FAUNAL, FLORAL, WETLAND AND AQUATIC ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED THARISA MINE DEVELOPMENT PROJECT, NORTH WEST PROVINCE

Prepared for

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SECTION C – Faunal Assessment

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1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a faunal, floral, wetland and aquatic ecological assessment as part of the environmental assessment and authorisation process for the proposed mine developments related to the Tharisa Mine, hereafter referred to as the "subject property" (Section A: Figures 2 & 3). The subject property is situated immediately to the north of the N4 roadway within the North West Province. The town of Marikana is situated approximately 3km to the north, and the towns of Lapologang, Tsilong Village and Silver City (formerly Mmaditlhokwa Village) are located approximately 3km to the west, while Rustenburg is located 30km to the northwest. Existing infrastructure within the Mining Rights Area (MRA) include two open pit areas, various waste rock dumps, a plant and office area, return and raw water dams, a storm water dam, a sewage treatment plant (STP) and a Run-of-Mine (ROM) pad, while the proposed development, which forms the focus of this study, includes the expansion of open pit and waste rock dump areas.

2 GENERAL SITE SURVEY

A site visit was undertaken during November 2013 to determine the ecological status of the subject property and the surrounding areas. A reconnaissance 'drive around' followed by a thorough 'walk through' on foot was undertaken to determine the general habitat types found throughout the study area and, following this, specific study sites or areas were selected that were considered to be representative of the habitats found within the subject property. Special emphasis was placed on areas that may potentially support Red Data Listed (RDL) faunal species. Sites were investigated on foot in order to identify the occurrence of the dominant faunal communities, species and habitat diversities. The presence of any faunal inhabitants of the study area was also assessed through direct visual observation or identifying such species through calls, tracks, scats and burrows.

The faunal categories covered in this assessment are mammals, avifauna, reptiles, amphibians, invertebrates, spiders and scorpions.

3 METHOD OF ASSESSMENT

3.1 Desktop Study

Initially a desktop study was undertaken to gather background information regarding the subject property and its surrounding areas. All relevant authorities were consulted regarding conservational species lists, and all the latest available literature was utilised to gain a thorough understanding of the area and its surrounding habitats. Included in the desktop study was the baseline ecological assessment compiled by Natural Scientific Services (2008) entitled 'Tharisa Minerals Biodiversity Assessment'. This information was then used to determine the potential biodiversity lists and expected RDL faunal species for the proposed development site and surrounding areas. This information incorporated (amongst others) data on vegetation types, habitat suitability and biodiversity potential coupled to this information.

3.2 Literature review

Threatened or RDL faunal species which have been recorded in the North West Province as per the North West Province State of the Environment Report (NW SoER) of 2002 are listed in Appendices A – F. This information was cross-referenced with information from the International Union for the Conservation of Nature (IUCN) Red Data list for 2013 (http://www.iucnredlist.org).

3.3 Field 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. In addition, the levels of anthropogenic activity in the subject property and surrounding area may determine whether species will be observed.

3.3.1 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 1). Once the animal is inside the trap, it steps on a small plate that causes the door to snap shut, thereby capturing the individual. Trapping took place within relatively undisturbed small mammal habitat identified in the vicinity of the Sterkstroom River traversing the centre of the subject property. 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 1: Sherman trap and bait used to capture small mammal species.

Larger faunal species were recorded during the field assessment with the use of visual identification, spoor, call and dung.

3.3.2 Avifauna

The Southern African Bird Atlas Project 2 database (http://sabap2.adu.org.za/) lists for the Quarter Degree Squares (QDSs) 2527CB and 2527DA (Appendix G) was compared with the recent field survey of avifaunal species identified on the subject property. Field surveys were undertaken utilising a pair of Vespa 7x50 binoculars and bird call identification techniques were utilised during the assessment in order to accurately identify avifaunal species.

3.3.3 Reptiles

Reptiles were physically identified during the field survey. Rocks in the vicinity of the Rocky Outcrop Habitat Unit were overturned and inspected and any reptiles encountered were identified. Other habitat areas where reptiles were likely to reside were also investigated. 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 subject property.

3.3.4 Amphibians

All amphibian species encountered within the subject property were recorded during the field assessment with the use of direct visual identification along with other identification aids such

as call identification. Amphibian species flourish in and around wetland and riparian areas. It is in these areas that specific attention was paid to when searching for amphibian species. However, 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. However, the data gathered during the assessment along with the habitat analysis provided an accurate indication of which amphibian species are likely to occur on the subject property.

3.3.5 Invertebrates

A list of visually identified and observed invertebrate species was compiled during the field surveys. However, due to their cryptic nature and habits, varied stages of life cycles, seasonal and temporal fluctuations within the environment, it is unlikely that all invertebrate species will have been recorded during the site assessment period. Nevertheless, the data gathered during the general invertebrate assessment along with the habitat analysis provided an accurate indication of which invertebrate species are likely to occur on the subject property.

3.3.6 Spiders and Scorpions

Suitable habitats, such as natural vegetation and rocky outcrop areas, 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 RDL scorpions within the subject property.

3.4 Red Data Species Assessment

3.4.1 Fauna and the Red Data Sensitivity Index

Given the restrictions of field assessments to identify all the faunal species that possibly occur on a particular property, the Red Data Sensitivity Index (RDSIS) has been developed to provide an indication of the potential RDL faunal species that could reside in the area, while simultaneously providing a quantitative measure of the subject property's value in terms of conserving faunal diversity. The RDSIS is based on the principles that when the knowledge of a species' historical distribution is combined with a field assessment that identifies the degree to which the property supports a species' habitat and food requirements, interpretations can be made about the probability of that particular species residing within the subject property. Repeating this procedure for all the potential RDL faunal species of the area and collating this information then provides a sensitivity measure of the

property that has been investigated. The detailed methodology to determine the RDSIS of the property is presented below:

Probability of Occurrence (POC): Known distribution range (D), habitat suitability of the site (H) and availability of food sources (F) on site were determined for each of the species. Each of these variables is expressed a percentage (where 100% is a perfect score). The average of these scores provided a POC score for each species. The POC value was categorised as follows:

- **0-20% = Low;**
- **21-40% = Low to Medium;**
- **41-60% = Medium;**
- **61-80% = Medium to High and**
- **81-100% = High**

POC = (D+H+F)/3

Total Species Score (TSS): Species with POC of more than 60% (High-medium) were considered when applying the RDSIS. A weighting factor was assigned to the different IUCN categories providing species with a higher conservation status, a higher score. This weighting factor was then multiplied with the POC to calculate the TSS for each species. The weighting as assigned to the various categories is as follows:

- **Data Deficient = 0.2;**
- **Rare = 0.5;**
- **Near Threatened = 0.7;**
- **Vulnerable = 1.2;**
- **Endangered = 1.7 and**
- **Critically Endangered = 2.0**.

TSS = (IUCN weighting*POC) where POC > 60%

Average Total Species (Ave TSS) and Threatened Taxa Score (Ave TT): The average of all TSS potentially occurring on the site is calculated. The average of all the Threatened taxa (TT) (Near threatened, Vulnerable, Endangered and Critically Endangered) TSS scores are also calculated. The average of these two scores (Ave TSS and Ave TT) was then calculated in order to add more weight to threatened taxa with POC higher than 60%.

Ave = Ave TSS [TSS/No of Spp] + Ave TT [TT TSS/No of Spp]/2

RDSIS: The average score obtained above and the sum of the percentage of species with a POC of 60% or higher of the total number of RDL species listed for the area was then calculated. The average of these two scores, expressed as a percentage, gives the RDSIS for the area investigated.

RDSIS = Ave + [Spp with POC>60%/Total no Of Spp*100]/2

RDSIS interpretation:

Table 1: RDSIS value interpretation with regards to RDL faunal species importance on the subject property.

RDSIS Score	RDL mammal importance
0-20%	Low
21-40%	Low-Medium
41-60%	Medium
60-80%	High-Medium
81-100%	High

4 FAUNAL ASSESSMENT

4.1 Faunal habitat

Faunal habitat describes the particular environment in which organisms live. The various habitat units as identified within the subject property are discussed in detail in Section B and include the Transformed Bushveld Habitat Unit, the Scattered Bushveld Habitat Unit, the Rocky Outcrop Habitat Unit, the Wetland Habitat Unit and the Transformed Habitat Unit.

The dominant habitat unit within the subject property is the Transformed Habitat Unit, which includes historical and current agricultural and mining areas. These areas provide less suitable habitat for faunal species than the Rocky Outcrop and Wetland Habitat Units, where the majority of faunal species present were noted and where the majority of larger mammal species, reptiles and amphibians are expected to reside. While the latter two habitat units provide good faunal habitat, the Scattered Bushveld Habitat Unit, which includes areas of low rocky substrate, provides reasonable habitat for faunal species, particularly avifauna.

Figure 2: The Rocky Outcrop Habitat Unit within the central portion of the subject property providing faunal habitat for a number of species.

4.2 Mammals

During the two day field assessment several mammal species, namely *Lepus saxatilis* (Scrub Hare), *Cynictis penicillata* (Yellow Mongoose), *Sylvicapra grimmia* (Common Duiker), *Crocidura mariquensis* (Swamp musk shrew), *Raphicerus campestris* (Steenbok), *Ichneumia albicauda* (White tailed Mongoose) and *Lemniscomys rosalia* (Single-striped mouse) were observed, either directly or through the identification of scat and spoor as indicated in Table 2 and Figures 3 – 5 below. According to the North West Province SoER (2002) and the IUCN (2013), the above mentioned species are all considered to be non-threatened mammal species. A list of threatened mammal species for the North West Province is included in Appendix A (NW SoER, 2002).

Table 2: Mammal species known to occur within the subject property.

Scientific Name	Common Name	NW Status	IUCN Status
Lepus saxatilis	Scrub Hare	LC	LC
Cynictis penicillata	Yellow Mongoose	LC	LC
Sylvicapra grimmia	Common Duiker	LC	LC
Crocidura mariquensis	Swamp musk shrew	LC	LC
Raphicerus campestris	Steenbok	LC	LC
Ichneumia albicauda	White tailed Mongoose	LC	LC
Lemniscomys rosalia	Single-stripped mouse	LC	LC

LC = Least Concern

Several other mammal species may also reside or forage within the subject property or utilise it as a migratory or movement corridor, especially smaller mammal species such as mice and shrews. In addition, which may be found in the area include *Galerella sanguinea* (Slender Mongoose), *Caracal caracal* (Caracal), *Leptailurus serval* (Serval), *Hystrix africaeaustralis* (South African Porcupine) and *Canis mesomelas* (Black Backed Jackal), amongst others (Table 3). In terms of conservation the abovementioned mammal species are considered to be of Least Concern by both the IUCN (2013) and the NW SoER (2002). Livestock such as goats and cattle were also noted within the subject property.

Table 3: Mammal species expected within the subject property and surrounding region.

Scientific Name	Common Name	NW Status	IUCN Status
Galerella sanguinea	Slender Mongoose	LC	LC
Caracal caracal	Caracal	LC	LC
Leptailurus serval	Serval	LC	LC
Hystrix africaeaustralis	South African Porcupine	LC	LC
Canis mesomelas	Black Backed Jackal	LC	LC
Helogale parvula	Common Dwarf Mongoose	LC	LC
Genetta tigrina	Cape Genet	LC	LC
Genetta genetta	Common Genet	LC	LC
Ictonyx striatus	Striped Polecat	LC	LC

LC = Least Concern

In terms of conservation, no RDL or threatened mammal species were encountered during the field assessment. Furthermore, the likelihood of any threatened mammal species as listed in Appendix A being encountered within the subject property is considered to be low due to the high levels of anthropogenic activity such as agricultural activity, historic and current mining activities and human settlement within the subject property. These activities have led to limited favourable faunal habitat being available for a high diversity and abundance of faunal species. The proposed mine development activities are therefore considered unlikely to pose a threat to mammal species conservation in the region provided that the sensitivity map and buffer zones as provided in Section A of this report are adhered to, with specific mention of preventing mining impacts within the Rocky Outcrop and Wetland Habitat Units.

Figure 3: *Raphicerus campestris* (Steenbok) and *Sylvicapra grimmia* (Common Duiker) droppings noted within the subject property.

Figure 4: *Canis lupus familiaris* (Domestic dog) and *Ichneumia albicauda* (White-tailed Mongoose) spoor noted within the subject property.

Figure 5: *Cynictis penicillata* (Yellow Mongoose) corpse and droppings noted within the subject property.

4.3 Avifauna

Avifaunal surveys were conducted across the entire subject property and all avifaunal species seen or heard during the time of the field assessment were recorded. Table 4 lists all the avifaunal species identified during the assessment as well as their current IUCN status. Images of a number of these avifaunal species photographed on site are included in Figures 6 & 7 below. The complete list of RDL avifaunal species occurring within the region is included in Appendix B (NW SoER, 2002) and the reference for finding complete lists of avifaunal species expected for the QDSs 2527CB and 2527DA (SABAP2) are included in Appendix G.

From Table 4 below it can be seen that all avifaunal species identified within the subject property are common species known to reside within or utilise the bushveld and wetland habitat in the region and may be either permanently or occasionally present within the subject property.

Table 4: Avifaunal species recorded during the survey.

Scientific Name	Common Name	IUCN status
Merops apiaster	European Bee-eater	LC
Numida meleagris	Helmeted Guineafowl	LC
Mirafra sabota	Sabota Lark	LC
Prina subflava	Tawny Flanked Prina	LC
Stigmatopelia senegalensis	Laughing Dove	LC
Aquila verreauxii	Black Eagle	LC
Urocolius indicus	Red faced Mouse bird	LC
Hirundo albigularis	White throated Swallow	LC
Euplected orix	Red Bishop	LC
Anhinga rufa	African Darter	LC
Fulica cristata	Red knobbed Coot	LC
Pternistes swainsonii	Swansons Francolin	LC
Ardea cinerea	Grey Heron	LC
Ardea melanocephala	Black headed Heron	LC
Psophocichla litsitsirupa	Ground scraper Thrush	LC
Cisticola juncidis	Zitting Cisticola	LC
Acridotheres tristis	Indian Myna	LC
Vidua regia	Shaft tailed Whydah	LC
Bradornis infuscatus	Marico Flycather	LC
Streptopelia capicola	Cape Turtle Dove	LC
Circaetus cinereus	Brown Snake-eagle	LC
Falco biarmicus	Lanner Falcon	LC
Tyto alba	Barn Owl	LC
Melaenornis pammelaina	Southern Black Flycather	LC
Anthus caffer	Bushveld Pipit	LC
Pycononotus tricolor	Darked Capped BulBul	NYBA
Vanellus coronatus	Blacksmith Plover	LC
Lanius collaris	Common Fiscal Shrike	LC
Euplectes orix	Southern Red Bishop	LC
Quelea quelea	Red Billed Quelea	LC
Trachyphonus vaillantii	Crested Barbet	LC
Bubulcus ibis	Cattle Egret	LC
Merops apiaster	European Bee-eater	LC
Euplectes afer	Yellow-crowned Bishop	LC
Halcyon albiventris	Brown-hooded Kingfisher	LC
Cossypha caffra	Cape Robin-chat	LC
Vanellus coronatus	Crowned Lapwing	LC
Corythaixoides concolor	Grey Go-away-bird	LC
Alopochen aegyptiaca	Egyptian Goose	LC
Circaetus pectoralis	Black Chested Snake Eagle	NYBA
Anas undulata	Yellow-Billed Duck	LC
Bostrychia hagedash	Hadeda Ibis	LC
Euplectes albonotatus	White Winged Widowbird	LC

Scientific Name	Common Name	IUCN status
Ploceus velatus	Southern Masked Weaver	LC

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

The subject property is situated within the Magaliesberg/ Witwatersberg Important Bird Area (IBA SA025). This IBA is relatively large and well conserved and several large raptor species are known to breed in these areas along the mountain stretches of the Magaliesberg range to the south of the Tharisa Mine. RDL birds occurring within this IBA area may utilise the less disturbed areas of the subject property as foraging habitat. The two most important avifaunal species of concern in the Magaliesberg/ Witwatersberg IBA are *Sagittarius serpentarius* (Secretary bird) and *Gyps coprotheres* (Cape Vulture), which are included in Table 5 which lists avifaunal with a POC of higher than 60%.

No threatened RDL avifaunal species were identified during the site survey. However, the likelihood that some of these RDL avifauna species utilising the subject property for foraging purposes or as a migratory corridor, with specific reference to raptor species, is considered high. Threatened avifaunal species known to occur in the region are listed in Appendix B. Threatened species with a greater than 60% POC of utilising the subject property, predominantly for foraging purposes, are *Tyto capensis* (African Grass Owl), *Falco peregrinus* (Peregrine Falcon), *Polemaetus bellicosus* (Martial Eagle), *Sagittarius serpentarius* (Secretary bird) and *Gyps coprotheres* (Cape Vulture) (Table 5).

Table 5: North West Province RDL avifauna species with a POC of more than 60% (Appendix B).

Scientific Name	Common Name	NW status	IUCN status	POC %
Tyto capensis	*African Grass Owl*	VU	LC	63
Falco peregrinus	*Peregrine Falcon*	R	LC	70
Polemaetus bellicosus	*Martial Eagle*	VU	NT	66
Sagittarius serpentarius	*Secretary bird*	NT	VU	64
Gyps coprotheres	*Cape Vulture*	VU	VU	62

VU = Vulnerable, NT = Near threatened, R = Rare.

Figure 6: *Dicrurus adsimilis* (Fork tailed drongo) on the left and *Ploceus velatus* (Southern Masked Weaver) nest on the right observed within the subject property.

Figure 7: *Anhinga rufa* (African darter) and *Plectropterus gambensis* (Spur-winged Goose) within the vicinity of the Sterkstroom on the left and *Halcyon albiventris* (Brown hooded kingfisher) on the right as observed within the subject property.

Sufficient suitable habitat for avifaunal species is present in the areas surrounding the subject property, particularly to the south within the Magaliesberg region and it is therefore considered unlikely that the proposed mine development project will have a significant impact on avifaunal species' diversity and abundance. Most of the threatened avifauna species (Appendix B) known to occur in the region are considered to be highly mobile species and if present, will only utilise the subject property for foraging purposes or as a migration corridor. Due to their high mobility, such avifaunal species will be able to move to areas of improved favourability should the habitat within the subject property be further disturbed. The proposed mine development activities are thus unlikely to pose a significant conservation threat to RDL avifauna species within the subject property, provided that mitigation measures as provided are adhered to.

4.4 Reptiles

One common reptile species was identified within the Rocky Outcrop Habitat Unit during the field assessment, namely *Trachylepsis striata* (Striped Skink) (Table 6 & Figure 8). Reptiles are notoriously difficult to detect, are well camouflaged and have good senses to hide from predators, thus often making on-site observations of reptiles difficult. Other common non threatened reptile species expected to occur within the vicinity of the subject property are *Chamaeleo dilepis* (Flap necked chameleon), *Naja nivea* (Cape Cobra), *Bitis arietans* (Puff Adder), *Agama atra* (Southern Rock Agama) and *Dispholidus typas* (Boomslang) (Table 7). None of the abovementioned reptile species are considered to be threatened (IUCN, 2013; NW SoER, 2002). The complete list of RDL reptile species occurring within the North West Province is included in Appendix D.

Table 6: Reptile species recorded during the survey.

Scientific Name	Common Name	NW Status	IUCN Status
Trachylepsis striata	Striped skink	LC	LC

LC = Least Concern.

Figure 8: *Trachylepsis striata* (Striped skink) observed within the Rocky Outcrop Habitat Unit within the central portion of the subject property.

Table 7: Reptile species expected to occur within the subject property.

Scientific Name	Common Name	NW Status	IUCN Status
Chamaeleo dilepis	Flap necked chameleon	LC	LC
Naja nivea	Cape Cobra	LC	LC
Bitis arietans	Puff Adder	LC	LC
Agama atra	Southern Rock Agama	LC	LC
Dispholidus typas	Boomslang	LC	LC
Pachydactylis affinis	Transvaal Gecko	LC	LC
Meroles squamulosus	Common rough-scaled lizard	LC	LC

LC = Least Concern.

The subject property offers favourable habitat for reptile species within rocky bushveld areas in the Scattered Bushveld Habitat Unit and within the Rocky Outcrop Habitat Unit within the centre of the subject property in the vicinity of the existing open pit areas.

One RDL reptile species, namely *Python sebae natalensis* (African Rock Python) is known to occur within the North West Province and has a RDSIS of greater than 60% of occurring

within the Tharisa Mine boundary (Table 8), due to its distribution range and the probability of this species utilising the subject property for habitat, foraging and possibly migratory purposes. Although this species is not listed as threatened by the IUCN, it is regionally indicated as being vulnerable. Habitat modification and human ignorance are possibly the two greatest threats to this snake in the North West Province. It is partially protected by legislation and occurs on several reserves in the province (NW SoER, 2002). If present, *P. natalensis* will be restricted to areas within the vicinity of the Rocky Outcrop and Wetland Habitat Units.

Table 8: Reptile species expected to reside in this region with a threatened status which has a POC of more than 60% (Appendix D).

Scientific Name	Common Name	NW Status	IUCN Status	POC
Python natalensis	South African Python	VU	NYBA	66

VU = Vulnerable, NYBA = Not yet been assessed.

Due to the high levels of historical and current anthropogenic activities within the subject property and surrounding region, the proposed mine activities are deemed unlikely to pose a significant conservation threat to *P. natalensis* or other reptile species in the region, provided that mitigation measures as provided, such as conservation of the Rocky Outcrop and Wetland Habitat Units, are adhered to. If *P. natalensis* is found within the proposed development footprint areas, this species should be safely relocated to an appropriate and safe area by an accredited snake handler.

4.5 Amphibians

No amphibian species were encountered during the field assessment, partially due to the non-perennial nature of the majority of the drainage lines traversing the subject property. It is expected that the majority of amphibian species are most likely to occur on the subject property are inhabitants of the Wetland Habitat Unit.

Common species which may occur along the drainage lines within and in the vicinity of the subject property include *Ptychadena anchietae* (Plain Grass Frog), *Afrana angolensis* (Common River frog), *Xenopus laevis* (Platanna), *Cacosternum boettgeri* (Common Caco), *Schismaderma carens* (Red toad), *Tomopterna cryptotis* (Tremolo sand frog), *Kassina senegalensis* (Bubbling kassina), *Phrynomantis bifasciatus* (Banded Rubber Frog) *Amietophrynus gutturalis* (Guttural toad), *Tomopterna natalensis* (Natal sand frog), and *Ptychadena mossambica* (Striped grass frog), amongst others, none of which are considered to be threatened (NW SoER 2002, IUCN 2013) (Table 9). These common species may occur

within the Wetland Habitat Unit under favourable conditions during the rainy seasons. A list of RDL amphibian species known to occur within the region is included in Appendix E.

Table 9: Amphibian species expected to occur within the subject property.

Scientific Name	Common Name	NW Status	IUCN Status
Kassina senegalensis	Bubbling Kassina	LC	LC
Phrynomantis bifasciatus	Banded Rubber Frog	LC	LC
Afrana angolensis	Common River Frog	LC	LC
Schismaderma carens	Red Toad	LC	LC
Poyntonophrynus fenoulheti	Fenoulhet's Toad	LC	LC
Amietophrynus garmani	Eastern Olive Toad	LC	LC
Amietophrynus gutturalis	Gutteral Toad	LC	LC
Amietophrynus poweri	Lowveld Toad	LC	LC
Cacosternum boettgeri	Common Caco	LC	LC
Phrynobatrachus natalensis	Natal Dwarf Puddle Frog	LC	LC
Ptychadena anchietae	Plain Grass Frog	LC	LC
Ptychadena mossambica	Broad-banded Grass Frog	LC	LC
Strongylopus fasciatus	Striped Stream Frog	LC	LC
Tomopterna cryptotis	Common sand Frog	LC	LC
Tomopterna natalensis	Natal Sand Frog	LC	LC
Xenopus laevis	Platanna	LC	LC

LC = Least Concern.

The only amphibian species listed as being of concern within the North West Province is *Pyxicephalus adspersus* (African Bullfrog). This species is considered by the NW SoER (2002) to be Near Threatened. *P. adspersus* is however listed by the IUCN (2013) as being of Least Concern because, although it is losing breeding habitat in certain areas due to urbanisation, and it is also eaten in parts of its range, it has a wide distribution, is tolerant of a broad range of habitats, has a presumed large population, and is unlikely to be declining fast enough to qualify for listing in a more threatened category (IUCN, 2013). It is common in many of the southern parts of its range and although its population numbers have apparently declined in South Africa, especially in Gauteng Province, it is still locally common in some places (IUCN, 2013).

The POC for the *P. adspersus* species is below 60%, due to a low habitat and food availability score. The high level of anthropogenic and agricultural activities, as well as the mining activities occurring within and in the vicinity of the subject property, is likely to further lower the POC of this species.

In terms of conservation, there is a low possibility of encountering RDL or threatened amphibian species within the subject property and associated wetland habitat. The proposed mine development activities are therefore deemed unlikely to pose a significant conservation threat to *P. adspersus* and other amphibian species within the subject property, provided that mitigation measures as provided are adhered to, with specific reference to conservation of the Wetland Habitat Unit and associated buffer zones.

4.6 Invertebrates

The invertebrate assessment conducted was a general assessment with the purpose of identifying common species and taxa in the subject property. As such, the invertebrate assessment is not an indication of the complete invertebrate diversity potential of the proposed development site and surrounding area. A representation of commonly encountered families in the Insecta class that were observed during the assessment is listed in Table 10 below, with selected species recorded. A list of RDL invertebrate species known to occur within the region, of which none were recorded during the assessment, is included in Appendix E.

Table 10: General results from the invertebrate collection and observation during the field assessment.

Insects	Comments
Order: Lepidoptera (Butterflies & Moths)	These are all commonly occurring species typical of the locality and habitat
Family: Nymphalidae	
Subfamily: Danainae	Visual observations
Danaus chrysippus aegyptius (African monarch)	
Subfamily: Nimphalinae	
Junonia hierta (Yellow pansy)	Visual observations
Byblia ilythia (Spotted joker)	
Family: Pieridae	
Eurema hecabe (Common grass Yellow)	Visual observations
Beleonis creona (African Common White)	
Family: Saturniidae	Visual observations
Bunaea alcinoe (Emperor moth)	
Order: Orthoptera (Grasshoppers, Crickets & Locusts)	These are all commonly occurring species typical of the locality and habitat
Family: Anostostomatidae	Visual observations
Onosandrus sp	
Family: Gryllidae	Visual observations (Figure 9)
Gryllus bimaculatus (Common garden cricket)	
Family: Tettigoniidae	
Conocephalus caudalis (Meadow Katydid)	Visual observations
Enyaliopsis sp (Corn cricket)	
Family: Acrididae	Visual observations
Cannula gracilis (Grass mimicking Grasshopper)	

Order: Hymenoptera & Isoptera (Ants, Bees, Termites & Wasps)	These are all commonly occurring species typical of the locality and habitat
Family: Apidae *Apis mellifera scutellata* (African honey bee)	Visual observations
Family: Vespidae *Vespula germanica* (Hornet wasps)	Visual observations
Family: Termitidae Odontotermes latericus (Harvester Termites)	Visual observations
Order: Coleoptera (Beetles)	These are all commonly occurring species typical of the locality and habitat
Family: Meloidae *Mylabris oculata* (CMR Bean beetle)	Visual observations
Family: Lycidae *Lycus melanurus* (Hook winged Net winged beetle)	Visual observations
Family: Coccinellidae *Hippodamia variegata* (Spotted amber ladyavifauna) *Cheilomenes lunata* (Lunate ladybug)	Visual observations (Figure 10)
Family: Geotruidae *Geotrupes egeriei* (Earth-boring dung beetles)	Visual observations
Order: Phasmatodea (Stick insects)	These are all commonly occurring species typical of the locality and habitat
Family: Heteronemiidae *Maransis* rufolineatus (Grass stick insect)	Visual observations
Order: Mantodea (Mantids)	These are all commonly occurring species typical of the locality and habitat
Family: Mantidae *Sphodromantis lineola* (African Praying mantis)	Visual observations
Order: Neuroptera (Lacewings)	These are all commonly occurring species typical of the locality and habitat
Family: Myrmeleontidae *Brachyplectron* sp (Antlion)	Visual observations (Figure 9)
Order: Hamiptera (Cicadas)	These are all commonly occurring species typical of the locality and habitat
Family: Cicadidae *Platypleura haglundi (Orange wing cicadas)*	Visual observations (Figure 10)

Figure 9: *Brachyplectron sp* (Antlion) trap on the left and *Gryllus bimaculatus* (Common garden cricket) to the right.

Figure 10: *Platypleura haglundi* (Orange wing cicadas) on the left and *Cheilomenes lunata* (Lunate ladybug) to the right.

The results from the invertebrate survey comprise invertebrate species that are common to the area. Due to anthropogenic impacts, such as mining and agricultural activities having already occurred within the subject property, loss of natural invertebrate habitat has taken place, which reduces invertebrate presence and abundance as well as the probability of RDL species being present. The proposed development is unlikely to contribute to a loss of invertebrate diversity in the region.

4.7 Spiders and scorpions

No threatened spider or scorpion species are listed in the North West Province SoER (2002). Therefore, a record of threatened spiders and scorpions was acquired from the most recent RDL spider and scorpion data available for South Africa using the South African National Biodiversity Institute (SANBI) threatened species database (http://www.speciesstatus.sanbi.org) as presented in Appendix F. Trapdoor and Baboon spiders are listed as threatened throughout South Africa (Dippenaar-Schoeman, 2002).

Table 11 lists the only spider species identified during the site visit, namely Olurunia ocellata (Grass funnel-web spider) (Figure 11). No evidence was encountered of SANBI endangered or threatened Mygalomorphae arachnids which includes both Baboon and Trapdoor spiders.

It should, however, be noted that these species are notoriously difficult to detect. The latter species was noted within the Rocky Outcrop Habitat Unit.

No scorpion species were encountered, even though thorough searches, including the overturning of numerous rocks, were undertaken. The 2008 survey by Natural Scientific Services (Tharisa Minerals Biodiversity Assessment, 2008), however notes that two scorpion species, which are protected under Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10, 2004), were encountered within the subject property, namely *Opistophthalmus glabrifrons* (Shiny burrowing scorpion) and *Hadogenes gracilis* (Flat rock scorpion). These species are typically found within rocky outcrop habitat. And although not RDL listed by the IUCN (2013) or the NW SoER (2002), are considered to be of high conservation importance.

The presence of the abovementioned scorpion species emphasises the need to conserve the Rocky Outcrop Habitat Unit within the Tharisa Mine MRA. Provided that this and other mitigation measures as provided are adhered to, the proposed mine developments are unlikely to pose a significant conservation threat to spider and scorpion species within the subject property.

Table 11: Araneae species recorded during the survey.

Common Name	Scientific Name	NW status	IUCN status
Olurunia ocellata	Grass funnel-web spider	LC	LC

LC = Least Concern

Figure 11: *Olurunia ocellata* (Grass funnel-web spider) found throughout the study area.

5 FAUNAL RED DATA SPECIES ASSESSMENT

No RDL faunal species were identified during the site survey. All faunal species that were assessed during the calculation of the RDSIS for the site are included in Appendix H, which lists faunal species known to occur within the North West Province. Six RDL or threatened species, presented in Table 12, were found to have a 60% or greater probability of occurring within the subject property and its immediate vicinity.

Table 12: Threatened faunal species with a 60% or greater Probability of Occurrence (POC) within or in the vicinity of the subject property.

Scientific Name	Common Name	NW status	IUCN status	POC %
Tyto capensis	*African Grass Owl*	VU	LC	63
Falco peregrinus	*Peregrine Falcon*	R	LC	70
Polemaetus bellicosus	*Martial Eagle*	VU	NT	66
Sagittarius serpentarius	*Secretary bird*	NT	VU	64
Python natalensis	South African Python	VU	NYBA	66
Gyps coprotheres	*Cape Vulture*	VU	VU	62

VU = Vulnerable, NT = Near threatened, R = Rare, NYBA = Not yet been assessed.

The species listed in the table above were then used to calculate the RDSIS for the subject property, the results of which are presented in Table 13.

Table 13: Red Data Sensitivity Index Score calculated for the subject property.

Red Data Sensitivity Index Score	
Average Total Species Score	**64**
Average Threatened Taxa Score	**70**
Average (Ave TSS + Ave TT/2)	**67**
% Species greater than 60% POC	**6%**
RDSIS of Site	**37%**

The RDSIS assessment of the subject property potential RDL fauna yielded a low score of 37%, indicating a low importance with regards to RDL faunal species conservation within the region. All the species listed in Table 12 above, with a POC of 60% or more, have a real probability of permanently or occasionally inhabiting the area. However, as most of the available faunal habitat has experienced some level of transformation, with specific reference to the Transformed Habitat Unit, which covers the majority of the subject property, it is likely that only more wide ranging avifaunal species, which are highly mobile, may occasionally occur within the subject property. None of the IUCN RDL species indicated in Table 12 were directly or indirectly observed during the field assessment, and with the exception of the Rocky Outcrop and Wetland Habitat units, which may potentially provide habitat for *Python natalensis* (Rock Python) the subject property cannot be regarded as important in terms of RDL faunal species conservation.

The proposed mine development activities will thus have a low impact on RDL faunal conservation within the subject property and in the surrounding region provided that the sensitivity map developed for the subject property is adhered to.

6 IMPACT ASSESSMENT

6.1 Impact Discussion

The impact tables below serve to summarise the significance of perceived impacts on the faunal biodiversity of the subject property. The tables present the impact assessment according to the method described in Section A and also indicate the mitigation measures required to minimise the impacts. In addition, an assessment of the significance of the perceived impacts is presented, taking into consideration the available mitigatory measures assuming that they are fully implemented.

6.1.1 IMPACT 1: Impact on faunal habitat

Activities leading to impact

Pre-Construction	Construction	Operational	Decommissioning and Closure
Poor planning leading to the placement of new mining infrastructure within sensitive faunal habitat areas with special mention of wetland and rocky outcrop areas which have a higher biodiversity capacity	Site clearing, the removal of vegetation and blasting of rocky areas leading to faunal habitat loss	On-going disturbance of faunal habitat due to general mining operational activities	Disturbance of faunal habitat as part of demolition and closure activities
Inadequate design of infrastructure leading to faunal food source decline	Construction of infrastructure within potential migratory corridors which changes faunal behavioural patterns and leads to loss	Increased introduction of alien floral species due to disturbance and further transformation of natural faunal habitat	On-going risk of seepage into the groundwater system beyond closure
Inadequate design of infrastructure leading to changes in faunal habitat	Construction of access and haul roads within areas of increased ecological sensitivity	Risk of discharge and spillages from all operational facilities, including pipelines, which may pollute the receiving environment	On-going risk of discharge and spillages beyond closure
	Fire hazards leading to a loss of faunal habitat	Runoff from the mine activities and waste rock dumps which may pollute natural faunal water supplies	Insufficient aftercare and maintenance leading to post closure impacts on faunal habitat due to poor management
		Fire hazards leading to a loss of faunal habitat	Ineffective and insufficient rehabilitation of disturbed faunal habitat areas leading to a permanent loss of faunal habitat
		Erosion and sedimentation as a result of infrastructure development affecting faunal habitat	Insufficient rehabilitation maintenance leading to erosion and sedimentation
			Permanent presence of alien plant species leading to further transformation of natural faunal habitat

Aspects of faunal ecology affected

Construction	Operational	Decommissioning and Closure
Changes to the faunal community due to habitat loss and transformation	Changes to the faunal community due to habitat loss and transformation	Changes to the faunal community due to habitat loss and transformation
Direct impact on faunal habitat	Direct impact on faunal habitat	Direct impact on faunal habitat
Loss of faunal biodiversity	Loss of faunal biodiversity	Loss of faunal biodiversity

Without Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
	5	3	4	4	5	8	13	104 (High)

Essential mitigation measures:

- It must be ensured that, as far as possible, all development is placed outside of sensitive faunal habitat areas such as the Rocky Outcrop and Wetland Habitat Units.
- Areas of increased ecological importance and sensitivity, such as the Rocky Outcrop and Wetland Habitat Units, should be considered during all phases of mine planning and construction activities.
- No activities are to infringe upon these sensitive areas or associated buffer zones.
- The boundaries of the development footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas.
- The proposed development footprint areas should remain as small as possible.
- Edge effects of all construction and operational activities, such as erosion and alien plant species proliferation, which may affect faunal habitat, need to be strictly managed in all areas of increased ecological sensitivity.
- It must be ensured that mining related waste or spillage and effluent do not affect the sensitive habitat boundaries and associated buffer zones.
- All areas of increased ecological sensitivity should be designated as No-Go areas and be off limits to all unauthorised vehicles and personnel. Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss.
- It must be ensured that the mine process water system is managed in such a way as to prevent discharge to the receiving environment.
- Should any RDL faunal species be noted within the development footprint areas, these species should be relocated to similar habitat within or in the vicinity of the subject property with the assistance of a

suitably qualified specialist.

- No trapping or hunting of fauna is to take place.
- All informal fires in the vicinity of mining operations and new construction areas should be prohibited.
- It must be ensured that migratory connectivity is maintained, especially with respect to the Wetland and Rocky Outcrop Habitat Units.
- All soils compacted as a result of construction activities falling outside development footprint areas should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas. Alien and invasive vegetation control should take place throughout the all phases of the development and beyond decommissioning.
- All disturbed habitat areas must be rehabilitated and planted with indigenous floral species as soon as possible to ensure that faunal ecology is re-instated.

Recommended mitigation measures:

- Demarcation of sensitive habitats may be considered.

With Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
	4	3	2	2	4	7	8	56 (Medium-Low)

Probable latent impacts:

- Loss of faunal habitat may lead to altered faunal biodiversity.
- A decrease in faunal species abundance may occur throughout the subject property due to habitat transformation.

6.1.2 IMPACT 2: Impact on faunal diversity

Activities leading to impact

Pre-Construction	Construction	Operational	Decommissioning and Closure
Design and placement of infrastructure leading to a decline in faunal diversity	Disturbance within the subject property leading to a decline in faunal diversity	On-going operations and construction of infrastructure leading to migratory corridor alterations which alter faunal behavioural patterns and over all biodiversity	Insufficient aftercare and maintenance leading to post closure impacts on faunal diversity due to poor management and rehabilitation of faunal habitat

Loss of suitable faunal habitat and migratory areas leading to a decrease in faunal biodiversity	Collision of construction vehicles with faunal species	A decline in faunal diversity due to operational activities	Disturbance of faunal habitat as part of demolition and closure activities
	Vehicles accessing site through sensitive faunal habitat areas, with special mention of wetland and rocky outcrop areas	Collision of operational vehicles with faunal species	Ineffective monitoring of rehabilitation due to poor management
	Poaching of faunal species due to increased human activity on site	Vehicles accessing site through sensitive faunal habitat areas, with special mention of wetland and rocky outcrop areas	Ineffective and insufficient rehabilitation of disturbed faunal habitat areas leading to loss of faunal diversity
	Construction of infrastructure leading to migratory corridor alterations which alter faunal behavioural	Poaching of faunal species due to increased human activity on site	

Aspects of faunal ecology affected

Construction	Operational	Decommissioning and Closure
Direct impact on faunal diversity	Direct impact on faunal diversity	Direct impact on faunal habitat during decommissioning
Loss of faunal diversity	Loss of faunal diversity	Loss of faunal diversity
Changes to the faunal community	Changes to the faunal community	Changes to the faunal community

Without Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
	4	3	4	4	4	7	12	84 (Medium-high)

Essential mitigation measures:

- The proposed development footprint areas should remain as small as possible and where possible be confined to already disturbed areas.
- It must be ensured that, as far as possible, all development is placed outside of sensitive faunal habitat areas such as the Rocky Outcrop and Wetland Habitat Units and associated buffer zones.
- No trapping or hunting of fauna is to take place and access control into sensitive areas must be implemented to ensure that no illegal trapping or poaching takes place.

- It must be ensured that migratory connectivity between wetland areas and rocky outcrops is maintained where possible.
- All faunal habitat areas, where disturbed, are to be rehabilitated to ensure that faunal ecology is re-instated upon completion of construction works.
- It is recommended that a speed limit of 40km/h is implemented on all roads running through the subject property in order to minimise risk to RDL and other fauna from vehicles. Speed humps should be constructed to help slow vehicles and help mitigate collision with faunal species.

With Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
	3	3	3	3	3	6	9	54 (Medium-Low)

Probable latent impacts:

- A decrease in faunal species diversity may lead to loss of species richness over time.

6.1.3 IMPACT 3: Impact on important faunal species

Activities leading to impact

Pre-Construction	Construction	Operational	Decommissioning and Closure
Removal of indigenous vegetation leading to loss of potential RDL faunal species	Site clearing and the removal of vegetation leading to the loss of potential RDL faunal species	Continuous disturbance and transformation of habitat for potential RDL faunal species during the operational phase of the proposed development	Ineffective rehabilitation and monitoring leading to latent impacts
Loss of suitable RDL faunal habitat and migratory areas due to poor planning leading to a decrease in potential RDL faunal biodiversity and occurrence	Increased poaching risk of potential RDL faunal species and fire hazards due to increased human activity on site impacting on such species	Increased poaching risk of potential RDL faunal species and fire hazards due to increased human activity on site impacting on such species	Disturbance of faunal habitat as part of decommissioning and closure activities leading to loss of potential RDL faunal species
	Vehicles accessing site through sensitive habitat areas, with specific reference to wetland and rocky outcrop areas	A decline in potential RDL faunal diversity due to operational activities extending into areas of increased ecological importance	Loss of faunal habitat and RDL faunal biodiversity due to poor rehabilitation planning

Pre-Construction	Construction	Operational	Decommissioning and Closure
	Direct impact on potential RDL faunal species as a result of construction activities	Operational vehicles accessing site through sensitive faunal habitat which may potentially host RDL faunal species, including more mobile avifaunal species	Ineffective and insufficient rehabilitation of disturbed faunal habitat areas leading to permanent loss of potential RDL faunal species and habitat
	Loss of potential RDL faunal biodiversity due to habitat loss and a decrease in food supply	Vehicles accessing site through sensitive potential RDL faunal habitat areas	
	Collision of construction vehicles with potential RDL faunal species		

Aspects of faunal ecology affected

Construction	Operational	Decommissioning and Closure
Direct impact on potential RDL faunal habitat	Direct impact on potential RDL faunal habitat	Direct impact on potential RDL faunal habitat during decommissioning
Loss of potential RDL faunal biodiversity	Loss of potential RDL faunal biodiversity	Loss of potential RDL faunal biodiversity
Changes to the potential RDL faunal community, within the greater region, due to habitat loss and transformation	Changes to the potential RDL faunal community, within the greater region, due to habitat loss and transformation	Changes to the potential RDL faunal community, within the greater region, due to habitat loss and transformation

Without Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
	3	3	4	3	4	6	11	66 (Medium-low)

Essential mitigation measures:

- The proposed development footprint areas should remain as small as possible and where possible be confined to already disturbed areas.
- It must be ensured that, as far as possible, all development is placed outside of sensitive faunal habitat areas such as the Rocky Outcrop and Wetland Habitat Units and associated buffer zones.
- No trapping or hunting of fauna is to take place. Access control into more sensitive habitat areas must be implemented to ensure that no illegal trapping or poaching takes place.
- All areas of increased ecological sensitivity should be off limits to all unauthorised vehicles and

personnel.

- Edge effects of all construction and operational activities, such as erosion and alien plant species proliferation, which may affect faunal habitat, need to be strictly managed in these areas.
- Should any RDL species be noted within the subject property, these species should be relocated to similar habitat within or in the vicinity of the subject property with the assistance of a suitably qualified specialist.
- It must be ensured that migratory connectivity between wetland areas and rocky outcrops is maintained where possible.
- All faunal habitat areas, where disturbed, are to be rehabilitated to ensure that faunal ecology is re-instated upon completion of construction works.

Recommended mitigation measures:

- Education and awareness campaigns on faunal species and their habitat are recommended to help increase awareness, respect and responsibility towards the environment for all staff and contractors.
- It is recommended that a speed limit of 40km/h is implemented on all roads running through the subject property in order to minimise risk to RDL and other fauna from vehicles. Speed humps may be constructed to help slow vehicles and help mitigate collision with faunal species.

With Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
	2	3	3	3	3	5	9	45 (Low)

Probable latent impacts:

- A decrease in potential RDL faunal species diversity may lead to loss of species richness over time.

6.2 Impact Assessment Conclusion

Based on the above assessment it is evident that there are three possible impacts on the faunal ecology within the subject property. Table 14 below summarises the findings, indicating the significance of each impact before management takes place and the likely significance of the impacts if management and mitigation takes place. From the table it is evident that if effective management takes place, all potential faunal impacts may be reduced.

Table 14: A summary of the results obtained from the assessment of faunal ecological impacts.

Impact	Unmanaged	Managed
1: Impact on faunal habitat and ecological structure	High	Medium-High
2: Impact on faunal diversity and ecological integrity	Medium-High	Medium-Low
3: Impact on potential RDL faunal species	Medium-Low	Low

7 RECOMMENDATIONS

After conclusion of this faunal assessment, the following recommendations are made:

- It must be ensured that, as far as possible, all development is placed outside of sensitive faunal habitat areas such as the Rocky Outcrop and Wetland Habitat Units.
- Areas of increased ecological importance and sensitivity, such as the Rocky Outcrop and Wetland Habitat Units, should be considered during all phases of mine planning and construction activities.
- No activities are to infringe upon these sensitive areas or associated buffer zones.
- The boundaries of the development footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas.
- The proposed development footprint areas should remain as small as possible.
- Demarcation of sensitive habitats may be considered.
- Edge effects of all construction and operational activities, such as erosion and alien plant species proliferation, which may affect faunal habitat, need to be strictly managed in all areas of increased ecological sensitivity.
- It must be ensured that mining related waste or spillage and effluent do not affect the sensitive habitat boundaries and associated buffer zones.
- All areas of increased ecological sensitivity should be designated as No-Go areas and be off limits to all unauthorised vehicles and personnel. Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the proposed development activities.
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss.
- It must be ensured that the mine process water system is managed in such a way as to prevent discharge to the receiving environment.
- Should any RDL faunal species be noted within the development footprint areas, these species should be relocated to similar habitat within or in the vicinity of the subject property with the assistance of a suitably qualified specialist.
- It is recommended that a speed limit of 40km/h is implemented on all roads running through the subject property in order to minimise risk to RDL and other fauna from vehicles. Speed humps should be constructed to help slow vehicles and help mitigate collision with faunal species.

- Education and awareness campaigns on faunal species and their habitat are recommended to help increase awareness, respect and responsibility towards the environment for all staff and contractors.
- No trapping or hunting of fauna is to take place and access control into sensitive areas must be implemented to ensure that no illegal trapping or poaching takes place.
- All informal fires in the vicinity of mining operations and new construction areas should be prohibited.
- It must be ensured that migratory connectivity is maintained, especially with respect to the Wetland and Rocky Outcrop Habitat Units.
- All soils compacted as a result of construction activities falling outside development footprint areas should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas. Alien and invasive vegetation control should take place throughout the all phases of the development and beyond decommissioning.
- All disturbed habitat areas must be rehabilitated and planted with indigenous floral species as soon as possible to ensure that faunal ecology is re-instated.

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FAUNAL APPENDICES

Appendix A: RDL Mammal species that occur in the North West Province (NW SoER, 2002).

Common Name	Species	NW Status
Rough-haired golden mole	*Chrysos palaxvillosus*	CR
Tessebe	*Damaliscus lunatuslunatus*	EN
Wild dog	*Lycaon pictus*	EN
White tailed Mouse	*Mystromys albicaudatus*	EN
Cheetah	*Acinonyx jubatus*	VU
Spotted necked Otter	*Lutram aculicollis*	NT

Appendix B: RDL Avifaunal species that occur in the North West Province (NW SoER, 2002).

Common Name	Species	NW Status
Egyptian Vulture	*Neophron percnopterus*	EN
Wattled Crane	*Grus carunculata*	EN
Bittern	*Botaurus stellaris*	VU
Cape Vulture	*Gyps coprotheres*	VU
Lappet-faced Vulture	*Torgostra cheliotus*	VU
Martial Eagle	*Polemaetus bellicosus*	VU
Bateleur	*Terathopiuse caudatus*	VU
Kori Bustard	*Ardeotis kori*	VU
Ludwig's Bustard	*Neotisludwigii*	VU
Red-winged Pratincole	*Glareola pratincola*	Rare
Little Bittern	*Ixobrychus minutes*	Rare
Open-billed Stork	*Anastomusla melligerus*	Rare
Saddle-billed Stork	*Ephippiorhynchus senegalensis*	Rare
Marabou Stork	*Leptoptilo scrumeniferus*	Rare
Yellow-billed Stork	*Mycteria ibis*	Rare
Bearded Vulture	*Gypaetus barbatus*	Rare
Palmnut Vulture	*Gypohierax angolensis*	Rare
Peregrine Falcon	*Falco peregrinus*	Rare
White-winged Flufftail	*Sarothrura ayresi*	Rare
Chestnut-banded Plover	*Charadrius pallidus*	Rare
Red-winged Pratincole	*Glareola pratincola*	Rare
Short-tailed Pipit	*Anthus brachyurus*	Rare
Grass owl	*Tyto capensis*	VU
Secretary bird	*Sagittarius serpentarius*	NT
Yellow-throated Sandgrouse	*Pterocles gutturalis*	NT

Appendix C: RDL Reptile species that occur in the North West Province (NW SoER, 2002).

English Name	Species	NW Status
Striped harlequin Snake	*Homoroselaps dorsalis*	R
South African Python	*Python natalensis*	V
Blunt tailed worm lizard	*Dalophi apistillum*	DD
Nile Crocodile	*Crocodylus niloticus*	V

Appendix D: RDL Amphibians species that occur in the North West Province (NW SoER, 2002).

English Name	Species	NW Status
African Giant Bullfrog	*Pyxicephalas adspersus*	NT

Appendix E: RDL Invertebrates species that occur in the North West Province (NW SoER, 2002).

English Name	Species	NW Status
Highveld Blue	*Lepidochrysops praeterita*	EN
Marsh Sylph	*Metisella meninx (Trimen)*	VU
Hilltop hopper	*Platyleshes dolomitica*	VU

Appendix F: RDL Spider and scorpion species that occur in the North West Province (NW SoER, 2002).

English Name	Species	NW Status
None specified		

Appendix G: South Africa Avifauna Atlas Project 2 database listed avifauna species expected to occur in the QDSs 2527CB and 2527DA

Refer to http://sabap2.adu.org.za/ for full species lists.