fully implemented, it is the opinion of the specialist that all impacts can be effectively reduced to acceptable levels.

It is the opinion of the ecologists that this study provides the relevant information required in order to implement Integrated Environmental Management (IEM) and to ensure that the best long-term use of the ecological resources in the study area will be made in support of the principles of sustainable development.

MANAGEMENT SUMMARY

Scientific Terrestrial Services (STS) was appointed to conduct a Biodiversity Assessment as part of the environmental impact assessment and authorisation process for the proposed expansion activities at the Mamatwan Mine, near Hotazel in the Northern Cape Province.

The proposed expansion activities associated with the study area and assessed during the current assessment include the following:

- Development of a top-cut stockpile, and crushing and screening plant;
- Construction and operation of a railway loop and associated infrastructure; and
- Installation of a pipeline: Three alternatives are proposed, with alternative 1 considered as the preferred alternative by the proponent.

Specific outcomes required from this report include the following:

- To define the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of the biodiversity associated with the study area;
- To conduct a Species of Conservation Concern (SCC) assessment, including potential for such species to occur within the study area;
- To provide faunal and floral inventories of species as encountered on site;
- To determine and describe habitats, communities and ecological state of the study area;
- To describe the spatial significance of the study area with regards to surrounding natural areas;
- To identify and consider all sensitive landscapes, including rocky ridges, wetlands and any other ecologically important features, if present; and
- To determine direct and indirect environmental impacts that the project activities might have on the biodiversity of the study area and to develop mitigation and management measures for all phases of the development.

BIODIVERSITY ASSESSMENT RESULTS:

1) Desktop Assessment

- According to the National Biodiversity Assessment (2018), the majority of the study area is classified as falling within the remaining extent of the Kathu Bushveld (LC), except where expansion activities are situated within existing mining areas. Based on the field assessment results, areas classified as the Kathu Bushveld although degraded was still associated with a number of Kathu Bushveld endemics, and can subsequently be considered as the Kathu Bushveld habitat;
- In terms of the mining and biodiversity guidelines (2013) the study area does not fall into any biodiversity priority areas and is therefore no mining constraints placed on this area according to this dataset; and
- As per the Northern Cape Critical Biodiversity Areas (2016) database, the study area is not associated with any CBAs, but where vegetation remains the study area is classified as “other natural areas”. This indicates that although portions within the study area is considered as natural vegetation, these areas are not considered important for preserving a specific ecosystem, species, nor is it considered important for maintaining long-term ecological functioning in the landscape as a whole.

2) Floral Assessment Results:

- Three habitat units were identified, i.e. Kathu Bushveld, Degraded Bushveld and Transformed Habitat;
- Two vegetation communities could be distinguished within the Kathu Bushveld Habitat unit, in line with the Natural Scientific Services CC (NSS, 2018) assessment, namely:
    - *Senegalia (Acacia) mellifera - Vachellia (Acacia) haematoxylon – Grewia flava* Kathu Bushveld, and;
    - *Senegalia (Acacia) mellifera – Stipagrostis* Open Kathu Bushveld;
- Although individual species abundance differed for the vegetation communities, the species composition was similar, and both vegetation communities can be considered representative of the Kathu Bushveld vegetation type. Subsequently, these vegetation communities are considered as a single habitat unit, namely the Kathu Bushveld;
- The Kathu Bushveld Habitat unit was associated with habitat degradation as a result of edge effects arising from ongoing mining activities which have led to the establishment of Alien

Invasive Plant (AIP) species as well as bush encroachment by indigenous species such as *Senegalia mellifera* in areas. This habitat unit did however provide suitable habitat for a number of National Forest Act, 1998, (Act 84 of 1998, amended in September 2011) (NFA) and Northern Cape Nature Conservation Act, 2009 (Act 9 of 2009) (NCNCA) protected floral species and is of intermediate ecological importance and sensitivity;

- The Degraded Bushveld includes the NSS (2018) vegetation type *Acacia* dominated vegetation in recovery, as well as the rehabilitated mine dumps, and the outer slopes of the currently utilised mine dumps, where vegetation has managed to re-establish. This habitat unit has been severely degraded, comprising largely of grasses and a few scattered trees. This habitat unit still provided habitat for NFA protected trees, although a lower abundance of individuals was recorded as opposed to the Kathu Bushveld. This habitat unit is therefore of moderately low ecological importance and sensitivity;
- Areas falling within the study area that was utilised on a regular basis for mining, or where ground clearing activities have resulted in no vegetation remaining or where vegetation was limited to Alien Invasive Plant (AIP) species was classified as transformed. Due to the lack of natural vegetation within these areas, the floral ecological importance and sensitivity is considered low; and
- A number of protected floral species were observed at the time of the assessment and include the NFA protected trees *Vachellia erioloba* and *V. haematoxylon.* Also observed was a number of NCNCA protected species, namely *Boophone disticha, Harpagophytum procumbens*, and *Tridentea sp*. It is recommended that a summer season walkdown be undertaken and all protected floral species within the final development footprint be marked by means of GPS. It is highly likely that a higher abundance of floral SCC individuals will be recorded during the summer season, when individuals are flowering. Permits will have to be obtained from the Department of Agriculture, Forestry and Fisheries (DAFF) and the Northern Cape Department Environment and Nature Conservation (NCDENC) for all protected species to be disturbed as a result of the proposed expansion activities prior to commencement. All herbaceous protected floral individuals should be rescued and relocated by a suitably qualified contractor.

3) Faunal Assessment Results

- Historical and current mining activities, in much of the study area and its immediate vicinity, have led to edge effects and a decrease in available natural faunal habitat. Furthermore, these activities continue to cause disturbances which likely repel some fauna;
- No sensitive faunal corridors will be disturbed that may limit habitat connectivity;
- Mostly commonly occurring faunal species who are known to occur throughout the region and are not considered threatened, who have broad habitat requirements enabling them to utilise various area both within and without the mine were observed within the study area;
- A single SCC was directly observed within the study area, *Orycteropus afer* (Aardvark). There is a high likelihood for a further five SCC to occur on the site: *Opistophthalmus ater* (Steinkopf Burrowing Scorpion) and two further burrowing scorpions *Opistophthalmus wahlbergii* and *Opistophthalmus carinatus* as well as *Aquila verreauxii* (Verreaux's Eagle) and *Anthus crenatus* (African Rock Pipit);
- The footprint of the proposed activities will occur directly adjacent to the current mining activities which will ensure the cumulative footprint of the entire development are compact rather than dispersed within the study area; and
- The proposed development is deemed unlikely to pose a long-term conservation threat to the faunal species diversity and assemblage in the region.

BIODIVERSITY IMPACT ASSESSMENT:

1) Floral Impact Assessment

Following the floral assessment, the impacts associated with the proposed development activities were determined. A summary of the outcome of the impact assessment is provided below.

The pre-construction phase, especially from a floral resource management perspective, is essential in ensuring that activities associated with all phases of the project have the lowest possible impact on the receiving environment. In this regard, scoring of the pre-planning phase is considered important, since although it is unlikely to result in an immediate impact, failure to effectively plan, and implement an AIP control plan, a rehabilitation plan, obtain the necessary floral permits as well as design and implement a rescue and relocation plan prior to the onset of ground clearing activities, the impact is likely to be higher during the construction and operational phase., as well as the decommissioning and closure phase.

The increased impact significance prior to mitigation is largely attributed to the loss of floral habitat and diversity not of the direct footprint but also the surrounding ecology due to AIP proliferation. The proposed development will result in a change from a largely natural landscape to hardened infrastructure, and the intensity of the impact is therefore considered to result in a moderate to permanent change in the landscape. The impact is further considered to be long-term to permanent as post development rehabilitation is unlikely to restore the floral ecology to predevelopment conditions. The impact is lastly considered definite, as floral habitat will have to be removed for the construction of the proposed infrastructure.

Table A: A summary of the impact significance on floral resources.

	Planning Phase		Construction and Operational Phase		Rehabilitation Phase	
Infrastructure Component	**Unmanaged**	**Mitigated**	**Unmanaged**	**Mitigated**	**Unmanaged**	**Mitigated**
Impact of floral Habitat and Diversity						
Top-cut stockpile	Medium	Low	High	Medium	High	Medium
Crushing and Screening Plant	Low	Very Low	Medium	Low	Medium	Very Low
Borehole Drilling	Very Low	Insignificant	Very Low	Insignificant	Very Low	Insignificant
Dewatering Pipeline Alternative 1	Low	Very Low	Medium	Low	Medium	Low
Dewatering Pipelines Alternative 2 and 3	Medium	Very Low	Medium	Low	Medium	Low
New offices, future stockpile area and contractor laydown	Low	Very Low	Low	Very Low	Low	Very Low
Manganese Rail line and road and security checkpoint	Medium	Low	High	Medium	High	Medium
Impact on Floral SCC						
Top-cut stockpile	High	Medium	High	High	Medium	Low
Crushing and Screening Plant	Low	Very Low	Medium	Low	Low	Very Low
Borehole Drilling	Very Low	Insignificant	Very Low	Insignificant	Very Low	Insignificant
Dewatering Pipeline Alternative 1	Medium	Low	Medium	Low	Medium	Low
Dewatering Pipelines Alternative 2 and 3	Medium	Low	Medium	Low	Medium	Low
New offices, future stockpile area and contractor laydown	Low	Very Low	Low	Very Low	Low	Very Low
Manganese Rail line and road and security checkpoint	High	Medium	High	High	Medium	Low

2) <u>Faunal Impact Assessment</u>

Based on the impact assessment of potential impacts on faunal habitat, diversity and SCC associated with the study areas, it is evident that the impacts arising from the proposed development will range from very low to medium for faunal habitat and diversity, and very low to medium for faunal SCC prior to the implementation of mitigation measures. With mitigation implemented, all impacts can be reduced in duration, extent and intensity. Pre-construction planning is an important step in ensuring that sensitive environments be considered during planning to ensure the lowest possible impacts are incurred to the local environment. Unabated development without proper consideration for faunal habitat will lead to higher impacts through the construction and rehabilitation phases.

Table B: Faunal impact assessment for the proposed mining activities

	Planning Phase		Construction and Operational Phase		Rehabilitation Phase	
Habitat Unit	**Unmanaged**	**Mitigated**	**Unmanaged**	**Mitigated**	**Unmanaged**	**Mitigated**
Impact of Faunal Habitat and Diversity						
Top-cut stockpile	Medium	Medium	Medium	Medium	Medium	Medium

	Planning Phase		Construction and Operational Phase		Rehabilitation Phase	
Habitat Unit	**Unmanaged**	**Mitigated**	**Unmanaged**	**Mitigated**	**Unmanaged**	**Mitigated**
Crushing and Screening Plant	**Medium**	**Very Low**	**Medium**	**Very Low**	**Low**	**Very Low**
Borehole Drilling	**Very Low**	**Insignificant**	**Very Low**	**Insignificant**	**Very Low**	**Very Low**
Dewatering Pipeline Alternative 1	**Very Low**	**Very Low**	**Very Low**	**Very Low**	**Very Low**	**Very Low**
Dewatering Pipelines Alternative 2 and 3	**Low**	**Very Low**	**Low**	**Very Low**	**Low**	**Low**
New offices, road, security checkpoint and contractor laydown	**Very Low**	**Very Low**	**Very Low**	**Very Low**	**Very Low**	**Very Low**
Manganese Rail line and additional infrastructure	**Medium**	**Low**	**Medium**	**Low**	**Low**	**Low**
Impact on Faunal SCC						
Top-cut stockpile	**Medium**	**Medium**	**Medium**	**Medium**	**Medium**	**Medium**
Crushing and Screening Plant	**Low**	**Very Low**	**Low**	**Very Low**	**Low**	**Low**
Borehole Drilling	**Very Low**	**Very Low**	**Very Low**	**Very Low**	**Very Low**	**Very Low**
Dewatering Pipeline Alternative 1	**Low**	**Low**	**Low**	**Low**	**Low**	**Low**
Dewatering Pipelines Alternative 2 and 3	**Low**	**Low**	**Low**	**Low**	**Very Low**	**Very Low**
New offices, road, security checkpoint and contractor laydown	**Very Low**	**Very Low**	**Very Low**	**Very Low**	**Very Low**	**Insignificant**
Manganese Rail line and additional infrastructure	**Medium**	**Low**	**Medium**	**Low**	**Medium**	**Medium**

Sensitivity

The section below summarise the findings of the biodiversity sensitivity assessment based on:

- the presence or potential occurrence 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.

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

Habitat Unit	Sensitivity	Development Implications
Kathu Bushveld	**INTERMEDIATE** Conservation Objective Preserve and enhance the biodiversity of the habitat unit and surrounds while optimising development potential.	This habitat unit is of intermediate ecological sensitivity. Based on the desktop assessment, this habitat unit is not of conservation importance. However, a number of protected floral species and a single faunal species were observed and is likely inhabited by several more faunal species due to the suitably available habitat and movement patterns of potential faunal SCC, contributing to the sensitivity of this habitat unit. Permits will have to be obtained from DAFF and NCDENC prior to removal/destruction of any protected faunal and floral specimens. All herbaceous protected floral and faunal species should be rescued and relocated by a suitably qualified contractor prior to any ground disturbance activities. Development within this habitat unit is not prohibited from a floral and faunal resource management perspective, although the development footprint should be minimised, and care should be taken not to disturb the surrounding natural habitat. A rehabilitation and AIP control and Management Plan should also be implemented at the onset of the commencement of the expansion activities, to limit spread of AIPs and further degradation of the surrounding floral habitat.
Degraded Bushveld	**MODERATELY LOW** Conservation Objective	This habitat unit is not considered ecologically important from a floristic perspective. The Degraded Bushveld habitat unit is no longer considered representative of the reference vegetation type, i.e. the Kathu Bushveld, and provides limited suitable habitat for floral SCC and native floral species, although a number of protected floral species were observed

Habitat Unit	Sensitivity	Development Implications
	Optimise development potential while improving biodiversity intactness of surrounding natural habitat and managing edge effects.	during the field assessment. The necessary permits will have to be obtained for the removal of all protected species prior to ground disturbance activities taking place. The habitat unit is of moderately low conservation significance. Two avian SCC may utilise this habitat, one for foraging only (Verreaux's Eagle) and the other likely breeds within this unit (African Rock Pipit). If breeding sites are recorded a suitably qualified specialist should be contacted to recommend mitigation measures. To reduce opportunities for AIPs to be exchanged between the Degraded Bushveld habitat and surrounding natural areas i.e Kathu Bushveld habitat unit during all phases of the development, an AIP management plan should be implemented for the clearance of listed alien species before expansion activities commence.
Transformed	**LOW** Conservation Objective Optimise development potential.	The Transformed Habitat is of low ecological importance and sensitivity due to the modified floral species composition of these areas comprising predominantly of bare soils or AIP species. Ecological functioning and habitat integrity are significantly compromised, and these areas should be optimised for development. Edge effect impacts on the surrounding natural vegetation should be well managed to limit the spread of AIP species to the surrounding areas. These disturbances have reduced the suitability of the habitat for faunal species who will largely avoid these locations due to the lack of resources and continuous disturbances from mine personnel and activities.

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BIODIVERSITY ASSESSMENT AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED EXPANSION ACTIVITIES AT THE MAMATWAN MINE, NEAR HOTAZEL, NORTHERN CAPE PROVINCE

Prepared for

SLR Consulting (South Africa) (Pty) Ltd

May 2020

Part A: Background Information

Prepared by: Scientific Terrestrial Services
Report author M. Meintjies
Report reviewer N. Cloete (Pr.Sci.Nat)
Report Reference: STS 190041
Date May 2020

DOCUMENT GUIDE

The following table indicates the requirements for Specialist Studies as per Appendix 6 of Government Notice 326 as published in Government Notice 40772 of 2017, amendments to the Environmental Impact Assessment (EIA) Regulations, 2014 as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998).

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Part A: Appendix E
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Part A: Appendix E
b)	A declaration that the specialist is independent	Part A: Appendix E
c)	An indication of the scope of, and the purpose for which, the report was prepared	Part A: Section 1.2 Part B: Section 1.1 Part C: Section 1.1
cA)	An indication of the quality and age of base data used for the specialist report	Part A: Section 2.1 and 3.1 Part B: Section 2 Part C: Section 2
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Part B and C
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Part A: Section 1.3 and 2 Part B, Section 2 Part C: Section 2
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Part B and C
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Part B and C
g)	An identification of any areas to be avoided, including buffers	Part B and C
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Part B and C
i)	A description of any assumptions made and any uncertainties or gaps in knowledge	Part A: Section 1.3 Part B: Section 1.3 Part C: 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	Part B and C
k)	Any mitigation measures for inclusion in the EMPr	Part B and C
l)	Any conditions for inclusion in the environmental authorisation	Part B and C
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Part B and C
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Part B and C
(iA)	Regarding the acceptability of the proposed activity or activities	Part B and C
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Part B and C
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q)	Any other information requested by the competent authority	N/A

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GLOSSARY OF TERMS

Alien and Invasive species	A species that is not an indigenous species; or an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.
Biome	A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.
CBA (Critical Biodiversity Area)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges.
Endangered	Organisms in danger of extinction if causal factors continue to operate.
Endemic species	Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g. southern Africa), national (South Africa), provincial, regional or even within a particular mountain range.
ESA (Ecological Support Area)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
IBA (Important Bird and Biodiversity Area)	The IBA Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that: are globally threatened, have a restricted range, are restricted to specific biomes/vegetation types or sites that have significant populations.
Indigenous vegetation (as per the definition in NEMA)	Vegetation occurring naturally within a defined area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Invasive species	Means any species whose establishment and spread outside of its natural distribution range; they threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species; and may result in economic or environmental harm or harm to human health
Least Threatened	Least threatened ecosystems are still largely intact.
Phyto Centres and Regions of Endemism	Most of southern Africa's endemic plants are concentrated in only a few, relatively small areas, known as regions or centres of endemism. Not only do these centres hold clues to the origin and evolution of the botanical diversity within a particular area, but these are also areas that, if conserved, would safeguard the greatest number of plant species (Van Wyk & Smith 2001).
RDL (Red Data listed) species	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
SCC (Species of Conservation Concern)	The term SCC in the context of this report refers to all RDL (Red Data) and IUCN (International Union for the Conservation of Nature) listed threatened species as well as protected species of relevance to the project.

LIST OF ACRONYMS

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

1 INTRODUCTION

Scientific Terrestrial Services (STS) was appointed to conduct a Biodiversity Assessment as part of the environmental impact assessment and authorisation process for the proposed Mamatwan Mine Project, near Hotazel, Northern Cape Province. The Mamatwan Mine (MMT) is located within the John Taolo Gaetsewe District Municipality and the Joe Morolong Local Municipality.

The MMT is situated approximately 17km south of the town of Hotazel, 32,6km north of the town of Kathu and 43km west of the town of Kuruman. The R380 runs directly adjacent to the MMT in a north-south direction from Hotazal to Kathu, the M31 roadway is located approximately 14km east of MMT and the N14 highway is located approximately 24km southeast of the MMT. The MMT Mine is situated south of the UMK Mining Right Area (MRA), and east of the Tsipi MRA. The location and extent is indicated in Figures 1 & 2.

The proposed MMT expansion activities include the following, and will henceforth collectively be referred to as the "study area" (Figure 3):

- Development of a top-cut stockpile; and crushing and screening plant;
- Construction and operation of a railway loop and associated infrastructure; and
- Installation of a pipeline: Three alternatives are proposed, with alternative 1 considered as the preferred alternative by the proponent.

The purpose of this report (Part A) is to define the biodiversity of the study area from a desktop conservation database perspective. It is the objective of this desktop assessment to provide detailed information to guide the fieldwork components (discussed in Parts B and C) to ensure that all relevant ecological aspects are considered prior to performing the field assessments. This report is not a standalone report and should be considered together with the outcome of the biodiversity assessments (Part B and C).

1.1 *Project Description*

South32 operates the opencast manganese Mamatwan Mine, part of the legal entity of Hotazel Manganese Mines (Pty) Ltd, which started operations in 1963. MMT holds the following environmental permits and authorisations:

- A Mining right (Reference number: NC 256 MR) issued and approved by the former Department of Minerals and Energy (DME) (currently the Department of Mineral Resources (DMR)) in May 2006;
- An Environmental Management Programme (EMP reference number NC 6/2/2/118) that was approved in November 2005;

- An Air Emissions Licence (AEL) (Licence number: NC/AEL/NDM/ZRH01/2014) issued by the Northern Cape Department of Environment and Nature Conservation (DENC) in March 2015;
- An amended Integrated Water Use Licence (IWUL) License number: 10/D41K/AGJ/1537) issued by the Department of Water and Sanitation (DWS) in January 2012 as amended in October 2017; and
- An Environmental Authorisation (Reference number: NC/KGA/HOT3/07) for bulk fuel storage issued by former Department of Tourism, Environment and Conservation (currently DENC) in July 2007.

MMT proposes to undertake an integrated regulatory process to cater for layout/activity changes that have already taken place as well as proposed layout/activity changes to be undertaken in future. The table below provides further information.

Table 1: Summary of the changes that have already taken place as well as proposed changes at the MMT.

1. Layout changes and activities that have already taken place	
Layout changes that have already taken place	**Activities that have already taken place**
➢ Expansion of the north eastern and south eastern waste rock dump;	➢ The use of Adam's pit for the disposal of mine wastewater, tailings and storage of product
➢ Establishment and changes to the rehabilitation criteria of waste rock dumps	➢ The abstraction of mine water from Adam's pit for dust suppression
➢ Expansion of the stockyard	➢ Irrigation of gardens and veld using treated sewage effluent
➢ Potable and process water storage facilities	
2. Proposed layout changes and activities	
Proposed layout changes	**Proposed activity changes**
➢ Establishment of a top-cut stockpile and associated crushing and screening plant	➢ Sale of waste rock as aggregate
➢ Establishment of stormwater management infrastructure	➢ Re-processing of the Dense Medium Separation (DMS) and Sinter Fines
➢ Changes to waste rock dump height	
➢ Establishment of a pipeline to transport abstracted water from Middelplaats to MMT	
➢ Upgrading the railway and railway loadout station	

All activities already in progress or layout changes already implemented (Section 1 of Table 1) for which environmental authorisation have not been obtained have been assessed by STS as part of the S24G rectification assessment (STS, 2019). The current study focused on all proposed layout/activity changes as highlighted in Section 2 of Table 1 above and are discussed in greater detail below. Refer to Figure 3 below for all proposed layout/activity changes assessed during the current field assessment.

1.1.1 Proposed layout changes and activities

Top-cut stockpile and crushing and screening plant

Additional storage space is required to stockpile top-cut material prior to processing at the sinter plant. The top-cut material will need to be subjected to crushing and screening via a mobile crushing and screening plant, prior to the material being sent to the sinter plant. The estimated height for the proposed top-cut stockpile is between 50 m and 80 m at a maximum, which corresponds with the adjacent waste rock dumps.

Abstraction boreholes and water pipeline alternatives

MMT further proposes to abstract water from the Middelplaats Mine as and when water is not available from the open pit (dewatering) or from the Vaal Gamagara Water Pipeline. Water will be abstracted via two proposed boreholes. A pipeline to transfer the water from the Middelplaats Mine to MMT will need to be established. Three alternative routes are being considered with Alternative 1 the preferred route option.

Increased capacity of the Manganese rail line

Transnet Freight Rail (TFR) plans to increase the capacity of the Manganese rail line. In order to meet the TFR expansion requirements the loading rate of trains at the MMT needs to be increased. The plan to achieve this will be through the establishment of a new railway loop, new loadout station, product stockpile areas, stacker and reclaimers (Figure 3).

New offices and parking areas

Part of the expansion will include the construction of new site offices for contractors laydown areas as well as additional parking for contractors and staff (Figure 3).

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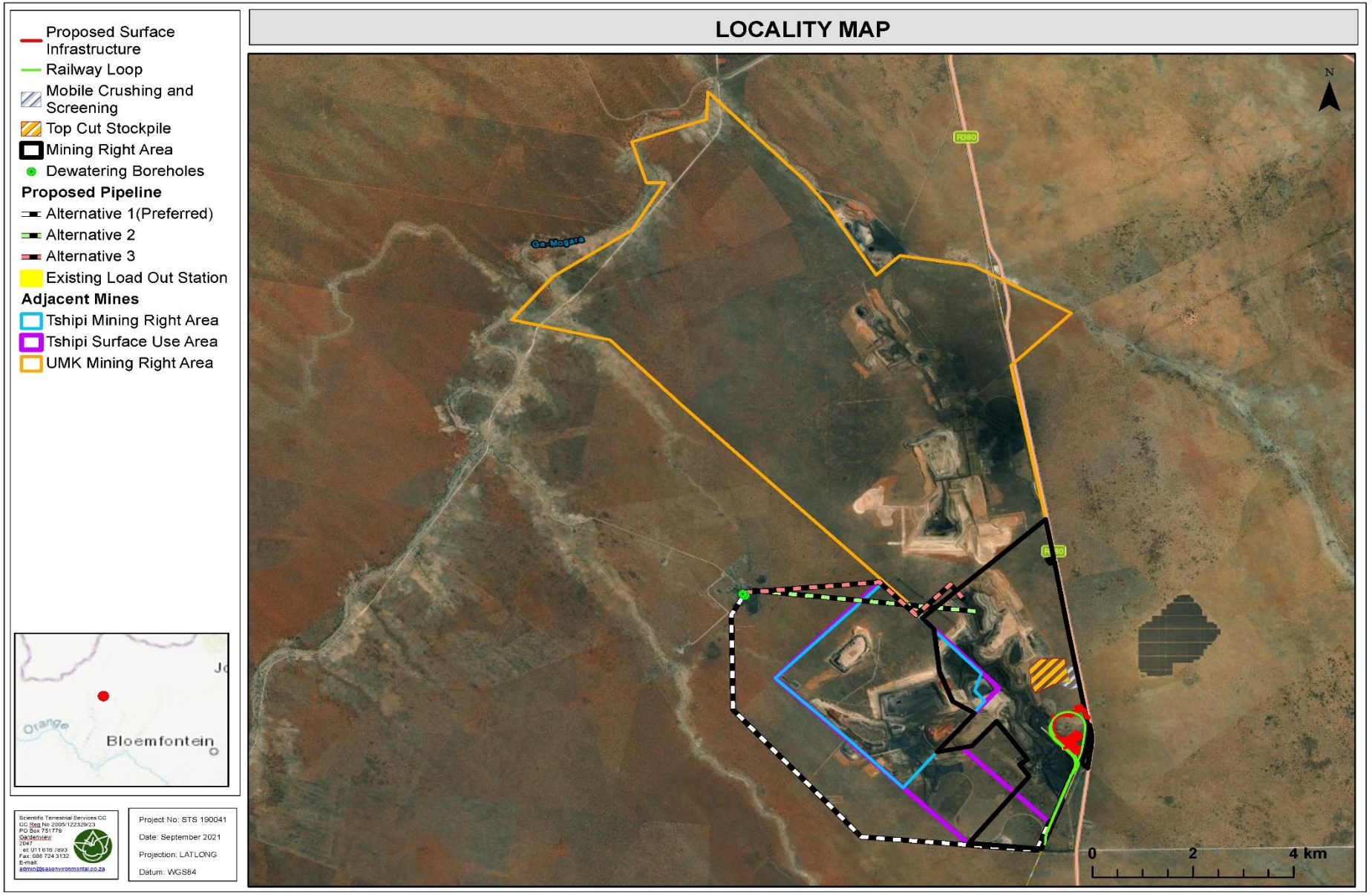

Figure 1: The Mamatwan Mining Right Area, proposed infrastructure expansion areas as well as surrounding mine boundaries indicated on digital satellite imagery.

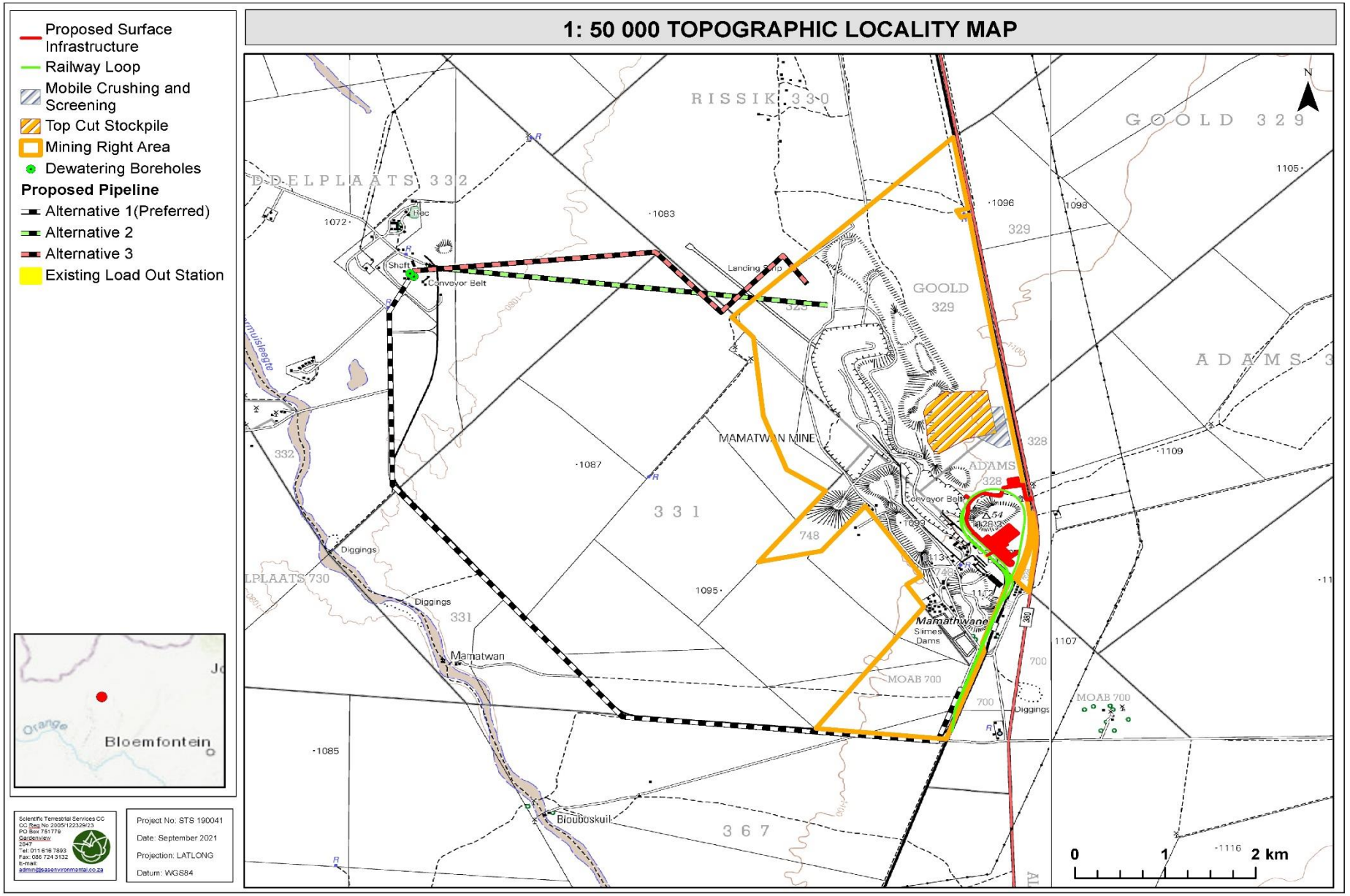

Figure 2: The study area depicted on a 1:50 000 topographical map in relation to the surrounding area.

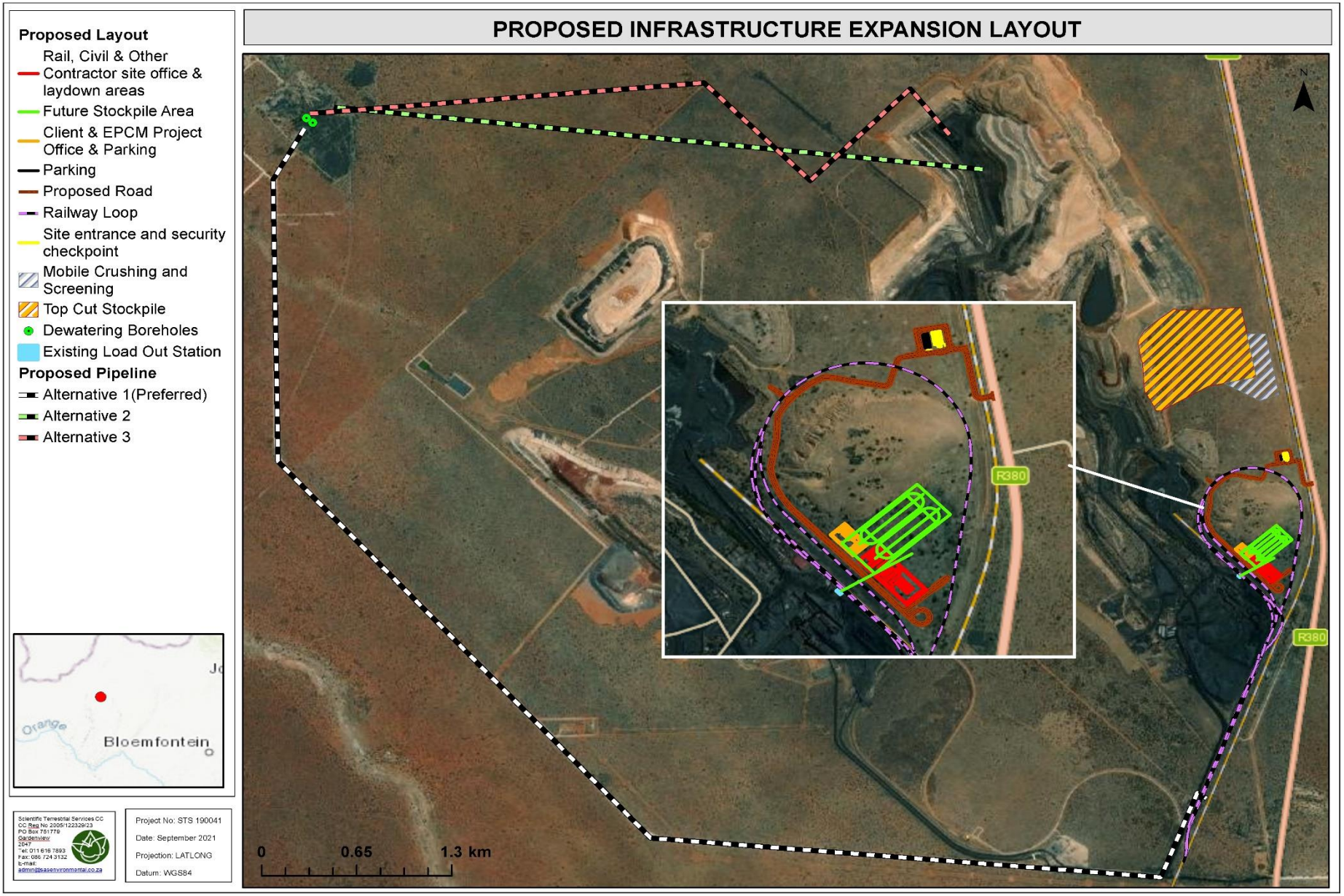

Figure 3: Proposed expansion activities of the Mamatwan Mine.

1.2 *Scope of Work*

Specific outcomes in terms of the report (Part A) are as follows:

- Compile a desktop assessment with all relevant information as presented by the South African National Biodiversity Institute (SANBI)'s Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org), including the National Biodiversity Assessment (2018), Mining and Biodiversity Guidelines (2013) and the Northern Cape Critical Biodiversity Areas database (2016);
- To outline the legislative requirements that were considered for the assessment (Appendix B); and
- To provide the methodologies followed relating to the impact assessment and development of the mitigation measures (Appendix C) that was applied in the biodiversity assessments.

1.3 *Assumptions and Limitations*

The following assumptions and limitations are applicable to this report:

- The biodiversity desktop assessment is confined to the study area and does not include detailed results of the neighbouring and adjacent properties; although the sensitivity of surrounding areas is included on the respective maps; and
- It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics within the study area at the scale required to inform the EIA process. However, this information is considered useful as background information to the study and, based on the desktop results, sufficient decision making can take place with regards to the development activities.

1.4 *Legislative Requirements*

The following legislative requirements were considered during the assessment:

- The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996);
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- The Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA)
- Government Notice R598 Alien and Invasive Species Regulations as published in the Government Gazette 37885 dated 1 August 2014 as it relates to the National Environmental Management Biodiversity Act, 1998 (Act 107 of 1998);
- The Conservation of Agricultural Resource Act, 1983 (Act No. 43 of 1983) (CARA);
- The National Forest Act, 1998 (Act No. 84 of 1998, amended 2001) (NFA);
- Government Notice 536 List of Protected Tree Species as published in the Government Gazette 41887 dated 7 September 2018 as it relates to the National Forest Act, 1998 (Act No. 84 of 1998); and
- The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA).

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

2 ASSESSMENT APPROACH

2.1 *General Approach*

Maps and digital satellite images were generated prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. Relevant databases and documentation that were considered during the assessment of the study area included:

- National Protected Areas Expansion Strategy (NPAES) Focus Areas for Protected Area Expansion, 2009 (Formally and Informally Protected Areas);
- South Africa Conservation Area Database, Quarter 3, 2019;
- South Africa Protected Area Database, Quarter 3, 2019;
- South African National Biodiversity Institute (SANBI) Threatened Species Programme (TSP);
- Northern Cape Critical Biodiversity Areas (2016);
- Mucina and Rutherford, 2018:
    - Biomes, Bioregions and Vegetation Type(s);

- National Biodiversity Assessment, 2018;
- Mining and Biodiversity Guidelines, 2013;
- Important Bird and Biodiversity Areas (IBAs), 2015, in conjunction with the South African Bird Atlas Project (SABAP2); and
- International Union for Conservation of Nature (IUCN), and Pretoria National Herbarium Computer Information Systems (PRECIS).

3 RESULTS OF THE DESKTOP ANALYSIS

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

The following section contains data accessed as part of the desktop assessment and are presented as a “dashboard” report below (Table 2). The dashboard report aims to present concise summaries of the data on as few pages as possible in order to allow for improved assimilation of results by the reader to take place. Where required, further discussion and interpretation are provided.

Table 2: Summary of the conservation characteristics for the study area – falling within the Quarter Degree Square (QDS) 2722BD.

CONSERVATION DETAILS PERTAINING TO THE STUDY AREA (VARIOUS DATABASES)	
NBA (2018) (Figure 4)	According to the National Biodiversity Assessment (2018), the majority of the study area is classified as falling within the remaining extent of the Kathu Bushveld (Least Concern (LC)), except where expansion activities are situated within existing mining areas. According to the NBA (2018), the vegetation type is poorly protected (PP). Ecosystem types are categorised as "not protected", "poorly protected", "moderately protected" and "well-protected" based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act, 2003 (Act No. 57 of 2003), and compared with the biodiversity target for that ecosystem type. Ecosystems not occurring within any protected area, or where less than 50% of the biodiversity target has been met, are considered "poorly protected".
SAPAD (2019); SACAD (2019) and NPAES (2009)	According to the National Protected Areas Expansion Strategy (NPAES, 2009) database, the South African Protected Area Database (SAPAD, 2019) and the South African Conservation Areas Database (SACAD, 2019) the study area does not fall within a protected or conservation area or nature reserve, nor is it situated within 10 km of a formal protected area.
Northern Cape CBAs (Figure 5)	According to the Northern Cape Critical Biodiversity Areas (2016) database, the study area is not associated with any CBAs, but where vegetation remains is classified as other natural areas. An **Ecological Support Area (ESA)** is however situated 320 m southwest of the Proposed Pipeline Alternative 1. This indicates that although portions within the study area is considered as natural vegetation, these areas are not considered important for preserving a specific ecosystem, species, nor is it considered important for maintaining long-term ecological functioning in the landscape as a whole
IBA (2015)	The study area does not fall within an Important Bird and Biodiversity Area (IBA, 2015), nor is it located within 10 km of an IBA.
IMPORTANCE OF THE STUDY AREA ACCORDING TO THE MINING AND BIODIVERSITY GUIDELINES (2013)	
In terms of the mining and biodiversity guidelines (2013) the study area does not fall into any biodiversity priority areas and there is therefore no mining development constraints placed on the study area.	

DESCRIPTION OF THE VEGETATION TYPE(S) RELEVANT TO THE STUDY AREA (MUCINA & RUTHERFORD 2006; 2018)						
Biome	According to Mucina and Rutherford (2012), the study area is located within the **Savanna Biome**.					
Bioregion	The proposed study area is situated within the Eastern **Kalahari Bushveld Bioregion**.					
Vegetation Type	The proposed study area falls within the **Kathu Bushveld (SVk 12)** vegetation type.					
Climate	Summer and autumn rainfall with very dry winters.					
	Altitude (m)	**MAP* (mm)**	**MAT* (°C)**	**MFD* (Days)**	**MAPE* (mm)**	**MASMS * (%)**
	960–1 300	300	18.5	27	2883	85
Distribution	Northern Cape Province: Plains from Kathu and Dibeng in the south, through Hotazel, vicinity of Frylinckspan to the Botswana border roughly between Van Zylsrus and McCarthysrus.					
Geology & Soils	Aeolian red sand and surface calcrete, deep (>1.2 m) sandy soils of Hutton and Clovelly soil forms. Land types mainly Ah and Ae, with some Ag (Mucina & Rutherford, 2012). This soil data is for the vegetation type as identified by Mucina & Rutherford as a whole, and not specific to the study area.					
Conservation	Least threatened. Target 16%. None conserved in statutory conservation areas. More than 1% already transformed, including the iron ore mining locality at Sishen, one of the biggest open-cast mines in the world. Erosion is very low.					
Vegetation & landscape features	Medium-tall tree layer with *Vachellia erioloba* in places, but mostly open and including *Boscia albitrunca* as the prominent trees. Shrub layer generally most important with, for example, *Senegalia mellifera, Diospyros lycioides* and *Lycium hirsutum*. The grass layer is variable in cover. **Biogeographically Important Taxa (Kalahari endemics)** Small Tree: *Vachellia luederitzii* var. *luederitzii*. Graminoids: *Anthephora argentea*, *Megaloprotachne albescens*, *Panicum kalaharense*. Herb: *Neuradopsis bechuanensis*.					

NORTHERN CAPE PROVINCIAL SPATIAL DEVELOPMENT FRAMEWORK (NCPSDF, 2019)
The NCPSDF is to function as an innovate strategy that will apply sustainability principles to all forms of land use management throughout the Northern Cape as well as to facilitate practical results, as it relates to the eradication of poverty and inequality and the protection of the integrity of the environment. The study area also falls within the Gamagara corridor. The Gamagara Corridor comprises the mining belt of the John Taolo Gaetsewe and Siyanda districts and runs from Lime Acres and Danielskuil to Hotazel in the north. The corridor focuses on the mining of iron and manganese.

CBA = Critical Biodiversity Areas; ESA = Ecological Support Area; IBA = Important Bird and Biodiversity Areas; 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); NBA = National Biodiversity Assessment; NPAES = National Protected Areas Expansion Strategy; SACAD = South African Conservation Areas Database, SAPAD = South African Protected Areas Database.

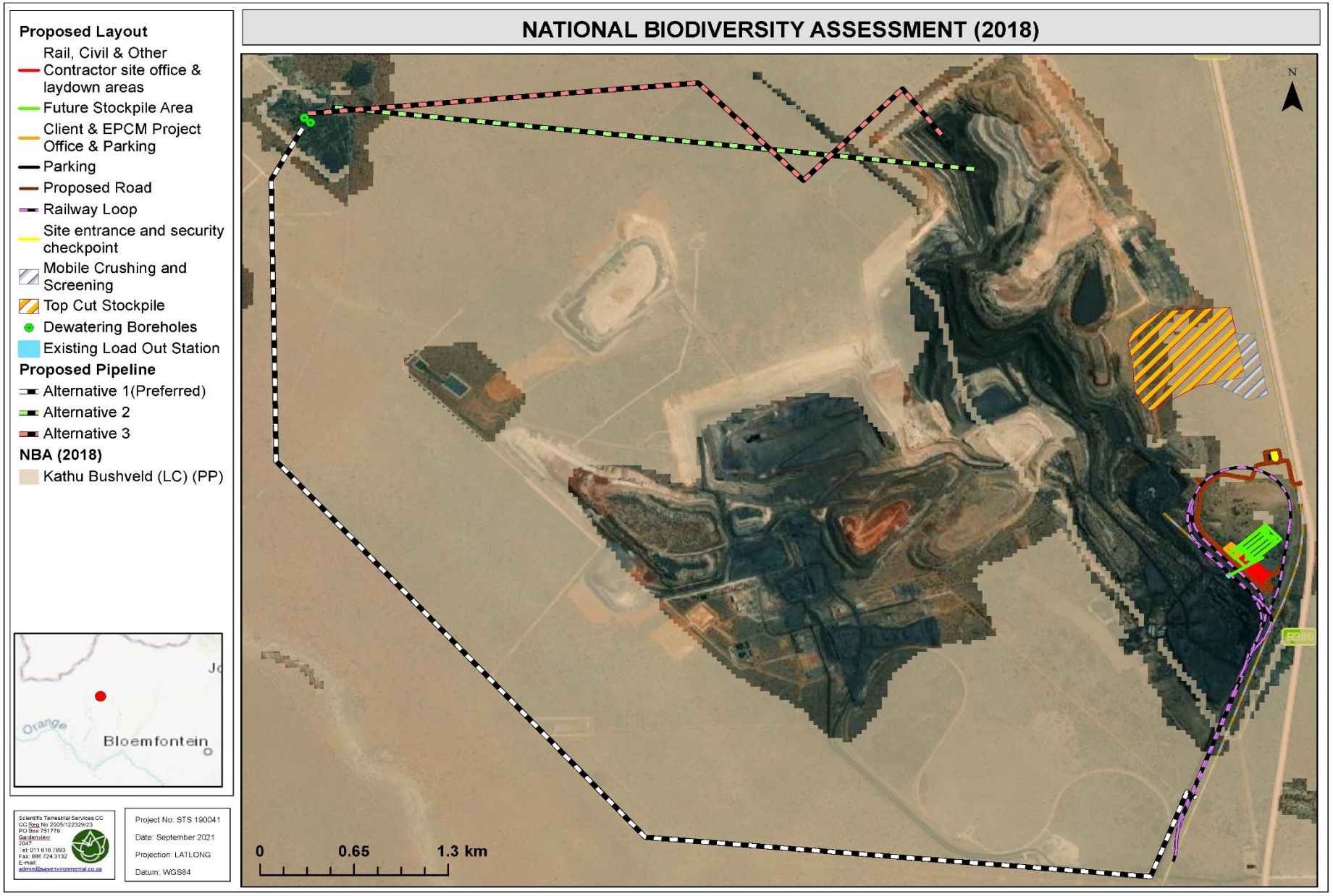

Figure 4: Remaining extent of the Kathu Bushveld (LC) (PP) vegetation type according to the National Biodiversity Assessment (2018).

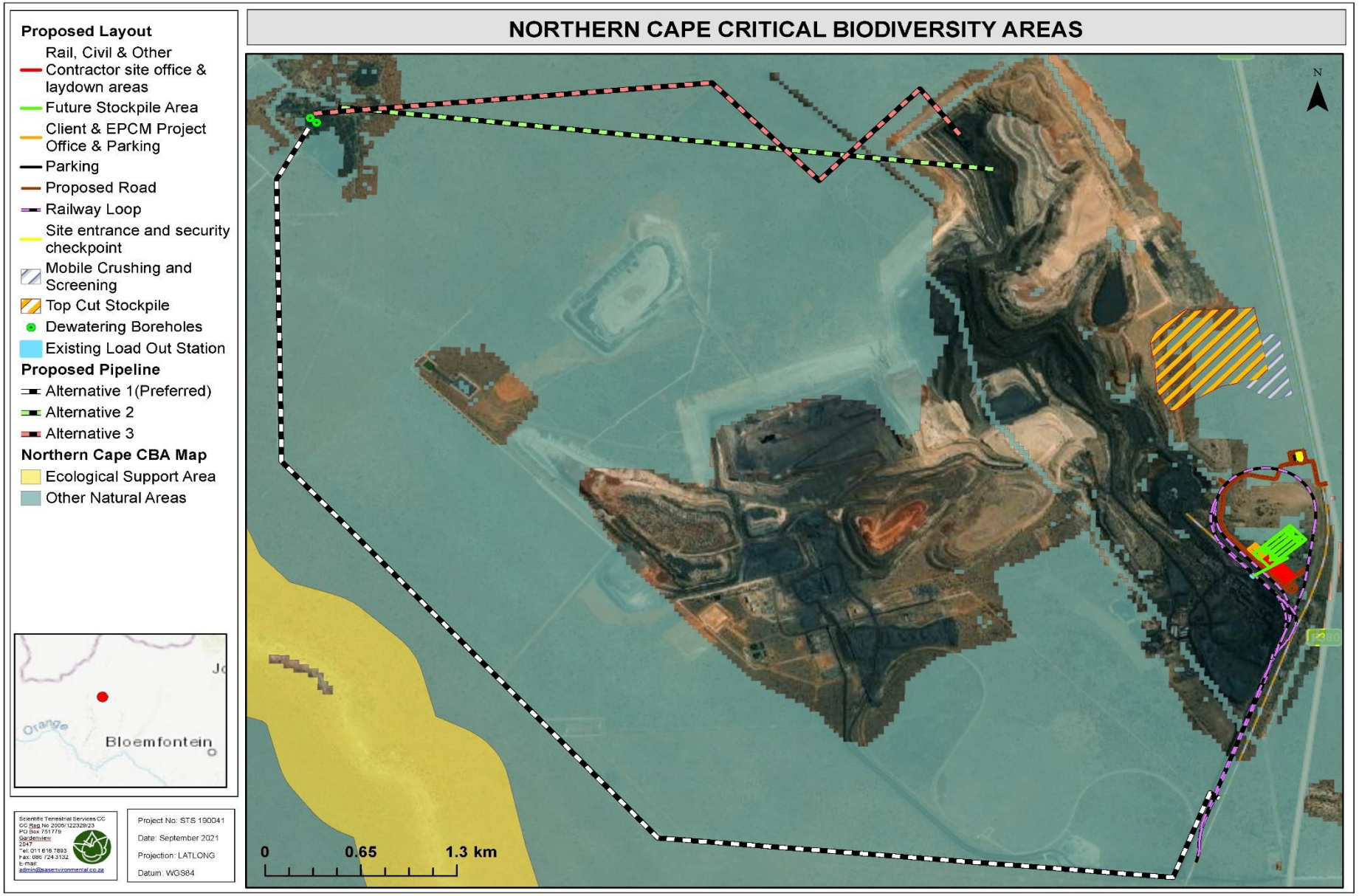

Figure 5: Ecological Support Areas (ESA) in close proximity to the study area according to the Northern Cape CBA Map (2016).

4 STRUCTURE OF THE REPORT

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

Part B presents the results of the floral field assessment, data analyses and discussion of the results. The section then presents the results of the impact assessment where the impacts on floral ecology and biodiversity are discussed.

Part C presents the results of the faunal field assessment, data analyses and discussion of the results. The section then presents the results of the impact assessment where the impacts on faunal ecology and biodiversity are discussed.

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APPENDIX A: Indemnity and Terms of Use of this Report

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

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APPENDIX B: Legislative Requirements

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

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

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

The National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) and the associated Environmental Impact Assessment (EIA) Regulations (GN R326 as amended in 2017 and well as listing notices 1, 2 and 3 (GN R327, R325 and R324 of 2017), 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 Environmental Impact Assessment process depending on the nature of the activity and scale of the impact.

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

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

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

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

- The management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity;
- The use of indigenous biological resources in a sustainable manner;
- The fair and equitable sharing among stakeholders of the benefits arising from bioprospecting 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.

Government Notice 598 Alien and Invasive Species Regulations (2014), including the Government Notice 864 Alien Invasive Species List as published in the Government Gazette 40166 of 2016, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004);

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

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

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

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

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

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

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

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

September 2011)

According to the department of Agriculture, Land Reform and Rural Development (previously the Department of Agriculture, Forestry and Fisheries (DAFF)) ©2019 website (https://www.daff.gov.za/daffweb3/): "In terms of the National Forests Act of 1998 certain tree species (types of trees) can be identified and declared as protected. The Department of Water Affairs and Forestry followed an objective, scientific and participative process to arrive at the new list of protected tree species, enacted in 2004. All trees occurring in natural forests are also protected in terms of the Act. Protective actions take place within the framework of the Act as well as national policy and guidelines. Trees are protected for a variety of reasons, and some species require strict protection while others require control over harvesting and utilization."

Applicable sections of the NFA pertaining to the proposed project include the below:

<u>Section 12:</u>
Declaration of trees as protected
(1) The Minister may declare-

a) particular tree,
b) a particular group of trees,
c) a particular woodland; or
d) trees belonging to a particular species,
to be a protected tree, group of trees, woodland or species.

(2) The Minister may make such a declaration only if he or she is of the opinion that the tree, group of trees, woodland or species is not already adequately protected in terms of other legislation.

(3) In exercising a discretion in terms of this section, the Minister must consider the principles set out in section 3(3) of the NFA.

Section 15(1):
No person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence granted by the Minister or in terms of an exemption from the provisions of this subsection published by the Minister in the Gazette.

Contravention of this declaration is regarded as a first category offence that may result in a person who is found guilty of being.

For the latest list of protected trees refer to: Government Notice 536 List of Protected Tree Species as published in the Government Gazette 41887 dated 7 September 2018.

The Northern Cape Nature Conservation Act (NCNCA, Act No 9 of 2009)

The purpose of this Act is to provide for the sustainable utilisation of wild animals, aquatic biota and plants; to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; to provide for offences and penalties for contravention of the Act; to provide for the appointment of nature conservators to implement the provisions of the Act; to provide for the issuing of permits and other authorisations; and to provide for matters connected therewith.

Restricted activities involving specially protected plants:
49(1) No person may, without a permit –
(a) Pick;
(b) Import;
(c) Export;
(d) Transport;
(e) Possess;
(f) Cultivate; or
(g) Trade in,
A specimen of a specially protected plant
Restricted activities involving protected plants
50 (1) Subject to the provision of section 52, no person may, without a permit –
(a) Pick;
(b) Import;
(c) Export;
(d) Transport;
(e) Cultivate; or
(f) Trade in,
A specimen of a protected plant.

APPENDIX C: Impact Assessment Methodology

Ecological Impact Assessment Method

The method to be used for assessing risks/impacts is outlined in the sections below.

PART A: DEFINITIONS AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, spatial extent and duration**
Criteria for ranking of the INTENSITY of environmental impacts	**VH**	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilisation against the project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. A small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	**VL**	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	M	Medium-term, 5 to 10 years.
	H	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	VH	Very long, permanent, +20 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	**VL**	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	Regional/National

PART B: DETERMINING CONSEQUENCE							
INTENSITY = VL							
DURATION	Very long	**VH**	**Low**	**Low**	**Medium**	**Medium**	**High**
	Long term	**H**	**Low**	**Low**	**Low**	**Medium**	**Medium**
	Medium term	**M**	**Very Low**	**Low**	**Low**	**Low**	**Medium**
	Short term	**L**	**Very low**	**Very Low**	**Low**	**Low**	**Low**
	Very short	**VL**	**Very low**	**Very Low**	**Very Low**	**Low**	**Low**
INTENSITY = L							
DURATION	Very long	**VH**	**Medium**	**Medium**	**Medium**	**High**	**High**
	Long term	**H**	**Low**	**Medium**	**Medium**	**Medium**	**High**
	Medium term	**M**	**Low**	**Low**	**Medium**	**Medium**	**Medium**
	Short term	**L**	**Low**	**Low**	**Low**	**Medium**	**Medium**
	Very short	**VL**	**Very low**	**Low**	**Low**	**Low**	**Medium**
INTENSITY = M							
DURATION	Very long	**VH**	**Medium**	**High**	**High**	**High**	**Very High**
	Long term	**H**	**Medium**	**Medium**	**Medium**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**Medium**	**High**	**High**
	Short term	**L**	**Low**	**Medium**	**Medium**	**Medium**	**High**
	Very short	**VL**	**Low**	**Low**	**Low**	**Medium**	**Medium**
INTENSITY = H							
DURATION	Very long	**VH**	**High**	**High**	**High**	**Very High**	**Very High**
	Long term	**H**	**Medium**	**High**	**High**	**High**	**Very High**
	Medium term	**M**	**Medium**	**Medium**	**High**	**High**	**High**
	Short term	**L**	**Medium**	**Medium**	**Medium**	**High**	**High**
	Very short	**VL**	**Low**	**Medium**	**Medium**	**Medium**	**High**
INTENSITY = VH							
DURATION	Very long	**VH**	**High**	**High**	**Very High**	**Very High**	**Very High**
	Long term	**H**	**High**	**High**	**High**	**Very High**	**Very High**
	Medium term	**M**	**Medium**	**High**	**High**	**High**	**Very High**
	Short term	**L**	**Medium**	**Medium**	**High**	**High**	**High**
	Very short	**VL**	**Low**	**Medium**	**Medium**	**High**	**High**
			VL	**L**	**M**	**H**	**VH**
			A part of the site/ property	Whole site	Beyond the site, affecting neighbours	Extending far beyond site but localised	Regional/ National
			EXTENT				

PART C: DETERMINING SIGNIFICANCE							
PROBABILITY (of exposure to impacts)	Definite/ Continuous	**VH**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Probable	**H**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Possible/ frequent	**M**	**Very Low**	**Very Low**	**Low**	**Medium**	**High**
	Conceivable	**L**	**Insignificant**	**Very Low**	**Low**	**Medium**	**High**
	Unlikely/ improbable	**VL**	**Insignificant**	**Insignificant**	**Very Low**	**Low**	**Medium**
			VL	**L**	**M**	**H**	**VVH**
			CONSEQUENCE				

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
Very High	Potential fatal flaw unless mitigated to lower significance.
High	It must have an influence on the decision. Substantial mitigation will be required.
Medium	It should have an influence on the decision. Mitigation will be required.
Low	Unlikely that it will have a real influence on the decision. Limited mitigation is likely required.
Very Low	It will not have an influence on the decision. Does not require any mitigation
Insignificant	Inconsequential, not requiring any consideration.

***VH = very high, H = high, M= medium, L= low and VL= very low and + denotes a positive impact.**

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[1]:

- 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;
- **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;

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

- **Functional rehabilitation** which focuses on ensuring that the ecological functionality of the ecological resources on the focus 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.[2]

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[3] 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.

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

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

APPENDIX D: Vegetation Types

Kathu Bushveld (SVk 12)

Figure D1: Open savanna dominated by *Vachellia erioloba*, *Senegalia mellifera* and *Grewia flava* with low cover of *Stipagrostis ciliate* against the red sand east of Oupos, in the Kuruman District north of Kathu. Photo reference: Mucina and Rutherford (2012) p. 522.

Remark One of the most strikingly dominant areas of fairly tall *Vachellia erioloba* is centred on the town of Kathu, which was built around many of these trees.

Table D1: Dominant & typical floristic species of Kathu Bushveld (Mucina & Rutherford, 2012)

Group	Species
Woody Species	
Tall tree	*Vachellia erioloba* (d)
Small trees	*Boscia albitrunca* (d), *Senegalia mellifera* subsp. *detinens* (d), *Terminalia sericea*.
Tall shrubs	*Diospyros lycioides* subsp. *lycioides* (d), *Dichrostachys cinerea*, *Grewia flava*, *Gymnosporia buxifolia*, *Rhigozum brevispinosum*
Low shrubs	*Aptosimum decumbens*, *Grewia retinervis*, *Nolletia arenosa*, *Sida cordifolia*, *Tragia dioica*
Herbaceous species	
Herbs	*Acrotome inflata*, *Erlangea misera*, *Gisekia africana*, *Heliotropium ciliatum*, *Hermbstaedtia fleckii*, *Hermbstaedtia odorata*, *Limeum fenestratum*, *Limeum viscosum*, *Lotononis platycarpa*, *Senna italica* subsp. *arachoides*, *Tribulus terrestris*
Graminoids	
Grasses	*Aristida meridionalis* (d), *Brachiaria nigropedata* (d), *Centropodia glauca* (d), *Eragrostis lehmanniana* (d), *Schmidtia pappophoroides* (d), *Stipagrostis ciliata* (d), *Aristida congesta*, *Eragrostis biflora*, *Eragrostis chloromelas*, *Eragrostis heteromera*, *Eragrostis pallens*, *Melinis repens*, *Schmidtia kalahariensis*, *Stipagrostis uniplumis*, *Tragus berteronianus*.

***(d) – Dominant species for the vegetation type**

APPENDIX E: Declaration and Specialists CV's

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

Marelie Meintjies	BSc Plant Science (University of Pretoria)
Daryl van der Merwe	MSc. Cand. (Conservation Biology) (University of Cape Town)
Nelanie Cloete	MSc Botany and Environmental Management (University of Johannesburg)
Christopher Hooton	BTech Nature Conservation (Tshwane University of Technology)
Kim Marais	BSc (Hons) Zoology (Herpetology) (University of the Witwatersrand)
Stephen van Staden	MSc Environmental Management (University of Johannesburg)

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

Company of Specialist:	Scientific Terrestrial Services		
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E-mail:	Nelanie@sasenvgroup.co.za		
Qualifications	MSc Environmental Management (University of Johannesburg) MSc Botany (University of Johannesburg) BSc (Hons) Botany (University of Johannesburg) BSc (Botany and Zoology) (Rand Afrikaans University)		
Registration / Associations	Professional member of the South African Council for Natural Scientific Professions (SACNASP) Member of the South African Association of Botanists (SAAB) Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa group Member of the Grassland Society of South Africa (GSSA)		

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	2007	Cell:	082 442 7637
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

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

I, Marelie Meintjies, declare that -

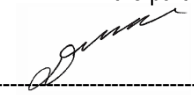
- I act as the **independent specialist** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity 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

Signature of the Specialist

I, Daryl van der Merwe, declare that -

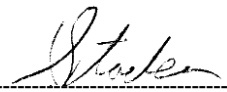
- I act as the **independent specialist** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

I, Stephen van Staden, declare that -

- I act as the **independent specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

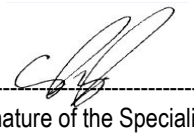
I, Nelanie Cloete, declare that -

- I act as the **independent specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

Signature of the Specialist

I, Christopher Hooton, declare that -

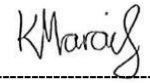
- I act as the **independent specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

I, Kim Marais, declare that -

- I act as the **independent specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF MARELIE MEINTJIES

PERSONAL DETAILS

Position in Company	Junior Field Biologist
Date of Birth	8 July 1986
Nationality	South African
Languages	English, Afrikaans
Joined SAS Group of Companies	April 2015

EDUCATION

Qualifications

MSc Medicinal Plant Science (University of Pretoria)	2014
BSc (Hons) Medicinal Plant Science (University of Pretoria)	2012
BSc Biotechnology (University of Pretoria)	2011

COUNTRIES OF WORK EXPERIENCE

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

SELECTED PROJECT EXAMPLES

Terrestrial Assessments

- Floral Ecological Assessment as part of the Environmental Assessment and Authorisation Process for the proposed Leslie 2 underground coal mining operation, Gauteng Province.
- Floral Ecological Assessment as part of the Environmental Assessment and Authorisation Process for the proposed development of Zwavelpoort 373-JR Portions 116 and 130, Pretoria, Gauteng Province
- Floral Ecological assessment for the Jeannette Expansion Project at the Taung Gold International Mine near Welkom, Free State Province.
- Terrestrial Sensitivity Scan as part of the Environmental Authorisation Process for the proposed Sagewood Ext 17 development within the Summerset Area, Gauteng
- Terrestrial Sensitivity Scan as part of the Environmental Authorisation Process for the proposed Kyalami X4 development, Midrand, Gauteng Province
- Terrestrial Ecological Sensitivity Scan as part of the Environmental Assessment and Authorisation Process for the proposed development on erf 199, Witfield, Boksburg, Gauteng Province
- Terrestrial Ecological Scan as part of the Environmental Authorisation Process for the proposed development of Witfontein Ext 87, Gauteng province
- Terrestrial Sensitivity Scan as part of the environmental impact assessment and authorisation process for the proposed development of a pipeline in Kriel, Mpumalanga Province.

Desktop Ecological Assessments

- Aquatic and Wetland Scoping Assessment as part of the Environmental Assessment and Authorisation Process for the Proposed Witfontein Mining Project, near Bethal, Mpumalanga Province
- Freshwater Resource Scoping Assessment as part of the Environmental Assessment and Authorisation Process for the Proposed Photovoltaic Solar Energy Facility on the Heuningklip Farm near Vredenburg, Western Cape Province
- Desktop Ecological Assessment and Site Sensitivity Report as part of the Environmental Assessment and Authorisation Process prior to Prospecting Activities on the Farm Zeekoebaart 306 Rd, Postmasburg, Northern Cape Province
- Desktop Ecological Assessment as part of the environmental assessment and authorisation process for the Genet Manganese (Pty) Ltd prospecting area on the farm Lemoenkloof No 456, Northern Cape Province.

Screening Assessment

- Desktop Ecological Assessment and Field Verification Report as part of the Screening Assessment for the Proposed Soweto Power Park Ext 3, Gauteng Province

Miscellaneous Projects

- Desktop Ecological Assessment and Site Sensitivity Report as part of the Elikhulu TSF Facility site selection process, Evander, Mpumalanga Province
- Ecological Screening Assessment, Ground Truthing and Site Sensitivity Report for the Proposed Tubatse SEZ. Steelpoort, Limpopo Province
- Identification of Important Medicinal Plant Species to be rescued and relocated as part of the Rescue and Relocation Plan for the area earmarked for surface infrastructure at the Yzermyn Colliery near Dirkiesdorp, Mpumalanga
- Biodiversity Survey for the BMW Group South Africa at the Rosslyn Manufacturing Plant, Rosslyn, Gauteng Province
- Biodiversity and Ecosystem Health for Limpopo Province, South Africa Thematic Chapter as part of Limpopo Environmental Outlook Report
- Literature Review and Initial Assessment on the control of Alien and Invasive Plants associated with aquatic environments within the City of Johannesburg

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION – DARYL VAN DER MERWE

PERSONAL DETAILS

Position in Company	Ecologist
Date of Birth	28 May 1990
Nationality	South African
Languages	English, Afrikaans
Joined SAS Group of Companies	2019

EDUCATION

Qualifications

BSc Environmental Sciences (University of Pretoria)	2014
BSc (Honours) Plant Science (University of Pretoria)	2015
MSc Conservation Biology Candidate (University of Cape Town)	2019

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga and Limpopo

SELECTED PROJECT EXAMPLES

Faunal Assessments

- Terrestrial report as part of environmental assessment and authorisation process for the proposed sewer pipeline from the Dal Fouche Mine to Impala Mine between Springs and Brakpan, Gauteng Province
- Faunal and floral ecological assessment as part of the environmental assessment and authorisation process for the proposed Khwezela Dragline route from the Kromdraai section to Navigation section of the Anglo American LANDAU Colliery near Emalahleni in the Mpumalanga Province

Previous Work Experience

- Two years of environmental consulting at Polygon Environmental Planning, Tzaneen, Limpopo.

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

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

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

EDUCATION

Qualifications

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

COUNTRIES OF WORK EXPERIENCE

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

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

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

REFERENCES

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

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

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

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

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2013
MSc Botany (University of Johannesburg)	2007
BSc (Hons) Botany (University of Johannesburg)	2005
BSc (Botany and Zoology) (Rand Afrikaans University)	2004
Short Courses	
Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017

COUNTRIES OF WORK EXPERIENCE

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

SELECTED PROJECT EXAMPLES

Floral Assessments

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

Environmental and Ecological Management Plans

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

- Development of the Limpopo Province Environmental Outlook Report.

Permit applications for protected tree and floral species

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

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTOPHER HOOTON

PERSONAL DETAILS

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

EDUCATION

Qualifications

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

COUNTRIES OF WORK EXPERIENCE

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

SELECTED PROJECT EXAMPLES

Faunal Assessments

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

Previous Work Experience

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

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF KIM MARAIS

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered member of the South African Council for Natural Scientific Professions (SACNASP 117137/17)

EDUCATION

Qualifications

Short course in the identification of Aquatic and wetland plants	2019
Short course in Tools for Wetland Assessment (Rhodes University)	2018
Certificate in Environmental Law for Environmental Managers (CEM)	2014
Certificate for Introduction to Environmental Management (CEM)	2013
BSc (Hons) Zoology (Herpetology) (University of the Witwatersrand)	2012
BSc (Zoology and Environment, Ecology and Conservation) (University of Witwatersrand)	2011

COUNTRIES OF WORK EXPERIENCE

South Africa – All Provinces

West Africa – Uganda

SELECTED PROJECT EXAMPLES

Faunal Screening Assessments

- Faunal Screening as part of the Brand se Baai Mining expansion, West Coast, Western Cape.
- Faunal Screening for the proposed Vergenoegd residential estate, Cryodon, Western Cape.
- Faunal Screening as part of the baseline investigation of the Swartklip Site for the proposed Cape Town international Airport Wetland Offset, Khayalitscha, Western Cape.
- Faunal screening for the proposed Glengary development, Durbanville, Western Cape.

Wetland Delineation and Wetland Function Assessment

Various **Freshwater Assessments**, including:

- Wetland Offset Plan for the Cape Town International Airport, Cape Town.
- Wetland offset investigation for the proposed Idas Valley residential development, Stellenbosch, Western Cape.
- Freshwater Assessment for the Swartklip Site as part of the Cape Town International Airport Wetland Offset requirements, Cape Town.
- Freshwater Assessment for the proposed road upgrades to Protea and Waarburgh Roads, Joostenbergvlakte, Western Cape.
- Freshwater Verification and Risk Assessment for the proposed upgrading of road culverts associated with the Main Road 287, 288 and trunk road 32/1, Bonnievale, Western Cape.
- Freshwater Assessment for the installation of a side cut drain north of the existing Kleinmond cemetery, Kleinmond, Western Cape.

- Freshwater Assessment for the proposed Melkhoutfontein residential development and associated services, Stillbaai, Western Cape.
- Freshwater Assessment associated with the Section 24G rectification process for the unauthorised dams within Tierhoek, Citrusdal, Western Cape.
- Freshwater Assessment associated with the Section 24G rectification process for the unauthorised Kleinberg dams, Citrusdal, Western Cape.
- Freshwater Assessment for the proposed sediment removal from an existing irrigation dam and installation of a sediment containment system at the Boschenmeer Golf Estate, Paarl, Western Cape.
- Freshwater Assessment for the proposed Heuningklip Solar Farm, Vredenburg, Western Cape.
- Freshwater screening for the proposed Doornfontein Solar Farm, Velddrift, Western Cape.
- Freshwater Screening for the proposed Valentia underground shooting range, Paarl, Western Cape.
- Freshwater Assessment for the proposed Baden Powell Industrial development, Western Cape.
- Freshwater Assessment for the decommissioning of five landfill sites within the Drakenstein Municipality, Western Cape.
- Freshwater Assessment for the proposed De Hoop Residential Development, southern Paarl, Western Cape.
- Freshwater assessment for the proposed Vredenburg Wind Energy Facility, Vredenburg, Western Cape.
- Wetland Assessment for the proposed Excelsior Wind Energy Farm and associated powerline infrastructure, Swellendam, Western Cape.
- Wetland Assessment for the sewage Bulk Service System for the Drakenstein Municipality, Paarl, Western Cape.
- Freshwater screening for the proposed Vendome residential Development, Paarl, Western Cape.
- Wetland Assessment for the Riverclub Development for the Val de Vie development, Paarl, Western Cape.
- Wetland Assessment for the Riverfarm Development for the Val de Vie development, Paarl, Western Cape.
- Wetland Assessment for the development of three agricultural dams for irrigation of crops, Cape Farms, Western Cape.
- Wetland Assessment for the Willow Wood Estate Sewage pipeline upgrade, D'Urbanvale, Western Cape.
- Wetland Assessment for the rectification of infilling of a freshwater feature, D'Urbanvale, Western Cape.
- Freshwater Assessment for the stabilisation of the Franschhoek River embankment, Leeu Estates, Franschhoek, Western Cape.
- Freshwater Assessment for the proposed Helderburg Hospital, Somerset West, Western Cape.
- Freshwater Assessment for the Vergenoegd Wine Estate, Cryodon, Western Cape.
- Freshwater assessment for the proposed upgrade of the community school, Elandsdift farm, Sir Lowry's Pass, Western Cape.

Various **Freshwater Rehabilitation and Management Plans**, including:

- Detailed Method Statement for the rehabilitation and Maintenance of the wetland associated with the Gentleman's Estate Plots, Val de Vie, Paarl, Western Cape.
- Detailed method statement for the rectification and rehabilitation of a storm water system, D'Urbanvale, Western Cape.
- Rehabilitation Plan for the proposed de Hoop Residential Development, Paarl, Western Cape.
- Rehabilitation Plan for the proposed abstraction and storage of water from the Diep River in a 500,000m^3 dam, Durbanville, Western Cape.
- Rehabilitation Plan for the proposed bulk water pipeline over the Kuils River, Belhar, Western Cape.
- Rehabilitation and implementation plan for the proposed IDas Valley residential development offset requirements, Stellenbosch, Western Cape.

Water Use Authorisations and ECO input

- WUA for the SANRAL N3 De Beers Pass Section within the Free State and KwaZulu-Natal.
- Assistance with the WULA for the Mzimvubu Water Project, Eastern Cape.
- WUA for the Excelsior Wind Energy Farm and associated powerline infrastructure, Swellendam, Western Cape.
- WUA for the Golden Valley Phase II Wind Energy Facility, Eastern Cape.
- WUA for the Sewage Bulk Service system for the Val de Vie Polo and Lifestyle Estate, Paarl, Western Cape.
- WUA for the Riverfarm Development for the Val de Vie Polo and Lifestyle Estate, Paarl, Western Cape.
- WUA for the Pearl Valley II Development for the Val de Vie Polo and Lifestyle Estate, Paarl, Western Cape.
- WUA for the Levendal Village for the Val de Vie Polo and Lifestyle Estate, Paarl, Western Cape.
- WUA for a residential Development, Klapmuts, Western Cape.
- WUA for the Riverclub Development for the Val de Vie Polo and Lifestyle Estate, Paarl, Western Cape.
- WUA for the proposed Copperton Wind Energy Facility, Northern Cape.
- WUA for the proposed bulk water pipeline crossing over the Kuils River, Bellville, Western Cape.
- WUA for the proposed Vergenoegd Village residential development near Crydon, Western Cape.
- Validation and Verification process of three farms in Franschhoek, Western Cape.
- Validation and Verification process for Farm 1165 in Durbanville, Western Cape.
- WUA for the De Hoop Lifestyle Estate, Paarl, Western Cape.
- WUA for the proposed Platrug Dam with storage capacity of 500,000m^3, Western Cape.

- WUA for the proposed Boland Park residential development, Western Cape.
- WUA for the proposed Symphony Way residential development, Delft, Western Cape.
- WUA for the proposed abstraction and storage of groundwater on erf 3239 and Farm Watervliet 1224, Paarl, Western Cape.
- WUA for the proposed abstraction of groundwater as part of the Belhar development, Belhar, Western Cape.

Specialist **Environmental Control Work**

- ECO of WUL conditions for the proposed bridge and access road over the Berg River, Val de Vie Estate, Paarl.
- ECO of WUL conditions for the proposed bulk water pipeline over the Kuils River, City of Cape Town, Belhar, Western Cape.
- ECO of WUL conditions for the proposed Riverclub residential development, Paarl, Western Cape.
- Various specialist freshwater input into EMP's and landscape plans, Western Cape.

SCIENTIFIC TERRESTRIAL SERVICES

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www.sasenvironmental.co.za

BIODIVERSITY ASSESSMENT AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED EXPANSION ACTIVITIES AT THE MAMATWAN MINE, NEAR HOTAZEL, NORTHERN CAPE PROVINCE

Prepared for

SLR Consulting (South Africa) (Pty) Ltd

May 2020

Part B: Floral Assessment

Prepared by: Scientific Terrestrial Services
Report author M. Meintjies
Report reviewer N. Cloete (Pr.Sci.Nat)
Report Reference: STS 190041
Date May 2020

DOCUMENT GUIDE

The following table indicates the requirements for Specialist Studies as per Appendix 6 of Government Notice 326 as published in Government Notice 40772 of 2017, amendments to the Environmental Impact Assessment (EIA) Regulations, 2014 as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998).

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Part A: Appendix E
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Part A: Appendix E
b)	A declaration that the specialist is independent	Part A: Appendix E
c)	An indication of the scope of, and the purpose for which, the report was prepared	Part A: Section 1.2 Part B: Section 1.2
cA)	An indication of the quality and age of base data used for the specialist report	Part A: Section 2.1 and 3.1 Part B: Section 2
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Part B: Section 5
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Part A: Section 1.2 and 2 Part B: Section 1.2
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Part B: Appendix A
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	Part B: Section 4
g)	An identification of any areas to be avoided, including buffers	Part B: Section 4
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Part B: Section 4
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Part A: Section 1.3 Part B: Section 1.2
j)	A description of the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Part B: Section 3 and 5
k)	Any mitigation measures for inclusion in the EMPr	Part B: Section 5
l)	Any conditions for inclusion in the environmental authorisation	Part B: Section 5
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Part B: Section 5
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Part B: Section 6
(iA)	Regarding the acceptability of the proposed activity or activities	Part B: Section 5
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Part B: Section 5
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q)	Any other information requested by the competent authority	N/A

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LIST OF ACRONYMS

CBA	Critical Biodiversity Area
CR	Critically Endangered
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EN	Endangered
ESA	Ecological Support Area
GIS	Geographic Information System
GPS	Global Positioning System
IUCN	International Union for the Conservation of Nature
MPRDA	Mineral and Petroleum Resource Development Act
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)
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 Listed
SABAP 2	Southern African Bird Atlas 2
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
STS	Scientific Terrestrial Services CC
TOPS	Threatened or Protected Species
TSP	Threatened Species Programme
VU	Vulnerable

GLOSSARY OF TERMS

Alien and Invasive species	A species that is not an indigenous species; or an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.
Biome	A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.
CBA (Critical Biodiversity Area)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges.
Endangered	Organisms in danger of extinction if causal factors continue to operate.
Endemic species	Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g. southern Africa), national (South Africa), provincial, regional or even within a particular mountain range.
ESA (Ecological Support Area)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
Indigenous vegetation (as per the definition in (NEMA)	Vegetation occurring naturally within a defined area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Integrity (ecological)	The integrity of an ecosystem refers to its functional completeness, including its components (species) its patterns (distribution) and its processes.
Least Threatened	Least threatened ecosystems are still largely intact.
RDL (Red Data listed) species	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
SCC (Species of Conservation Concern)	The term SCC in the context of this report refers to all RDL (Red Data) and IUCN (International Union for the Conservation of Nature) listed threatened species as well as protected species of relevance to the project.

1 INTRODUCTION

1.1 Background

Scientific Terrestrial Services (STS) was appointed to conduct a Biodiversity Assessment as part of the environmental impact assessment and authorisation process for the proposed Mamatwan Mine Project, near Hotazel, Northern Cape Province. The Mamatwan Mine (MMT) is located within the John Taolo Gaetsewe District Municipality and the Joe Morolong Local Municipality.

The MMT is situated approximately 17 km south of the town of Hotazel, 32.6 km north of the town of Kathu and 43 km west of the town of Kuruman. The R380 runs directly adjacent to the MMT in a north-south direction from Hotazal to Kathu, the M31 roadway is located approximately 14 km east of MMT and the N14 highway is located approximately 24 km southeast. The location and extent is indicated in Figures 1 & 2 of Part A.

The proposed MMT expansion activities include the following, and will henceforth collectively be referred to as the "study area":

- Development of a top-cut stockpile; and crushing and screening plant;
- Construction and operation of a railway loop and associated infrastructure; and
- Installation of a pipeline: Three alternatives are proposed, with alternative 1 considered as the preferred alternative by the proponent.

For a detailed Project description of all expansion activities, please refer to Part A.

The purpose of this report is to define the floral ecology of the study are area, to identify areas of increased Ecological Importance and Sensitivity (EIS), as well as the mapping of such areas, and to describe the Present Ecological State (PES) of the study area.

1.2 Scope of Work

Specific outcomes in terms of the report are as follows:

- To provide inventories of floral species as encountered within the study area;
- To determine and describe habitat types, communities and the ecological state of the study area and to rank each habitat type based on conservation importance and ecological sensitivity;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and/ or any other special features;
- To conduct a Red Data Listed (RDL) species assessment as well as an assessment of other Species of Conservation Concern (SCC), including the potential for such species to occur within the study area;

- To provide detailed information to guide the activities associated with the proposed development activities within the study area; and
- To ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements and the provision of ecological services in the local area.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The floral assessment is confined to the study area and does not include the neighbouring and adjacent properties or the entire MMT;
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. The most limiting condition was the extreme drought still experienced at the time of the assessment, with the majority of forbs reduced to underground plant parts or died back to unidentifiable parts. On-site data were augmented with historic studies undertaken for the Mamtwan Mine (NSS, 2018). On this basis, the floral ecology associated with the study area is considered to been adequately assessed and considered, and the information provided is sufficient to allow for informed decision making and to facilitate integrated environmental management;
- Sampling by its nature means that not all individuals are assessed and identified. Some species and taxa within the study area may, therefore, have been missed during the assessment;
- A field assessment was undertaken from the 5th to the 7th of November 2019 (spring season), to determine the floral ecological status of the study area, and to “ground-truth” the results of the desktop assessment (presented in Part A). A more accurate assessment would require that assessments take place in all seasons of the year, especially within the flowering season of most floral species. On-site data was significantly augmented with all available desktop data and previous studies undertaken for the Mamatwan Mine (NSS, 2018), and together with project experience in the area, the findings of this assessment are considered to be an accurate reflection of the ecological characteristics of the study area.
- Herbaceous floral SCC during the site assessment were reduced to underground parts, with a few remnant leaves/ seeds identified. The abundance of herbaceous SCC is therefore anticipated to be higher than what was observed during the field assessment. It is recommended that a summer walkdown (January to February) be undertaken and all herbaceous SCC marked, in order to accurately determine the

number of individuals that need to be rescued and relocated during the proposed mining development, as part of the requirements for the permit application.

2 ASSESSMENT APPROACH

The field assessment was undertaken from the 5th to the 7th of November 2019 (spring season), to determine the floral ecological status of the study area. To accurately determine the ecological state of the study area and to capture comprehensive data with respect to floral ecology, the following methodology was followed:

- Maps and digital satellite imagery were consulted prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. The results of these analyses were used to guide the fieldwork component;
- All relevant information as presented by SANBI's Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org), including the Northern Cape Critical Biodiversity Areas (2016) was consulted to gain background information on the physical habitat and potential floral diversity associated with the study area; and
- For the field assessments, a reconnaissance 'walkabout' was undertaken to determine the general habitat types found throughout the study area - with special emphasis being placed on areas that may potentially support floral SCC. The field assessments took place on foot in order to identify the occurrence of the dominant plant species and habitat diversities. A detailed explanation of the method of assessment is provided in **Appendix A** of this report; and
- For the methodologies relating to the impact assessment and development of the mitigation measure, please refer to **Appendix C of Part A** of the report.

2.1 Sensitivity Mapping

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

3 RESULTS OF THE FLORAL ASSESSMENT

3.1 Previous Floral Assessments (NSS, 2018)

A baseline biodiversity assessment for MMT has been undertaken during 2013 by Natural Scientific Services CC (NSS). This assessment was updated in July 2018 (NSS, 2018). During the 2018 assessment all natural vegetation was classified as *Acacia* Thornveld (include both *Acacia* Thornveld and Degraded *Acacia* Thornveld), with all mining and infrastructure areas as well as disturbed patched classified as Transformed habitat. The habitat units were divided into the following vegetation units (NSS, 2018) (Figure 1 below):

- *Acacia* Thornveld:
  - *Acacia haematoxylon*[1] *– Grewia flava* Thornveld;
  - *Acacia mellifera*[2] *- Acacia haematoxylon – Grewia flava* Thornveld*;* and
  - *Acacia mellifera – Stipagrostis* Open Thornveld*;*
- Degraded *Acacia* Thornveld:
  - Dense *Acacia mellifera* Thornveld;
  - *Acacia mellifera* Bushclumps; and
  - *Acacia* dominated vegetation in recovery;
- Transformed Habitat:
  - Disturbed Patched; and
  - Mining and Infrastructure.

[1] Now referred to as *Vachellia haematoxylon*
[2] Now referred to as *Senegalia mellifera*

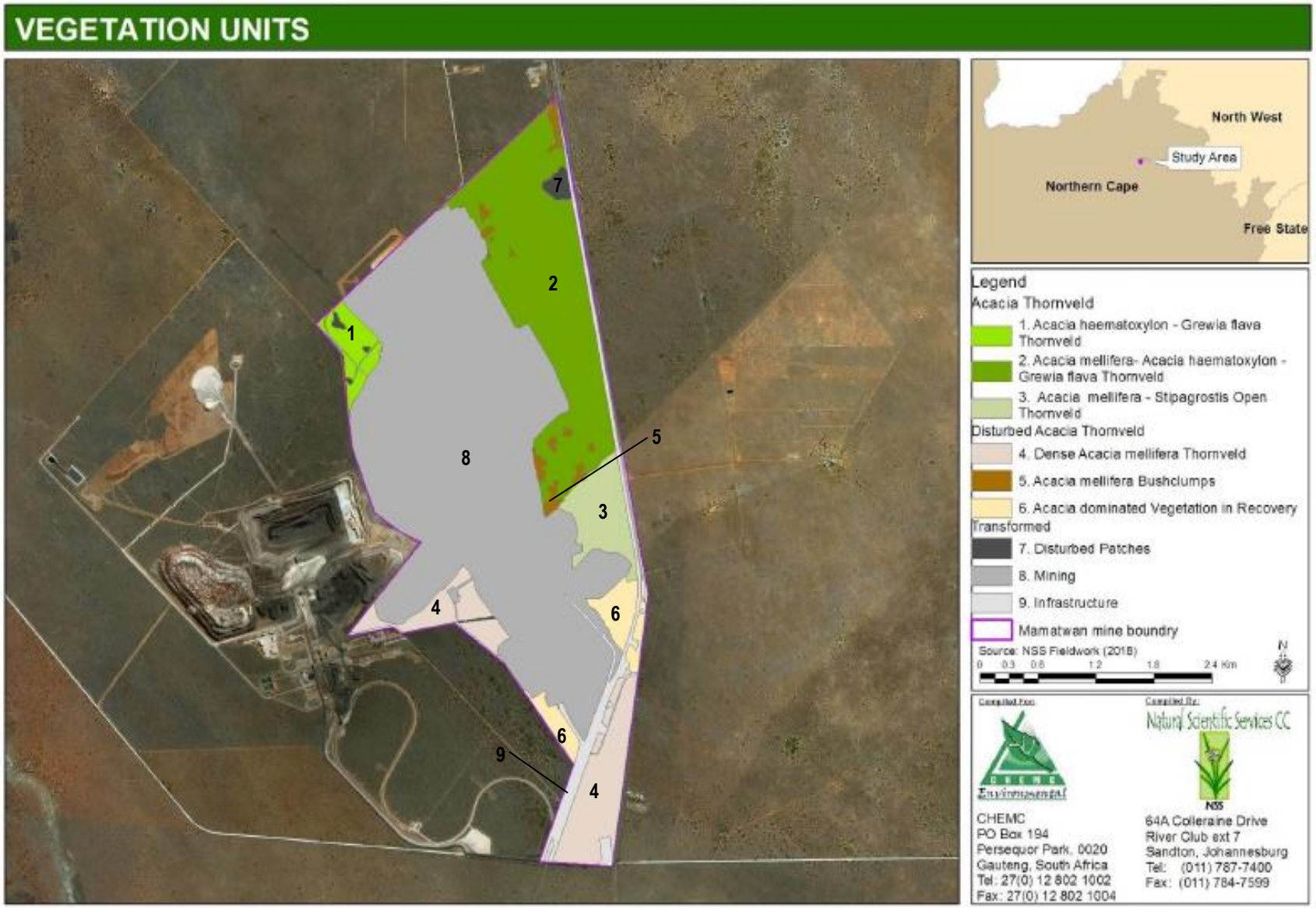


Figure 1: Vegetation units identified by NSS (2018) within the Mamatwan Mine.

3.2 Field Assessment Results (2019)

The November 2019 assessment distinguishes between three broad habitat units namely the Kathu Bushveld (previous *Acacia* Thornveld), Degraded Bushveld (previous Degraded *Acacia* Thornveld) and Transformed Habitat. The table below indicate the habitat units identified during the field assessment, together with the extent of each habitat unit.

Table 1: Habitat units identified within the study area, and the extent of each habitat unit.

Habitat Unit	Area (ha)	% of Total Area
Kathu Bushveld	257.8	75%
Degraded Bushveld	53.87	16%
Transformed Habitat	31.25	9%

Kathu Bushveld

The Kathu Bushveld Habitat unit include those areas previously defined by NSS (2018) as *Acacia* Thornveld; and includes the vegetation communities *Acacia mellifera* - *Acacia haematoxylon* – *Grewia flava* Thornveld and *Acacia mellifera* – *Stipagrostis* Open Thornveld.

During the field assessment two vegetation communities in line with the NSS (2018) assessment could be distinguished namely:

- *Senegalia (Acacia) mellifera* - *Vachellia (Acacia) haematoxylon* – *Grewia flava* Kathu Bushveld - largely associated with the top-cut stockpile, crushing and screening plant, and all of the proposed pipeline alternatives; and
- *Senegalia (Acacia) mellifera* – *Stipagrostis* Open Kathu Bushveld - largely associated with the eastern portion of the railway loop.

Although individual species abundance differed for these vegetation communities, the species composition was similar, and both vegetation communities can be considered representative of the Kathu Bushveld vegetation type. Both vegetation communities further provide habitat for Northern Cape Nature Conservation Act, 2009 (Act No 9 of 2009) protected floral species. These vegetation communities will henceforth be considered as a single habitat unit, namely the Kathu Bushveld.

Degraded Bushveld

The study area is largely confined to the natural areas situated to the east and west of the existing Mamatwan Mine, with few portions of the study area overlapping within existing mining areas. This habitat unit comprises the NSS (2018) vegetation unit formerly referred to as Degraded *Acacia* Thornveld - *Acacia* dominated vegetation in recovery. Also included are all

mining areas associated with vegetated areas, such as the rehabilitated historic mine dumps, as well as the outer slopes of currently utilised dumps, where vegetation has managed to re-establish. Although these areas were classified as transformed habitat by NSS (2018), they can also be considered as vegetation in recovery and as such were included in the Degraded Bushveld habitat unit.

Transformed Habitat

Areas falling within the study area that was utilised on a regular basis for mining, or where ground clearing activities has resulted in no vegetation to remain or where vegetation was limited to Alien Invasive Plant (AIP) species was classified as transformed. Due to the lack of natural vegetation within these areas, the floral ecological importance and sensitivity is considered to be low and these areas were not further assessed.

Figure 2: Conceptual illustration of the habitat units associated with the proposed expansion activities.

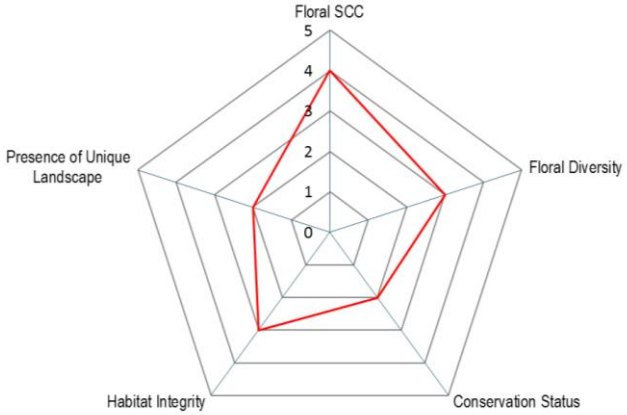
3.3 Kathu Bushveld

Kathu Bushveld Habitat Sensitivity	Intermediate

Habitat Description: The Kathu Bushveld Habitat unit can be classified as open Savanna, with a prominent well-developed shrub layer. The woody layer was dominated within this vegetation community, often occurring clumped together. The grass layer is variable in cover, with bare soil patches notable throughout the habitat unit. The herbaceous layer was also limited and can largely be attributed to the time of the assessment, whereby herbaceous species have died back.

Notes of Photographs:
Above: *Vachellia haematoxylon* in the foreground, with stands of *Senegalia mellifera* evident in the background;
Below: Variable grass layer with bare soil patches evident in the foreground, with the well-developed shrub layer comprising a few taller trees *(Vachellia erioloba*) in the background.

FLORAL HABITAT SENSITIVITY GRAPH



Typical view of the Kathu bushveld habitat unit associated with the study area.

Floral Species of Conservation Concern (SCC)	During the field assessment, no floral SCC were observed within the Kathu Bushveld. One floral SCC *Hoodia gordonii* (Data deficient – Insufficient Information) have an increased probability to occur within the study area. A number of national and provincial protected species were however observed within this habitat unit: The high significance attributed to the SCC score is as a result of the high abundance of individuals encountered within this habitat unit, particularly for the NFA protected species. ➢ National Forest Act, 1998, (Act 84 of 1998, amended in September 2011) (NFA): • *Vachellia erioloba* and *V. haematoxylon;* ➢ Northern Cape Nature Conservation Act, 2009 (Act 9 of 2009) (NCNCA): • Schedule 1: *Harpagophytum procumbens;* and • Schedule 2: *Boophone disticha* and *Tridentea* sp*;* ➢ National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004) Threatened or Protected Species (TOPS): • *Harpagophytum procumbens.* A number of other protected floral species have an increased probability to occur within this habitat unit. Refer to Section 3.5 for a detailed discussion. Prior to any ground clearing activities, permits will have be obtained from the Department of Environment, Forestry and Fisheries (DEFF) (formerly the Department of Agriculture, Forestry and Fisheries(DAFF)) and the Northern Cape Department of Environment and Nature Conservation (NCDENC).

<table>
<tr><td rowspan="3">Conservation Status of Vegetation Type/Ecosystem</td><td rowspan="3">The National Biodiversity Assessment (2018), indicates that this habitat unit falls within the remaining extent of the Kathu Bushveld. This vegetation type is however considered to be Least Threatened. The study area is not located within an area considered to be of biodiversity importance according to the Mining and Biodiversity Guidelines. The Northern Cape CBA map (2016) classifies the habitat unit as Other Natural Areas, however there are no Critical Biodiversity Areas (CBA), nor any Ecological Support Areas (ESA) associated with the study area. The habitat unit is considered to be of moderately low conservation importance.</td><td>Habitat integrity/Alien and Invasive species</td></tr>
<tr><td>Habitat degradation of this habitat unit has taken place as a result of vegetation clearing along the boundary fence to deter criminal activity (NSS, 2018), as well as for prospecting activities. Edge effects from mining activities as well as grazing by game and livestock has also led to increased pressure on this habitat unit, which has resulted in bush encroachment by the indigenous Senegalia mellifera in areas, particularly adjacent to mining activities and current infrastructure. A number of individuals of the AIP tree Prosopis glandulosa were also noted within this habitat unit, however proliferation of this species was not extensive. The habitat integrity of the Kathu Bushveld is considered to be of an intermediate level.</td></tr>
<tr><td>Presence of Unique Landscapes</td></tr>
<tr><td colspan="2">The habitat unit is not considered unique within the landscape but is represented within the larger Kathu- Kuruman region. This vegetation type is further considered Least Threatened. This can largely be attributed to the low percentage of the vegetation type considered transformed (over 1% according to Mucina & Rutherford, 2012).</td></tr>
<tr><td>Floral Diversity</td><td colspan="2">The Kathu Bushveld vegetation type is not considered a highly diverse vegetation unit, with a limited number of woody, graminoid and forb species expected to occur. The woody layer associated with the Kathu Bushveld Habitat unit comprised of a prominent tall shrub layer dominated by Senegalia melliefra, Vachellia haematoxylon, and Grewia flava. Several dwarf shrubs were also observed and included amongst others Lagerra decurrens and Lasiosiphon polycephalus. The forb layer was largely died-back to underground plant parts, however a number of succulent and bulbous species associated with the understory were noted such as Sansevieria aethiopica, Tridentea sp. and Boophone disticha. A number of additional species such as Kalanchoe thyrsiflora, Bulbine sp, and Ruschia cf. griquensis were also noted during previous studies (NSS, 2018). These species were not observed during the current assessment as a result of the extenuating dry period, limiting plant growth. The grass layer was dominated by Stipagrostis uniplumis, Eragrostis lehmanniana and Aristida meridionalis.

The floral diversity associated with the Kathu Bushveld are considered to be of an intermediate level. Refer to Appendix C for a comprehensive species list encountered during the current assessment as well as recorded by NSS (2018).</td></tr>
<tr><td colspan="3">Business Case, Conclusion and Recommendations:
The floral ecological importance and sensitivity of this habitat unit is considered Intermediate. The habitat unit is not considered of conservation importance according to the various datasets assessed. The habitat unit nonetheless, provides suitable habitat for a number of national and provincially protected species. Although these species are not considered threatened as defined by the Threatened Species Programme: Red List of South African Plants, updated 2017, these species are still protected and require permits to be removed/ destroyed. During the field assessment all protected individuals encountered were marked, however it is highly likely that individuals of the forb species recorded, i.e B. disticha, H. procumbens, and Tridentea sp. may have been missed. Other NCNCA protected species are likely to utilise this habitat unit as discussed in Section 3.5 below. Once designs have been finalised for infrastructure associated with a specific expansion activity, but prior to commencement of construction activities, a floral walkdown will need to be undertaken in the correct flowering season in order to mark all herbaceous protected floral species. This should preferably be undertaken during February/March when the majority of species will be in flower.

Development within this habitat unit is unlikely to unacceptably impact on provincial and conservation targets for the Kathu Bushveld vegetation type. The proposed expansion activities will result in the loss of protected species individuals, and the development footprint should be minimised to what is essential. All herbaceous protected floral species should be rescued and relocated to similar habitat outside of the development footprint, or be used for landscaping within the existing mine boundary. All natural areas outside of the development footprint areas should also be preserved and enhanced where possible.

In order to minimise post-development rehabilitation and AIP control costs, it is recommended that all areas where bare soils are exposed as a result of the development activities should immediately be rehabilitated and reseeded with an indigenous grassland seed mixture. Removal of AIP species to a registered waste facility as well as implementation of AIP control and maintenance measures at the onset of construction will limit the spread of AIP species to surrounding natural habitat, and subsequently limit the footprint area for which AIP control management will have to be implemented during the operational activities.</td></tr>
</table>

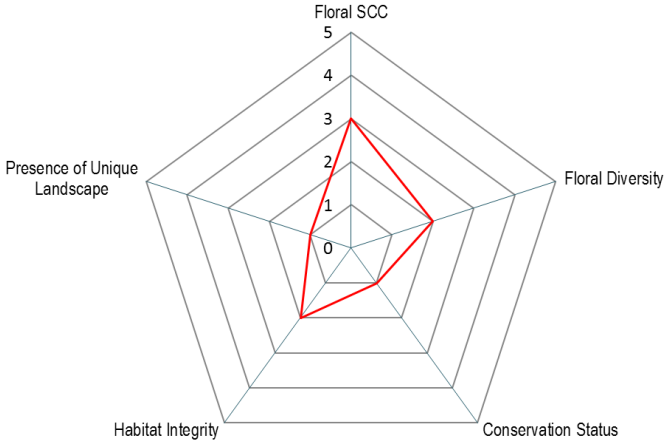
3.4 Degraded Bushveld

Degraded Bushveld Habitat Sensitivity	Moderately Low

Habitat Description:
The degraded bushveld habitat unit comprised predominantly of grasses, with a number of trees and shrubs observed. These areas were, however, subject to more severe and extensive anthropogenic related activities which have resulted in decreased species diversity as well as the establishment of an increased number of AIP individuals.

Note on Photographs:
Above: Mine dumps immediately west of the proposed top-cut stockpile area; **Middle:** Rehabilitated historic mine dumps, comprising predominantly of graminoids. **Below:** Degraded bushveld associated with the southern portion of the railway loop.

Floral Habitat Sensitivity Graph:



Floral Species of Conservation Concern (SCC)

During the field assessment a number of individuals of the NFA protected species i.e *V. erioloba* and *V. haematoxylon*, as well as a single individual of the NCNCA protected species *B. disticha* were observed. The abundance of NFA protected species were significantly lower as opposed to the Kathu Bushveld, which can be ascribed to the degraded nature of this habitat unit. Removal of individuals within this habitat unit will require permits from the relevant authorities prior to ground clearing activities. It is less likely for other protected species listed in Section 3.5 to utilise this habitat unit due to the severely degraded nature of the habitat.

<table>
<tr><td rowspan="3">Floral Diversity</td><td rowspan="3">The floral diversity of this habitat unit is considered to be moderately low, largely as a result of anthropogenic related activities associated with this habitat unit, which has resulted in the removal of a large number of woody species. This habitat unit comprised predominantly of grass species often associated with disturbance such as Stipgrostis uniplumis, Schmidtia kalahariensis and Pennisetum setaceum. The dominant tree species observed was Searsia lancea, with a few Kathu bushveld endemics such as Vachellia erioloba and Vachellia mellifera noted. Herbaceous species observed include species often associated with exposed soils and include amongst others Argemone ochroleuca, and Helichrysum argyrospaerum</td><td>Presence of Unique Landscapes</td></tr>
<tr><td>No unique landscapes important to flora were present due to the severely degraded nature of this habitat unit resulting from mining activities.</td></tr>
<tr><td>Habitat integrity/Alien and Invasive species</td></tr>
<tr><td>Conservation Status of Vegetation Type/Ecosystem</td><td colspan="2">Habitat integrity is diminished due to mining and development activities which have severely altered the soil profile through dumping of waste material discard dumps as well as manganese rock in areas. This has not only altered the floral species composition but has also allowed for the establishment of AIP species such as Prosopis glandulosa, Nicotiana glauca, Argemone ochroleuca, and Pennisetum setaceum.</td></tr>
<tr><td colspan="3">Business Case, Conclusion and Recommendations:
This habitat unit is of moderately low ecological importance and sensitivity. The sensitivity can largely be attributed to the habitat unit still supporting protected floral species despite the severely degraded habitat. The abundance of individuals was significantly lower as compared to the Kathu Bushveld Habitat Unit. There are no developmental constraints associated with this habitat unit due to the highly degraded nature of this habitat unit, and activities within this habitat unit must be optimised. Prior to any ground clearing activities, a permit will however need to be obtained for all protected floral species that will be removed during construction activities.

Due to the area already being exposed to disturbances and showing signs of being susceptible to AIP proliferation, care must be taken to limit edge effects on the surrounding natural areas. Furthermore, it is recommended that an alien and invasive floral species management plan be developed to manage alien floral species proliferation within this habitat unit and the transformed habitat unit. All infrastructure not geographically specific should be situated within the Degraded Bushveld and Transformed Habitat unit, in order to limit the impact on the natural surrounding Kathu Bushveld.</td></tr>
</table>

3.5 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. A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7 of the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) (NEMBA).

The SCC assessment not only considers floral SCC recorded on site during the field assessment but also includes a Potential of Occurrence (POC) assessment where the assessment takes suitable habitat to support any such species into consideration. Thus, for the POC assessment, the following protected species lists were utilised:

- The Northern Cape Nature Conservation Act, 2009 (Act 9 of 2009);
- Government Notice 256 Threatened or Protected Species (TOPS) as published in the Government Gazette 38600 of 2015 as it relates to the National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004); and
- Government Notice 908 List of Protected Tree Species as published in the Government Gazette 38215 as it relates to the National Forest Act, 1998, (Act 84 of 1998, amended in September 2011).

The following SCC/ protected species obtained a POC of 60% or more, with a number of species also recorded within the study area at the time of the assessment. During the POC assessment, the known distribution range of the species, suitable habitat within the study area as well as the level of habitat degradation are taken into consideration. Refer to Appendix A for the method of assessment:

Table 2: SCC/ Protected species observed within the study area at the time of assessment or within increased likelihood to utilise the study area

Species	Threat Status	Habitat Unit	POC	Recorded by NSS (2018)
NFA				
Vachellia erioloba	LC	Recorded within all habitat units during the assessment	100%	Yes
Vachellia haematoxylon	LC	Recorded within all habitat units during the assessment	100%	Yes
Boscia albitrunca	LC	Suitable habitat within the Kathu Bushveld, and observed in the surrounding region during the field assessment	67%	No

NCNCA				
Schedule 1				
Harpagophytum procumbens	LC	Recorded within the Kathu Bushveld Habitat Unit	100%	No
Hoodia gordonii	DDD	Suitable habitat within the Kathu Bushveld	60%	No
Lessertia frutescens subsp. *frutescens*	LC	Suitable habitat within the Kathu Bushveld	60%	No
Schedule 2				
Boophone disticha	LC	Observed within the Kathu Bushveld and Degraded Bushveld Habitat	100%	Yes
Tridentea sp. likely T. gemmiflora (Stapelia gemmiflora)	LC	Recorded within the Kathu Bushveld	100%	No
Babiana hypogaea	LC	Previously recorded by STS in the vicinity of the study area. Suitable habitat within the Kathu Bushveld	80%	Yes
Boscia albitrunca	LC	Suitable habitat within the Kathu Bushveld, and observed in the surrounding region during the field assessment	67%	No
Nerine laticoma	LC	Suitable habitat within the Kathu Bushveld habitat unit	60%	No
TOPS				
Harpagophytum procumbens	LC	Recorded within the Kathu Bushveld Habitat Unit	100%	No

From the table above it is evident that a number of protected floral species have been recorded within the study area or have a high probability of occurring within the study area, particularly the Kathu Bushveld. Removal of the species listed above during the proposed expansion activities is considered unavoidable from both the Kathu Bushveld and Degraded Bushveld habitat units. It is however considered possible to rescue and relocate the herbaceous species, and subsequently, a rescue and relocation plan should be designed and implemented for such species. The rescue and relocation plan should be overseen by a suitable qualified botanist/ horticulturalist, with experience in rescue and relocation of floral species. Once designs have been finalised and prior to any ground clearing activities, a floral walkdown will need to be undertaken in the correct flowering season in order to mark all herbaceous protected floral species. This should preferably be undertaken during February/March when the majority of species will be in flower. Permits should be obtained from the relevant authorities for the removal/ destruction of all protected species falling within the development footprint.

Figure 3: Protected species encountered within the study: *Vachellia haematoxylon* (Top left); *Vachellia erioloba* (Top Right), *Harpagophytum procumbens* (Middle Left), *Tridentea sp.* (Middle Right), and *Boophone disticha* (Bottom).

3.6 Medicinal Plant Species

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

Table 3: Dominant traditional medicinal floral species identified during the field assessment. Medicinal applications and application methods are also presented (van Wyk, Oudtshoorn, Gericke, 2009). Alien species are indicated with an asterisk (*).

Species	Name	Plant parts used
Asparagus suaveolens	Wild Asparagus	Rhizomes and flashy roots
Dichrostachys cinerea	Sickle Bush	Roots
Elephantorrhiza elephantina	Eland's Bean	Roots
Tarchonanthus camphoratus	Camphor Bush	Leaves
Vachellia erioloba	Camel Thorn	Pods, Gum, Bark, Roots
Ziziphus mucronata	Buffalo Thorn	Roots, Bark and Leaves
Dicoma sp.		Leaves and Twigs
Harpagophytum procumbens	Devil's Claw	Roots
Salvia runcinata	Wild Sage	Leaves
Sansevieria aethiopica	Bowstring Hemp	Rhizomes and Leaves
Senna italica subsp. arachoides	Wild Senna	Leaves
Boophone disticha	Poison Bulb	Bulb Scales

A moderately low abundance of medicinal species was encountered during the field assessment and can be attributed to the limited floral diversity associated with the study area and the Kathu Bushveld in general. The species listed in the table above are common, widespread species and not confined to the study area; nor are they unique within the region. *Boophone disticha* and *Harpagophytum procumbens* are however protected within the Northern Cape Province. Several individuals of *B. disticha* and *H. procumbens* were found within the Kathu Bushveld habitat. These species would need to be rescued and relocated to suitable habitat outside of the disturbance footprint area, which should be undertaken by an aptly qualified contractor. Thus, if rescue and relocation is implemented for these species no other risks to their populations within the larger region, or locally, are foreseen for medicinal plants.

3.7 Alien and Invasive Plant (AIP) Species

Alien and invasive floral species are floral species of exotic origin which are invading previously pristine areas or ecological niches (Bromilow, 2001). Not all weeds are exotic in origin but, as these exotic plant species have very limited natural "check" mechanisms within the natural environment, they are often the most opportunistic and aggressively growing species within the ecosystem. They are often the most dominant and noticeable within an

area. Disturbances of the ground through trampling, excavations or landscaping often leads to the dominance of exotic pioneer species that rapidly dominate the area. Under natural conditions, these pioneer species are overtaken by sub-climax and climax species through natural veld succession. This process, however, takes many years to occur, with the natural vegetation never reaching the balanced, pristine species composition prior to the disturbance. There are many species of indigenous pioneer plants, but very few indigenous species can out-compete their more aggressively growing exotic counterparts.

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

- A decline in species diversity;
- Local extinction of indigenous species;
- Ecological imbalance;
- Decreased productivity of grazing pastures; and
- Increased agricultural input costs.

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

Table 4: Dominant alien floral species identified during the field assessment with their invasive status as per NEMBA: Alien and Invasive Species Lists, GN R598 of 2016.

Scientific name	Common name	Origin	NEMBA Category	Habitat Unit
WOODY SPECIES				
Nicotiana glauca	Wild Tobacco	Argentina	1b	Degraded Bushveld Transformed
Prosopis glandulosa	Mesquite	Mexico	3	Degraded Bushveld Transformed
FORB SPECIES				
Argemone ochroleuca	Mexican Poppy	Central America	1b	Degraded Bushveld Transformed
GRAMINOID SPECIES				
Pennisetum setaceum	Fountain Grass	North Africa	1b	Degraded Bushveld

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).

Of the alien species recorded during the field investigation (Table 3), three are listed as NEMBA Category 1b species, with one species recorded as NEMBA 3. Alien species located within the proposed development areas need to be removed regularly as part of maintenance activities - according to the NEMBA: Alien and Invasive Species Regulations, GN R864 of 2016.

Although the table indicates a low diversity of alien species observed in the study area, a variety of indigenous species commonly associated with bush encroachment were present throughout the study area. As such the low diversity of alien invasive species within the study area is not an indication that the study area is in a good ecological condition, as portions of the study area were also subject to bush encroachment, forming dense bush clumps. Species associated with bush encroachment noted include:

- *Senegalia mellifera* (Black Thorn),
- *Senegalia hebeclada* (Candle Thorn)*;*
- *Grewia flava* (Wild Rasin); and
- *Tarchonanthus camphoratus* (Camphor Bush).

The above-listed species should also be managed to prevent any further bush encroachment in the surrounding area. The mining expansion footprint should as far as possible be kept free from weeds and alien vegetation. As part of rehabilitation activities, it is recommended that monitoring of the study area occurs bi-annually for the duration the operational phase of the mine, so as to ensure that no new alien vegetation growth occurs.

4 SENSITIVITY MAPPING

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

Table 5: A summary of the sensitivity of each habitat unit and implications for development.

Habitat Unit	Sensitivity	Development Implications
Kathu Bushveld	**INTERMEDIATE** Conservation Objective Preserve and enhance the biodiversity of the habitat unit and surrounds while optimising development potential.	This habitat unit is of intermediate ecological sensitivity. Based on the desktop assessment, this habitat unit is not of high conservation importance, however this habitat unit is associated with an intermediate floral diversity, and support a number of protected floral species with a high abundance of protected individuals observed, contributing to the sensitivity of this habitat unit. Permits will have to be obtained from DEFF and NCDENC prior to removal/destruction of any protected individuals. All herbaceous protected floral species should be rescued and relocated by a suitably qualified contractor prior to any ground disturbance activities. Development within this habitat unit is not prohibited from a floral resource management perspective, although the development footprint should be minimised, and care should be taken not to disturb the surrounding natural habitat. A rehabilitation and AIP control and Management Plan should also be implemented at the onset of the commencement of the expansion activities, to limit spread and further degradation of the surrounding floral habitat.
Degraded Bushveld	**MODERATELY LOW** Conservation Objective Optimise development potential while improving biodiversity intactness of surrounding natural habitat and managing edge effects.	This habitat unit is not considered ecologically important from a floristic perspective. The Degraded Bushveld habitat unit is no longer considered representative of the reference vegetation type, i.e. the Kathu Bushveld, and provides limited suitable habitat for floral SCC and native floral species. A number of protected floral species were observed in these areas during the field assessment, however individual abundance was significantly lower as opposed to the Kathu Bushveld Habitat Unit. The necessary permits will have to be obtained for the removal of all protected species prior to ground disturbance activities taking place. The habitat unit is of moderately low conservation significance. To reduce opportunities for AIPs to be exchanged between the Degraded Bushveld habitat and surrounding natural areas i.e. Kathu Bushveld habitat unit during all phases of the development, an AIP management plan should be implemented for the clearance of listed alien species before expansion activities commence.
Transformed	**LOW** Conservation Objective Optimise development potential.	The Transformed Habitat is of low ecological importance and sensitivity due to the modified floral species composition of these areas comprising predominantly of bare soils or AIP species. Ecological functioning and habitat integrity are significantly compromised, and these areas should be optimised for development. Edge effect impacts on the surrounding natural vegetation should be well managed to limit the spread of AIP species to the surrounding areas.

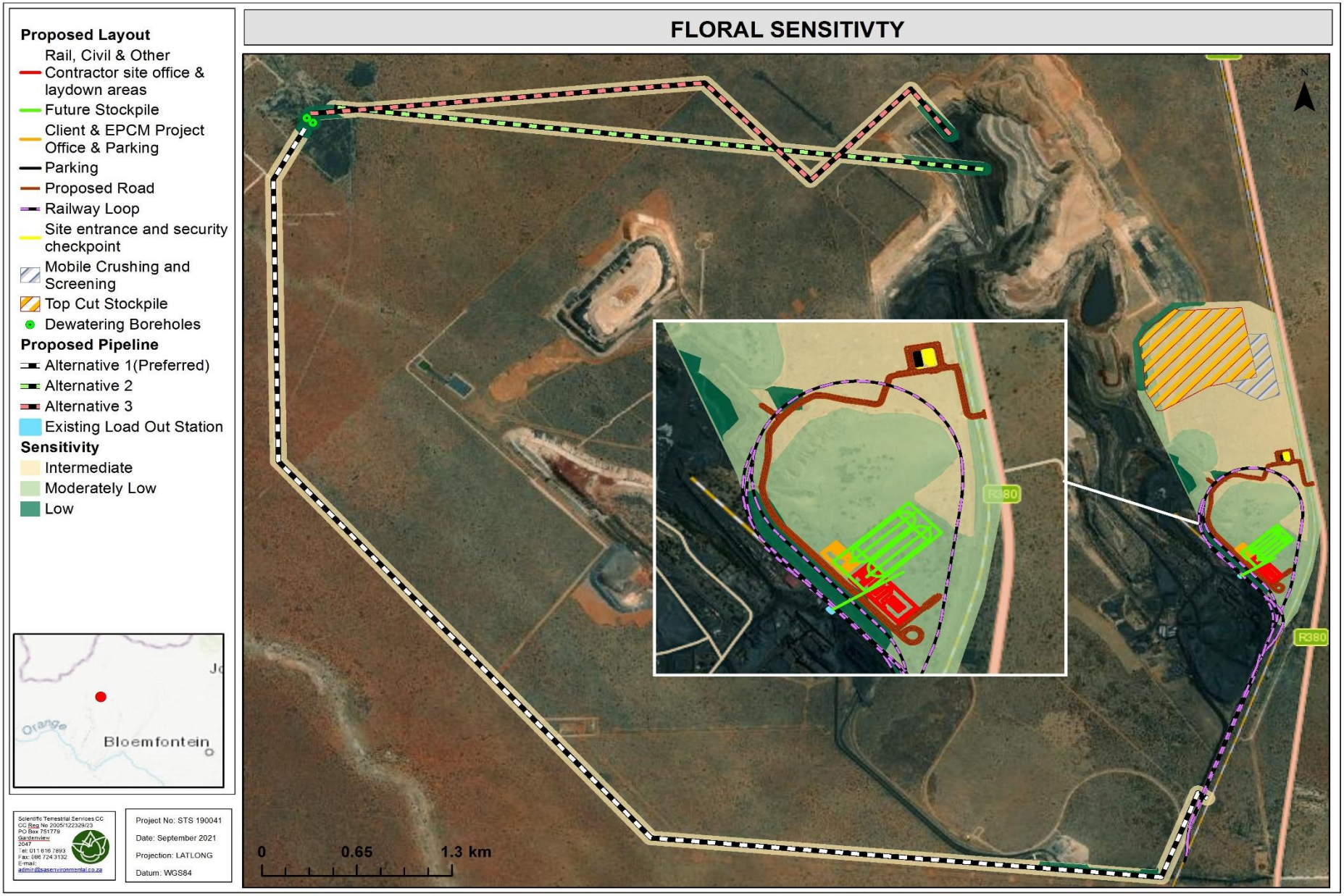


Figure 4: Sensitivity map for the study area.

5 IMPACT ASSESSMENT

The sections below provide the significance of perceived impacts on the floral ecology of the study area. An impact discussion and assessment of all potential construction, operational and decommissioning phase impacts are provided in Section 5.1. All mitigatory measures required to minimise the perceived impacts are presented in Section 5.3, with input on recommended floral and faunal monitoring presented in Section 7.4.

The impact assessment was based on the proposed layout as provided by the proponent (refer to Part A Section 1.1), which indicates the following:

The planned expansion activities assessed in this section of the report are as follows:

- Additional storage space is required for top-cut material. Prior to the material being sent to the sinter plant for primary crushing and screening will be required. Crushing and screening is proposed to be undertaken by a mobile crushing and screening plant. Due to the significantly smaller development footprint required for the crushing and screening plant, the impact assessment for the top-cut stockpile and crushing and screening plant was undertaken separately;
- Additional boreholes are required for water abstraction. MMT proposes to drill two boreholes at the currently unutilised Middelplaats mine. Three water pipeline alternatives are proposed. All three pipeline alternatives fall within the Kathu Bushveld, however Pipeline Alternative 1 is located within the existing road reserve. The impact assessment arising from the construction of Pipeline Alternatives 2 and 3 are anticipated to be similar, and these alternatives have been assessed together. The impact arising from Pipeline Alternative 1 is expected to be lower as this alternative is associated with an area of increased disturbance. This alternative was subsequently assessed separately; and
- Transnet Freight Rail (TFR) plans to increase the capacity of the Manganese rail line, by increasing the loading rate of trains. In order to meet the TFR expansion requirements the loading rate of trains at the MMT needs to be increased. The plan to achieve this will be through the establishment of a new railway loop, new loadout station, product stockpile areas, stacker and reclaimers.

5.1 Activities and Aspect Register

The table below indicates the perceived risks to floral species associated with the activities pertaining to the proposed mine expansion.

Table 6: Activities and aspects likely to impact on the floral resources of the study area. Blocks with a more red colour were regarded as having a higher impact significance and were rated higher in the impact assessment.

ACTIVITIES AND ASPECTS REGISTER
Planning Phase
- Potential failure to obtain the necessary permits for removal of protected floral species.. - **Impact**: Potential fines imposed on the mine by the relevant authorities
- Potential failure to implement a rescue and relocation of protected forb species. - **Impact**: Permanent loss of protected floral species from the study area
- Potential failure to have a Rehabilitation Plan developed and ready for implementation before the commencement of mining activities. - **Impact**: Without a developed rehabilitation plan it could lead to the exposure of areas of bare soil, which aren't immediately rehabilitated, and the subsequent establishment of AIP species and loss of viable soils for optimal plant growth.
- Potential failure to implement an Alien and Invasive Plant (AIP) Management/Control Plan before construction activities commence. - **Impact:** Continued displacement of indigenous species by AIPs, subsequently leading to a loss in floral diversity, as well as displacement/ mortality of protected floral species.
- Potential failure to implement an Erosion Control Plan for sloped areas leading to sedimentation of lower lying habitat and degradation of soil structure. **Impact:** Loss of favourable floral habitat and consequently declines in floral diversity.
- Potential inadequate design of infrastructure leading to pollution of soils as a result of, e.g., seepage/leaks from infrastructure failure. - **Impact:** Contaminated soils lead to a loss of viable growing conditions for plants and results in a decrease of floral habitat, diversity, SCC and medicinal species – rehabilitation effort will also be increased as a result.
Construction and Operational Phase
- Site clearing and the removal of vegetation. - **Impact:** Loss of floral habitat and loss of floral SCC.
- Proliferation of AIP species that colonise areas of increased disturbances and that outcompete native species, including the further transformation of adjacent or nearby natural areas. - **Impact:** Loss of favourable floral habitat outside of the direct development footprint, including a decrease in floral diversity, potential loss of floral SCC.
- Potential failure to correctly stockpile topsoil removed during construction activities leading to: • Potential contamination of topsoil stockpiles with AIP propagules; • Compaction of stockpiled topsoil leading to loss of viable soils for rehabilitation; and • Inefficient vegetating of stockpiled topsoil resulting in loss and degradation of soils. - **Impact:** Loss of viable soils for rehabilitation, thus hampering the potential for floral species to successfully establish during rehabilitation activities. Ultimately a loss of floral diversity will result.
- Failure to concurrently rehabilitate bare areas or disturbed sites as soon as they become available, potentially resulting proliferation of AIPs. - **Impact:** Long-term loss of favourable habitat for the establishment of floral species. Loss of floral diversity.
- Potentially poorly managed edge effects: • Ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to a continual proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas altering the floral habitat; and • Potential erosion stemming from soil left bare leading to sedimentation of downslope floral habitat. - **Impact:** Loss of floral habitat, diversity and SCC within the direct expansion development footprint of the mine. Loss of surrounding floral diversity and floral SCC through the displacement of indigenous flora by AIP species - especially in response to disturbance in natural areas.
- Failure to implement ongoing monitoring of rescued and relocated floral species leading to individual mortality. - **Impact:** Permanent loss of protected floral species from the area.
- Potential failure to implement a Biodiversity Action Plan (BAP), including the auditing of the BAP. Potential failure to initiate concurrent rehabilitation and implement an alien floral control plan during the operational phase, - **Impact:** Potentially leading to a permanent transformation of floral habitat and long-term degradation of important floral habitat within the surrounding region, i.e. floral communities associated with Kathu Bushveld. This will lead to a residual loss of biodiversity.

ACTIVITIES AND ASPECTS REGISTER
- Habitat fragmentation resulting from the expansion activities and poorly rehabilitated areas. - **Impact:** Long-term changes in floral structure, altered genetic fitness and potential loss of SCC.
- Overexploitation through the removal and/or collection of important or sensitive medicinal and floral SCC beyond the direct footprint area. - **Impact:** Local loss of floral SCC abundance and diversity.
- Risk of contamination from all operational facilities may pollute the receiving environment. - **Impact:** Leading to altered floral habitat.
- Seepage form the top cut stockpile affecting soils and the groundwater regime. - **Impact:** Altered floral habitat.
- Erosion as a result of mining development, stormwater runoff and on-going disturbance of soils due to operational activities. - **Impact:** Leading to a loss of floral habitat.
- Dumping of excavated and construction material outside of designated areas, promoting the establishment of AIPs. - **Impact:** Loss of floral habitat, diversity and SCC.
- Dust generated during construction and operational activities accumulating on the surrounding floral individuals, altering the photosynthetic ability of plants[3] and potentially further decreasing optimal growing/re-establishing conditions. - **Impact:** Declines in plant functioning leading to loss of floral species and habitat for optimal growth.
Decommissioning & Closure Phase
- Potential ineffective rehabilitation of exposed and impacted areas potentially leading to a shift in vegetation type. - **Impact:** Permanent loss of floral habitat, diversity and SCC, and a higher likelihood of edge effect impacts on adjacent and nearby natural vegetation of increased sensitivity.
- Potential poor management and failure to monitor rehabilitation efforts, leading to: • Landscapes left fragmented, resulting in reduced dispersal capabilities of floral species and a decrease in floral diversity; • Compacted soils limiting the re-establishment of natural vegetation; • Increased risk of erosion in areas left disturbed. - **Impact:** Long-term (or permanent) loss of floral habitat, diversity and SCC.
- Potentially poorly implemented and monitored AIP Management programme leading to the reintroduction and proliferation of AIP species. - **Impact:** Permanent loss of surrounding natural floral habitat, diversity and SCC.
- On-going risk of contamination from mining facilities beyond closure. - **Impact:** Permanent impact on floral habitat.
- On-going seepage and runoff may affect the groundwater regime beyond closure. - **Impact:** Loss of niche floral habitat and associated species.
- Rehabilitation of currently degraded habitat and AIP clearance of already proliferated areas. - **Impact (positive):** Some ecological functioning will be restored that has been lost due to AIP proliferation and habitat transformation.

[3] Sett, R. (2017). Responses in plants exposed to dust pollution. Horticulture International Journal, 1(2), 00010.).

5.3 Floral Impact Assessment Results

The following table indicates the perceived risks to the floral ecology associated with all phases of the proposed development. The table also provides the findings of the impact assessment undertaken with reference to the perceived impacts prior to the implementation of mitigation measures and following the implementation of mitigation measures. The mitigated results of the impact assessment have been calculated on the premise that all mitigation measures as stipulated in this report are adhered to and implemented. Should such actions not be adhered to, it is highly likely that post-mitigation impact scores will increase.

The pre-construction phase, especially from a floral resource management perspective, is essential in ensuring that activities associated with all phases of the project have the lowest possible impact on the receiving environment. In this regard, scoring of the pre-planning phase is considered important, since although it is unlikely to result in an immediate impact, failure to effectively plan, and implement an AIP control plan, a rehabilitation plan, obtain the necessary floral permits as well as design and implement a rescue and relocation plan prior to the onset of ground clearing activities, the impact is likely to be higher during the construction and operational phase., as well as the decommissioning and closure phase.

Table 7: Impact on the floral habitat, diversity and SCC arising from the proposed development activities.

	UNMANAGED							MANAGED					
Expansion Activity	**Intensity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Significance**		**Intensity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Significance**
Pre-Construction (Planning) Phase													
Impact of floral Habitat and Diversity													
Top-cut stockpile	M	H	M	**M**	VH	**Medium**		L	M	L	**L**	VH	**Low**
Crushing and Screening Plant	L	M	L	**L**	H	**Low**		VL	M	VL	**VL**	M	**Very Low**
Borehole Drilling	VL	L	VL	**VL**	M	**Very Low**		VL	VL	VL	**VL**	L	**Insignificant**
Dewatering Pipeline Alternative 1	L	L	L	**L**	H	**Low**		VL	L	VL	**VL**	M	**Very Low**
Dewatering Pipelines Alternative 2 and 3	M	L	L	**M**	H	**Medium**		L	L	VL	**L**	M	**Very Low**
New offices, future stockpile area and contractor laydown	L	L	M	**L**	L	**Low**		L	L	L	**L**	L	**Very Low**
Manganese Rail line and road and security checkpoint	M	H	M	**M**	VH	**Medium**		L	M	L	**L**	VH	**Low**
Impact on Floral SCC													
Top-cut stockpile	H	H	M	**H**	VH	**High**		M	M	L	**M**	VH	**Medium**
Crushing and Screening Plant	L	M	L	**L**	H	**Low**		VL	M	VL	**VL**	M	**Very Low**
Borehole Drilling	VL	L	VL	**VL**	M	**Very Low**		VL	VL	VL	**VL**	L	**Insignificant**

	UNMANAGED						MANAGED					
Expansion Activity	**Intensity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Significance**	**Intensity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Significance**
Dewatering Pipeline Alternative 1	M	H	L	**M**	H	**Medium**	L	M	VL	**L**	H	**Low**
Dewatering Pipelines Alternative 2 and 3	M	H	L	**M**	H	**Medium**	L	M	VL	**L**	M	**Low**
New offices, future stockpile area and contractor laydown	L	L	M	**L**	L	**Low**	L	L	L	**L**	L	**Very Low**
Manganese Rail line and road and security checkpoint	H	H	M	**H**	VH	**High**	M	M	L	**M**	VH	**Medium**
Construction and Operational Phase												
Impact of floral Habitat and Diversity												
Top-cut stockpile	H	H	M	**H**	VH	**High**	M	H	L	**M**	VH	**Medium**
Crushing and Screening Plant	L	H	L	**M**	H	**Medium**	VL	H	VL	**L**	H	**Low**
Borehole Drilling	VL	L	VL	**VL**	M	**Very Low**	VL	VL	VL	**VL**	L	**Insignificant**
Dewatering Pipeline Alternative 1	M	M	L	**M**	VH	**Medium**	L	L	VL	**L**	H	**Low**
Dewatering Pipelines Alternative 2 and 3	H	M	L	**M**	VH	**Medium**	L	L	VL	**L**	H	**Low**
New offices, future stockpile area and contractor laydown	L	L	M	**L**	L	**Low**	L	L	L	**L**	L	**Very Low**
Manganese Rail line and road and security checkpoint	H	H	M	**H**	VH	**High**	M	H	L	**M**	VH	**Medium**
Construction and Operational Phase												
Impact on Floral SCC												
Top-cut stockpile	H	H	M	**H**	VH	**High**	H	H	L	**H**	VH	**High**
Crushing and Screening Plant	M	H	L	**M**	VH	**Medium**	L	H	VL	**L**	H	**Low**
Borehole Drilling	VL	L	VL	**VL**	M	**Very Low**	VL	VL	VL	**VL**	L	**Insignificant**
Dewatering Pipeline Alternative 1	M	H	L	**M**	VH	**Medium**	L	H	VL	**L**	VH	**Low**
Dewatering Pipelines Alternative 2 and 3	M	H	L	**M**	VH	**Medium**	L	H	VL	**L**	VH	**Low**
New offices, future stockpile area and contractor laydown	L	L	M	**L**	L	**Low**	L	L	L	**L**	L	**Very Low**
Manganese Rail line and road and security checkpoint	H	H	M	**H**	VH	**High**	H	H	L	**H**	VH	**High**
Decommissioning and Closure Phase												
Impact of floral Habitat and Diversity												
Top-cut stockpile	H	H	M	**H**	H	**High**	M	M	L	**M**	H	**Medium**
Crushing and Screening Plant	M	H	L	**M**	H	**Medium**	L	M	VL	**L**	M	**Very Low**
Borehole Drilling	VL	L	VL	**VL**	M	**Very Low**	VL	VL	VL	**VL**	L	**Insignificant**
Dewatering Pipeline Alternative 1	M	H	L	**M**	H	**Medium**	L	M	VL	**L**	H	**Low**
Dewatering Pipelines Alternative 2 and 3	M	H	L	**M**	H	**Medium**	L	M	VL	**L**	M	**Low**

	UNMANAGED							MANAGED					
Expansion Activity	**Intensity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Significance**		**Intensity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Significance**
New offices, future stockpile area and contractor laydown	L	L	M	**L**	L	**Low**		L	L	L	**L**	L	**Very Low**
Manganese Rail line and road and security checkpoint	H	H	M	**H**	H	**High**		M	M	L	**M**	H	**Medium**
Impact on Floral SCC													
Top-cut stockpile	M	H	M	**M**	H	**Medium**		L	M	L	**L**	M	**Low**
Crushing and Screening Plant	L	M	M	**M**	M	**Low**		VL	M	VL	**L**	L	**Very Low**
Borehole Drilling	VL	L	VL	**VL**	M	**Very Low**		VL	VL	VL	**VL**	L	**Insignificant**
Dewatering Pipeline Alternative 1	M	M	L	**M**	VH	**Medium**		L	L	VL	**L**	H	**Low**
Dewatering Pipelines Alternative 2 and 3	H	M	L	**M**	VH	**Medium**		L	L	VL	**L**	H	**Low**
New offices, future stockpile area and contractor laydown	L	L	M	**L**	L	**Low**		L	L	L	**L**	L	**Very Low**
Manganese Rail line and road and security checkpoint	M	H	M	**M**	H	**Medium**		L	M	L	**L**	M	**Low**

5.4 Impact Discussion

5.4.1 Impact on Floral Habitat and Diversity

Based on the impact assessment results it is evident that the most significant impacts will occur during the construction and operational phase where vegetation clearing will result in a loss of floral habitat, diversity and SCC. Significant impacts is still however likely during the planning and decommissioning and closure phase, and is largely attributed to the loss of floral habitat and diversity in the surrounding landscape due to ineffective AIP control, as well as the potential loss of floral SCC beyond the development footprint area. Although the planning phase will not result in an immediate impact on the floral ecology, lack/ poor planning will likely result in more significant impacts during the construction, operation and decommissioning and closure phases. Of utmost importance is the design and implementation of AIP control plan during the planning phase. Permits to remove/ destroy/ as well as rescue and relocation of floral SCC should also be obtained during the planning phase.

The habitat sensitivity associated with the study area range from intermediate to low as discussed in Section 4 of this report. All three water Pipeline Alternatives as well as the top-cut stockpile, crushing and screening plant, as well as the northern portion of the Mamatwan Manganese Railway loop falls within the Kathu Bushveld Habitat, considered to be of

intermediate floral sensitivity. The south eastern portion of the Manganese Railway falls within the Degraded Bushveld Habitat unit, classified to be of moderately low sensitivity whilst the south western portions falls within the transformed habitat unit, considered to be of low sensitivity.

The most significant impact is expected to arise from the development of the top-cut stockpile, due to the large development footprint within habitat of increased sensitivity. Pipeline Alternative 1 is situated within the existing road reserve, where edge effect impacts have been higher as oppose to Pipeline Alternatives 1 and 2. The impact on floral habitat and diversity is subsequently considered to be lower for Pipeline Alternative 1.

From a floral perspective the upgrade of the Manganese Railway will impact on the floral ecology of the area as a result of vegetation clearance.

Due to the significant impact arising from the development of the top-cut stockpile and the railway loop (and to a degree the remaining activities, though of lesser impact significance), the implementation of all mitigation measures stipulated in this report is of high importance. Implementation of mitigation will restrict the impact to the development footprint and limit edge effects on surrounding natural Kathu Bushveld habitat outside of the development footprint. Of particular importance is the control of AIP species, to limit the spread of such species to surrounding sensitive habitat.

5.4.2 Impacts on Floral SCC

During the field assessment a number of NFA and NCNCA protected floral species were observed throughout the study area, and include *Vachellia erioloba, V. haematoxylon, Boophone disticha, Harpagophytum procumbens,* and *Tridentea sp.* Removal/ destruction of any of these will require permits from DOFF and NCDENC. Due to the drought onsite conditions, identification of all protected herbaceous species/individuals was difficult, and a summer walk down of all final development footprint areas will have to be undertaken and all protected individuals marked. Failure to initiate a summer walkdown, and subsequent rescue and relocation will result in the permanent loss of these protected floral species. None of the species associated with the study area is considered threatened and are species with large distribution ranges throughout the Northern Cape, and the country as a whole. Loss of individuals from the study area although considered a high impact, is not considered detrimental for the conservation of these species within the province. Loss of individuals should still be minimised by implementing a rescue and relocation plan for herbaceous

species, as well as by limiting the development footprint to what is essential and actively managing edge effects on the surrounding natural area.

5.4.3 Probable Latent Impacts

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

- Continued loss of floral habitat of increased sensitivity, i.e. Kathu Bushveld;
- Continued loss of and altered floral species diversity;
- Alien and invasive plant proliferation, particularly in sensitive habitat where bare soils are left exposed;
- Permanent loss of floral SCC and suitable habitat; and
- Disturbed areas are highly unlikely to be rehabilitated to pre-development conditions of ecological functioning and loss of floral habitat, species diversity and floral SCC will most likely be long term.

5.4.4 Cumulative Impacts

The proposed expansion activities will result in further clearance of indigenous vegetation. The immediate area is associated with the existing Mamata and Tshipi mines, with the Black Rock, and United Manganese of Kalahari Mines also situated in surrounding region. Mining activities associated with these mines has led to the degradation of the surrounding natural habitat. As such the area that will be cleared is no longer considered pristine. The additional impact attributed to the expansion activities is not considered to contribute significantly to the conservation and ecology of the larger area. The expansion activities will however lead to the permanent loss of floral SCC, and as such all mitigation measures as listed below should be implemented to limit the number of individuals that will be affected.

5.5 Integrated Impact Mitigation

The table below highlights the key, general integrated mitigation measures that are applicable to the proposed mining development in order to suitably manage and mitigate the ecological impacts that are associated with all phases of the proposed development activities.

Provided that all management and mitigation measures are implemented, as stipulated in this report, the overall risk to floral diversity, habitat and SCC can be mitigated and minimised.

Table 8: A summary of the mitigatory requirements for floral resources.

Project phase	*Pre-construction Phase*
Impact Summary	*Loss of floral habitat, species and floral SCC*
	Proposed mitigation and management measures:

Management Measures	**Floral Habitat and Diversity** - Minimise loss of indigenous vegetation where possible through effective planning and limiting the development footprint to what is essential. The designs must further adhere to all legislation and all possible precautions taken to prevent potential spills and /or leaks. - It is recommended that prior to the commencement of construction activities the entire construction servitude be fenced off, and clearly demarcated to limit footprint creep and edge effects; **Floral SCC** - It is recommended that prior to any construction/ earth moving activities are to take place, a detailed walkdown of all-natural areas falling within the final expansion footprint area be undertaken and all protected floral species be marked. - The walkdown should be undertaken during the summer season (February/March) when most herbaceous floral species will be in flower, and accurate identification will be easier. - Once all floral SCC and NCNCA protected floral species within the development footprint has been identified, a rescue and relocation plan should be designed specifically to each species. Rescue and relocation activities need to take place prior to commencement of any expansion activities. Rescue and relocation need to be overseen by a suitably qualified contractor/ mine employee. The success of relocation actions need to be monitored quarterly for a minimum period of three years post-relocation; and - The necessary permits need to be obtained from DOFF and NCDENC prior to the implementation of rescue and relocation activities. **AIP Control and Ongoing Rehabilitation** - Prior to the commencement of construction activities, an AIP Management/Control Plan should be compiled for implementation: • Removal of alien invasive species should preferably commence during the pre-construction phase and continue throughout the construction, operational, decommissioning and post-closure phases. AIPs should be cleared within areas where they have become proliferate within the existing mining and infrastructure areas (Degraded Bushveld and Transformed Habitat) as well as where new infrastructure is planned before any construction activities commence, thereby ensuring that no AIP propagules are spread, or soils contaminated with AIP seeds, during construction phases; • An AIP Management/Control Plan should be implemented by a qualified professional. No chemical control of AIPs to occur without a certified professional; • Of particular importance is the control of *Prosopis glandules*, which comprise of a deep-rooted taproot as well as an extensive lateral root system. This species subsequently not only compete with the indigenous *V. erioloba* for deep groundwater but also take-up sparse precipitation within the soil profile. This species also has a high transpiration rate, which further result in a rapid decline of the water table (Schattschneider and February, 2013). The proliferation of these species have the potential to result in significant long-term negative impacts on the surrounding landscape, particularly the NFA protected species *V. erioloba and V. haematoxylon,* which play a vital role in the ecosystem by providing habitat for a number of floral and faunal species (Seymour &Milton, 2003); and - Prior to the commencement of construction activities on site, a rehabilitation plan should be developed for implementation throughout the development phases.
Project phase	*Construction and Operational Phase*
Impact Summary	*Loss of floral habitat, species and floral SCC*
Management Measures	***Proposed mitigation and management measures:*** **Development footprint** - The footprint areas of all surface infrastructure must be minimised to what is absolutely essential and within the designated and approved boundary; - No additional habitat is to be disturbed during the operational phase of the development. All material placed on the top-cut stockpile should be restricted to the footprint area that is authorised. Weekly monitoring and recording of the footprint area must be done; - Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the construction activities. Additional road construction should be limited to what is absolutely necessary, and the footprint thereof kept to a minimum. Any temporary roads should be rehabilitated as soon as they are no longer in use to prevent effects of habitat fragmentation;

	- No dumping of waste on site should take place. As such it is advised that waste disposal containers and bins be provided during the construction phase for all construction rubble and general waste; - Cut vegetation from site clearing to be removed immediately and not allowed to accumulate within surrounding natural habitat: - If any spills occur, they should be immediately cleaned up to avoid soil contamination that can hinder floral rehabilitation later down the line. Spill kits should be kept on site within workshops. In the event of a breakdown, maintenance of vehicles must take place with care, and the recollection of spillage should be practised preventing the ingress of hydrocarbons into the topsoil, - Natural habitat outside of the direct mining footprint areas must be avoided, and no construction vehicles, personnel, or any other construction-related activities are to encroach upon these areas; and - The footprint of daily operational activities must be strictly monitored to ensure that edge effects from the operational facilities do not affect the surrounding floral habitat. **Alien Vegetation** - Edge effects of all construction activities, such as erosion and alien plant species proliferation, which may affect adjacent Kathu Bushveld Habitat, need to be strictly managed adjacent to the project footprint areas. Specific mention in this regard is made of *Prosopis glandules* and all Category 1b AIP species, in line with the NEMBA Alien and Invasive Species Regulations (2016), as identified within the study area; - An Alien and Invasive Plant Management and Control Plan must be designed and implemented in order to monitor and control alien floral recruitment; and - Ongoing alien and invasive plant monitoring and clearing/control should take place throughout all phases of the development, and the project perimeters should be regularly checked for AIP proliferation and to prevent spread into surrounding natural areas; - AIP management for construction-phase activities should be focused on limiting their spread, e.g. roadsides (gravel and tarred roads) should be monitored, as they serve as common corridors along which AIP species are introduced and dispersed, and disturbed areas should regularly be monitored for AIP recruitment until successfully rehabilitated; and - Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility which complies with legal standards. **Floral SCC** - During the surveying and site-pegging phase of surface infrastructure, all potential floral SCC as well as protected floral species that will be affected by surface infrastructure must be marked and, where possible, relocated to suitable habitat surrounding the disturbance footprint. The removal and/or rescue and relocation should be overseen by a qualified specialist, in association with a suitably qualified horticulturist. The relevant permits must be applied for from the various authorities prior to the commencement of the construction phase; - No collection of floral SCC or medicinal floral species within the site boundary must be allowed by construction personnel; and - Edge effect control needs to be implemented to prevent further degradation and potential loss of floral SCC and protected floral species outside of the proposed expansion footprint area. **Dust** - Dust pollution has been associated with poor photosynthetic functionality in plants[4]. There is evidence of dust pollution leading to a reduction in chlorophyll, including chlorophyll degradation and reduced photosynthetic activity[5;6], resulting from dust deposition on leaf surfaces. Dust deposition also result in stomata clogging[7], which

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	causes a decreased rate of carbon dioxide exchange, carbon assimilation, transpiration, and therefore decreased net photosynthesis; and - An effective dust management plan must be designed and implemented in order to mitigate the impact of dust on flora throughout the construction and operational phase. **Fire** - No illicit fires must be allowed during the construction and operational phases of the proposed expansion activities; and - Fire breaks should be maintained during the operational phase. **Stormwater** - Adequate stormwater management must be incorporated into the design of the proposed development in order to prevent erosion of topsoil and the loss of floral habitat through the discharge of dirty water into the receiving environment. In this regard, special mention is made of: - Sheet runoff from cleared areas, paved surfaces and access roads needs to be curtailed; and - Runoff from paved surfaces should be slowed down by the strategic placement of bioswales. **Rehabilitation** - Rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan compiled by a suitable specialist. This rehabilitation plan should consider all development phases of the project indicating rehabilitation actions to be undertaken during and once construction has been completed, ongoing rehabilitation during the operational phase of the project as well as rehabilitation actions to be undertaken during decommissioning and closure; - The construction process should be phased to limit the extent of exposed areas at any one time and ensure that the time between initial disturbance and completion of construction is as short as possible with rehabilitation occurring concurrently where feasible; - Any natural areas beyond the expansion footprint, that have been affected by the construction and operational activities, must be rehabilitated using indigenous species; - As part of a Biodiversity Action Plan (BAP), floral monitoring should be done annually during operational activity. Please also refer to the monitoring guidelines below; - Rehabilitation must be implemented concurrently, and disturbed areas must be rehabilitated as soon as such areas become available. This will not only reduce the total disturbance footprint but will also reduce the overall rehabilitation effort and cost; and - All soils compacted as a result of construction activities falling outside of the project area should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas.
Project phase	*Decommissioning and Closure Phase*
Impact Summary	*Loss of floral habitat, species and SCC*
	Rehabilitation - All infrastructure and mining operation footprints should be rehabilitated in accordance with a rehabilitation plan compiled by a suitable specialist; - All rehabilitated areas should be rehabilitated to a point where natural processes will allow the ecological functioning and biodiversity of the area to be re-instated as per the post-closure objective; and - Rehabilitation efforts must be implemented for a period of at least five years after decommissioning and closure. **Alien Vegetation** - Edge effects of decommissioning and closure activities, such as erosion and alien plant species proliferation, which may affect adjacent sensitive habitat, need to be strictly managed adjacent to the expansion footprint; - Ongoing alien and invasive vegetation monitoring and eradication should take place throughout the closure/ decommissioning phase of the development, and the Mamatwan Operations and immediate surrounding area (50 m from the perimeters) should be regularly checked during the decommissioning phase for alien vegetation proliferation to prevent spread into surrounding natural area; and - An Alien and Invasive Plant Management and Control Plan must be designed and implemented in order to monitor and control alien floral recruitment in disturbed areas. The alien floral control plan must be implemented for a period of at least 5 years after decommissioning and closure.

5.6 Floral Monitoring

It is recommended that a floral monitoring plan be designed and implemented throughout all phases of the proposed expansion activities, should it be approved. The following points aim to guide the design of the monitoring plan. The monitoring plan should be continually updated and refined for site-specific requirements:

- Permanent monitoring plots must ideally be established in areas surrounding the expansion activities, particularly to the north and east of the top cut stockpile. These plots should be designed in such a way to accurately monitor the following parameters:
  - Recruitment of indigenous species and of alien and invasive species, particularly the establishment of *Prosopis glandules*;
  - Alien vs Indigenous plant ratio, especially *Vachellia erioloba* vs. *P. glandules*;
  - Erosion levels and the efficacy of erosion control measures; and
  - Monitoring to be undertaken annually for the first three years of the operational phase. Should no significant recruitment of additional AIPs be observed during this time, monitoring can be undertaken every two years for the remainder of the operational phase, as well as three years post closure.
- Monitoring of footprint area as well as a 50 m buffer surrounding the footprint area should persist throughout the operational phase to ensure these areas are not adversely affected by the mining operations;
- Monitoring of concurrent rehabilitation must also take place throughout all phases of the proposed mining development and for a period of five years after decommissioning and closure of each rehabilitated or infrastructure area;
- The rehabilitation plan should be continuously updated in accordance with the monitoring results in order to ensure that optimal rehabilitation measures are employed;
- Results of the monitoring activities must be taken into account during all phases of the proposed mining expansion activities and action must be taken to mitigate impacts as soon as negative effects from these activities become apparent; and
- The method of monitoring must be designed to be subjective and repeatable in order to ensure consistent results.

6 CONCLUSION

STS was appointed to conduct a Biodiversity Assessment as part of the environmental impact assessment and authorisation process for the proposed expansion activities at the Mamatwan Mine, near Hotazel, Northern Cape Province.

The proposed expansion activities associated with the study area include the following:

- Development of a top cut stockpile and crushing and screening plant;
- Railway loop; and
- Installation of a pipeline: Three alternatives are proposed, with alternative 1 considered as the preferred alternative.

During the field assessment three habitat units were identified, i.e. Kathu Bushveld, Degraded Bushveld and Transformed Habitat. The Kathu Bushveld comprised the majority of the study area, and degraded as a result of edge effects related to mining activities which has resulted in bush encroachment and AIP establishment in areas, this habitat unit comprised a number of protected floral species, and is of intermediate ecological importance and sensitivity.

The Degraded Bushveld has been severely altered from the reference Kathu Bushveld due to historic ground clearing/ disturbance activities, comprising predominantly of a grass layer, with a number of woody individuals scattered throughout the area, and is of moderately low ecological importance and sensitivity. The transformed habitat was largely void of vegetation or were associated with AIP species, and is considered to be of low ecological importance and sensitivity.

A number of protected floral species was observed at the time of the assessment, and include the NFA protected trees *Vachellia erioloba* and *V. haematoxylon.* Also observed was a number of NCNCA protected species, namely *Boophone disticha, Harpagophytum procumbens*, and *Tridentea sp*. It is recommended that a summer walkdown be undertaken and all protected floral species within the final development footprint be marked by means of GPS. Permits will have to be obtained from DEFF and NCDENC for all protected species prior to commencement of expansion activities. All herbaceous protected floral individuals should be rescued and relocated by a suitably qualified contractor.

Following the floral ecological assessment within the study area, the impacts associated with the proposed development activities were determined. The impacts arising from the proposed development will range from very low to high for floral habitat, diversity and SCC for the various expansion related activities. The most significant impacts is expected to arise from the development of the topcut stockpile and manganese Railway Line due to the extent of vegetation clearance and subsequent loss of protected floral species that will occur from

development of these infrastructure. With mitigation measures fully implemented, it is the opinion of the specialist that all impacts can be reduced.

The objective of this study was to provide sufficient information on the floral significance of the area, together with other studies on the physical and socio-cultural environment for the EAP and the relevant authorities to apply the principles of Integrated Environmental Management (IEM) and the concept of sustainable development. The need for conservation as well as the risks to other spheres of the physical and socio-cultural environment need to be compared and considered along with the need to ensure sustainable economic development of the country.

It is the opinion of the ecologists that this study provides the relevant information required in order to implement IEM and to ensure that the best long-term use of the ecological resources in the study area will be made in support of the principle of sustainable development.

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APPENDIX A: Floral Method of Assessment

Floral Species of Conservational Concern Assessment

Prior to the field visit, a record of all potential floral SCC and their habitat requirements was acquired making use of relevant national and provincial list published in:

- the Northern Cape Nature Conservation Act, 2009 (Act 9 of 2009),
- Government Notice 256 Threatened or Protected Species (TOPS) as published in the Government Gazette 38600 of 2015 as it relates to the National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004); and
- Government Notice 908 List of Protected Tree Species as published in the Government Gazette 38215 as it relates to the National Forest Act, 1998, (Act 84 of 1998, amended in September 2011).

Throughout the floral assessment, special attention was paid to the identification of any of these SCC as well as the identification of suitable habitat that could potentially support these species.

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

Each factor contributes an equal value to the calculation.

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

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

Floral Habitat Sensitivity

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

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

Each of these values contribute equally to the mean score, which determines the floral habitat sensitivity class in which each habitat unit falls. A conservation and land-use objective is also assigned to each

sensitivity class which aims to guide the responsible and sustainable utilization of the habitat unit in question. In order to present the results use is made of spider diagrams to depict the significance of each aspect of floral ecology for each vegetation type. The different classes and land-use objectives are presented in the table below:

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

Score	Rating significance	Conservation objective
1.0 < 1.5	Low	Optimise development potential.
≥1.5 <2.5	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
≥2.5 <3.5	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
≥3.5<4.5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
≥4.5 ≤ 5.0	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX B: Floral SCC

The species listed below and protected within the various legislature have an increased probability of occurring within the study area. Species identified at the time of assessment are emboldened.

Table B1: NFA (1998) plant list for the tree species expected to occur within the study area.

Family	Scientific Name	Habitat	Threat Status	POC (%)
Fabaceae	*Vachellia erioloba*	Savanna, semi-desert and desert areas with deep, sandy soils and along drainage lines in very arid areas, sometimes in rocky outcrops	LC	100
Fabaceae	*Vachellia haematoxylon*	Bushveld, usually on deep Kalahari sand between dunes and dry watercourses.	LC	100
Capparaceae	*Boscia albitrunca*	This species is found in the drier parts of southern Africa, in areas of low rainfall.	LC	60

LC = Least Concern

Table B2: NCNCA (2009) plant list for the floral species likely to occur within the study area.

Family	Scientific Name	Habitat	Schedule	Threat Status	POC (%)
Apocynaceae	*Hoodia gordonii*	Occurs in a wide variety of arid habitats from coastal to mountainous, also on gentle to steep shale ridges, found from dry, rocky places to sandy spots in riverbeds.	Schedule 1	DDD	60
Fabaceae	*Lessertia frutescens* subsp. *frutescens*	Occurs naturally throughout the dry parts of southern Africa.	Schedule 1	LC	60
Pedaliaceae	*Harpagophytum procumbens*	Well drained sandy habitats in open savanna and woodlands.	Schedule 1	NE	100
Amaryllidaceae	*Boophone disticha*	Dry grassland and rocky areas	Schedule 2	LC	100
Amaryllidaceae	*Nerine laticoma*	*Nerine laticoma* occurs in a broad band stretching from the dry inland parts of Namibia eastwards and southwards through southern Botswana, Limpopo, Gauteng, the North-West, Northern Cape, Free State and Lesotho. It usually occurs in large colonies on deep, red, sandy soils.	Schedule 2	LC	60
Apocynaceae	*Orbea lutea subsp. lutea*	The plants grow in scrub, savanna (Acacia and mopane veld) and grassland at altitudes of 500-1500 m in full sun or semi-shade	Schedule 2	LC	47
Apocynaceae	*Tridentea sp.*		Schedule 2	LC	100
Asphodelaceae	*Aloe grandidentata*	Nama karoo shrubland, occurs on ironstone ridges, but in the eastern part of the range it is also found on calcrete.	Schedule 2	LC	40
Capparaceae	*Boscia albitrunca*	This species is found in the drier parts of southern Africa, in areas of low rainfall.	Schedule 2	LC	60
Iridaceae	*Babiana hypogaea* (All species of Iridaceae)	Red sand plains. Usually in Kalahari Sand or stony laterite in open woodland or grassland	Schedule 2	LC	80

DDD = Data deficient – Insufficient Information; NE = Near Endemic; LC = Least Concern

Table B3: TOPS plant list for the floral species expected to occur within the Northern Cape.

Family	Scientific Name	Habitat	Growth Form	TOPS Threat Status	POC (%)
Aizoaceae	*Cheiridopsis peculiaris*	Gravels and shale derived from metamorphic rocks of the Namaqualand Complex	Succulent	CR	20
Aizoaceae	*Conophytum herreanthus subsp. Herreanthus*	Quartz patches	Succulent	CR	0
Asphodelaceae	*Aloidendron pillansii*	Succulent Karoo shrubland on dry, rocky dolomite and gneiss hillsides.	Succulent, Tree	EN	0
Amaryllidaceae	*Haemanthus granitcus*	Namaqualand Klipkoppe Shrubland or Namaqualand Granite Renosterveld.	Geophyte	EN	20
Aizoaceae	*Lithops dorotheae*	Fine-grained, sheared, feldspathic quartzite	Succulent	EN	0
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	33
Amaryllidaceae	*Brunsvigia herrei*	Succulent Karoo Shrubland, granitic soils on flats and sometimes in deposits of fairly large stones.	Geophyte	VU	0
Aizoaceae	*Conophytum bachelorum*	Rocky outcrops	Succulent	VU	0
Aizoaceae	*Conophytum ratum*	Spongy quartz soil.	Succulent	VU	0
Amaryllidaceae	*Gethyllis grandiflora*	Sandy and or stony soils in arid karroid shrubland.	Geophyte	VU	20
Amaryllidaceae	*Gethyllis namaquensis*	Coastal dunes and gravelly mountain slopes in succulent karoo shrubland.	Geophyte	VU	0
Amaryllidaceae	*Brunsvigia josephinae*	Heavy clay soils.	Geophyte	VU	0
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	0
Amaryllidaceae	*Cyrtanthus herrei*	Deeply shaded rock ledges on south-facing rocky slopes.	Bulb	P	0
Aizoaceae	*Sceletium tortuosum*	Quartz patches and is usually found growing under shrubs in partial shade.	Succulent	P	20
Pedaliaceae	*Harpagophytum procumbens*	Well drained sandy habitats in open savanna and woodlands.	Herb	P	100

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

APPENDIX C: Floral Species List

Table C1: Dominant plant species encountered in the study areas during the field assessment. Alien species are indicated with an asterisk (*).

Species *Alien **Succulent	Habitat Unit		
	Kathu Bushveld	Degraded Bushveld	Transformed
TREES AND SHRUBS			
**Nicotiana glauca*		X	X
**Prosopis glandulosa*	X	X	X
Asparagus suaveolens	X		
Blepharis sp.	X		
Dichrostachys cinerea	X		
Elephantorrhiza elephantina	X		
Grewia flava	X	X	
Hirpicium echinus	X		
Laggera decurrens	X		
Lasiosiphon polycephalus	X		
Searsia lancea		X	
Senegalia mellifera	X		
Tarchonanthus camphoratus	X		
Vachellia erioloba	X		
Vachellia haematoxylon	X		
Vachellia hebeclada subsp. *hebeclada*	X		
Ziziphus mucronata	X		
HERBS			
**Argemone ochroleuca*		X	X
Acrotome sp.	X		
Dicoma sp.	X		
Harpagophytum procumbens	X		
Helichrysum argyrospaerum	X	X	
Hirpicium sp.	X		
Nidorella hottentoitica	X		
Salvia runcinata	X		
Sansevieria aethiopica	X		
Senecio consanguineus	X	X	
Tridentea sp.* likely *T. gemmiflora (Stapelia gemmiflora)	X		
CREEPERS AND CLIMBERS			
Acanthosicyos naudinianus		X	
Coccinia rehmanii	X		
Senna italica subsp. *arachoides*	X		
BULBS			
Boophone disticha			
GRASSES/			
**Pennisetum setaceum*			
Aristida congesta subsp. *congesta*	X		
Aristida meridionalis	X	X	X
Centropodia glauca	X		
Chrysopogon serrulatus		X	
Enneapogon cenchroides	X		
Eragrostis curvula	X		
Eragrostis lehmanniana	X		
Eragrostis truncata	X		
Stipagrostis uniplumis	X		
PARASITES			
Tapinanthus oleifolius	X		

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BIODIVERSITY ASSESSMENT AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED EXPANSION ACTIVITIES AT THE MAMATWAN MINE, NEAR HOTAZEL, NORTHERN CAPE PROVINCE

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Part C: Faunal Assessment

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DOCUMENT GUIDE

The following table indicates the requirements for Specialist Studies as per Appendix 6 of Government Notice 326 as published in Government Notice 40772 of 2017, amendments to the Environmental Impact Assessment (EIA) Regulations, 2014 as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998).

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Part A: Appendix F
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Part A: Appendix F
b)	A declaration that the specialist is independent	Part A: Appendix F
c)	An indication of the scope of, and the purpose for which, the report was prepared	Part A: Section 1.2 Part C: Section 1.1
cA)	An indication of the quality and age of base data used for the specialist report	Part A: Section 2.1 and 3.1 Part C: Section 2
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Part C: Section 5
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Part A: Section 1.2 and 2 Part C: Section 2
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Part C: Appendix A
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.	Part C: Section 4
g)	An identification of any areas to be avoided, including buffers	Part C: Section 4
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Part C: Section 4
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Part A: Section 1.3 Part C: Section 1.2
j)	A description of the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Part C: Section 3 and 5
k)	Any mitigation measures for inclusion in the EMPr	Part C: Section 5
l)	Any conditions for inclusion in the environmental authorisation	Part C: Section 5
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Part C: Section 5
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Part C: Section 6
(iA)	Regarding the acceptability of the proposed activity or activities	Part C: Section 5
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Part C: Section 5
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q)	Any other information requested by the competent authority	N/A

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ACRONYMS

BGIS	Biodiversity Geographic Information Systems
CR	Critically Endangered
DAFF	Department: Agriculture, Forestry and Fisheries
EAP	Environmental Assessment Practitioner
EIS	Ecological Importance and Sensitivity
EN	Endangered
EW	Extinct in the Wild
GIS	Geographic Information System
GPS	Global Positioning System
IBA	Important Bird Area
IEM	Integrated Environmental Management
IUCN	International Union for Conservation of Nature and Natural Resources
LC	Least Concern
NCNCA	Northern Cape Nature Conservation Act
NT	Near Threatened
NYBA	Not yet been assessed
P	Protected
PES	Present Ecological State
POC	Probability of Occurrence
PRECIS	Pretoria Computerised Information System
QDS	Quarter Degree Square
RDL	Red Data Listed
RE	Regionally Extinct
SABAP	Southern African Bird Atlas Project
SANBI	South Africa National Biodiversity Institute
STS	Scientific Terrestrial Services
SCC	Species of Conservation Concern
TOPS	Threatened or Protected Species
VU	Vulnerable

GLOSSARY OF TERMS

Alien and Invasive species	A species that is not an indigenous species; or an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.
CBA (Critical Biodiversity Area)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges.
Endangered	Organisms in danger of extinction if causal factors continue to operate.
Endemic species	Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g. southern Africa), national (South Africa), provincial, regional or even within a particular mountain range.
ESA (Ecological Support Area)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
Integrity (ecological)	The integrity of an ecosystem refers to its functional completeness, including its components (species) its patterns (distribution) and its processes.
Least Threatened	Least threatened ecosystems are still largely intact.
RDL (Red Data listed) species	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
SCC (Species of Conservation Concern)	The term SCC in the context of this report refers to all RDL (Red Data) and IUCN (International Union for the Conservation of Nature) listed threatened species as well as protected species of relevance to the project.

1. INTRODUCTION

1.1 *Background*

Scientific Terrestrial Services (STS) was appointed to conduct a Biodiversity Assessment as part of the Environmental Impact Assessment (EIA) and authorisation process for the proposed Mamatwan Mine Project, near Hotazel, Northern Cape Province. The Mamatwan (MMT) Mine is located within the John Taolo Gaetsewe District Municipality and the Joe Morolong Local Municipality.

The MMT is situated approximately 17km south of the town of Hotazel, 32,6km north of the town of Kathu and 43km west of the town of Kuruman. The R380 runs directly adjacent to the MMT in a north-south direction from Hotazal to Kathu, the M31 roadway is located approximately 14km east of MMT and the N14 highway is located approximately 24km southeast of the MMT. The MMT Mine is situated south of thw UMK Mining Right Area (MRA), and east of the Tsipi MRA. The location and extent is indicated in Figures 1 & 2 of Part A.

The proposed MMT expansion activities include the following, and will henceforth collectively be referred to as the "study area":

- Development of a top cut stockpile and crushing and screening plant;
- Construction and operation of a railway loop and associated infrastructure; and
- Installation of a pipeline: Three alternatives are proposed, with alternative 1 considered as the preferred alternative by the proponent.

For a detailed Project description of all expansion activities, please refer to Part A.

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

- To provide inventories of faunal species as encountered within the study area;
- To determine and describe habitat types, communities and the ecological state of the study area and to rank each habitat type based on conservation importance and ecological sensitivity;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and/ or any other special features;
- To conduct a Red Data Listed (RDL) species assessment as well as an assessment of other Species of Conservation Concern (SCC), including potential for such species to occur within the study area;

- To provide detailed information to guide the proposed MMT expansion activities associated with the study area; and
- To ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements and the provision of ecological services in the local area.

1.2 *Assumptions and Limitations*

The following assumptions and limitations are applicable to this report:

- The faunal assessment is confined to the study area and does not include the neighboring and adjacent properties nor the MRA (Mining Right Area);
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most faunal communities have been accurately assessed and considered and the information provided is considered sufficient to allow informed decision making to take place and facilitate integrated environmental management;
- Due to the nature and habits of most faunal taxa, the high level of surrounding anthropogenic activities, it is unlikely that all species would have been observed during a field assessment of limited duration. Therefore, site observations were compared with literature studies where necessary;
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa within the footprint area may therefore have been missed during the assessment; and
- A field assessment was undertaken from the 5th to the 7th of November 2019 (spring season), to determine the faunal ecological status of the study area, and to “ground-truth” the results of the desktop assessment (presented in Section A). 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 specialist experience in the area, and the findings of this assessment are considered to be an accurate reflection of the ecological characteristics of the study area.

2. ASSESSMENT APPROACH

The field assessment was undertaken from the 5th to 7th of November 2019 (spring season), to determine the faunal ecological status of the study area. A reconnaissance ‘walkabout’ was initially undertaken to determine the general habitat types found throughout the study area, following this, specific study sites were selected that were considered to be representative of the habitats found within the area, with special emphasis being placed on areas that may

potentially support faunal Species of Conservation Concern (SCC). Sites were investigated on foot in order to identify the occurrence of fauna within the footprint area. Sherman and camera traps were used to increase the likelihood of capturing and observing mammal species, notably nocturnal mammals.

A detailed explanation of the method of assessment is provided in Appendix A of this report. The faunal categories covered in this assessment are mammals, avifauna, reptiles, amphibians, general invertebrates and arachnids.

2.1 *General approach*

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

- Maps and digital satellite images were consulted prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. An initial visual on-site assessment of the study area was made in order to confirm the assumptions made during consultation of the maps;
- Literature review with respect to habitats, vegetation types and species distribution was conducted;
- Relevant databases considered during the assessment of the footprint area included the Important Bird and Biodiversity Areas (IBA, 2015), South African Bird Atlas Project 2 (SABAP2), International Union for Conservation of Nature (IUCN) and the Northern Cape Critical Biodiversity Areas (2016);
- Specific methodologies for the assessment, in terms of field work and data analysis of faunal ecological assemblages are presented in Appendix A of this report.
- For the methodologies relating to the impact assessment and development of the mitigation measures, please refer to Appendix B of this report.

2.2 *Sensitivity Mapping*

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

3. FAUNAL ASSESSMENT RESULTS

3.1 *Faunal Habitat*

The study area comprises three faunal habitat units. These habitat units are discussed briefly in terms of faunal utilisation and importance below. For a more detailed description and discussion of floral component associated with these habitat units refer to the Section B report (Floral Report).

Table 1: Habitat units identified within the study area, and the extent of each habitat unit.

Habitat Unit	Area (ha)	% of Total Area
Kathu Bushveld	257.8	75%
Degraded Bushveld	53.87	16%
Transformed Habitat	31.25	9%

Kathu Bushveld

This unit comprises natural vegetation which has not undergone any large-scale transformation. Is has further been is subdivided into *Senegalia mellifera -Stipagrostis* Open Bushveld and *Senegalia mellifera – Vachelia haematoxylon Grewia flava* Bushveld. Within this unit only grazing from domestic animals (sheep, cows, goats, donkeys, horses and mules) was noted to have had an impact on the habitat. These impacts have not been enough to degrade the habitat unit, however, it is likely that it has increased the competition for resources which may in turn reduce the abundance of any endemic mammals. During the site assessment it was obvious that several fossorial species of mammals are present as numerous burrows were strewn across the vegetation unit. Signs of common antelope were also observed throughout the site, although abundance appears low as these species were seldom directly observed. The habitat is relatively intact and natural Kathu Bushveld encompasses the MMT ensuring suitable habitat for fauna is around the locality. The majority of this unit is present within “Other Natural Areas” according to the 2016 Northern Cape Critical Biodiversity Areas map.

Degraded Bushveld

Degraded Bushveld locations occur in the south eastern portion of the study area where open veld recovering from a disturbance, possibly dumping of waste material, and two rehabilitated stockpiles are present. The unit does not resemble the adjacent Kathu Bushveld and lacks the dominant tree species *Senegalia mellifera* and *Vachellia haematoxylon*, which have been substituted by *Searsia lanceolate* within this habitat unit. The unit has the densest grass layer which will offer good forage for grazers and plenty of seeds for small granivores, invertebrates

and birds. Within the unit the rehabilitated stockpiles are largely homogenous in their grass and forb species composition and will likely only provide valuable forage for fauna for a short period of time during the year, when flowers and seed are produced.

Transformed habitat

The transformed habitat unit consists of areas where active and historic mining activities and its associated infrastructure occurs/occurred and where current waste rock and product storage dumps occur. In these locations vegetation has been cleared for mining activities, road infrastructure and any other associated mining infrastructure, which has resulted in significant alternations to the topography. This unit is largely devoid of vegetation or is composed of homogenous stands of vegetation which offer limited habitat and forage for fauna. A high abundance of pioneer grass species was observed, including *Hyparrhenia hirta*. It is deemed likely that common faunal species would utilise this habitat unit and common avifaunal species may utilise the area for breeding and foraging. The majority of the habitat is not considered to be of conservation significance according to any datasets assessed.

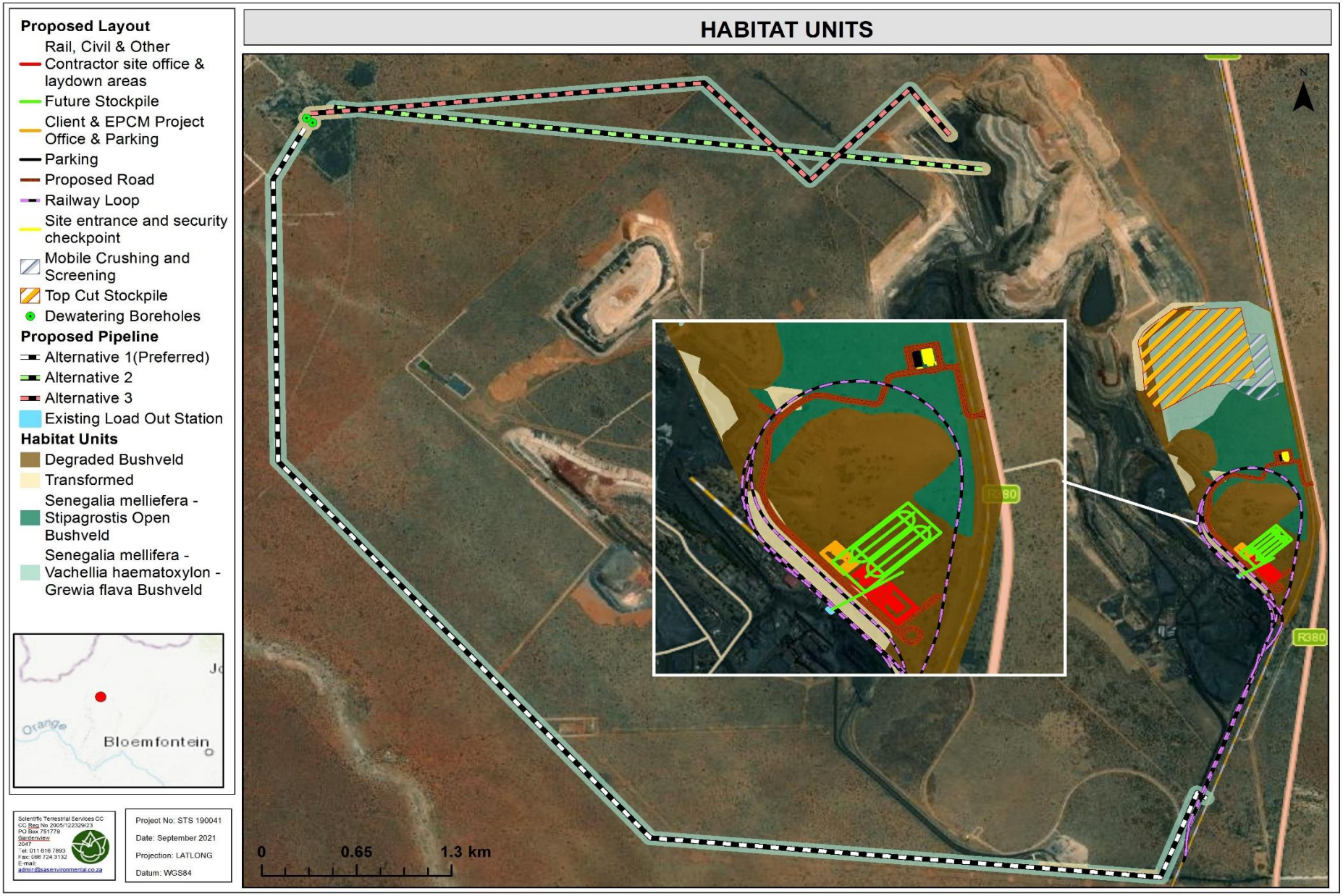
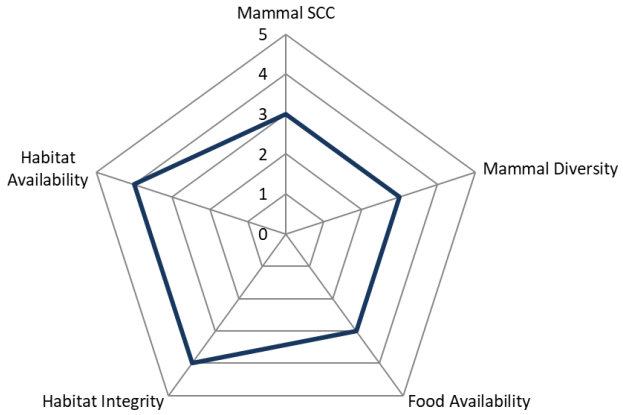


Figure 1: Habitat units encountered within the study area.

3.2 *Mammals*

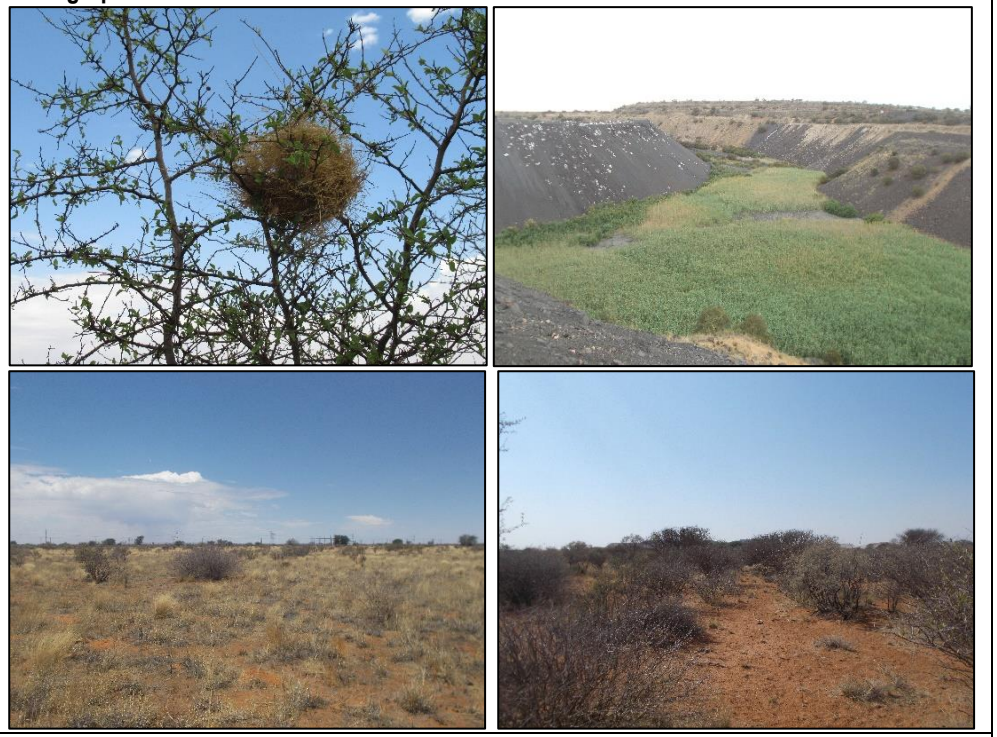
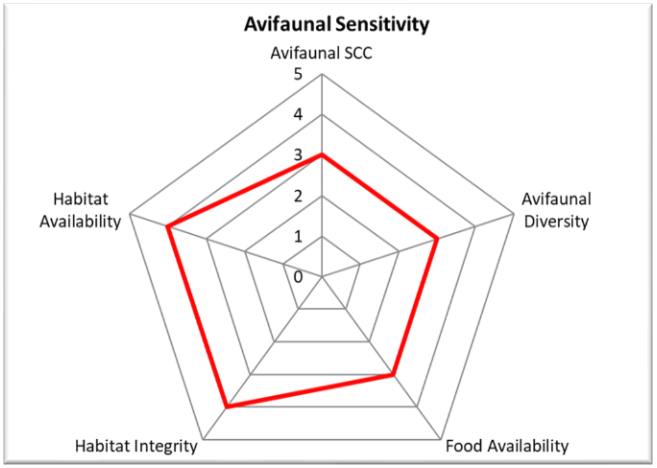
Table 2: Field assessment results pertaining to mammal species within the study area.

<table>
<tr><td>Faunal Class: Mammal</td><td>Mammal Habitat Sensitivity</td><td>Intermediate</td><td rowspan="2">Photograph:
 
</td></tr>
<tr><td colspan="3">Notes on photograph:
Top: Left - Canis mesomelas (Black-backed Jackal) was observed via a camera trap along the preferred pipeline route within the kathu bushveld habitat unit. Right – Sylvicapra grimmia (Common Duiker) camera trap image at the same location.
Bottom: Orycteropus afer (Aardvark) and Hystrix africaeaustralis (Porcupine) images captured near an overflowing reservoir adjacent to the preferred pipeline route.
Mammal Sensitivity Graph:
 
</td></tr>
<tr><td>Faunal SCC/ Endemics/ TOPS</td><td colspan="2">A single mammal SCC was encountered during the field assessment, namely, Orycteropus afer (Aardvark) a Threatened Or Protected Species (TOPS) according to the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (Threatened Or Protected Species Regulations). The presence of further SCC is likely considering the relatively undisturbed nature of the larger region where minor anthropogenic activities and movement occur outside of the mining areas. Many of the SCC which may occur on site are very secretive mammals that inhabit burrows during the day, only coming out at night to forage. Though mining activities</td><td>Business Case and Conclusion
The current active mining area is completely transformed and absent of any sensitive habitat to support mammal SCC. The undisturbed Kathu Bushveld habitat presents suitable habitat for several mammal species, although a low probability of occurrence is anticipated. Signs of nocturnal fossorial mammals were abundant and scattered throughout the study area. Mammal sensitivity for the entire location is considered intermediate.
The proposed MMT activities are unlikely to have a significant impact of mammal habitat or diversity since these areas are located directly adjacent to existing mining areas and these areas were noted to be predominantly occupied by commonly occurring species which do not have restricted ranges or habitat requirement. Furthermore, constant disturbances from current mining have likely ensured that any SCC refrain from entering the study area, remaining in the surrounding more suitable habitat available around the active mining areas.</td></tr>
</table>

	do occur in the general locality, it is unlikely that it inhibits the presence of SCC in locations which have not experienced any degradation or transformation. It is possible that a number of mammal SCC could occur on the study area, although their probability of occurrence is considered fairly low (please refer to section 3.8 of this report for the SCC probability of occurrence). The current active mining area will be absent of any SCC as the area is completely degraded and offers no forage for SCC species.	All phases of development must be monitored, to ensure edge effects from these areas do not affect the natural habitat adjacent to the proposed development.
Faunal Diversity	Mammal diversity has been affected in part as a result of the existing mining activities and general human activities within the study area. Moreover, the landscape is homogenous limiting the habitats available and reducing specialised niche environments which would increase diversity. Some mammal species will have vacated the natural portions of Kathu Bushveld alongside the active mining area due to the aforementioned disturbances, reducing the species diversity of the location to intermediate. A NEMBA TOPS protected species *Orycteropus afer* (Aardvark) was observed within the proposed pipeline route (on a camera trap) and burrows were observed throughout the site. The remaining mammal diversity was mostly restricted to those species which are ubiquitous with large ranges. (Rock Hyrax) have reportedly taken up residence within some of the Discard dumps and Waste rock stockpiles. Please refer to Appendix C for the full list of species identified on site.	
Food Availability	Due to the historical and current anthropogenic activities in the study area, the forage available is limited to locations outside the active mining area. Food availability for grazers and browsers within some disturbed locations (e.g. rehabilitated waste rock dumps) is moderately low due to the homogenous nature of the vegetation which likely provides forage for a limited period of time annually. The remaining undisturbed Kathu Bushveld provides intermediate to moderately high forage largely because of competition for grazing resources with domestic animals.	
Habitat Integrity	The study area is almost completely surrounded by natural portions of Kathu Bushveld that has experienced only minor anthropogenic disturbances. Directly east of the study area lies Tshipi Borwa mine while 1 km north lies UMK Mine, these are the only transformed locations within a general locality. The habitat beyond these existing mines is largely intact and only disturbed by domestic livestock grazing reducing the integrity to a small degree.	
Habitat Availability	Habitat availability is considered moderately high. Although habitat transformation has occurred within the active mining areas, with minor invasion by alien species, the Kathu Bushveld unit within the study area is still capable of providing habitat to a number of small, medium and large mammal species. Habitat availability is, however expected to be limited to common and widespread species as a result of the homogeneity of the landscape and vegetation unit.	

3.3 *Avifauna*

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

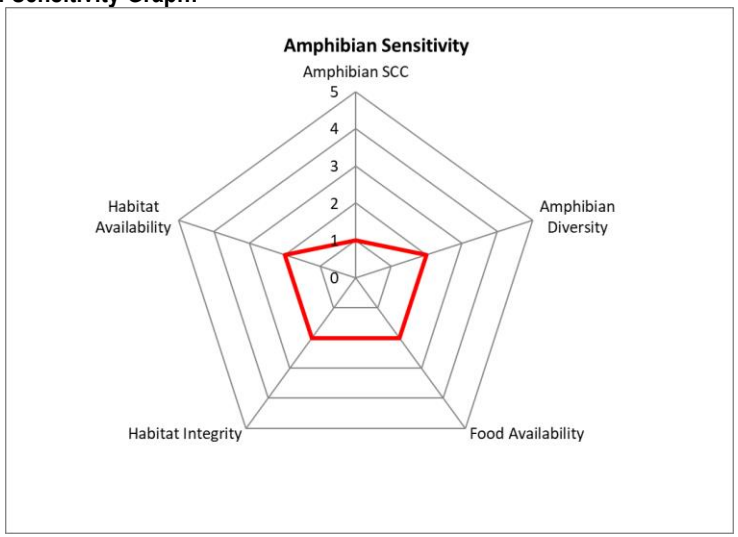
<table>
<tr><td colspan="2">Faunal Class: Avifaunal</td><td>Avifaunal Habitat Sensitivity</td><td>Intermediate</td><td rowspan="2">Photograph:
  </td></tr>
<tr><td colspan="4">Notes on photograph:
Top: Left – Sporopipes squamifrons (Scaly-feathered finch) nest located within the Kathu bushveld habitat unit. Right – Thick bed of Phragmites sp associated with the artificial system, providing habitat for avifaunal species that build nests in dense reeds. Bottom: Typical open (left) and closed (right) Kathu Bushveld providing habitat for avifauna.</td></tr>
<tr><td colspan="4">Avifaunal Sensitivity Graph:
 
</td></tr>
<tr><td>Faunal SCC/Endemics/TOPS/</td><td colspan="3">No avifaunal species listed as a SCC were encountered during the field assessment. The presence of several SCC within the area is, however deemed possible, although species will likely only be utilised for foraging as opposed to breeding. The following SCC are considered likely to utilise the study area at any given point in time Aquila verreauxii (Black eagle, VU), Gyps africanus (White-backed Vulture, CR), Neotis ludwigii (Ludwig's Bustard, EN), Polemeatus bellicosus (Martial Eagle, EN), Aquila rapax (Tawny Eagle EN), Gyps coprotheres</td><td>Business Case and Conclusion:

The avifaunal habitat sensitivity for the study area is considered to be intermediate. Although a large contingent of SCC are considered likely to utilise the study area for foraging, only one SCC was deemed to potentially utilise the site for breeding: the African Rock Pipit – utilising the available rocky and grassy hillslopes created by the mining activities. The large contingent of raptors, (all known to have wide ranging) are considered unlikely to breed within the study area due to the lack of tall trees which would be required to build their nests.</td></tr>
</table>

	(Cape Vulture, EN), *Torgos tracheliotos* (Lappet-faced Vulture, EN) and *Falco biarmicus* (Lanner Falcon, VU). *Cursorius rufus* (Burchell's courser, VU), *Sagittarius serpentarius* (Secretarybird, VU), *Anthus crenatus* (African Rock Pipit, NT) and *Ardeotis kori* (Kori Bustard, NT). *Anthus crenatus* (African Rock Pipit, NT) may utilize the study area to breed and have previously been observed on the rocky hillslopes of Waste rock stockpiles. The remaining SCC are unlikely to breed here as the disturbances from human activity likely causes to much disturbance to make the study area preferable to adjacent farms and farm portions.	Potential impacts arising from the proposed MMT activities are unlikely to impact on SCC diversity or abundance due to the current disturbances arises from the existing mining activity at the site. Mitigation measures as set out within this report must be adhered to, to prevent negative impacts on avifaunal SCC.
Faunal Diversity	The avifaunal diversity associated with the study area was intermediate and comprised mainly of common avifaunal species that have become accustom to high levels of anthropogenic activities. Since habitat structure is often considered the primary determinant of bird assemblages it is anticipated that the largely homogenous structure of the study area will be mirrored by a relatively narrow assemblage of birds. Species observed on site include: Cape turtledove (*Streptopelia capicola*), Red-eyed Bulbul (*Pycnonotus nigricans*), Crimson-breasted shrike (*Laniarius astrococcineus*), Karoo Prinia (*Prinia masulosa*), Long-billed crombec (*Sylvietta rufescens*), African Hoopoe (*Upupa africana*), Neddicky (*Cisticola fulvicapillus*) and others. Please refer to Appendix C for the full list of species identified on site.	
Food Availability	The study area is considered to have an intermediate amount of forage for avian species. The Kathu Bushveld habitat unit offers sufficient food for the avian assemblage observed within the study area. Much of the transformed unit offers little forage as it is largely devoid of vegetation and therefore suitable habitation locations for avian forage. Within the transformed habitat there are two locations water is pumped to. The first location creates a bed of reeds where food resources are likely high. The second location where water is pumped is largely absent of vegetation with poor water quality and likely does not support any invertebrates and supplies little to avifauna in terms of food.	
Habitat Integrity	The study area is almost surrounded by natural portions of Kathu Bushveld that has experienced only minor anthropogenic disturbances. Directly east of the study area lies Tshipi Borwa mine while 1 km north lies UMK Mine, these are the only transformed locations within a general locality. The habitat beyond these existing mines is largely intact and only disturbed by domestic livestock grazing which has the potential to cause structural changes to herbaceous vegetation. The study area comprises of natural, degraded and transformed locations which offer varying degrees of integrity. As they all are adjacent natural bushveld it is likely that they will be transverse during foraging. The highly mobile nature of avifauna does not allow for the study area to be looked at in isolation.	
Habitat Availability	Habitat availability is considered moderately high within the study area. The Kathu Bushveld offers good habitat for avifaunal species yet the lack in heterogeneity of the landscape reduces the habitat available for specialist birds who have specific niche requirements. Degraded Bushveld offers suitable habitat similar in structure, which is a primary determinant of bird species assemblages, to the Kathu Bushveld and thus available habitat for avifaunal species. The transformed habitat units of the active mining area offer minimal habitat suitable for feeding or breeding for most species. It must be noted that the rehabilitated waste rock dumps and pits in the north western portion of the study area may be inhabited by a breeding pair of regionally near threatened African Rock Pipit's (unconfirmed during the site visit).	

3.4 *Amphibians*

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

<table>
<tr><td>Faunal Class:
Amphibians</td><td>Amphibian Habitat Sensitivity</td><td>Moderately low</td><td rowspan="2">Photograph:
  </td></tr>
<tr><td colspan="3">Notes on Photograph:
Habitat for amphibians was limited within the study area to the artificial freshwater features which have arisen from the mine releasing process water and excess water into old pits.</td></tr>
<tr><td colspan="3">Amphibian Sensitivity Graph:
 
</td><td></td></tr>
<tr><td>Faunal SCC/Endemics/TOPS/</td><td colspan="2">No amphibian SCC were observed during the field assessment. Moreover, no pans or ephemeral streams transverse the study area making it unlikely that locations of standing or running surface water necessary for most amphibian species survival and breeding occur on the site.
The regionally NT Pyxicephalus adspersus (Giant Bullfrog) is unlikely to occur due to the lack of suitable aquatic habitat for this species on site.</td><td>Business Case and Conclusion

The amphibian habitat sensitivity within the study area is considered moderately low. The freshwater habitats which suit the amphibian lifestyle are absent from the study area and the habitat that is available is completely artificial and formed/created from mining processes. As such, impacts as a result of the proposed development activities on amphibians will be limited.</td></tr>
</table>

Faunal Diversity	No amphibians were observed within the study area during the field assessment. The arid nature of the locality and the absence of any pans or intermittently flowing streams limits the possibility of any diverse assemblage of amphibians. Only *Breviceps adspersus* (Bushveld rain frog) an amphibian species not dependant on water for breeding and development may occur within the study area. For a full list of species observed see Appendix D.
Food Availability	Invertebrates form the primary food source of many amphibian species. Invertebrate abundance within the study area was moderately high which provides sufficient food availability for amphibians, although, without sufficient suitable habitat for a diverse assemblage of amphibians having sufficient food resources holds no ground to confirming an abundance of amphibian species.
Habitat Integrity	Habitat integrity for amphibians is considered moderately low as few suitable locations where breeding can be accomplished and sustainable for long term persistence of amphibians occur within the study area. The potential areas are limited to two locations where water used for mining processes, usually degrading water quality, is pumped into old pits. As amphibians are sensitive to water quality it is unlikely to be favourable or suitable to complement all phases of the amphibian life cycle.
Habitat Availability	The freshwater habitats which normally provide suitable locations for breeding and maintaining a moist epidermis required for amphibian respiration are absent. Artificial waterways where water is discharged after processing of material are present though the water quality is not likely favourable for amphibians and therefore they are considered likely to be unsuitable habitat.

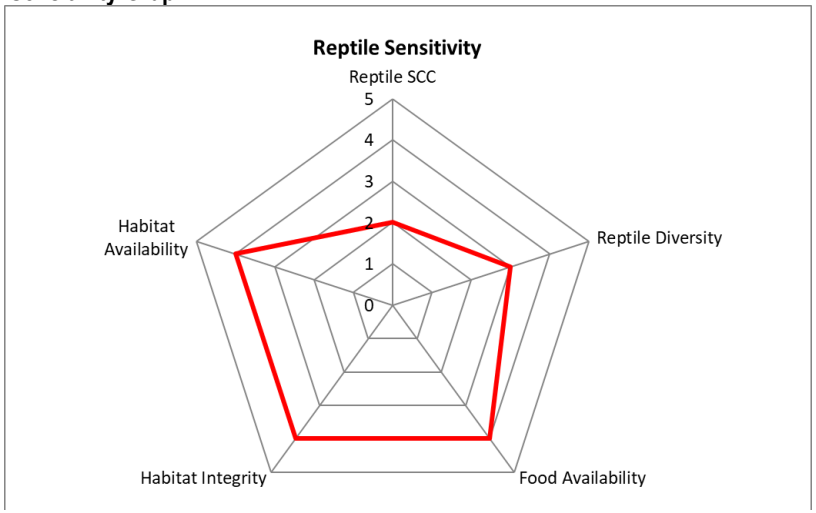
3.5 *Reptiles*

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

Faunal Class: Reptiles	Reptile Habitat Sensitivity	Intermediate

Notes on Photograph:
Top: *Pedioplanis lineoocellata* (Spotted sand lizard) was a commonly observed species throughout the study area.
Bottom: Left – *Heliobolus lugubris* (Bushveld lizard) occurred in lower densities than the Spotted sand lizard. Right – *Pseudapsis cana* (Mole snake) observed within the proposed top cut bushveld vegetation unit.

Reptile Sensitivity Graph:



Photograph:

Faunal SCC/Endemics/TOPS/	No reptile SCC were observed during the field assessment. There is a possibility that two SCC, namely: *Chamaeleo dilepis* (Common flap-neck chameleon) and the *Python sebae* (African rock python) may occur on the site within the Kathu Bushveld. African Rock pythons often utilize burrows dug by Aardvark to breed in and escape to when disturbed. However, the large amount of anthropogenic movement through the site and fencing will likely reduce the habitat suitability for the large bodied python.

Business Case and Conclusion
Although a limited reptile assemblage is expected to be present and it is unlikely that reptile SCC will occur within the study area, it is still important to ensure that the impacts from the proposed MT expansion activities be kept as small as possible. This can be achieved by avoiding unnecessary disturbance and minimising construction footprints. It must also be ensured that all disturbed areas are rehabilitated on decommissioning to prevent the proliferation of alien and invasive plant species.

Faunal Diversity	A low reptile diversity was observed during the field assessment however, this is likely due to the secretive nature of many reptile species. It is likely that the study area will have an intermediate reptile diversity. Although the active mining activities have resulted in the loss of suitable habitat (predominantly due to food resources not being available) the remainder of the site, even disturbed locations and building infrastructure will likely provide suitable habitat for a number of reptile species. Mining activities will increase lighting in the area, which will likely attract various insect species, a staple food resource for many smaller reptile species. Common species e.g. *Ptenopus garrulus* (Common barking gecko) and *Pedioplanis lineoocellata* (Spotted sand lizard) were observed during the field assessment. For a full list of species observed see Appendix D.	
Food Availability	The high levels of anthropogenic activities have not resulted in large reductions in food availability for reptiles. Small mammal and insects, the primary prey of reptiles, do not have extensive spatial requirements and are able to breed and survive in even disturbed locations. With an influx of human activity there is a likely increase in insect activity (due to increased lighting and food sources brought in by workers) and small mammals (i.e. rodents) Therefore, it is unlikely that shortages in food availability would be the main limitation for reptiles within the study area. Moreover, burrows which can be utilised for shelter were observed throughout the site and provide enough locations for breeding sites.	
Habitat Integrity	The transformed habitat unit in completely surrounded by intact Kathu Bushveld which has only been disturbed by grazing domestic animals. The transformed habitat comprises a small footprint when looking at the locality within the region, indicating increased habitat integrity. The Kathu Bushveld habitat unit is the most intact habitat present within the study area and may therefore provide improved habitat conditions for common reptile species and potential SCC, as listed above. Buildings and areas where rubble have been disposed of may provide suitable habitat for common reptile species within the study area.	
Habitat Availability	The entire study area provides moderately high habitat availability for reptile species within the locality. The Kathu Bushveld unit will be favoured by a diverse assemblage of reptiles as sufficient burrows and vegetation structure is available for habitation. The active mining area is transformed and will likely be abundantly inhabited by common adaptable species which do not have specific habitat requirement due to the potential influx of food resources. These locations will likely attract reptiles from the adjacent Kathu Bushveld to forage where prey abundance is high. The rehabilitated/revegetated waste rock dumps, within the Transformed habitat, are currently being recolonized by a more representative assemblage of reptiles as the habitat is gradually becoming more like the adjacent Kathu Bushveld.	

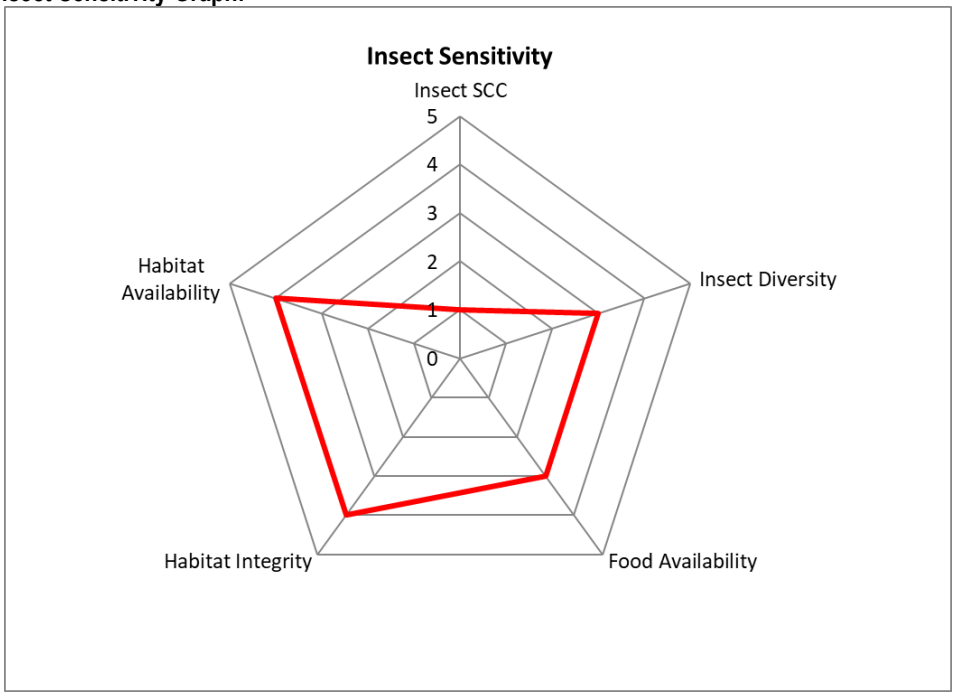
3.6 *Insects*

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

Faunal Class: Insects	Insect Habitat Sensitivity	Intermediate

Notes on Photograph:
Top: Left -. *Passalidius fortipes* (Burrowing ground beetle) captured in a pit-fall trap. Right – *Apterogyna* sp. (Velvet ant) observed in the Kathu Bushveld habitat unit. **Middle:** Left - *Eremoides bicristatus* (Crested Owlfly) located in the Kathu Bushveld habitat unit. Right – Ridged seed beetle (*Stips* sp.), captured within the pit-fall trap. **Bottom:** Left – Leaf cutter bees from the family Megachilidae. Right – *Gonometa postica* (African Silk Moth) cocoons were seen throughout the site at low densities.

Insect Sensitivity Graph:

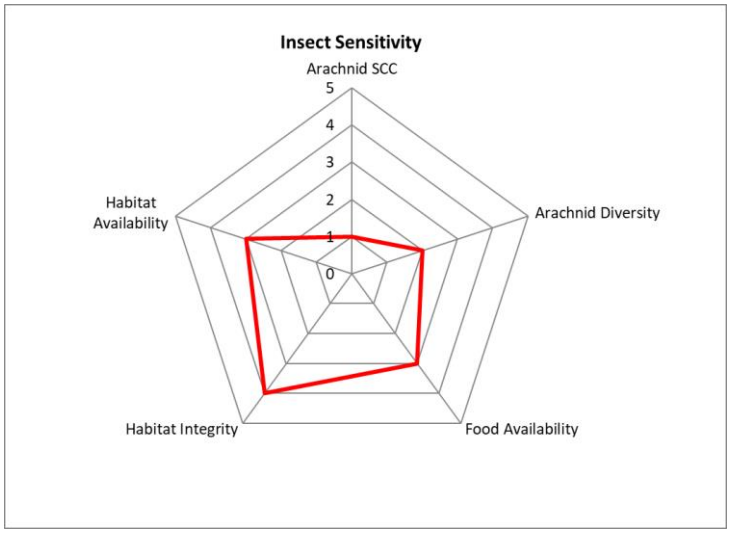


Photograph:

Faunal SCC/Endemics/TOPS/	No insect SCC were observed during the site assessment nor are any likely to occur within the study area.	**Business Case and Conclusion** The insect habitat sensitivity is considered intermediate. The floral characteristics of the surrounding habitat types do not support a wide diversity of insect species yet offer suitable habitat for an abundant number of insects. These species in turn are utilised as a food source by numerous other faunal species. As such, mitigation measures set out within this report must be adhered to. Impacts within the Kathu Bushveld vegetation unit should be minimised as far as possible.
Faunal Diversity	Insect diversity of the study area was intermediate even though very little rain had fallen prior to the site assessment. Insects often appear following heavy rain. Rain is often an extremely important environmental cue for insects to breed or enter a new stage within their life cycles. Diversity is expected to be higher following summer rain. Coleopterans, Orthopterans and Hymenopterans were the most abundant species within the study area, yet the diversity was restricted to a few commonly occurring species. Several Nymphalidae (Monarch butterflies) and Lycaenidae (Coppers and Blues), which are all specially protected within the Northern Cape Nature Conservation Act (Act No. 9 of 2009) (NCNCA), where observed within the study area, these could not be identified to species level as the specimens were skittish and did not allow for easy capture and photographing. *Grewia flava*, which was in flower, attracted many invertebrates and appears to be an important plant for many insects within the location. The highest invertebrate population density was observed within those areas of Kathu Bushveld that had not been exposed to habitat modification. For a full list of species observed see Appendix D.	
Food Availability	As much of the remaining Kathu Bushveld is in a good condition beyond the active mining area the food availability is considered intermediate. Competition for food resources for insects occurs in the form of domestic herbivores, mostly cattle, sheep and goats, leading to a slight reduction in the standing vegetation. Flora within the study area is mostly homogenous with no special features limiting the forage for specialist insects. The homogeneity of vegetation is likely mimicked by the invertebrate species assemblage, therefore it is expected that mostly common insect species will be encountered within study area due to the lack of specialist habitat.	
Habitat Integrity	The transformed habitat unit is almost completely surrounded by intact Kathu Bushveld which has predominantly been disturbed by grazing domestic animals and a few dilapidated buildings. The transformed habitat comprises a small footprint when looking at the locality within the region, indicating moderately high habitat integrity. The Kathu Bushveld habitat unit is the most intact habitat present within the study area and may therefore provide improved habitat conditions for insects.	
Habitat Availability	Suitable habitat for insects is provided throughout the site. Even degraded portions will offer habitat for insects though this will be restricted to a few species at low densities. Niche habitats for specialist insect species where limited as the topography was flat with no natural ridges or rocky locations and very little change in occurred throughout the study area. Thus, although there is sufficient habitat for insects it will likely only cater for those species which are ubiquitous.	

3.7 *Arachnids*

Table 7: Field assessment results pertaining to arachnid species within the study area.

<table>
<tr><td colspan="2">Faunal Class: Arachnids</td><td>Arachnid Habitat Sensitivity</td><td>Moderately Low</td><td rowspan="2">Photograph:
  </td></tr>
<tr><td colspan="4">Notes on Photograph:
Top: A colourful Solifugae which was observed during the field assessment within the Kathu Bushveld where the pipeline alternatives 2 and 3 are proposed. Right – A web belonging to a community of spiders from the genus Stegodyphus, observed throughout the site. Bottom: Left – Scorpion burrows were seen frequently yet no specimens were encountered. Right – Funnel-web spider nest likely belonging to the genus Agelena.</td></tr>
<tr><td colspan="5">Arachnid Sensitivity Graph:
 
</td></tr>
<tr><td>Faunal SCC/Endemics/TOPS/</td><td colspan="2">No arachnid SCC were observed within the study area. Opistophthalmus carinatus (Robust Burrowing Scorpion) and O. wahlbergii (Kalahari Burrower) which are listed in Schedule 2 of the NCNCA (2009) as protected, has been observed previously in the MRA and are likely to occur within the study area. O. ater, a NEMBA</td><td colspan="2">Business Case and Conclusion
The study is considered of moderately low habitat sensitivity for arachnids. No arachnid SCC were observed within the study area. It is highly unlikely that the proposed MMT activities will impact on the diversity of arachnids within the area. Although habitat for arachnids will be disturbed and the abundance may be reduced there are also possible gains which may arise within the disturbed areas where new rockier locations suitable for arachnid, especially scorpion, habitation will be created.</td></tr>
</table>

	TOPS species considered as critically endangered may also be present.	However, avoiding unnecessary disturbance, minimising construction footprints and ensuring that all disturbed areas are rehabilitated is still vital as arachnids only make a small component of faunal assemblages within ecosystems.
Faunal Diversity	Arachnid diversity on site was lower than expected. Community nesting spiders were by far the most observed species inhabiting most of the site where trees or short shrubs were present. A number of Funnel-web spider nest were also observed and likely belong to spiders within the genus *Agelena*. No scorpions were observed during the site assessment. Evidence of their presence was observed in the form of scorpion burrows, which occurred throughout the site at low densities. Whilst very few arachnid species were observed, it is expected that their diversity is underestimated in most environments due to their cryptic and crepuscular/nocturnal behaviour. The largely homogenous landscape will likely be inhabited by a low diversity assemblage of arachnid species. The Kathu Bushveld habitat unit and the fringes of the transformed mining locations are likely to support most of the arachnid assemblage within the study area. For a full list of species observed see Appendix D.	
Food Availability	Although a moderate diversity of insect species were observed within the study area, the abundance of insects was relatively low thereby limiting the food resources available for arachnids. Even though arachnids may take larger prey in the form of small mammals and reptiles, these will only suffice for larger specimens which likely account for a small percentage of the total abundance. The moderate diversity of insects, at a moderately low abundance within the study area provides a suitable food source for many of the arachnid species.	
Habitat Integrity	The transformed habitat unit where active mining is occurring is almost completely surrounded by intact Kathu Bushveld. The Kathu Bushveld is largely undisturbed, only having been slightly degraded by grazing domestic animals and a few old dilapidated buildings. Within the broader locality, the transformed active mining area makes up a small footprint creating a landscape with moderately high habitat integrity for arachnid species.	
Habitat Availability	Habitat availability is limited by the largely homogenous landscape structure, which is absent of any natural rocky outcrops or ridges, leading to an intermediate habitat availability for arachnid species. The Kathu bushveld, though largely natural, provides suitable habitat for a limited diversity of arachnids. The adjacent fringes of the transformed mining area will likely increase the habitat availability of the study area, yet, will only provide semi-permanent habitat because of the continually changing activity of the mine and the future rehabilitation.	

3.8 *Faunal Species of Conservational 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 B and C whose known distribution ranges and habitat preferences include the study area were taken into consideration.

Only one SCC listed in Appendix C, *Orycteropus afer* (Aardvark), was observed within the study area and its immediate surroundings. The following faunal SCC are considered to have a POC of 60% or higher and may occur within the study area.

Three burrowing Scorpions (*Opistophthalmus ater* (CR)*, Opistophthalmus carinatus* (NYBA) and *Opistophthalmus wahlbergii* (NYBA)) all have suitable habitat located within the study area and have distributions which overlap the study area. *Opistophthalmus ater* is considered critically endangered by NEMBA, while *Opistophthalmus carinatus* and *Opistophthalmus wahlbergii* are not. All the arachnid SCC are protected by the NCCA, as a result of illegal collecting. The lack of rocky areas will decrease habitat preference for these species, yet the suitable substrate will increase their probability of occurrence in the study area together with the moderate abundance of food. These scorpions will utilise the Kathu Bushveld habitat unit as well as the Degraded Bushveld vegetation units. Transformed locations may also be utilised, especially where waste rock provides rocky areas where these species may construct burrows.

Two avifaunal SCC have previously been observed within the study area. *Aquila verreauxii* (Verreaux's eagle) a regionally vulnerable species has been observed flying above the mine, by staff, likely in search of their preferred prey (Hyrax) which have taken up residence in the mine dumps and stockpiles since they have been artificially created. Although it is deemed unlikely that this species would breed in the study area, it is likely that the study area forms part of its foraging grounds. The near threatened *Anthus crenatus* (African Rock Pipit), which would not have inhabited the study area historically was observed during a previous survey by another company (NSS, 2018). This species prefers rocky and rocky scree habitats which have been developed by the mine activities in the form of rock and soil stockpiles. During the previous assessment it was suggested that the African rock pipits that were observed may be a breeding pair and are likely utilising an area in the north west of the MRA to breed.

Suitable habitat for two reptile SCC was observed on the site. *Chamaeleo dilepis* (Common flap-neck chameleon) inhabits coastal forest, moist and dry savannah, woodlands and bushy grasslands. The Kathu Bushveld unit has both more open and closed savannah with many low acacia trees which would be suitable for the species. Moreover, the insect abundance will likely ensure enough food is available for the Common flap-neck chameleon. *Python sebae* (African rock python) may occur on the site within the Kathu Bushveld where evidence of fossorial species was observed as these species would all be suitable prey items for African rock pythons and attract them to the study area. The burrows observed will also provide a location in which female pythons could lay their eggs.

Due to the possible presence of faunal SCC and suitable habitat within the study area, it can be concluded that the proposed development may affect faunal SCC conservation in the region. Should any faunal SCC listed in Appendix C of this report be encountered during the development of the proposed activities, all operations must be stopped immediately, and a biodiversity specialist must be consulted in order to determine the best way forward.

4. SENSITIVITY MAPPING

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

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

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Katha Bushveld	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.	Any disturbance of sensitive faunal habitat must be managed to reduce any significant impacts. In this regard, maintaining migratory corridors and connectivity is deemed essential. Care must be taken to prevent any negative impacts on vegetation and as such edge effects on this, and surrounding habitats, should be limited. Moreover, all mitigation measures should be correctly implemented as set out within this report.
Degraded bushveld	Moderately Low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	Very little impact on the faunal diversity is deemed likely for MMT expansion activities that will take place within this unit, however, faunal abundances are likely to be affected.

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
			Development within this habitat unit should be limited to the development footprint areas and should aim to reduce edge effects to remaining natural habitat adjacent this unit to the north.
Transformed Areas	Low	Optimise development potential.	Activities in this habitat unit are unlikely to impact on faunal species within the study. Care must be taken to limit edge effects on the surrounding natural areas.

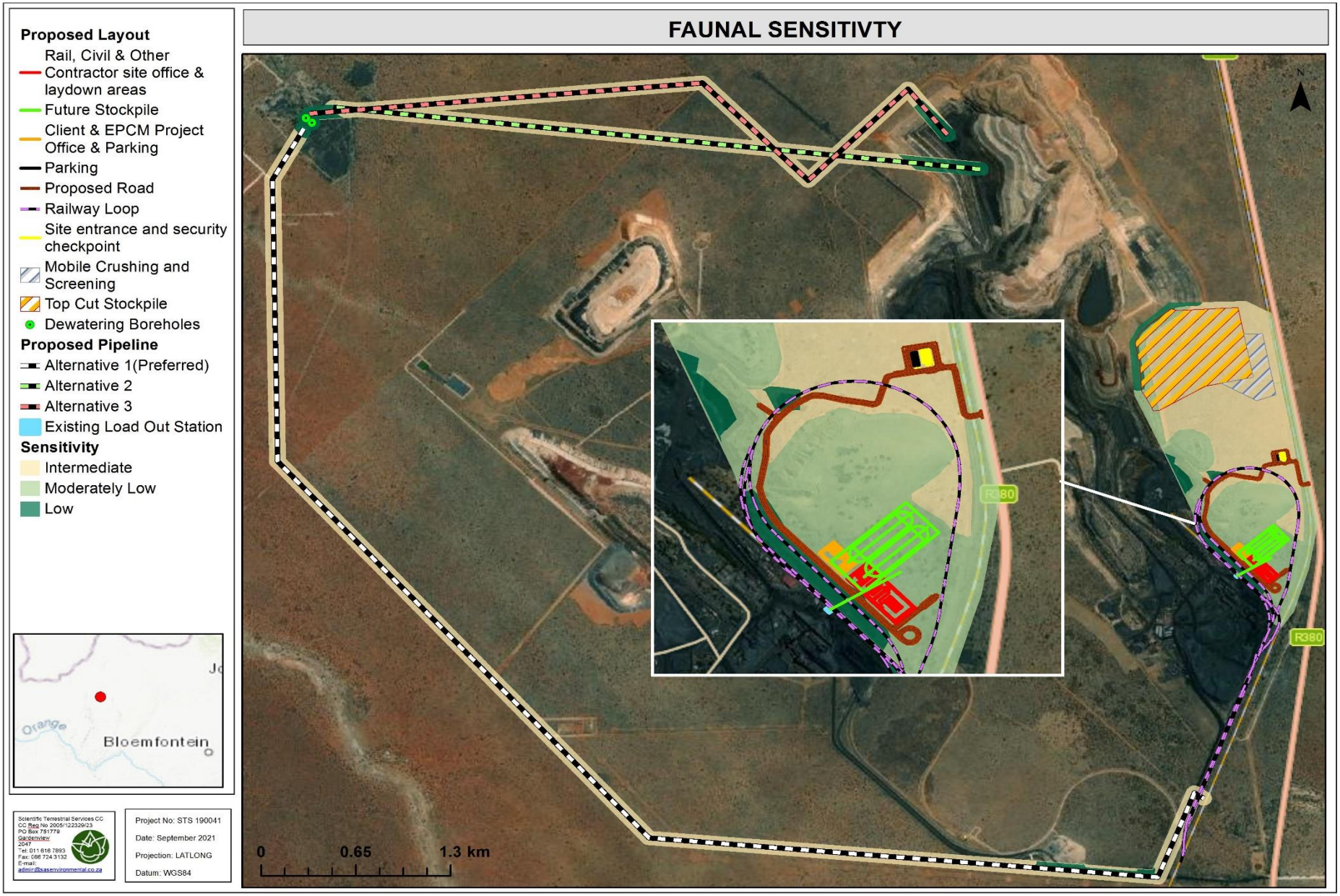


Figure 2: Sensitivity map for the study area.

5. IMPACT ASSESSMENT

The tables below serve to summarise the significance of perceived impacts on the faunal ecology of the study area, according to the method described in Part A (Appendix C), with each individual impact identified presented in Section 5.1 and 5.2 of this report. The impacts are considered with and without mitigation having taken place. A summary of the potential construction as well as rehabilitation and maintenance impacts are provided in Section 5.2. All the required mitigatory measures needed to minimise the impact is presented in Section 5.3.

The impact assessment is based on the initial proposed layout as provided by the proponent (refer to Part A Section 1.1), which indicates the following:
The planned expansion activities assessed in this section of the report are as follows:

- Additional storage space is required to stockpile top-cut material prior to processing at the sinter plant. The top-cut material will need to be subjected to crushing and screening via a mobile crushing and screening plant, prior to the material being sent to the sinter plant. The estimated height for the proposed top-cut stockpile is between 50 m and 80 m at a maximum, which corresponds with the adjacent waste rock dumps. Due to the significantly smaller development footprint required for the crushing and screening plant, the impact assessment for the top-cut stockpile and crushing and screening plant were undertaken separately;
- MMT further proposes to abstract water from the Middelplaats Mine as and when water is not available from the open pit (dewatering) or from the Vaal Gamagara Water Pipeline. Water will be abstracted via two proposed boreholes. A pipeline to transfer the water from the Middelplaats Mine to MMT will need to be established. Three alternative routes are being considered with Alternative 1 the preferred route option. All three pipelines fall within the Kathu Bushveld, however alternative 1 is located within the existing road reserve. The impact assessment arising from the construction of Pipeline Alternatives 2 and 3 are anticipated to be similar, and therefore these alternatives have been assessed together. The impact arising from Alternative 1 is expected to be lower as this alternative lies adjacent a gravel road which has already been disturbed. This alternative was subsequently assessed separately; and
- Transnet Freight Rail (TFR) plans to increase the capacity of the Manganese rail line. In order to meet the TFR expansion requirements the loading rate of trains at the MMT needs to be increased. The plan to achieve this will be through the establishment of a new railway loop, new loadout station, product stockpile areas, stacker and reclaimers.

- New offices, road, security checkpoint and parking areas. Adjacent to the railway further infrastructure which includes the proposed establishment of a road, parking, security checkpoint contractor offices and a contractor laydown area. As these structures fall largely within the footprint of the proposed railway, impacts are anticipated to be low.

5.1 Activities and Aspect Register

The table below indicates the perceived risks to faunal species associated with the activities pertaining to the proposed mine expansion.

Table 9: Activities and aspects likely to impact on the impact faunal resources of the study area. Blocks with a red colour were regarded as having a higher impact significance and were rated higher in the impact assessment. Green blocks suggest the lower impact aspects.

ACTIVITIES AND ASPECTS REGISTER
Planning Phase
- Potential failure to implement the required mitigation measures before and at the commencement of construction activities: • Potential failure to implement an Erosion Control Plan; • Potential failure to have a Rehabilitation Plan developed, and implemented, before the commencement of mining related expansion activities; and • Potential failure to implement an Alien and Invasive Plant (AIP) Management/Control Plan before construction activities commence. - **Impact**: Long-term or permanent degradation and modification of the receiving environment, loss of SCC and fauna habitat.
- Potential failure to obtain the necessary permits for removal of protected faunal species (arachnids). - **Impact**: Permanent loss of protected faunal species.
- Potential inadequate design of infrastructure leading to pollution of soils as a result of, e.g., seepage/leaks from infrastructure failure. - **Impact:** Contaminated soils lead to a loss of viable growing conditions for plants and results in a decrease of faunal habitat, diversity and SCC – rehabilitation effort will also be increased as a result.
Construction and Operational Phase
- Site clearing and the removal of vegetation. - **Impact:** Loss of faunal habitat and loss of faunal SCC.
- Proliferation of AIP species that colonise areas of increased disturbances and that outcompete native species, including the further transformation of adjacent or nearby natural areas. - **Impact:** Loss of favourable faunal habitat outside of the direct development footprint, including a decrease in faunal diversity and potential loss of faunal SCC.
- Potential failure to correctly stockpile topsoil removed during construction activities leading to: • Potential contamination of topsoil stockpiles with AIP propagules; • Compaction of stockpiled topsoil leading to loss of viable soils for rehabilitation; and • Inefficient vegetating of stockpiled topsoil resulting in loss and degradation of soils. - **Impact:** Loss of viable soils for rehabilitation, thus hampering the potential for faunal species to successfully recolonize during rehabilitation activities. Ultimately a loss of faunal diversity will result.
- Potential failure to concurrently rehabilitate bare areas or disturbed sites as soon as they become available, potentially resulting proliferation of AIPs. - **Impact:** Long-term loss of favourable habitat for the establishment of faunal species. Loss of faunal diversity.
- Potentially poorly managed edge effects: • Ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to a continual proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas altering the faunal habitat; and • Potential erosion stemming from soil left bare leading to sedimentation of downslope faunal habitat.

ACTIVITIES AND ASPECTS REGISTER
- **Impact:** Loss of faunal habitat, diversity and SCC within the direct expansion development footprint of the mine. Loss of surrounding faunal diversity and faunal SCC through the displacement of indigenous flora by AIP species - especially in response to disturbance in natural areas.
- Potential failure to implement a biodiversity action plan (BAP), including the auditing of the BAP. Potential failure to initiate concurrent rehabilitation and implement an alien floral control plan during the operational phase, - **Impact:** Potentially leading to a permanent transformation of faunal habitat and long-term degradation of important faunal habitat within the surrounding region, i.e. faunal communities associated with Kathu Bushveld. This will lead to a residual loss of biodiversity.
- Habitat fragmentation resulting from the expansion activities and poorly rehabilitated areas. - **Impact:** Long-term changes in faunal structure, altered genetic fitness and potential loss of SCC.
- Potential overexploitation through the removal and/or collection of important or sensitive faunal SCC beyond the direct footprint area on the property. - **Impact:** Local loss of faunal SCC abundance and diversity.
- Risk of contamination from all operational facilities may pollute the receiving environment. - **Impact:** Leading to altered faunal habitat.
- Potential seepage affecting soils and the groundwater regime. - **Impact:** Altered faunal habitat.
- Erosion as a result of mining development, stormwater runoff and on-going disturbance of soils due to operational activities. - **Impact:** Leading to a loss of faunal habitat.
- On-going abstraction, seepage and runoff may affect the groundwater regime beyond the operational phase. - **Impact:** Loss of niche faunal habitat and associated species.
- Potential dumping of excavated and construction material outside of designated areas, promoting the establishment of AIPs. - **Impact:** Loss of faunal habitat, diversity and SCC.
- Dust generated during construction and operational activities accumulating on the surrounding floral individuals, altering the photosynthetic ability of plants[1] and potentially further decreasing optimal growing/re-establishing conditions. - **Impact:** Decline in plant functioning leading to loss of floral species reducing the habitat suitability for faunal species.
Decommissioning & Closure Phase
- Potential ineffective rehabilitation of exposed and impacted areas potentially leading to a shift in vegetation type. - **Impact:** Permanent loss of faunal habitat, diversity and SCC, and a higher likelihood of edge effect impacts on adjacent and nearby natural vegetation of increased sensitivity.
- Potential poor management and failure to monitor rehabilitation efforts, leading to: • Landscapes left fragmented, resulting in reduced dispersal capabilities of faunal species and a decrease in faunal diversity; • Compacted soils limiting the re-establishment of natural vegetation; • Increased risk of erosion in areas left disturbed. - **Impact:** Loss of faunal habitat and diversity. The above aspects will also have a notable impact on area utilisation by common faunal species and SCC.
- Potentially poorly implemented and monitored AIP Management programme leading to the reintroduction and proliferation of AIP species. - **Impact:** Permanent loss of surrounding natural faunal habitat, diversity and SCC.
- On-going risk of contamination from mining facilities beyond closure. - **Impact:** Permanent impact on faunal habitat.
- On-going abstraction, seepage and runoff may affect the groundwater regime beyond closure. - **Impact:** Loss of niche faunal habitat and associated species.
- Rehabilitation of currently degraded habitat and AIP clearance of already proliferated areas. - **Impact (positive):** Some ecological functioning will be restored that has been lost due to AIP proliferation and habitat transformation.

[1] Sett, R. (2017). Responses in plants exposed to dust pollution. Horticulture International Journal, 1(2), 00010.).

5.1 *Impact Discussion*

5.1.1 Loss of Faunal Habitat and Ecological Structure

All proposed development activities that may impact on the faunal community of the study area are discussed below.

Construction of most of the railway loop and the pipeline route (alternatives 2 and 3) and the development of the top cut stockpile will result in the loss of faunal habitat of intermediate sensitivity within the natural Kathu Bushveld. Construction of the preferred pipeline route (alternative 1) will occur adjacent a gravel road within Kathu Bushveld, which has a reduced sensitivity due to the existing constant road traffic which has likely resulted in disturbances to reduce habitat suitability. For the linear developments, i.e. the railway loop and the pipeline alternative 2 and 3), impacts are anticipated to have less of an impact to the faunal assemblages as they generally have smaller footprints that do not encompass whole habitat units and thus leave enough suitable habitat adjacent the development. Similarly, the impacts are predominantly of a short duration, during the construction phase and once installed (specifically associated with the pipelines) the natural habitat can be re-established. The development of the Top cut stockpile will have a medium impact on the local fauna as evidence of several faunal species was observed here and the impact will be long lasting. With the implementation of mitigation measures, the impact significance will be reduced within all habitat units.

5.1.2 Loss of Faunal Diversity and Ecological Integrity

Faunal diversity within the study area ranges from intermediate for mammals, birds, reptiles and insects and moderately low for arachnids and amphibians. The sensitivities are as a result of both the constant anthropogenic activity associated with the current mining operations within the general area and, to a lesser extent, grazing of domestic animals which increases competition for resources in an already semi-arid landscape where resources are limited.

Understandably the species diversity within the natural portions of Kathu Bushveld is higher than in the degraded and transformed habitat units. The impact significance of the loss of faunal species diversity based on the proposed layout plans vary between Very Low to Medium prior to the implementation of mitigation measures and Very Low to Medium after mitigation. The relatively small footprint when considering the broader undisturbed locality should not cause any long-term impacts to the diversity or integrity of the ecosystem, provided sufficient rehabilitation is undertaken.

5.1.3 Impact on Important Faunal Species of Conservation Concern

Eight protected faunal species may inhabit different regions of the study area. *Chamaeleo dilepis* (Common flap-neck chameleon), *Python sebae* (African rock python), *Orycteropus afer* (Aardvark) have suitable habitat within the Kathu bushveld. *Opistophthalmus ater* (Steinkopf Burrowing Scorpion), *Aquila verreauxii* (Black eagle), *Anthus crenatus* (African Rock Pipit) and the Burrowing scorpions: *Opistophthalmus carinatus* and *Opistophthalmus wahlbergii* have a high likelihood of occurring in both the Kathu and Degraded Bushveld and within the Transformed habitat units.

Chamaeleo dilepis (Common flap-neck chameleon) will occupy the Kathu Bushveld where shrubby habitat will favour its arboreal lifestyle and insect abundance (prey) was at its highest abundances. *Orycteropus afer* (Aardvark) utilise a broad array of habitats within the region. Within the study area the Kathu Bushveld was the primary vegetation unit in which signs of Aardvark were observed. This species appeared to be completely absent from the disturbed Kathu bushveld and the transformed habitat units, keeping away from any form of disturbance to the veld. *Python sebae* (African rock python) are likely to mimic the distribution of Aardvark within the Kathu Bushveld as they will utilise burrows discarded by Aardvarks.

Contrary to logic the SCC's *Aquila verreauxii* (Black eagle) and *Anthus crenatus* (African Rock Pipit) are likely to utilise the Degraded and Transformed habitat units. *Aquila verreauxii* (Verreaux's eagle) will utilise the transformed unit to actively search out its primary prey item (Rock Hyrax) which have inhabited the waste rock dumps and soil stockpiles. A possible breeding pair of *Anthus crenatus* (African Rock Pipit) had been observed within the North Eastern portion of the study area (NSS, 2018) in both the degraded and transformed habitat units where the mining activities have created suitable habitat beyond its normal range. The Burrowing scorpions will find suitable habitat throughout the site, utilising degraded and natural areas where suitable burrowing substrate is available.

The impact associated with the loss of habitat for the above-mentioned species is of Very Low to Medium significance during the construction and operational phase and Very Low to Medium significance during the rehabilitation phase, prior to the implementation of mitigation measures. With the implementation of mitigation measures, the impact significance of the loss of important species may be further reduced, as mitigation measures will ensure that habitat for these species will be better protected.

5.1.4 Probable Latent Impacts

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

- Continued loss of faunal habitat;
- Potential decline in faunal abundance;
- Altered faunal assemblages and guild specific services;
- Loss of faunal SCC habitat and possible SCC occurrence both within the study area and in the surrounding habitats through edge effects;
- Potential increase of hunting/ trapping of mammal faunal species; and
- Disturbed areas are highly unlikely to be rehabilitated to baseline levels of ecological functioning and significant loss of faunal habitat, species diversity and faunal SCC will most likely be permanent.

5.1.5 Possible cumulative Impacts

Based on the number of faunal SCC expected to occur within the study area, it is likely that the location plays a role in supporting invertebrate, avian and mammalian SCC. As the surrounding landscape has escaped transformation and remains in a good ecological state the loss of habitat from the proposed MMT activities, specifically due to the close proximity of these activities to the already transformed habitat, is unlikely to cause any significant impacts on SCC as the current faunal species could relocate to more suitable habitat adjacent the development, where disturbance is limited. The Kathu Bushveld habitat is the most sensitive, yet, very little of the unit has been transformed and not threatened or protected within any legislation. It is unlikely that any long-term impacts will occur to mobile faunal SCC provided sufficient rehabilitation and post rehabilitation monitoring occurs. Lastly, ineffective control and monitoring of edge effects will result in the spread of AIP species to areas outside of the study area, which will further alter faunal habitat and subsequently faunal diversity within the habitats surrounding the study areas.

5.2 *Faunal Impact Assessment Results*

The table below serve to summarise the findings of the impact assessment undertaken with reference to the perceived impacts stemming from the proposed development activities as found in Part A (Appendix C). The tables below indicate the significance of the perceived impacts prior to the implementation of mitigation measures and following the implementation

of mitigation measures. The mitigated results of the impact assessment have been calculated on the premise that all mitigation measures as stipulated in this report are adhered to and implemented. Should such actions not be adhered to, it is highly likely that post mitigation impact scores will increase.

The table below highlights the key integrated mitigation measures that are applicable to all the development activities in order to suitably manage and mitigate the ecological impacts on fauna that are associated with the pre-construction, construction, operation and decommissioning phases of the proposed activities. Provided that all the management and mitigation measures as stipulated in this report are implemented the overall risk to faunal diversity, habitat and faunal SCC can be adequately mitigated and minimised.

The pre-construction phase is essential in ensuring that activities associated with all phases of the project have the lowest possible impact on the receiving environment. In this regard, scoring of the pre-planning phase is considered important, since although it is unlikely to result in an immediate impact, failure to effectively plan and implement an AIP control plan, a rehabilitation plan, a Biodiversity Action Plan and obtain the necessary faunal permits as well as design and implement a rescue and relocation plan prior to the onset of ground clearing activities, the impact is likely to be higher during the construction and operational phase, as well as the decommissioning and closure phase.

Table 10: Impact on the faunal habitat, diversity and SCC arising from the proposed development activities.

	UNMANAGED							Managed					
Expansion Activity	**Intensity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Significance**		**Intensity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Significance**
Pre-Construction (Planning) Phase													
Impact on faunal habitat and diversity													
Top-cut stockpile	H	H	VL	**M**	M	**Medium**		M	H	VL	**M**	M	**Medium**
Crushing and Screening Plant	L	M	VL	**M**	M	**Medium**		VL	M	VL	**VL**	M	**Very Low**
Borehole Drilling	VL	L	VL	**VL**	VL	**Very Low**		VL	VL	VL	**VL**	VL	**Insignificant**
Dewatering Pipeline Alternative 1	L	M	L	**VL**	VH	**Very Low**		VL	M	VL	**VL**	VL	**Very Low**
Dewatering Pipelines Alternative 2 and 3	M	L	L	**M**	L	**Low**		L	L	VL	**L**	L	**Very Low**
New offices, road, security checkpoint and contractor laydown	L	L	VL	**L**	L	**Very Low**		L	L	VL	**L**	L	**Very Low**

	UNMANAGED							Managed						
Expansion Activity	**Intensity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Significance**		**Intensity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Significance**
Manganese Rail line and additional infrastructure	M	H	VL	**M**	H	**Medium**		L	M	VL	**L**	H	**Low**
Impact on faunal SCC													
Top-cut stockpile	M	M	VL	**M**	VH	**Medium**		L	M	VL	**M**	VH	**Medium**
Crushing and Screening Plant	L	M	VL	**L**	VH	**Low**		VL	M	VL	**VL**	VH	**Very Low**
Borehole Drilling	VL	M	VL	**VL**	H	**Very Low**		VL	M	VL	**VL**	H	**Very Low**
Dewatering Pipeline Alternative 1	L	H	VL	**L**	H	**Low**		L	H	VL	**L**	H	**Low**
Dewatering Pipelines Alternative 2 and 3	M	H	VL	**M**	L	**Low**		M	H	VL	**M**	L	**Low**
New offices, road, security checkpoint and contractor laydown	L	H	VL	**L**	L	**Very Low**		VL	H	VL	**L**	L	**Very Low**
Manganese Rail line and additional infrastructure	M	H	VL	**M**	H	**Medium**		L	H	VL	**L**	H	**Low**
Construction and Operational Phase													
Impact on faunal habitat and diversity													
Top-cut stockpile	H	H	VL	**M**	M	**Medium**		M	H	VL	**M**	M	**Medium**
Crushing and Screening Plant	L	M	VL	**M**	M	**Medium**		VL	M	VL	**VL**	M	**Very Low**
Borehole Drilling	VL	L	VL	**VL**	VL	**Very Low**		VL	VL	VL	**VL**	VL	**Insignificant**
Dewatering Pipeline Alternative 1	L	M	L	**VL**	VH	**Very Low**		VL	M	VL	**VL**	VL	**Very Low**
Dewatering Pipelines Alternative 2 and 3	M	L	L	**M**	L	**Low**		L	L	VL	**L**	L	**Very Low**
New offices, road, security checkpoint and contractor laydown	L	L	VL	**L**	L	**Very Low**		L	L	VL	**VL**	L	**Very Low**
Manganese Rail line and additional infrastructure	M	H	VL	**M**	H	**Medium**		L	M	VL	**L**	H	**Low**

	UNMANAGED							Managed						
Expansion Activity	**Intensity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Significance**		**Intensity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Significance**
Construction and Operational Phase													
Impact on faunal SCC													
Top-cut stockpile	M	M	VL	**M**	VH	**Medium**		L	M	VL	**M**	VH	**Medium**
Crushing and Screening Plant	L	M	VL	**L**	VH	**Low**		VL	M	VL	**VL**	VH	**Very Low**

	UNMANAGED							Managed					
Expansion Activity	**Intensity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Significance**		**Intensity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Significance**
Borehole Drilling	VL	M	VL	**VL**	H	**Very Low**		VL	M	VL	**VL**	H	**Very Low**
Dewatering Pipeline Alternative 1	L	H	VL	**L**	H	**Low**		L	H	VL	**L**	H	**Low**
Dewatering Pipelines Alternative 2 and 3	M	H	VL	**M**	L	**Low**		M	H	VL	**M**	L	**Low**
New offices, road, security checkpoint and contractor laydown	L	H	VL	**L**	L	**Very Low**		VL	H	VL	**L**	L	**Very Low**
Manganese Rail line and additional infrastructure	M	H	VL	**M**	H	**Medium**		L	H	VL	**L**	H	**Low**
Decommissioning and Closure Phase													
Impact on faunal habitat and diversity													
Top-cut stockpile	M	H	VL	**M**	VH	**Medium**		M	M	VL	**M**	VH	**Medium**
Crushing and Screening Plant	L	M	VL	**L**	H	**Low**		VL	M	VL	**VL**	H	**Very Low**
Borehole Drilling	VL	L	VL	**VL**	H	**Very Low**		VL	VL	VL	**VL**	H	**Very Low**
Dewatering Pipeline Alternative 1	L	M	VL	**L**	H	**Very Low**		L	M	VL	**L**	H	**Very Low**
Dewatering Pipelines Alternative 2 and 3	M	M	VL	**M**	L	**Low**		M	M	VL	**M**	L	**Low**
New offices, road, security checkpoint and contractor laydown	L	L	VL	**L**	L	**Very Low**		VL	L	VL	**L**	L	**Very Low**
Manganese Rail line and additional infrastructure	H	H	VL	**M**	L	**Low**		M	M	VL	**M**	L	**Low**
Impact on faunal SCC													
Top-cut stockpile	M	H	VL	**M**	VH	**Medium**		M	H	VL	**M**	VH	**Medium**
Crushing and Screening Plant	L	H	VL	**L**	H	**Low**		VL	H	VL	**L**	H	**Low**
Borehole Drilling	VL	VL	VL	**VL**	H	**Very Low**		VL	VL	VL	**VL**	M	**Very Low**
Dewatering Pipeline Alternative 1	L	L	VL	**L**	H	**Low**		L	L	VL	**L**	H	**Low**
Dewatering Pipelines Alternative 2 and 3	M	L	VL	**L**	L	**Very Low**		L	L	VL	**L**	L	**Very Low**
New offices, road, security checkpoint and contractor laydown	L	L	VL	**L**	L	**Very Low**		L	L	VL	**L**	VL	**Insignificant**
Manganese Rail line and additional infrastructure	H	H	VL	**M**	VH	**Medium**		H	H	VL	**M**	VH	**Medium**

5.3 Integrated Impact Mitigation

The table below highlights the key, general integrated mitigation measures that are applicable to the proposed MMT expansion activities in order to suitably manage and mitigate the ecological impacts that are associated with all phases.

Provided that all management and mitigation measures are implemented, as stipulated in this report, the overall risk to faunal diversity, habitat and SCC can be mitigated and minimised, albeit still considered moderate for some aspects.

Table 11: A summary of the mitigatory requirements for faunal resources.

Project phase	*Pre-construction Phase*
Impact Summary	*Loss of faunal habitat, species and faunal SCC*
Management Measures	***Proposed mitigation and management measures:*** - It is recommended that prior to the commencement of construction activities the entire proposed top cut be fenced off and clearly demarcated, any burrows should be monitored after fencing has been established to ensure no SCC are utilizing the area. If SCC are noted permits for their removal are necessary; - Where possible, and feasible, all access roads should be kept to existing roads so to reduce fragmentation of existing natural habitat; - Development should consider sensitive habitats for fauna within the study area; - Prior to the commencement of construction activities on site an alien vegetation management plan should be compiled for implementation throughout all development phases; - Prior to the commencement of construction activities on site a rehabilitation plan should be developed for implementation throughout the development phases; - As part of the planning and preparation phase, a Fire Management Plan and Erosion plan should be developed and be in place before construction activities can commence; - Design of infrastructure should be environmentally sound, and all possible precautions taken to prevent potential spills and /or leaks; and - At all times, ensure that sound environmental management is in place during the planning phase.
Project phase	*Construction Phase*
Impact Summary	*Loss of faunal habitat, species and faunal SCC*
Management Measures	***Proposed mitigation and management measures:*** **Development footprint** - The footprint areas of all surface infrastructure must be minimised to what is absolutely essential and within the designated and approved MMT expansion activities boundary; - Vegetation outside of the footprint area is not to be cleared; - Vegetation clearance and commencement of construction activities should either be scheduled to coincide with low rainfall conditions when erosive stormwater is anticipated to be limited or alternatively stormwater controls must be established at the start of construction and dust suppression implemented; - Excavated topsoil must be stored with associated native vegetation debris for subsequent use in rehabilitation; - Any railway infrastructure and mining related activities including stockpiles should be placed within transformed areas or where possible, existing infrastructure should be used; - No dumping of general waste or construction material on site should take place. As such it is advised that waste disposal containers and bins be provided during the construction phase for all construction rubble and general waste; - If any spills occur, they should be immediately cleaned up to avoid soil contamination that can hinder faunal rehabilitation later down the line. Spill kits should be kept on site within workshops. In the event of a breakdown, maintenance of vehicles must take place with care, and the recollection of spillage should be practised preventing the ingress of hydrocarbons into the topsoil; - Natural habitat outside of the direct mining footprint areas must be avoided, and no construction vehicles, personnel, or any other construction related activities are to encroach upon these areas;

	- No hunting/trapping or collecting of faunal species is allowed; and - No informal fires by construction personnel are allowed. **Alien Vegetation** - Edge effects of all construction activities, such as erosion and alien plant species proliferation, which may affect adjacent Kathu Bushveld, need to be strictly managed adjacent to the natural portions of Kathu Bushveld; - An Alien and Invasive Plant Management and Control Plan must be designed and implemented in order to monitor and control alien faunal recruitment; and - Where areas are disturbed during construction activities, spread of alien invasive species within these areas should be continually monitored and controlled throughout the construction phase. **Faunal SCC** - No collection/ trapping or hunting of faunal SCCs may be allowed by any construction personnel; - During the surveying and site-pegging phases, all faunal SCC that will be affected by surface infrastructure must be marked and, where possible, relocated to suitable habitat surrounding the disturbance footprint. The relevant permits must be applied for from the Northern Cape Department of Environment and Nature Conservation (NCDENC) prior to the commencement of the construction phase; - Should any other faunal species protected under National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) or the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA) be encountered within the study area authorisation to relocate such species must be obtained from the NCDENC or the Department of Environmental Affairs (DEA); and - Edge effect control needs to be implemented to ensure no further degradation and potential loss of faunal SCC outside of the proposed project footprint area; - Should any SCC be observed on the site a biodiversity specialist should be contacted in order to map the best way forward; - Prior to vegetation clearing activities in the Kathu Bushveld habitat, the site should be inspected for the presence of burrowing scorpion burrows, pythons and Aardvark. If located, these species should be carefully excavated ensuring no harm to fauna, and relocated to similar surrounding habitat outside of the footprint area; - Smaller species such as scorpions and reptiles are likely to be less mobile during the colder period, as such should any be observed in the construction site during clearing and construction activities, they are to be carefully and safely moved to an area of similar habitat outside of the disturbance footprint. - Construction personnel are to be educated about these species and the need for their conservation. Smaller scorpion species and harmless reptiles should be carefully relocated by a suitably nominated construction person or nominated mine official. For larger venomous snakes, a suitably trained mine official should be contacted to affect the relocation of the species, should it not move off on its own; and - Should any snakes be encountered, either a suitably trained staff member or expert should be contacted to capture and relocate the specimen. No harm should done to any snakes located within the study area. **Dust** - An effective dust management plan must be designed and implemented in order to mitigate the impact of dust on flora throughout the construction phase. **Fire** - No illicit fires must be allowed during the construction phases of the proposed mining development. **Rehabilitation** - Any natural areas beyond the current opencast pit footprint, that have been affected by the construction activities, must be rehabilitated using indigenous species; and - All soils compacted as a result of construction activities falling outside of the project area should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas. - Revegetation of disturbed areas should be carried out in order to restore habitat availability and minimise soil erosion and surface water runoff; and - When rehabilitating a footprint site, it is imperative that as far as possible the habitat that was present prior to disturbances is recreated, so that faunal species that were displaced by vegetation clearing activities are able to recolonize the rehabilitated area

Project phase	*Operational Phase*
Impact Summary	*Loss of faunal habitat, species and Faunal SCC*
Management Measures	**Proposed mitigation and management measures:** **Development footprint** - The footprint and daily operation of all mining surface infrastructure areas must be strictly monitored to ensure that edge effects from the operational facilities do not affect the surrounding faunal habitat beyond the allowed footprint; - No hunting/trapping or collecting of faunal species is allowed; and - Following heavy rains, access roads are to be inspected for signs of erosion, which if found must be immediately rectified through appropriate erosion control measures. **Dust** - An effective dust management plan must be designed and implemented in order to mitigate the impact of dust on fauna and flora throughout the operational phase. **Stormwater** - Adequate stormwater management must be incorporated into the design of the proposed development in order to prevent erosion of topsoil and the loss of faunal habitat through the discharge of dirty water into the receiving environment. In this regard, special mention is made of: - Sheet runoff from cleared areas, paved surfaces and access roads needs to be curtailed; and - Runoff from paved/hardened surfaces should be slowed down by the strategic placement of berms. **Alien Vegetation** - Edge effects of all operational activities, such as erosion and alien plant species proliferation, which may affect adjacent natural habitat within surrounding areas, need to be strictly managed adjacent to the opencast pit footprint. Specific mention in this regard is made to alien or invasive plants species. - Ongoing alien and invasive vegetation monitoring and eradication should take place throughout the operational phase of the opencast pit operations, and the project perimeters should be regularly checked during the operational phase for alien vegetation proliferation to prevent spread into surrounding natural areas; and - Continue with and update the alien and invasive plant control plan accordingly. **Faunal SCC** - No collection of firewood (as this often provides microhabitats for small insect and arachnids) or faunal SCC is allowed by mining personnel; - Edge effect control needs to be implemented to ensure no further degradation and potential loss of faunal SCC outside of the proposed project area take place; and - It must be ensured that related operational activities are kept strictly within the development footprint. **Fire** - No illicit fires must be allowed during the operational phase of the proposed mining development. - Fire breaks should be maintained during the operational phase. **Rehabilitation** - Rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan compiled by a suitable specialist. This rehabilitation plan should consider all development phases of the project indicating rehabilitation actions to be undertaken during and once construction has been completed, ongoing rehabilitation during the operational phase of the project as well as rehabilitation actions to be undertaken during mine closure; - As part of a Biodiversity Action Plan (BAP), faunal monitoring should be done annually; - Rehabilitation must be implemented at all times, and disturbed areas must be rehabilitated as soon as such areas become available. This will not only reduce the total disturbance footprint but will also reduce the overall rehabilitation effort and cost; and

	- Following heavy rains, access roads are to be inspected for signs of erosion, which if found must be immediately rectified through appropriate erosion control measures.
Project phase	*Decommissioning and Closure Phase*
Impact Summary	*Loss of faunal habitat, species and SCC*
	Rehabilitation - All infrastructure and mining operation footprints should be rehabilitated in accordance with a rehabilitation plan compiled by a suitable specialist; - All rehabilitated areas should be rehabilitated to a point where natural processes will allow the ecological functioning and biodiversity of the area to be re-instated as per the post-closure objective; and - Rehabilitation efforts must be implemented for a period of at least five years after decommissioning and closure. **Alien Vegetation** - Edge effects of decommissioning and closure activities, such as erosion and alien plant species proliferation, which may affect adjacent sensitive habitat, need to be strictly managed adjacent to the opencast pit footprint; - Ongoing alien and invasive vegetation monitoring and eradication should take place throughout the closure/ decommissioning phase of the development, and the immediate surrounding area (30m from the perimeters) should be regularly checked during the decommissioning phase for alien vegetation proliferation to prevent spread into surrounding natural area; and - An Alien and Invasive Plant Management and Control Plan must be designed and implemented in order to monitor and control alien faunal recruitment in disturbed areas. The alien floral control plan must be implemented for a period of at least 5 years after decommissioning and closure to ensure faunal habitat is not degraded further.

5.4 Faunal Monitoring

It is recommended that a faunal monitoring plan be designed and implemented throughout all phases of the proposed expansion activities, should it be approved. The following points aim to guide the design of the monitoring plan. The monitoring plan should be continually updated and refined for site-specific requirements:

- It is recommended that monitoring points must be established in areas surrounding the mining area in order to monitor for mining edge effects from mining activities. The impacts associated with the mining activities may have cascading impacts on the neighbouring environment and as such should also be monitored. These points must be designed to accurately monitor the following parameters:
  - Species diversity (mammal, invertebrate, herpetofauna and avifauna);
  - Species abundance; and
  - Faunal community structure including species composition and diversity which should be compared to pre-development conditions;
- The following methods aim to guide the monitoring plan, although more detailed, site specific methods must be employed during the development and implementation of the monitoring plan:

- Monitoring should ideally be undertaken annually for the first three years following the inception of monitoring activities. Following this monitoring is recommended to be undertaken every 2 years as a minimum, but on a bi-annual basis ideally, one winter and one summer monitoring session;
- Pitfall traps can be used to monitor invertebrate diversity;
- Camera trap surveys should be conducted on a bi-annual basis, a winter and a summer trapping survey, for medium to large mammals, as well as cryptic and nocturnal species;
- Sherman traps can be used to monitor small mammal diversity;
- Fixed and random points for bird counts to determine species composition and diversity trends; and
- The presence of any *Anthus crenatus* (African Rock Pipit) breeding locations should be located and monitored bi-annually. If any disturbance occurs in the respective location it should not occur from October - January, which falls inside of its breeding season.

➢ Monitoring of rehabilitation activities must also take place throughout all phases of the proposed mining development and for a period of five years after decommissioning and closure to monitor faunal species recruitment and establishment in these areas;
➢ The rehabilitation plan must be continuously updated in accordance with the monitoring results in order to ensure that optimal rehabilitation measures are employed;
➢ Results of the monitoring activities must be taken into account during all phases of the proposed mining development and action must be taken to mitigate impacts as soon as negative effects (negative deviation from baseline conditions as determined by the baseline ecological assessments) from mining related activities become apparent; and
➢ The method of monitoring must be designed to be subjective and repeatable in order to ensure consistent results.

6. CONCLUSION

Scientific Terrestrial Services (STS) was appointed to conduct a faunal ecological assessment as part of an authorisation process for the proposed Mamatwan Mine Project, near Hotazel, Northern Cape. During the field assessment three habitat units were identified, i.e. Kathu Bushveld, Degraded Bushveld and Transformed habitat units. The Kathu Bushveld habitat is considered to be of intermediate faunal ecological importance, the Degraded Bushveld is of moderately low sensitivity and the Transformed habitat unit is considered to be of low faunal ecological importance.

Several SCC potentially occur within the study area though only one was directly observed during the field assessment. One mammal SCC, *Orycteropus afer* (Aardvark), was observed within the natural Kathu Bushveld. Impacts to the widespread species are unlikely as more suitable locations for their habitation encompass the site within the broader vegetation unit which is largely untransformed, offering sufficient space for their utilisation. Moreover, the constant anthropogenic activity associated with the existing mining activities has likely restricted the use of the study area for foraging only. Three burrowing Scorpions (*Opistophthalmus ater* (CR), *Opistophthalmus carinatus* (NYBA) and *Opistophthalmus wahlbergii* (NYBA)) all have suitable habitat located within the site and have distributions which overlap the study area. The lack of rocky areas will decrease habitat preference for these species, yet the suitable substrate for burrowing will increase their probability of occurrence in the study area. Loss of habitat for these species and a potential decrease in abundance is also likely.

Two avifaunal SCC have previously been observed within the study area. *Aquila verreauxii* (Verreaux's eagle) a regionally vulnerable species has been observed flying above the mine likely in search of their main prey (Hyrax) which have taken up residence in the mine dumps and stockpiles since they have been artificially created. This species will not breed in the study area though it will be used as a foraging ground. The near threatened *Anthus crenatus* (African Rock Pipit), which would not have inhabited the study area historically was observed during a previous survey by another company (NSS, 2018). This species prefers rocky and rocky scree habitats which have been developed by the mine activities in the form of rock and soil stockpiles. During the previous assessment it was suggested that the African rock pipits that were observed may be a breeding pair and are likely utilizing an area in the north west of the property to breed. Like the Verreaux's eagle their presence in this locality is as a result of the mining activities.

The objective of this study was to provide sufficient information on the faunal ecology of the area, together with other studies on the physical and socio-cultural environment for the Environmental Assessment Practitioner (EAP) and the relevant authorities to apply the principles of Integrated Environmental Management (IEM) and the concept of sustainable development. The needs for conservation as well as the risks to other spheres of the physical and socio-cultural environment need to be compared and considered along with the need to ensure economic development of the country. From a faunal perspective alternative 1 for the proposed pipeline is favoured.

It is the opinion of the ecologists that this study provides the relevant information required in order to implement an Integrated Environmental Management (IEM) plan and to ensure that the best long-term use of the ecological resources in the study will be made in support of the principle of sustainable development.

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APPENDIX A: Faunal Method of Assessment

It is important to note that due to the nature and habits of fauna, varied stages of life cycles, seasonal and temporal fluctuations along with other external factors, it is unlikely that all faunal species will have been recorded during the site assessment. The presence of anthropogenic activities near the study area 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 unlikely to be directly observed in the field because of their nocturnal/crepuscular and cryptic nature. A simple and effective solution to this problem is to use Sherman traps. A Sherman trap is a small aluminium box with a spring-loaded door (Figure A1). Once the animal is inside the trap, it steps on a small plate that causes the door to snap shut, thereby capturing the individual. In the event of capturing a small mammal during the night, the animal would be photographed and then set free unharmed early the following morning. Traps were baited with a universal mixture of oats, peanut butter, and fish paste.

Figure A1: Sherman trap and bait used to capture and identify small mammal species.

Motion sensitive infrared camera traps were used to capture medium to large mammal species (Figure A2). These cameras were placed along trails and near suitable habitat areas and left for the full duration of the field site visit.

Figure A2: Field cameras used to document medium to large mammal species.

Furthermore, 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 in the study area. Field surveys were undertaken utilising direct observation and bird call identification techniques 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. Pitfall traps was also utilised during the site assessment and all insect species captured identified, photographed and set free.

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 the 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 Conservation Concern Assessment

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

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

- Habitat disturbance.

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

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

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

Faunal Habitat Sensitivity

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

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

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

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

Score	Rating significance	Conservation objective
1.0 < 1.5	Low	Optimise development potential.
≥1.5 <2.5	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
≥2.5 <3.5	Intermediate	Preserve and enhance biodiversity of the habitat unit ar surrounds while optimising development potential.
≥3.5<4.5	Moderately high	Preserve and enhance the biodiversity of the habitat un limit development and disturbance.
≥4.5 ≤ 5.0	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX B: Faunal SCC

Table B1: TOPS list of faunal species (2015) expected to occur within the Northern Cape.

Scientific Name	Common Name	Threat Status	POC
Homopus signatus	Speckled tortoise	VU	0
Pachydactylus goodi	Good's Gecko	VU	0
Cordylus macropholis	Large-scaled Lizard	P	0
Cordylus imkeae	Rooiberg Girdled Lizard	P	0
Opistophthalmus ater	Steinkopf Burrowing Scorpion	CR	60
Acinonyx jubatus	Cheetah	VU	0
Manis temminckii	Pangolin	VU	25
Ceratotherium simum	Southern White Rhinoceros	P	0
Crocuta crocuta	Spotted Hyaena	P	0
Felis nigripes	Black-footed Cat	P	10
Hyaena brunnea	Brown Hyaena	NT	30
Neophron percnopterus	Egyptian Vulture	CR	3
Aquila rapax	Tawny Eagle	EN	10
Torgos tracheliotos	Lappet-faced Vulture	EN	10
Gyps africanus	White-backed Vulture	CR	10
Gyps coprotheres	Cape Vulture	EN	5
Neotis ludwigii	Ludwig's Bustard	EN	3
Polemaetus bellicosus	Martial Eagle	EN	4
Terathopius ecaudatus	Bateleur	EN	0
Anthropoides paradiseus	Blue Crane	P	0
Ardeotis kori	Kori Bustard	P	16
Orycteropus afer	Aardvark	P	100

CR= Critically Endangered, EN=Endangered, NT=Near Threatened, VU=Vulnerable, P=Protected

Faunal Species of Conservation Concern

Threatened species not yet listed above that may occur in the study area.

Common Name	Species	NCCA 2009 Status	IUCN 2015 Status	POC (%)
Honey badger	*Mellivora capensis*	Specially Protected	LC	20
African wild cat	*Felis silvestris*	Specially protected	LC	15
Striped polecat	*Ictonyx striatus*	Specially protected	LC	15
African striped weasel	*Poecilogale albinucha*	Specially protected	LC	5
Aardwolf	*Proteles cristata*	Specially protected	LC	20
Cape fox	*Vulpes chama*	Specially protected	LC	40
Southern African hedgehog	*Atelerix frontalis*	Specially protected	LC	25
Leopard	*Panthera pardus*	Specially protected	VU	10
Black eagle	*Aquila verreauxii*	Specially Protected	VU	60
White-backed Vulture	*Gyps africanus*	Specially Protected	CR	10
Ludwig's Bustard	*Neotis ludwigii*	Specieally protected	EN	10
Martial Eagle	*Polemeatus bellicosus*	Specially Protected	EN	20
Tawny Eagle	*Aquila rapax*	Specially Protected	EN	8
Cape Vulture	*Gyps coprotheres*	Specially Protected	EN	7
Lappet-faced Vulture	*Torgos tracheliotos*	Specially Protected	EN	5
Burchell's courses	*Cursorius rufus*	Protected	VU	15
Lanner Falcon	*Falco biarmicus*	Specially Protected	VU	8
Secretarybird	*Sagittarius serpentarius*	Specially Protected	VU	5
Kori Bustard	*Ardeotis kori*	NA	NT	8
African Rock Pipit	*Anthus crenatus*	Protected	NT	80
Burrowing scorpion	*Opistophthalmus carinatus*	Specially Protected	NYBA	80
Burrowing scorpion	*Opistophthalmus wahlbergii*	Specially Protected	NYBA	60
Common flap-neck chameleon	*Chamaeleo dilepis*	Specially Protected	LC	65
African rock python	*Python sebae*	Specially Protected		65

EN = Endangered, CR = Critically Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern, NYBA = Not yet been assessed, NE = Not Evaluated, NA = Not applicable

Table B2: Avifaunal Species for the pentad 2720_2255 within the QDS 2722BD.

Pentads	Link to pentad summary on the South African Bird Atlas Project 2 web page
2720_2255	http://sabap2.adu.org.za/coverage/pentad/2720_2255

APPENDIX C: Faunal Species List

Table C1: Mammal species recorded during the field assessment.

Scientific Name	Common Name	IUCN Status	NCNCA (2009)
Canis mesomelas	Black-backed Jackal	LC	NA
Sylvicapra grimmia	Common duiker	LC	Protected
Lepus saxatilis	Scrub hare	LC	Protected
Lepus capensis	Cape hare	LC	Protected
Procavia capensis	Rock hyrax	LC	Protected
Pedetes capensis	Springhare	LC	Protected
Papio ursinus	Chacma baboon	LC	NA
Fukomys damarensis	Damara mole rat	LC	Protected
Galerella sanguinea	Slender Mongoose	LC	Protected
Tragelaphus strepsiceros	Kudu	LC	Protected
Phacochoerus africanus	Warthog	LC	Protected
Raphicerus campestris	Steenbok	LC	Protected
Orycteropus afer	Aardvark	LC	Specially Protected
Hystrix africaeaustralis	Porcupine	LC	Protected

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

Table C2: Avifaunal species recorded during the field assessment.

Scientific name	Common name	IUCN Red List Status	NCNCA (2009)
Streptopelia capicola	Cape turtledove	LC	Protected species
Pycnonotus nigricans	Red-eyed Bulbul	LC	NA
Columba guinea	Speckled pigeon	LC	Protected
Falco rupicolus	Rock kestrel	LC	Specially protected
Uraeginthus granatinus	Violet eared waxbill	LC	Protected
Colies colius	White-backed mousebird	LC	NA
Tyto alba	Western barn owl	LC	Specially protected
Apus caffer	White-rumped Swift	LC	Protected
Ploceus velatus	Southern masked weaver	LC	NA
Laniarius astrococcineus	Crimson-breasted shrike	LC	Protected
Sylvietta rufescens	Long-billed crombec	LC	Protected
Upupa africana	African Hoopoe	LC	Protected
Sylvia subcaerulea	Chestnut-vented tit-babbler	LC	Protected
Prinia masulosa	Karoo Prinia	LC	Protected
Serinus flaviventris	Yellow Canary	LC	Protected
Passer melanurus	Cape Sparrow	LC	NA
Sporopipes squamifrons	Scaly-feathered Finch	LC	Protected
Spreo bicolor	Pied Starling	LC	Protected
Saxicola torquata	African Stonechat	LC	Protected
Anthus cinnamomeus	African Pipit	LC	Protected
Cisticola fulvicapillus	Neddicky	LC	Protected
Elanus caeruleus	Black-shouldered Kite	LC	Specially protected
Anthus crenatus (Previously observed)	African Rock Pipit	NT	Specially protected
Tockus nasutus	African Grey Hornbill	LC	Protected
Dicrurus adsimilis	Fork-tailed Drongo	LC	Protected

Hirundo fuligula	Rock Martin	LC	Protected
Parus cinerascens	Ashy Tit	LC	Protected
Batis pririt	Pririt Batis	LC	Protected
Sigelus silens	Fiscal Flycatcher	LC	Protected
Emberiza flaviventris	Golden-breasted Bunting	LC	Protected
Erythropygia paena	Kalahari scrub Robin	LC	Protected
Cinnyris talatala	White-bellied Sunbird	LC	Protected
Cinnyris fuscus	Dusky Sunbird	LC	Protected

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

Table C3: Reptile species recorded during the field assessment.

Scientific name	Common Name	IUCN 2016 Status	NCNCA 2009
Pedioplanis lineoocellata	Spotted sand lizard	NYBA	Protected
Heliobolus lugubris	Bushveld lizard	NYBA	Protected
Pseudapsis cana	Mole snake	NYBA	Specially protected
Ptenopus garrulus	Common barking gecko	LC	NA
Trachylepis spilogaster	Kalahari tree skink	LC	NA

LC = Least Concern, NYBA = Not Yet Been Assessed

Table C4: General invertebrate recorded during the field assessment.

Scientific Name	Common Name	IUCN 2016 Status
Hodotermes mossambicus	Northern harvester termite	NYBA
Junonia hierta	Yellow Pansy	LC
Passalidius fortipes	Burrowing ground beetle	NYBA
Apterogyna sp.	Velvet ant	NA
Eremoides bicristatus	Crested Owlfly	NYBA
Stips sp.	Ridged seed beetle	NYBA
Gonometa postica	African silk moth	NYBA
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

Scientific Name	Common Name	IUCN 2016 Status
Mylabris oculata	CMR Bean Beetle	NYBA

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

Table C5: Arachnid species recorded during the site assessment.

Common Name	Scientific Name	IUCN 2016 Status
Community nest spiders	*Stegodyphus* sp.	NA
Grass funnel-web spiders	*Agelena* sp.	NA
Sun spider	Solifugae sp	NA

LC = Least Concern, NYBA = Not Yet Been Assessed, NA = Not applicable