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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 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.

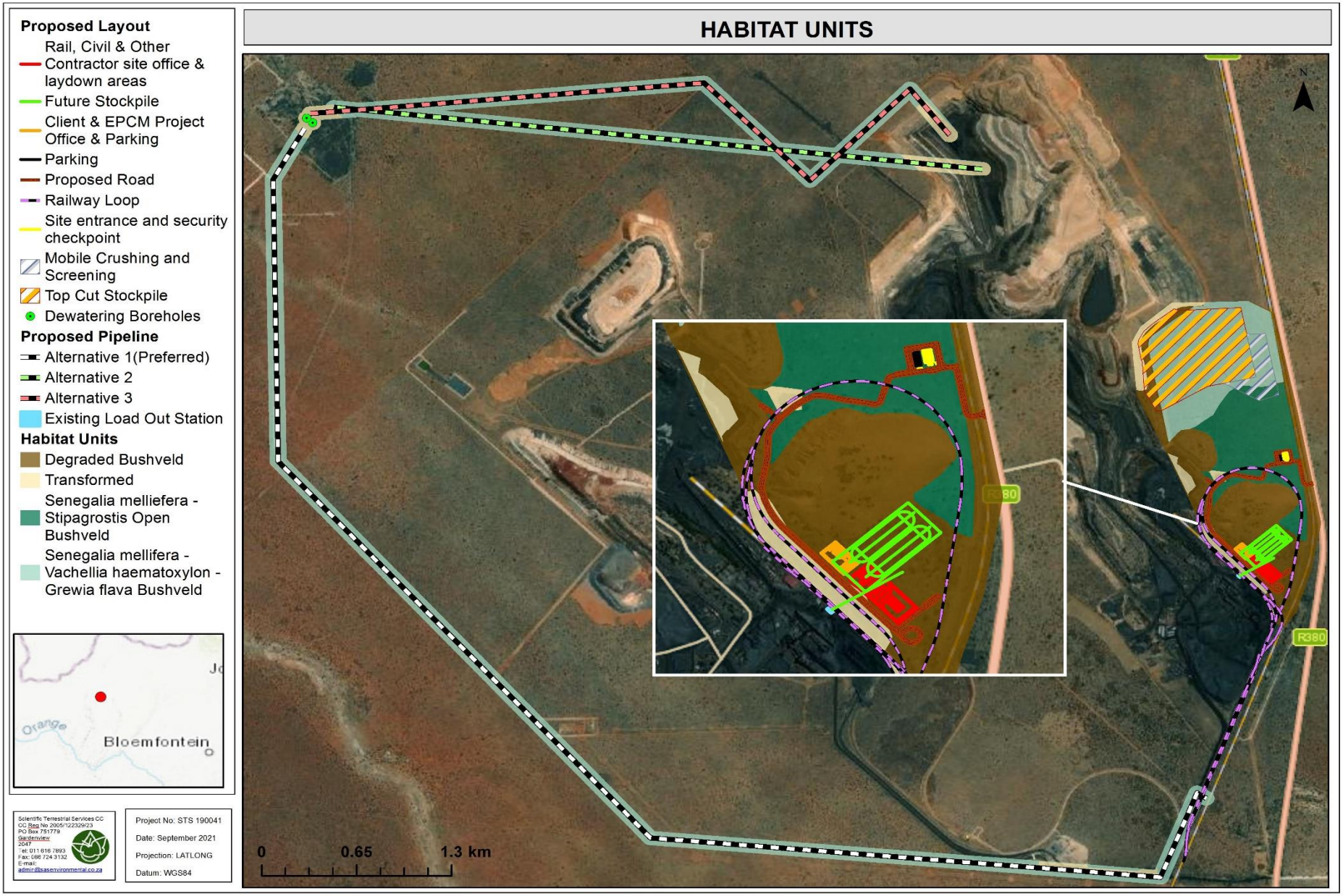
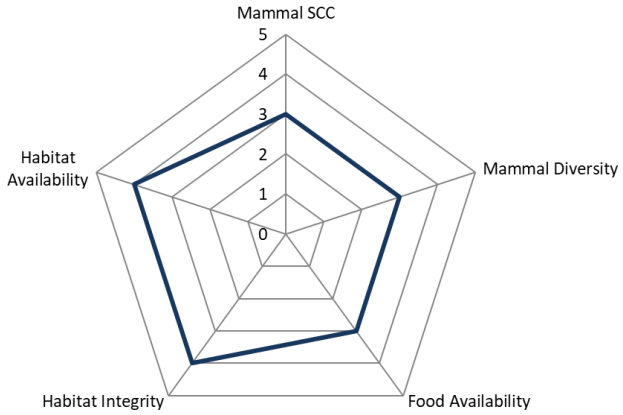


Figure 1: Habitat units encountered within the study area.

3.2 *Mammals*

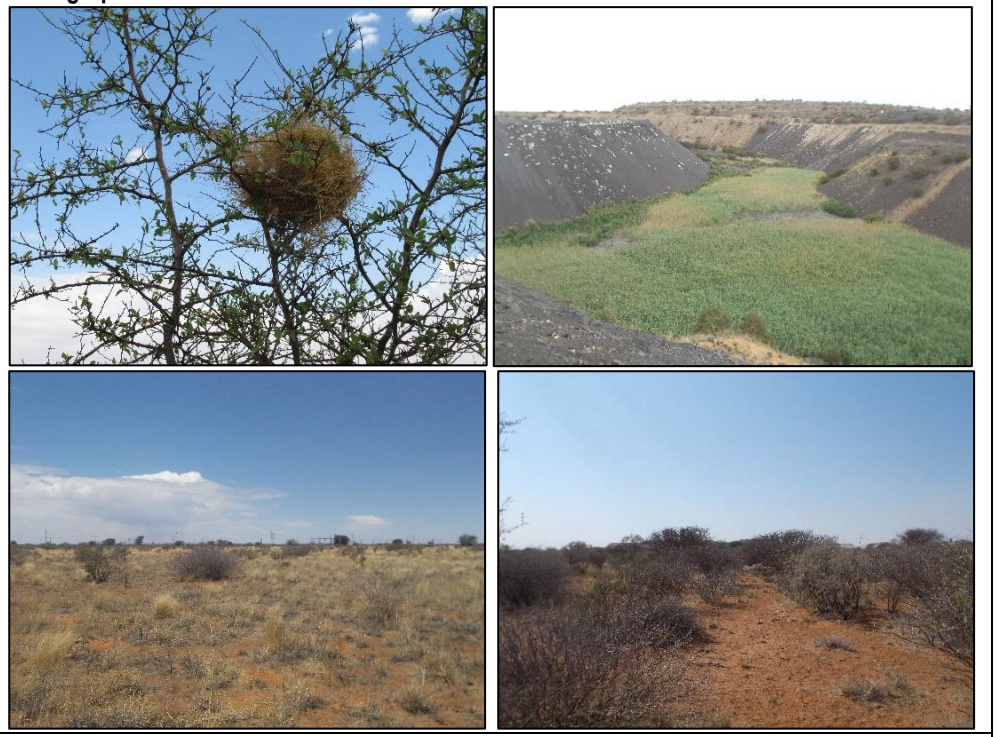
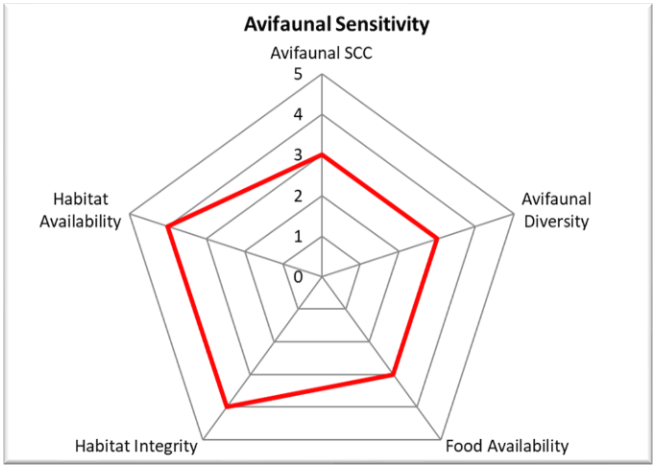
Table 2: Field assessment results pertaining to mammal species within the study area.

<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.

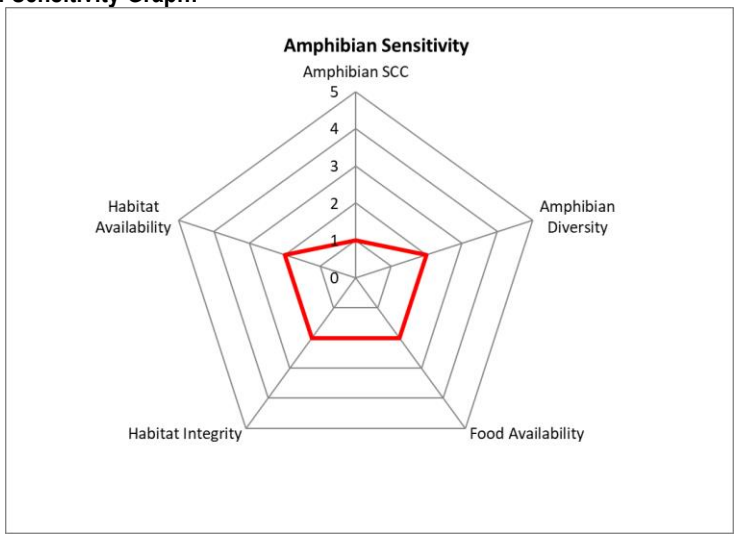
<table>
<tr><td colspan="2">Faunal Class: Avifaunal</td><td>Avifaunal Habitat Sensitivity</td><td>Intermediate</td><td rowspan="2">Photograph:
  </td></tr>
<tr><td colspan="4">Notes on photograph:
Top: Left – Sporopipes squamifrons (Scaly-feathered finch) nest located within the Kathu bushveld habitat 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.

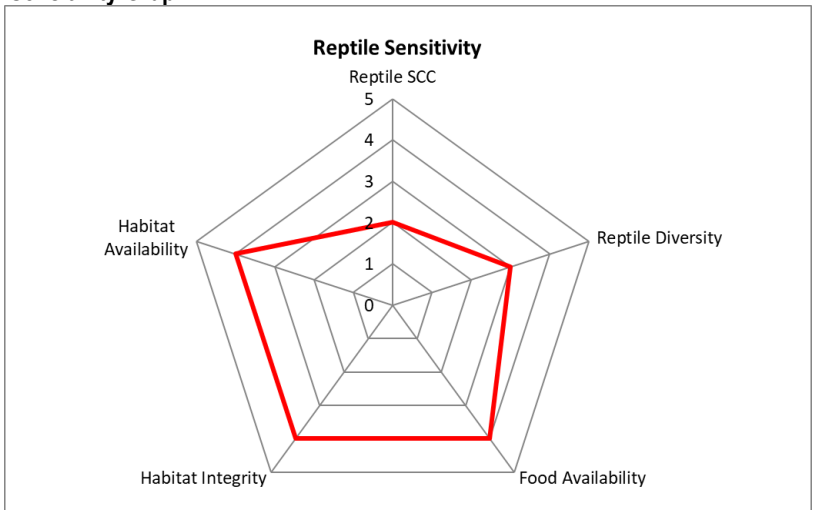
3.5 *Reptiles*

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.	

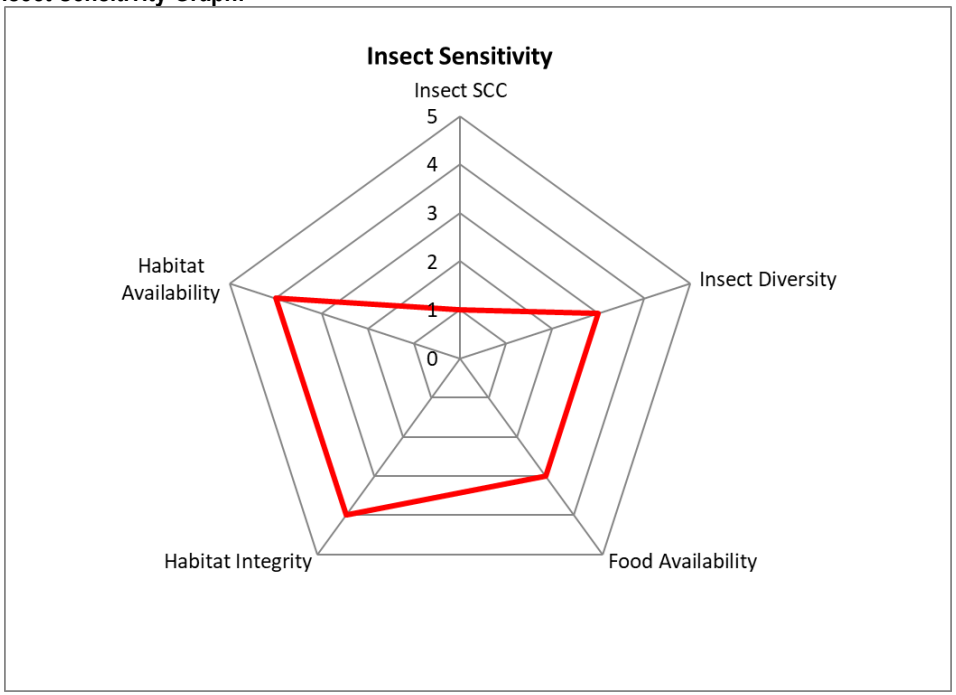
3.6 *Insects*

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:

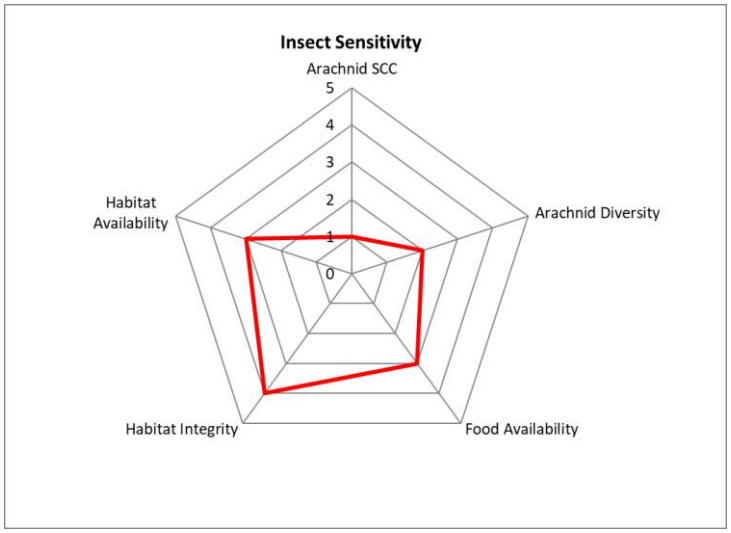


Photograph:

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.

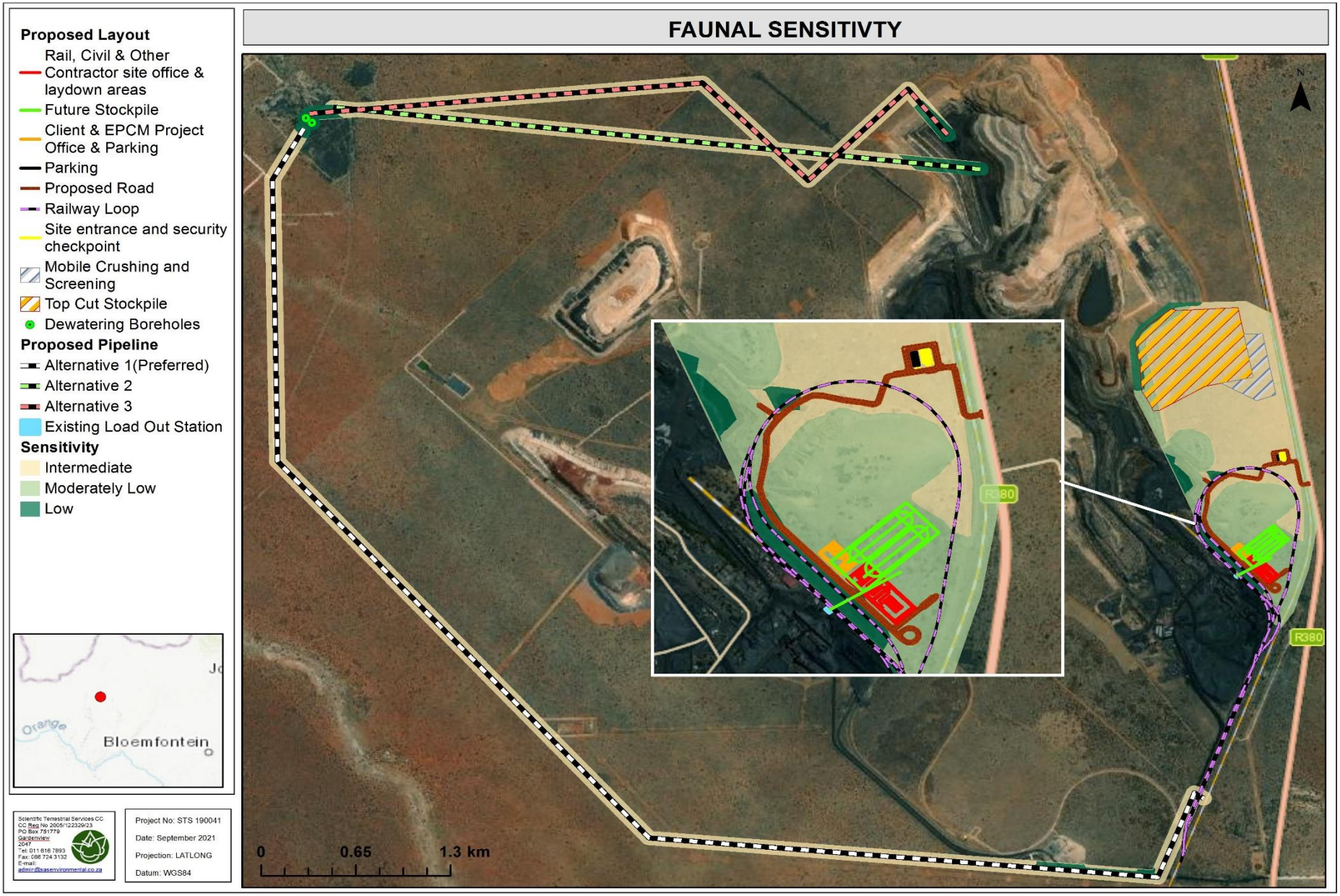


Figure 2: Sensitivity map for the study area.

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