# Appendix H.3

## TERRESTRIAL ANIMAL ASSESSMENT

# DALMANUTHA WIND ENERGY FARM PROJECT (ALTERNATIVE 1 AND 2)- TERRESTRIAL ANIMAL SPECIES SPECIALIST ASSESSMENT

WSP Group Africa Pty (Ltd)

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Submitted to:
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# Acronyms and Abbreviations

| Abbreviation | Explanation |
|---|---|
| AIS | Alien Invasive Species |
| AOO | Area of Occupancy |
| BI | Biodiversity Importance |
| BAP | Biodiversity Action Plan |
| CA | Conservation Areas |
| CBA | Critical Biodiversity Areas |
| CI | Conservation Importance |
| EIA | Environmental Impact Assessment |
| EMP | Environmental Management Programme |
| EOO | Extent of Occurrence |
| FI | Functional Integrity |
| Ha | Hectare |
| MPTA | Mpumalanga Parks and Tourism Agency |
| NEMA | National Environmental Management Act |
| NEMBA | National Environmental Management Biodiversity Act |
| PA | Protected Areas |
| QDS | Quarter Degree Square |
| RR | Receptor Resilience |
| SANBI | South African National Biodiversity Institute |
| SCC | Species of Conservation Concern |
| SEI | Site Ecological Importance |
| ToPS | Threatened or Protected Species |

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# Details of the Expertise of the Specialist

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| **Summary of Past Experience** | Andrew Zinn is a terrestrial ecologist with Hawkhead Consulting. In this role, he conducts varied specialist ecology studies, including flora and fauna surveys, for baseline ecological assessments and ecological impact assessments. He has over a decade of experience working in the fields of ecology and conservation research, and is registered as a Professional Natural Scientist (*Pr.Sci.Nat.*) – Ecological Science, with the South African Council of Natural Scientific Professions (SACNASP). Andrew has worked on projects in several African countries including Botswana, Democratic Republic of Congo, Ethiopia, Ghana, Mozambique, South Africa, Tanzania and Zambia. |
| A CV for Andrew Zinn is provided in Appendix A of this Report. | |

# Declaration of Independence by Specialist

I, Andrew Zinn, declare that I –

- Act as the independent specialist for the undertaking of a specialist section for the proposed Dalmanutha Wind Energy Farm (Alternative 1 and 1) Project;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- Do not have, nor will have, a vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document.

# 1. Introduction

Dalmanutha Wind (Pty) Ltd is proposing to develop the Dalmanutha Wind Energy Facility (WEF) Project (hereafter referred to as the "Project"), near Belfast in Mpumalanga Province, South Africa. Hawkhead Consulting was appointed by WSP Group Africa Pty (Ltd), on behalf of Dalmanutha Wind (Pty) Ltd., to conduct a Terrestrial Animal Species (fauna) Specialist Assessment for the proposed Project.

## 1.1. Scope and Purposes of this Report

This specialist study focused on terrestrial mammals (excl. bats) and herpetofauna (reptiles and amphibians), with a high-level investigation on terrestrial invertebrate species of conservation concern (SCC) (Note: separate avifauna and bat specialist studies have been conducted for the proposed Project).

The primary scope of work included:

- Collating and reviewing information and data on terrestrial fauna, specifically mammals, herpetofauna and invertebrate SCC that occur or potentially occur on-site and in the surrounding landscape;
- Conducting a field programme, comprising two seasonally representative field surveys, to collect field data on fauna species present on-site;
- Assessing the suitability of the Proposed project and the potential negative impacts on terrestrial fauna that may result from proposed Project activities; and
- Recommending mitigation and management measures for inclusion in the proposed Project's Environmental Management Programme (EMP) and/or Biodiversity Action Plan (BAP).

The purpose of this report is to: 1) present a baseline description of terrestrial fauna communities associated with the proposed Project site, 2) present the findings of an impact assessment for the proposed Project, and, 3) recommended applicable biodiversity mitigation and management measures.

This report should be read in conjunction with, *inter alia*, the Terrestrial Biodiversity and Plant Species Specialist Assessment report, which details additional terrestrial biodiversity baseline information related to the proposed Project site, including descriptions of the prevailing regional ecosystems, vegetation types, and conservation and biodiversity spatial planning, as well as more detailed descriptions of on-site vegetation communities and floristics.

## 1.2. Project Location and Delimits of the Study Area

The proposed Project complex comprises several conjoined agricultural farms that stretch southward from the N4 freeway in the north, to the KleinKomati River in the south. Collectively, these farms constitute the 'study area' for the proposed Project, and are shown with the proposed infrastructure layouts (two alternatives) in **Error! Reference source not found.** and **Error! Reference source not found.** (Refer to Section **Error! Reference source not found.** for a description of the two proposed Project alternatives).

The study area forms part of a broad area of land associated with the envisaged Dalmanutha Wind Energy Complex. Apart from the proposed Dalmanutha WEF, the Dalmanutha Wind Energy Complex also includes the proposed Dalmanutha West WEF and the proposed Dalmanutha Collector Switching Station and Powerline projects. These projects are subject to separate applications for environmental authorisation.

The R33 and R36 arterial roads are located to the west and east of the study area respectively. Several formal gravel roads, as well as numerous internal farming tracks/roads traverse the study area. The nearest major urban centre is Belfast, which is located 6.5 km to the north-west of the study area's northern boundary. Most of the study area falls within the 2530CC Quarter Degree Square (QDS), with a small portion in the northern located in the adjacent 2530CA QDS.

## 1.3. Project Description

The proposed Project consists of two alternatives, *viz*. Alternative 1 and Alternative 2. The facilities associated with each alternative are summarised below:

### 1.3.1. Alternative 1

The proposed Dalmanutha WEF will be developed with a capacity of up to 300 megawatts (MW). The proposed development footprint (buildable area) is approximately 400 ha (subject to finalisation based on technical and environmental requirements), and the extent of the Project area is approximately 9 197 ha (Figure 1). The development footprint of Alternative 1 will comprise the following key components:

*Wind Turbines*

- Up to 70 turbines, each with a foundation of approximately 25 $m^2$ in diameter (500 $m^2$ area requiring ~2 500$m^3$ concrete each) and approximately 3m deep;
- Turbine hub height of up to 200m;
- Rotor diameter of up to 200m; and
- Permanent hard standing area for each wind turbine (approximately 1 ha).

*IPP Portion On-Site Substation and Battery Storage Energy System*

- IPP portion onsite substation of up to 4 ha; and
- The Battery Energy Storage System (BESS) storage capacity will be up to 300MW/1200 megawatt-hour (MWh) with up to four hours of storage.

*Operation and Maintenance Building Infrastructure*

- Operations and maintenance (O&M) building infrastructure will be required to support the functioning of the WEF and for services required by operations and maintenance staff. The O&M building infrastructure will be near the onsite substation and will include:
  - Operations building of approximately 200 $m^2$;
  - Workshop and stores area of approximately 150 $m^2$ each;
  - Stores area of approximately 150 $m^2$; and
  - Refuse area for temporary waste and septic/conservancy tanks with portable toilets to service ablution facilities; and
  - The total combined area of the buildings will not exceed 5 000$m^2$.

*Construction Camp Laydown*

- Temporary laydown or staging area - Typical area 220 m x 100 m = 22000 m². Laydown area could increase to 30000 m² for concrete towers, should they be required;
- Sewage: septic and/or conservancy tanks and portable toilets; and
- Temporary cement batching plant, wind tower factory & yard of approximately 7ha.

*Access Roads*

- Internal and access roads with a width of between 8 m and 10 m, which can be increased to approximately 12 m on bends. The roads will be positioned within a 20 m wide corridor to accommodate cable trenches, stormwater channels and bypass /circles of up to 20 m during construction. Length of the internal roads will be approximately 60 km. As a precaution, a fixed road width of 10 m is used during the assessment of potential impacts.

*Associated Infrastructure*

Other associated infrastructure will include *inter alia*, a medium voltage (up to 33 kV) collector system, an over the fence 132kV cable to connect the onsite IPP substation to the Common Collector Switching Station, fencing, lightning protection, telecommunication infrastructure, stormwater channels, offices, operational control centre, maintenance area and workshop, ablution facilities., offices, warehouses, security building and substation building.

### 1.3.2. Alternative 2

The proposed Dalmanutha WEF will be developed with a capacity of up to 300 megawatts (MW). The proposed development footprint (buildable area) is approximately 400 ha (subject to finalisation based on technical and environmental requirements), and the extent of the project area is approximately 8 000 ha (Figure 2). The development footprint of Alternative 2 will comprise the following key components:

*Wind Turbines*

- Up to 44 turbines, each with a foundation of approximately 25 $m^2$ in diameter (500 $m^2$ area and requiring ~2 500 $m^3$ concrete each) and approximately 3m deep;
- Turbine hub height of up to 200 m;
- Rotor diameter of up to 200 m; and
- Permanent hard standing area for each wind turbine (approximately 1 ha per turbine).

*Solar Fields*

- Solar PV array comprising PV modules (solar panels), with a footprint approximately 160 ha; and
- Inverters, transformers and other required associated electrical infrastructure and components.

*IPP Portion On-Site Substation and Battery Storage Energy System*

- *As per Alternative 1*

*Operation and Maintenance Building Infrastructure*

- *As per Alternative 1*

### *Construction Camp Laydown*

- *As per Alternative 1*

### *Access Roads*

- *As per Alternative 1,* except 4 m wide internal gravel roads will be constructed between the arrays at the SEF

### *Associated Infrastructure*

- *As per Alternative 1*

## 1.4. Results of the Environmental Screening Tool

According to the National Web Based Screening Tool, the overall Animal Species Theme for the study area was rated 'High' sensitivity on account of the potential presence of several SCC.

These include the following threatened mammals; Robust Golden Mole (*Amblysomus robustus*) – Vulnerable, Rough-haired Golden Mole (*Chrysospalax villosus*) – Vulnerable, Maquassie Musk Shrew (*Crocidura maquassiensis*) – Vulnerable, Spotted-necked Otter (*Hydrictis maculicollis*) – Vulnerable, and Oribi (*Ourebia ourebi ourebi*) – Endangered, and the threatened and range-restricted Badplaas Black Millipede (*Doratogonus furculifer*) - Endangered. These SCC are discussed in more detail in Section 6 of this report.


*Figure 1: Map showing the extent of the study area, with the proposed Alternative 1 infrastructure layout.*


*Figure 2: Map showing the extent of the study area, with the proposed Alternative 2 infrastructure layout.*

# 2. Relevant Legislation and Guidelines

Relevant national and provincial legislation, associated guidelines and policies that are relevant to the environmental and biodiversity, and which were used to guide the Terrestrial Animal Species Specialist Assessment are listed in Table 1.

*Table 1: Relevant national and provincial environmental and biodiversity legislation, policies and guidelines.*

| Applicable Legislation and Guideline | Relevance to the Proposed Project |
|---|---|
| National Environmental Management Act, 1998 (Act No 107 of 1998) – NEMA | Section 24 of the NEMA, headed "Environmental Authorisations" sets out the provisions which are to give effect to the general objectives of Integrated Environmental Management, and laid down in Chapter 5 of the NEMA. In terms of section 24(1), the potential impact on the environment of listed activities must be considered, investigated, assessed and reported on to the competent authority charged by the NEMA with granting of the relevant environmental authorisation. In terms of section 24F(1) of the NEMA no person may commence an activity listed or specified in terms of section 24(2)(a) or (b) unless the competent authority has granted an environmental authorisation for the activity.<br><br>Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the NEMA (1998), when applying for environmental authorisation, the following are relevant to this study:<br><br>• Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species. |
| National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) | The NEMBA provides the framework under the NEMA for the:<br><br>• Management and conservation of South Africa's biodiversity;<br>• The protection of species and ecosystems that warrant protection;<br>• The fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; and<br>• The establishment and functions of a South African National Biodiversity Institute.<br><br>Amongst other components, the NEMBA includes:<br>• Lists of Critically Endangered, Endangered, Vulnerable and Protected Species (February 2007), with associated amendments (December 2007 and 3 June 2020) (ToPS);<br>• Threatened or Protected Species Regulations (February 2007); and<br>• National list of threatened terrestrial ecosystems for South Africa (2011), including the revised list, published on 18 November 2022. |

| Applicable Legislation and Guideline | Relevance to the Proposed Project |
|---|---|
| | The purpose of ToPS lists and regulations are to regulate the permit system concerning restricted activities involving specimens of listed threatened or protected species. The primary purpose of listing threatened ecosystems is to reduce the rate of ecosystem and species extinction by identifying 'witness' sites' of exceptionally high conservation value and enabling and facilitating proactive management of these ecosystems.<br><br>The NEMBA also provides a list of regulations and guidance concerning alien invasive species, including:<br>• A guideline for Monitoring, Control and Eradication Plans (September 2015);<br>• 2020 Alien and Invasive Species Regulations (September 2020); and<br>• 2020 Alien and Invasive Species Lists (March 2021) |
| Mpumalanga Nature Conservation Act (Act No. 10 of 1998) | Amongst other provisions, the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) provides lists of specially protected and protected flora and fauna. Of particular relevance to this specialist study are species of game and wild animals that are listed under:<br>• Schedule 1: Specially Protected Game;<br>• Schedule 2 Protected Game; and<br>• Schedule 4 Protected Wild Animals. |
| Other Relevant Policies, Plans and Guidelines | Other relevant policies, plans and guidelines that were considered during this study include:<br>• Mpumalanga Biodiversity Sector Plan;<br>• Draft National Biodiversity Offset Policy (2017);<br>• Species Environmental Assessment Guideline (SANBI, 2020);<br>• National Protected Area Expansion Strategy (2016). |

# 3. Study Methodology

This Terrestrial Animal Species Specialist Assessment investigated mammal, reptile and amphibian populations, as well as invertebrate SCC communities that occur or potentially occurring in the study area. Mammal, reptile and amphibians were studied using a combined approach based on a desktop literature review and field surveys. The invertebrate investigation was conducted at a high level and focused on potential SCC that may be present. This component was primarily based on literature review, targeted field work and an assessment of habitat suitability.

## 3.1. Desktop Data Collation and Literature Review

The aim of the desktop literature review component was to collate and review data and information pertaining to all terrestrial mammal, reptile and amphibian species, as well as invertebrate SCC that may occur in study area and surrounding landscape, based on known or historic distribution ranges. Data that were collated and reviewed were obtained from a variety of online and literature sources, as discussed below. It is noted that these data represent the most recent data that are available on these platforms.

### 3.1.1. Fauna Communities

*Mammals*

- A list of mammal species that are known to occur in the broader region was compiled based on the historic distribution ranges presented in Stuart and Stuart (2007); and
- These data were cross-referenced with mammal species listed for the Quarter Degree Squares (QDS) 2530CC and 2530CA on the MammalMAP database (FitzPatrick Institute of African Ornithology, 2022) and data obtained from the Mpumalanga Parks and Tourism Agency (MPTA).

*Herpetofauna (Reptiles and Amphibians)*

- A list of herpetofauna that potentially occur in the study area was compiled based on the distribution maps presented in Bates *et al*., (2014) for reptiles, and Minter *et al*., (2004) and Du Preez and Carruthers (2009) for amphibians; and
- Additional herpetofauna data were also sourced from ReptileMAP and FrogMAP for the QDS 2530CC and 2530CA (FitzPatrick Institute of African Ornithology, 2022) and data obtained from the MPTA.

*Invertebrates*

- Lists of invertebrate species potentially occurring in the study area were obtained from LepiMAP, LacewingMAP, OdonataMAP, DunbeetleMAP, ScorpionMAP and SpiderMAP for the QDS 2530CC and 2530CA (FitzPatrick Institute of African Ornithology, 2022). These were screened against available Red Lists to identify potential SCC.

## 3.2. Field Programme

The fauna field programme comprised two field surveys; the dry survey was conducted from 21st to 24th June 2022, while the wet season field survey was conducted 24th to 28th October 2022. The sampling methodologies used during the field surveys were based, in part, on those recommended in SANBI (2020), and included the following:

### 3.2.1. Mammals

Mammal sampling included both active and passive sampling methodologies:

- Active sampling of mammals included the use of baited motion-triggered camera traps (large- and medium-sized mammals) and Sherman traps (small mammals) placed at select sampling sites in the study area:
    - Camera traps were placed at ten fauna sampling sites. Sites were selected based on consideration of a combination of factors including 1) habitat type (woodland, grassland and wetland/riparian), 2) coverage of the study area, 3) proximity of water source, 4) presence of game trails/paths, and 5) general accessibility to field workers (refer to Appendix B (1) for map showing the location). The traps were operational continuously for the 24-hour cycle of each day of the survey. All devices were programmed to medium-sensitivity, with a one-minute delay between successive photographs to limit repeat triggers. Raw chicken pieces were used as a bait, and traps were rebaited each day as required; and
    - A grid of six Sherman traps was laid at four of the sampling sites in the study area. A home-made bait consisting of a mixture of oats, peanuts, peanut-butter, syrup and polony was used for the Sherman traps. Sherman traps were inspected each morning of the survey and rebaited as required;
    - A musk shrew specimen was collected from the field during the dry season survey and submitted to the Small Mammal Department at the Ditsong Museum of Natural History in Pretoria for identification;
- Passive sampling aimed to record mammals of all sizes and included direct observations, indirect observations and anecdotal evidence:
    - Direct observations were made during seven walked-transects and at 22-point scan locations, and during opportunistic encounters of mammals made while driving in the study area;
    - Indirect observations included the identification of mammal tracks, faeces, burrows and mounds made while conducting the walked-transects; and
    - Farmers and other land users were also consulted to obtain anecdotal evidence of mammal species present in the study area.

### 3.2.2. Herpetofauna (reptiles and amphibians)

Sampling for reptiles and amphibians also included both active and passive sampling:

- Pitfall and funnel trapping arrays: 5-10 litre buckets were dug into the ground and linked with plastic drift fences, creating a trapping array. Four funnel traps were also placed along the drift fences at each trapping array. Trapping arrays were located at the four sampling sites in the study area (Appendix B (2);
- Active night-time surveys for amphibians were also conducted during the wet-season survey and any opportunistic observations made while driving/working in the study area during both field surveys were recorded; and
- Farmers and other land users were also consulted to obtain anecdotal evidence of reptile/amphibian species present in the study area.

### 3.2.3. Invertebrates

- Field sampling for invertebrates specifically focused on the potential presence of Badplaas Black Millipede (*Doratogonus furculifer*). The pitfall trapping arrays discussed in Section 3.2.2 were used to sample for this millipede.

## 3.3. Assessment of Species of Conservation Concern

### 3.3.1. Threatened, Near Threatened and/or Protected Species Status

Species of conservation concern were based on the national Red Lists of threatened/near threatened fauna species, and the Protected status of species, as per national and provincial legislation. These included:

- Red List of Mammals of South Africa, Lesotho and Swaziland (Child *et al.*, 2016);
- SANBI's online Red List of South Africa Species (for reptiles, amphibians and invertebrates) (www.speciesstatus.sanbi.org);
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) - Threatened or Protected Species List (Notice 389 of 2013) (NEMBA ToPS List, 2007);
- Mpumalanga Nature Conservation Act (Act No. 10 of 1998); and
- Mpumalanga Red List of Threatened Fauna.

### 3.3.2. Habitat Suitability Assessments for Species of Conservation Concern

Based on the lists of SCC potentially present on-site, a 'probability of occurrence' of a species in the study area was determined by conducting habitat suitability assessments. The following parameters were used in the assessments:

- Habitat requirements: Most threatened species have very specific habitat requirements. The presence of these habitats in the study area was evaluated;
- Habitat status: The status or ecological condition of available habitat was assessed. Often a high level of habitat degradation will negate the potential presence of sensitive species; and
- Habitat linkage: Dispersal and movement between natural areas for breeding and feeding are important population-level processes. Habitat connectivity within the study area and to surrounding natural habitat and corridors was evaluated to determine the likely persistence of SCC.

Probability of occurrence was presented in the following categories:

- Recorded: Any SCC observed/documented in or close to the study area;
- Probable: the species is likely to occur in the study area due to suitable habitat and resources being present;
- Possible: The species may occur in the study area, or move through the study area (in the case of mobile species), due to potential habitat and/or resources; and
- Unlikely: the species will not likely occur in the study area due to lack of suitable habitat and resources, or significant differences in its Area of Occupancy (AOO) compared to its Extent of Occurrence (EOO).

## 3.4. Assessment of Site Ecological Importance

The ecological importance (sensitivity) of vegetation communities and habitats was determined using the protocol for evaluating site ecological importance (SEI) as published in SANBI's Species Assessment Guideline (SANBI, 2020). SEI is considered to be a function of the biodiversity importance (BI) of a receptor and its resilience to impacts (receptor resilience, RR), as per:

$$SEI = BI + RR.$$

Biodiversity importance is a function of conservation importance (CI) and the functional integrity (FI) of the receptor, as per:

$$BI = CI + FI$$

- **Conservation Importance** is defined as "the importance of a site for supporting biodiversity features of conservation concern present, e.g., populations of IUCN threatened and Near Threatened species (CR, EN, VU and NT), Rare species, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes" (SANBI, 2020).
- **Functional Integrity** is defined as "A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts" (SANBI, 2020).
- **Receptor Resilience** is defined as "the intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention" (SANBI, 2020).

For tables detailing the rating criteria for Conservation Importance, Functional Integrity and Receptor Resilience and the scoring matrices, refer to Appendix A. Table 2 presents a guideline for interpreting the SEI (SANBI, 2020).

*Table 2: Guidelines for interpreting SEI in the context of the proposed development activities*

| Site Ecological Importance | Interpretation in relation to proposed development activities |
|---|---|
| **Very High** | Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains. |
| **High** | Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities. |
| **Medium** | Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities. |
| **Low** | Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities. |
| **Very Low** | Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required. |

| Site Ecological Importance | Interpretation in relation to proposed development activities |
|---|---|
| Source: SANBI (2020). | |

# 4. Assumptions, Uncertainties and Gaps in Knowledge

The following assumptions, uncertainties and gaps in knowledge are highlighted for this specialist study:

- Field work was conducted over a four-day period in June and a five-day period in October 2022. Considering, *inter alia*, the size of the study area and various seasonal influences, it is possible that rare, cryptic or transient fauna species may not have been present and/or observed during the field surveys;
- The absence or non-recording of a specific fauna species, at a particular time, does not necessarily indicate that 1) the species does not occur there; 2) the species does not utilise resources in that area; or 3) the area does not play an ecological support role in the ecology of that species; and
- Given the difficulty of fully sampling and characterising the abundance and distribution of fauna species in the study area during the short period of time allocated to field work, the baseline descriptions were qualitative.

# 5. Characterisation of on-site Fauna Habitats

This section presents a brief description of the primary habitat types and possible fauna associations in the study area.

For a full description of vegetation communities in the study area, refer to the Terrestrial Biodiversity and a Plant Species Specialist Assessment report. The vegetation community map developed as part of that assessment is shown, in relation to the Alternative 1 and Alternative 2 proposed infrastructure layouts, in Figure 3 and Figure 4 respectively.

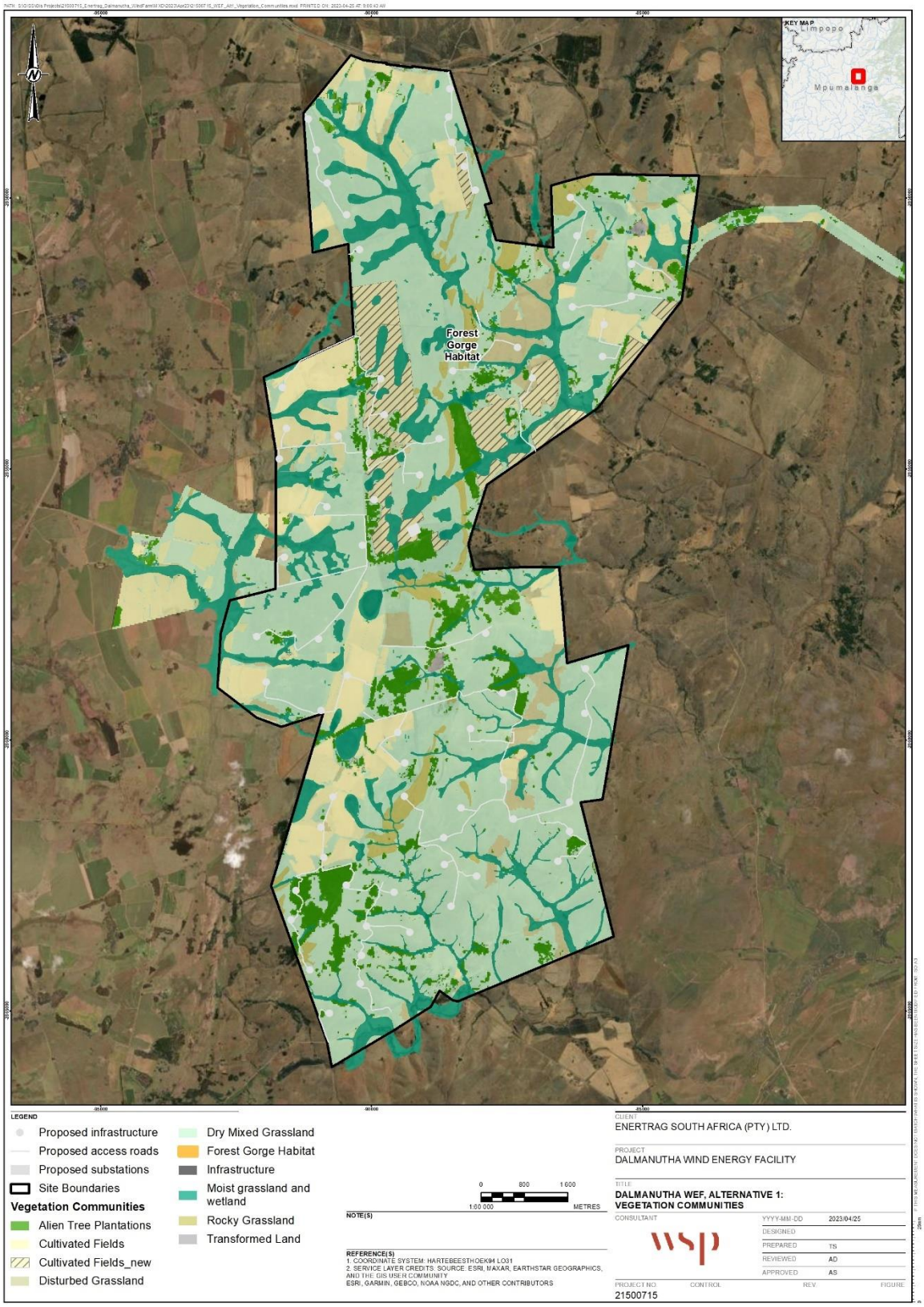


*Figure 3: Vegetation community map of the study area and proposed infrastructure layout for Alternative 1 (map taken from the Terrestrial Biodiversity and Plant Species Specialist Assessment report).*

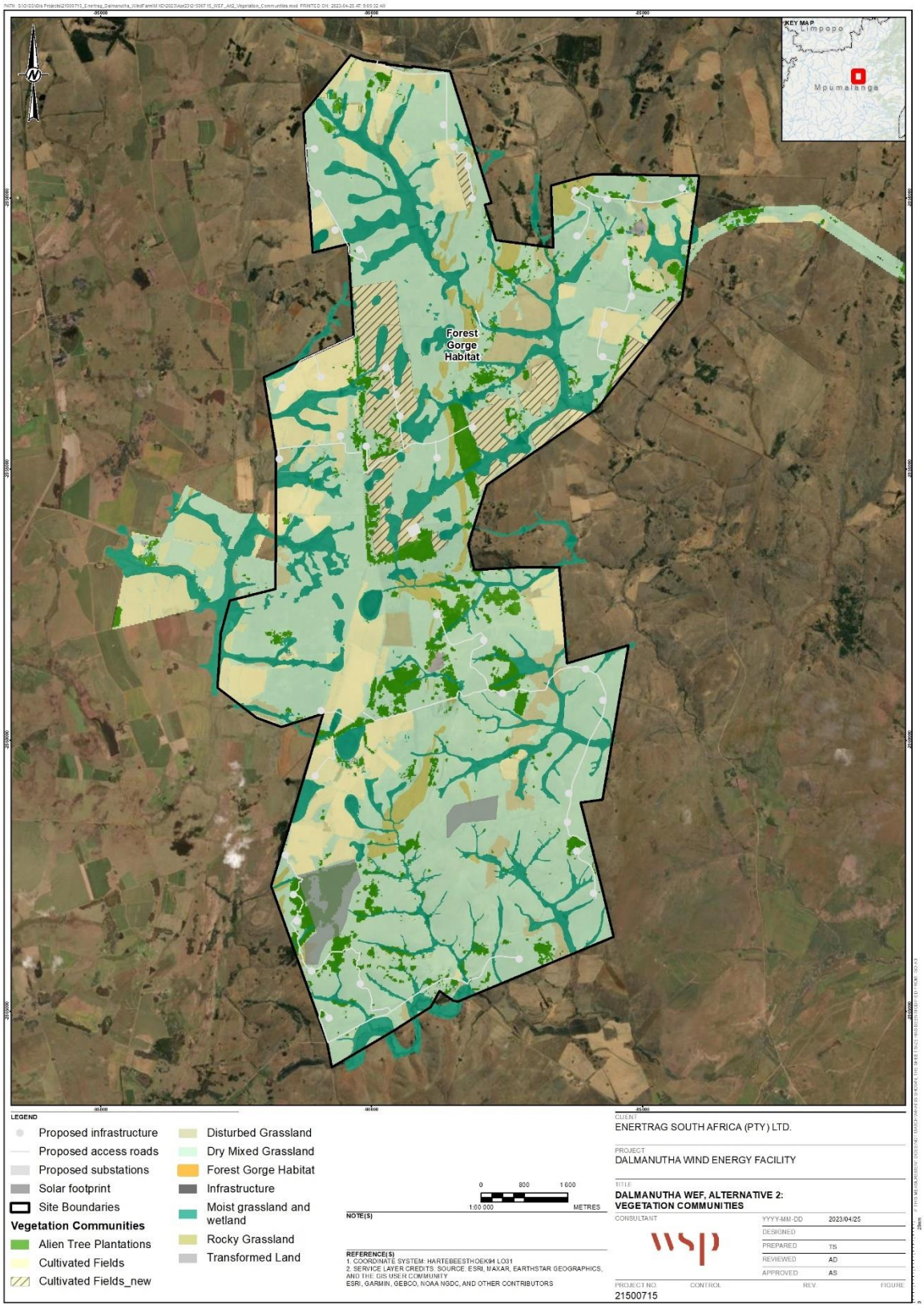


*Figure 4: Vegetation community map of the study area and proposed infrastructure layout for Alternative 2 (map taken from the Terrestrial Biodiversity and Plant Species Specialist Assessment report).*

## 5.1. Natural Habitat Types

The Terrestrial Biodiversity and Plant Species Specialist Assessment study for the proposed Project identified five natural vegetation communities in the study area, namely Dry Mixed Grassland, Disturbed Grassland, Rocky Grassland, Moist Grassland and Wetland, and Forest Gorge Habitat. For the purposes of this terrestrial fauna study, these communities have been grouped into three primary natural habitat formations, *viz*. grassland habitats, wetland and river habitats, and forest gorge habitat. These are summarised below:

### 5.1.1. Grassland Habitats

The majority of the study area is characterised by open terrestrial grassland habitat (comprising the Dry Mixed Grassland, Disturbed Grassland and Rocky Grassland vegetation communities). These range from grasslands occurring on flat or slightly undulating plains (Figure 5), to rocky grassland occurring along mountain ridges and at rocky outcrops (Figure 6).

Grassland habitats are critically important and support most of the diverse fauna assemblages that are known from the Highveld region. Large portions of grasslands in the study area are hilly and remote, and have relatively low levels of human accessibility. These areas are particularly important for larger mammal species (e.g., antelope) that may be sensitive to anthropogenic disturbances, such as hunting. Areas of rocky grassland also provide specific niche habitat for rupicolous fauna (e.g., reptiles, Rocky hyrax).

*Figure 5: Short open grassland, flanked by alien tree plantations.*

*Figure 6: Short, rocky grasslands are often characterised by scattered indigenous woody shrubs and trees favouring rupicolous fauna.*

### 5.1.2. Wetland and River Habitats

These habitats include moist grassland and wetlands, stream and river channels, pans and open farm dams (see Figure 7 and Figure 8). These habitats are functionally very important, and several aquatic and semiaquatic fauna species (e.g., otters, amphibians) are dependent upon them. Many other fauna species will also use these areas as key resource habitats for grazing (antelope), sheltering and hunting (predators).

*Figure 7: Well-vegetated stream located in the west of the study area.*

*Figure 8: Large farm dam located in the centre of the study area.*

### 5.1.3. Forest Gorge Habitat

This habitat type is confined to a short, deeply-incised river valley in the centre of the study area – shown in Figure 9Figure 9 and Figure 10. The valley bottom is dominated by indigenous forest, while the adjacent steep rocky cliffs are generally well-vegetated with grasses, forbs, shrubs and succulents. Forest gorge habitat significantly increases the degree of local-scale habitat heterogeneity in the study area, and this area will support a diverse fauna community, including both forest specialist and rupicolous species that are unlikely to be present in adjacent grassland areas.

*Figure 9: Well-wooded indigenous forest.*

*Figure 10: Well-vegetated cliffs enclose the gorge forest.*

## 5.2. Modified Habitat Types

Two primary modified habitat types were identified in the study area, namely alien tree plantations and cultivated fields. These are discussed below:

### 5.2.1. Alien Tree Plantations

Numerous alien tree plantations are present in the study area. These range from small woodlots and windrows, to large plantations and informal thickets/infestations (Figure 11). Despite being classified as a modified habitat type, alien tree plantations do provide well-wooded refuge areas that are likely to be used by fauna that may be sensitive to hunting and other forms of anthropogenic disturbance.

It is also expected that certain nocturnal fauna shelter among the trees during the day and emerge at night to forage in the adjacent open grasslands.

*Figure 11: Alien tree plantations provide dense, well-wooded habitat.*

### 5.2.2. Cultivated Fields

Portions of the study area are also characterised by cultivated fields. These are used for maize or soya production (Figure 12), or maintained as open pastures for grazing livestock. Cultivated fields are regularly disturbed and dominated by non-indigenous vegetation. Although certain fauna species may move through these areas and occasionally forage in them, considering the degree of ongoing disturbance and modification, cultivated fields are not considered important fauna habitat.

*Figure 12: Cultivated field under maize production.*

# 6. Terrestrial Fauna Baseline Characterisation

## 6.1. Mammals

Twenty-eight mammal species, ranging from small rodents to medium-sized antelope, were recorded in the study area during the field programme – listed in Table 3. Of these, 24 taxa were recorded during the dry season survey and 25 taxa during the wet season survey.

Apart from a single Blesbok (*Damaliscus pygargus phillipsi*), which is likely a reintroduced and actively managed taxon, all the recorded species are free-roaming[1]. Figure 13 to Figure 24 show select images of mammals photographed in the study area during the field programme.

Based on visual observations/encounters, the Common Duiker (*Sylvicapra grimmia*) was the most frequently recorded mammal species, with eight sightings, followed by the Yellow Mongoose (*Cynictis penicillata*) with four sightings and Steenbok (*Raphicerus campestris*) with three sightings. The most frequently caught species in baited Sherman traps was the Xeric Four-striped Mouse (*Rhabdomys pumilio*), with 22 individuals caught during the field programme.

The frequent sighting of a small troop of Vervet Monkey (*Chlorocebus pygerythrus*) in close proximity to stands of alien trees in study area during both the wet- and dry-season surveys is interesting, as it highlights the increased habitat heterogeneity provided by these well-wooded, yet anthropogenic and modified habitats in the study area and surrounding landscape.

The recorded mammal richness of the study area is considered high. The presence of free-roaming medium-sized antelope (e.g., the two Reedbuck species) suggests that the availability, heterogeneity (diversity) and condition (integrity) of suitable habitats on-site are high and that these areas are able to sustain a mammal assemblage that approaches a contemporary reference community for the landscape. It is noted that, based on a review of historic distribution maps in Stuart & Stuart (2007) and Childs *et al*., (2016) up to 78 mammal species have been documented the region in which the study area is located, and therefore potentially occur in the study area – these are listed in Appendix C.

For a discussion on mammal species of conservation concern recorded in the study area, refer to Section 6.1.1.

*Table 3: Mammal species recorded in the study area during the field surveys.*

| Family | Scientific Name | Common Name | Field Records | |
|---|---|---|---|---|
| | | | Dry season | Wet Season |
| Bathyergidae | *Cryptomys hottentotus / Georychus capensis** | Common / Cape Mole-rat | Earthen mounds | Earthen mounds |
| Bovidae | *Damaliscus pygargus phillipsi* | Blesbok | Visual observation | Visual observation |
| Bovidae | *Pelea capreolus* | Grey Rhebok | Visual observation | Visual observation |
| Bovidae | *Raphicerus campestris* | Steenbok | Visual observation | Visual observation |

[1] Mammals that are part of self-sustaining, natural populations and are able move freely across the landscape. I.e., they are not part of anthropogenically managed populations.

| Family | Scientific Name | Common Name | Field Records | |
|---|---|---|---|---|
| | | | Dry season | Wet Season |
| Bovidae | *Redunca arundinum* | Southern Reedbuck | Visual observation | Visual observation |
| Bovidae | *Redunca fulvorufula fulvorufula* | Mountain Reedbuck | Camera trap data | - |
| Bovidae | *Sylvicapra grimmia* | Common Duiker | Visual observation<br>Camera trap data | Visual observation<br>Camera trap data |
| Canidae | *Canis mesomelas* | Black-backed Jackal | Camera trap data<br>Track and scat | Visual observation<br>Camera trap data |
| Cercopithecidae | *Chlorocebus pygerythrus* | Vervet Monkey | Visual observation<br>Camera trap data | Visual observation<br>Camera trap data |
| Felidae | *Leptailurus serval* | Serval | Visual observation<br>Camera trap data | Visual observation<br>Camera trap data |
| Herpestidae | *Atilax paludinosus* | Water Mongoose | Track<br>Camera trap data | Camera trap data |
| Herpestidae | *Herpestes sanguineus* | Slender Mongoose | Camera trap data | Camera trap data |
| Herpestidae | *Ichneumia albicauda* | White-tailed Mongoose | - | Camera trap data |
| Herpestidae | *Cynictis penicillata* | Yellow Mongoose | - | Visual observation |
| Herpestidae | *Suricata suricatta* | Suricate | Anecdotal | - |
| Hystricidae | *Hystrix africaeaustralis* | Cape Porcupine | Faecal pellets | Camera trap data |
| Leporidae | *Lepus saxatilis* | Scrub Hare | Visual observation | Visual Observation |
| Leporidae | *Pronolagus saundersiae* | Hewitt's Red Rock Rabbit | Faecal pellets | - |
| Muridae | *Gerbilliscus sp.* | Gerbil species | Burrows | Burrows |
| Muridae | *Mastomys coucha* | Multimammate Mouse | Sherman trapping | Sherman trapping |
| Muridae | *Rhabdomys pumilio* | Xeric Four-striped Mouse | Sherman trapping | Sherman trapping |
| Muridae | *Dendromus mystacalis* | Chestnut Climbing Mouse | - | Pit fall trapping |
| Orycteropodidae | *Orycteropus afer* | Aardvark | Burrow and feeding signs | Camera trap data |
| Pedetidae | *Pedetes capensis* | Springhare | Burrows | Burrows |
| Procaviidae | *Procavia capensis* | Rock Hyrax | - | Visual observation |

| Family | Scientific Name | Common Name | Field Records | |
|---|---|---|---|---|
| | | | Dry season | Wet Season |
| Soricidae | *Mysorex varius*[#] | Forest Shrew | Sherman trapping | Sherman trapping |
| Suidae | *Potamochoerus larvatus* | Bushpig | Anecdotal Feeding signs | Feeding signs |
| Viverridae | *Genetta maculata* | Rusty-spotted Genet | Camera trap data | Visual observation Camera trap data |
| **As only earthen mounds were observed, it was not possible to confirm the species of Mole-rat.* | | | | |
| *[#] Identified by the Small Mammal Department at Ditsong Museum of Natural History.* | | | | |


*Figure 13: Mountain Reedbuck* (*Redunca fulvorufula fulvorufula*).


*Figure 14: Black-backed Jackal* (*Canis mesomelas*).


*Figure 15: Vervet Monkey* (*Chlorocebus pygerythrus*).


*Figure 16: Rusty-spotted Genet* (*Genetta maculata*).


*Figure 17: Slender Mongoose* (*Herpestes sanguineus*).


*Figure 18: Common Duiker* (*Sylvicapra grimmia*).


*Figure 19: Water Mongoose (Atilax paludinosus)*


*Figure 20: Aardvark (Orycteropus afer)*

*Figure 21: Chestnut Climbing Mouse (Dendromus mystacalis)*


*Figure 22: Serval (Leptailurus serval)*


*Figure 23: White-tailed Mongoose (Ichneumia albicauda)*

*Figure 24: Xeric Four-striped Mouse (Rhabdomys pumilio)*

### 6.1.1. Mammal Species of Conservation Concern

Three mammal species recorded in the study area during the field programme are listed on the national mammal Red List (Child *et al.*, 2016), namely Serval (*Leptailurus serval*), Mountain Reedbuck (*Redunca fulvorufula fulvorufula*) and Grey Rhebok (*Pelea capreolus*). These three taxa are discussed in more detail in Section 6.1.1.1 to 6.1.1.3.

Protected mammal species recorded in the study area include Steenbok (*Raphicerus campestris*) and Aardvark (*Orycteropus afer*), which are both listed as protected at a provincial level according to the Mpumalanga Nature Conservation Act (Act No. 10 of 1998), and the Southern Reedbuck (*Redunca arundinum*), which is listed as protected at both a national level (NEMBA ToPS List, 2007) and provincial level.

Based on historic distribution ranges, an additional 18 SCC (i.e., threatened and/or protected species) are known from the region and potentially occur in the study area. These are listed in Table 4, along with their conservation status, habitat preferences, and a 'probability of occurrence' in the study area based on habitat suitability assessments.

Additional SCC that are likely to be present, based on the authors previous work in the region, include *inter alia*, the Cape Clawless Otter (*Aonyx capensis*) and the Spotted-necked Otter (*Hydrictis maculicollis*). These species favour riparian habitats, with permanent water and are thus likely to be found close to streams and farm dams in the study area.

#### *6.1.1.1.Mountain Reedbuck*

The Mountain Reedbuck (Endangered) is a medium-sized grazing antelope (Figure 13) that inhabits rolling grassy hillsides and mountain slopes above 1 500 m (Estes, 1991). This species is territorial and gregarious, and is found in small herds ranging from 3 to 6 individuals (Estes, 1991). The estimated regional population size of Mountain Reedbuck is between 10 217 and 13 669 mature individuals, with purported densities in protected areas ranging from 10 to 1 150 individuals per 100 $km^2$ (Taylor *et al.*, 2016a). It is noted that no data are cited for private agriculture land. Moreover, no data are available on the EOO or AOO of this species. The primary threats to Mountain Reedbuck include poaching, increased natural predation, and disturbance from cattle herders and livestock (Taylor *et al.*, 2016a).

Mountain Reedbuck were photographed on a camera trap in montane grassland in the far south of the study area (co-ordinates S25 52.607 E30 06.173). These data indicated the presence of at least two individuals, and it is expected that they form part of a small breeding herd. It is also anticipated that additional breeding herds may be present in similar habitat in the north of study area (Pers. Comm. G. Lockwood). The local Mountain Reedbuck population is therefore considered viable. Considering the Red List status of this species (i.e., Endangered), the conservation importance of the Mountain Reedbuck population observed in the study area is considered high. Important habitat for this species includes rocky montane grassland and wetland areas.

#### *6.1.1.2.Grey Rhebok*

Grey Rhebok (Near Threatened) are medium-sized, territorial browsing antelope. They are gregarious, living in herds comprising one adult male and 1 to 15 females and young (Estes, 1991). They favour sourveld grassland and scrubland in hills and mountainous areas (Estes, 1991). The regional population size of Grey Rhebok is thought to be about 10 000 individuals, with an estimated

density in protected areas of 0.5 to 1.7 individuals per km$^2$ (Taylor *et al.*, 2016b). Threats to Grey Rhebok include increased levels of bush-meat and sport hunting (Taylor *et al.*, 2016b).

A single male Grey Rhebok was observed while conducting a walked-transect in an area of grassland in the centre of the study area (co-ordinates S25 46.773 E30 07.209) during the dry season survey, and a pair of female antelope was observed at approximately the same location during the wet season field survey. This suggests the presence of a small breeding herd. It is probable that other individuals/herds are present in similar habitat in the study area, and therefore the local population of Grey Rhebok is also considered viable. Important habitat for this species also includes rocky montane grassland and wetland areas.

#### *6.1.1.3.Serval*

The Serval (Near Threatened) is a small feline predator. They are solitary and territorial, and favour wetland, tall grassland and well-watered savanna habitats (Estes, 1991). Population densities range from 0.1 to 1.5 individuals per km$^2$, with a regional population estimated at 10 264 ±812 individuals (Ramesh, *et al.*, 2016). This species is able tolerate relatively high levels of anthropogenic activity, and is frequently found in farmland and mining/industrial land, provided sufficient suitable habitat is present and levels of persecution remain low (Ramesh, *et al.*, 2016). The loss and degradation of wetland and associated grassland habitats is the primary threat to Serval.

During the wet season field programme, this species was recorded on two camera traps and via direct visual observation. Considering the abundance of favourable hunting habitat (grassland and wetland) and the presence of ample refuge habitat (alien tree stands), it is expected that this species is fairly abundant in the study area with a viable population.

*Table 4: Mammal species of conservation concern occurring or potentially occurring in the study area.*

| Family | Scientific Name | Common Name | National Red List Status (2016) | NEMBA ToPS List (2007) | Mpumalanga Status | Habitat Preferences* | Probability of Occurrence |
|---|---|---|---|---|---|---|---|
| Bathyergidae | *Cryptomys hottentotus* | Common Mole-rat | Data Deficient | - | Data Deficient | Prefers deep sandy soils along rivers and in montane areas. | Recorded/Probable – Mole-rat mounds were observed in suitable habitat in the study area, but it is was not possible to identify the species. |
| Bovidae | *Connochaetes gnou* | Black Wildebeest | Least Concern | Protected | - | Open grassland plains and arid shrubland. | Unlikely - Mostly confined to managed populations in conservation areas or private land. |
| Bovidae | *Ourebia ourebi ourebi* | Oribi | Endangered | Endangered | Endangered / Protected | Short open grassland, with patches of taller grass. | Possible – Suitable habitat present, and according to MPTA records, this species has previously been recorded on several farms[2] in the study area. |
| Bovidae | *Pelea capreolus* | Grey Rhebok | Near Threatened | - | Protected | Sourveld grassland and scrubland in hills and mountainous areas. | Recorded |
| Bovidae | *Raphicerus campestris* | Steenbok | Least Concern | - | Protected | Range of habitats, including grassland and savanna. | Recorded |
| Bovidae | *Redunca arundinum* | Southern Reedbuck | Least Concern | Protected | Protected | Savanna and grassland habitats in mountainous areas. | Recorded |
| Bovidae | *Redunca fulvorufula fulvorufula* | Mountain Reedbuck | Endangered | - | Protected | Rolling grassy hillsides and mountain slopes. | Recorded |
| Canidae | *Vulpes chama* | Cape Fox | Least Concern | Protected | - | Range of habitats, including grassland and arid savanna. | Possible – Suitable habitat present. |
| Chrysochloridae | *Amblysomus robustus* | Robust Golden Mole | Vulnerable | Endangered | Vulnerable | Sandy soils in grassland areas. | Probable – Suitable habitat present, and according to MPTA records, this species has previously been recorded on several farms[3] in the study area |
| Chrysochloridae | *Amblysomus septentrionalis* | Highveld Golden Mole | Near Threatened | - | Near Threatened | Sandy soils in grassland areas. | Probable – Suitable habitat present, and according to MPTA records, this species has previously been recorded on a farm[4] in the study area |

[2] Farrefontein 349 JT, Lakenvlei 355 JT, Waterloo 367 JT, Winaarspoort 350 JT, Boesmanspruit 9 IT and Witkloof 408 JT.

[3] Avontuur 319 JT, Groenvlei 353 JT, Middelpunt 320 JT, Paardeplaats 380 JT, Tweefontein 357 JT and Zwartkoppies 316 JT.

[4] Tweefontein 357 JT.

| Family | Scientific Name | Common Name | National Red List Status (2016) | NEMBA ToPS List (2007) | Mpumalanga Status | Habitat Preferences* | Probability of Occurrence |
|---|---|---|---|---|---|---|---|
| Chrysochloridae | *Chrysospalax villosus* | Rough-haired Golden Mole | Vulnerable | Critically Endangered | - | Sandy soils in grassland areas. | Probable – Suitable habitat present, and according to MPTA records, this species has previously been recorded on a farm[5] in the study area |
| Erinaceidae | *Atelerix frontalis* | South African Hedgehog | Near Threatened | Protected | Near Threatened / Protected | Range of habitats, including grassland and savanna. | Probable – Suitable habitat present, and according to MPTA records, this species has previously been recorded on several farms[6] in the study area. |
| Felidae | *Felis nigripes* | Black-footed Cat | Vulnerable | Protected | Near Threatened | Open short grass areas in savanna and grassland habitats. | Possible - Suitable habitat present. |
| Felidae | *Leptailurus serval* | Serval | Near Threatened | Protected | Near Threatened | Wetland, tall grassland and well-watered savanna habitats. | Recorded |
| Felidae | *Panthera pardus* | Leopard | Vulnerable | Vulnerable | Near Threatened | Wide range of habitats, including grassland and savanna. | Unlikely/Possible – suitable habitat present, but a large and shy predator that is vulnerable to human persecution. |
| Hyaenidae | *Parahyaena brunnea* | Brown Hyaena | Near Threatened | Protected | Near Threatened / Protected | Savanna and grassland habitats. | Possible – Suitable habitat present. |
| Hyaenidae | *Proteles cristata* | Aardwolf | Least Concern | - | Protected | Savanna and grassland habitats. | Probable - Suitable habitat present, and according to MPTA records, this species has previously been recorded on a farm[7] in the study area |
| Muridae | *Dasymys incomtus* | African Marsh Rat | Near Threatened | - | Near Threatened | Moist grassland and wetland habitats. | Probable – Suitable habitat present. |
| Muridae | *Otomys auratus* | Vlei Rat (Grassland type) | Near Threatened | - | - | Moist grassland and wetland habitats. | Probable – Suitable habitat present. |
| Mustelidae | *Aonyx capensis* | Cape Clawless Otter | Near Threatened | Protected | Protected | Riparian habitats, with permanent water. | Probable – Suitable habitat present, and according to MPTA records, this species has previously been recorded on several farms[8] in the study area. |

[5] Avontur 319 JT.

[6] Kleinfontein 432 JS, Weltevreden 381 JT, Gelk 405 JT and Vlakfontein 418 JT.

[7] Boesmanspruit 9 IT.

[8] Blesboklaagte 488 JS, Waterloo 367 JT and Boesmanspruit 9 IT.

| Family | Scientific Name | Common Name | National Red List Status (2016) | NEMBA ToPS List (2007) | Mpumalanga Status | Habitat Preferences* | Probability of Occurrence |
|---|---|---|---|---|---|---|---|
| Mustelidae | *Hydrictis maculicollis* | Spotted-necked Otter | Vulnerable | Protected | Near Threatened / Protected | Riparian habitats, favouring large, open water bodies. | Probable – Suitable habitat present, and according to MPTA records, this species has previously been recorded on several farms[9] in the study area. |
| Mustelidae | *Mellivora capensis* | Honey Badger | Least Concern | Protected | Near Threatened / Protected | Savanna and grassland habitats | Probable – Suitable habitat present, and according to MPTA records, this species has previously been recorded on a farm[10] in the study area. |
| Orycteropodidae | *Orycteropus afer* | Aardvark | Least Concern | - | Protected | Savanna and grassland habitats. | Recorded |
| Soricidae | *Crocidura maquassiensis* | Maquassie Musk Shrew | Vulnerable | - | Vulnerable | Little is known of habitat preferences. Thought to favour rocky or montane grasslands. | Possible – Suitable habitat present. |
| Soricidae | *Crocidura mariquensis* | Swamp Musk Shrew | Near Threatened | - | Near Threatened | Reedbeds, wetlands and thick moist grassland in riverine habitats. | Probable – Suitable habitat present. |
| *Habitat preferences as per Skinner and Smithers (1990), Stuart and Stuart (2007) and Childs *et al.,* (2016). | | | | | | | |

[9] Waaikraal 385 JT and Boesmanspruit 9 IT.

[10] Braamfontein 465 JS.

## 6.2. Reptiles

Four reptile species were documented in the study area during the field programme. The presence of two species, *viz*., the Puffadder (*Bitis arietans arietans*) and Rinkhals (*Hemachatus haemachatus*), are based on anecdotal evidence provided by a local farmer. Spotted Grass Snake (*Psammophylax rhombeatus*) was observed while driving in the study area during both the dry- and wet season surveys (see Figure 25), while the Speckled Rock Skink (*Trachylepis punctatissima*) was recorded during the wet season survey. These are common species with widespread distributions, and are not of conservation concern.

Based on historic distribution ranges presented in Bates *et al*. (2014) and ReptileMAP records for the relevant QDS, up to 84 reptile species have been documented the region in which the study area is located, and therefore potentially occur in the study area – these are listed in Appendix D. Considering the high degree of habitat availability and heterogeneity in the study area - particularly the presence extensive rocky grassland areas and the area forested gorge habitat - it is anticipated that several additional reptile species are likely to be present.

### 6.2.1. Reptile Species of Conservation Concern

Ten reptile SCC potentially occur in the study area (Table 5). None of these species are listed as threatened or protected nationally. They are however, listed as threatened/near threatened at a provincial level. It noted that according to the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) all species of reptiles, excluding the monitors (e.g., *Varanus niloticus*) and all snakes, are considered 'protected' in Mpumalanga Province.

Data records from the Mpumalanga Tourism and Parks Agency (MPTA) indicate that Northern Dwarf Chameleon (*Bradypodion transvaalense*) was previously recorded in the study area. This endemic species is not listed as threatened on the national Red List, but it is listed as Vulnerable in Mpumalanga Province. Northern Dwarf Chameleon favour forest patches along the escarpment and in deep gorges. A small patch of forested gorge habitat is present in the study area, and it is therefore probable that this species is present (Bates *et al.,* 2014).

Apart from the several reptiles of conservation concern that are potentially present and that favour typical grassland species, SCC that are likely to occur in rocky grassland areas include Large-scaled Grass Lizard (*Chamaesaura macrolepis*) (Near Threatened, MP) and Breyer's Long-tailed Seps (*Tetradactylus breyeri*) (Vulnerable, MP), while a species such as the Many-spotted Snake (*Amplorhinus multimaculatus*) (Near Threatened, MP) is likely to be occur in wetlands and areas of riparian vegetation.

*Figure 25: Spotted Grass Snake (Psammophylax rhombeatus) photographed during the dry season field survey.*

*Table 5: Reptile species of conservation concern occurring and potentially occurring in the study area.*

| Family | Scientific Name | Common Name | National Red List Status | NEMBA ToPS List (2007) | Mpumalanga Status | Habitat Preferences* | Probability of Occurrence |
|---|---|---|---|---|---|---|---|
| Chamaeleonidae | *Bradypodion transvaalense* | Northern Dwarf Chameleon | Least Concern | - | Vulnerable | Forest patches along the escarpment and in deep gorges. | Probable – Suitable habitat present. |
| Colubridae | *Dasypeltis inornata* | Southern Brown Egg-eater | Least Concern | - | Near Threatened | Moist savanna in rocky areas. | Unlikely – No suitable habitat present. |
| Cordylidae | *Chamaesaura aenea* | Coppery Grass Lizard | Least Concern | - | Near Threatened | Grassy slopes and plateau. | Probable – Suitable habitat present. |
| Cordylidae | *Chamaesaura macrolepis* | Large-scaled Grass Lizard | Least Concern | - | Near Threatened | Rocky grassy hillsides | Probable – Suitable habitat present. |
| Gerrhosauridae | *Tetradactylus breyeri* | Breyer's Long-tailed Seps | Least Concern | - | Vulnerable | Montane and highveld grassland, with rocks and abandoned termitaria. | Possible - Suitable habitat present. |
| Lamprophiidae | *Amplorhinus multimaculatus* | Many-spotted Snake | Least Concern | - | Near Threatened | Reed beds, wetlands and riparian vegetation in grasslands. | Probable – Suitable habitat present. |
| Lamprophiidae | *Homoroselaps dorsalis* | Striped Harlequin Snake | Least Concern | - | Near Threatened | Semi-fossorial, favouring abandoned termitaria in grassland. | Probable – Suitable habitat present. |
| Lamprophiidae | *Homoroselaps lacteus* | Spotted Harlequin Snake | Least Concern | - | Near Threatened | Semi-fossorial, favouring sandy soils, abandoned termitaria and rocky areas. | Probable – Suitable habitat present. |
| Scincidae | *Acontias breviceps* | Short-headed Legless Skink | Least Concern | - | Vulnerable | Fossorial and found in montane grassland. | Possible - – Suitable habitat present. |
| Scincidae | *Acontias plumbeus* | Giant Legless Skink | Least Concern | - | Near Threatened | Mesic microhabitats in partly wooded habitats, grasslands or alluvial sands. | Unlikely – Limited suitable habitat present. |
| *Habitat preferences as per Branch (1998) and Bates *et al.,* (2014). | | | | | | | |

## 6.3. Amphibians

Six amphibian species was recorded during the field survey - these are listed in Table 6 (see Figure 26 and Figure 27). All six species are common amphibians with widespread distributions, and are not of conservation concern. Based on historic distribution ranges, up to 20 amphibian species are known from the region and potentially occur in the study area – these are listed in Appendix D.

Considering the abundance and varied aquatic habitats present in the study area, it is anticipated that several additional amphibian species are likely to be present. Apart from the Giant Bullfrog (*Pyxicephalus adspersus*), which is discussed below, all other species that potentially occur in the study area are also common and widespread species and not of conservation concern.

*Table 6: Amphibians recorded in the study area during the field programme*

| Family | Scientific Name | Common Name |
|---|---|---|
| Bufonidae | *Bufo gutturalis* | Guttural Toad |
| Pipidae | *Xenopus laevis* | Common Platanna |
| Pyxicephalidae | *Stongylopus fasciatus* | Striped Stream Frog |
| Pyxicephalidae | *Amietia angolensis* | Common River Frog |
| Pyxicephalidae | *Amietia fusigula* | Cape River Frog |
| Pyxicephalidae | *Cacosternum boettgeri* | Boettger's Caco |

### 6.3.1. Amphibian Species of Conservation Concern

The Giant Bullfrog is the only amphibian of conservation concern potentially occurring in the study area. This species is listed as 'protected' on the NEMBA ToPs list (2007), as well as 'protected' in Mpumalanga Province according to the Mpumalanga Nature Conservation Act, 1998). It is also listed as Vulnerable on the Mpumalanga Red List. Giant Bullfrog inhabit seasonally shallow pans, wetland and rained-filled depressions in savanna and grassland ecosystems. These habitats are present in the study area, and it is therefore probable that Giant Bullfrog are present.

*Figure 26: Common River Frog (Amietia angolensis).*

*Figure 27: Juvenile Striped Stream Frog (Stongylopus fasciatus).*

## 6.4. Invertebrate Species of Conservation Concern

The national environmental screening tool highlighted the potential presence of the range restricted Badplaas Black Millipede (*Doratogonus furculifer*) – Endangered (Rudolf, *et al*., 2017). This species is endemic to Mpumalanga and has an extent of occurrence (EOO) estimated at 580 $km^2$. It is known from a few sites near Belfast, Ndubazi and at an unspecified location between Barberton and Badplaas (Rudolf, *et al*., 2017). The habitat requirements of the Badplaas Black Millipede are poorly documented, but it is presumed to favour open grassland and potentially savanna type habitats. Similarly, the population densities of this species are unknown, although it is likely they occur at low densities (Rudolf, *et al*., 2017).

A juvenile *Doratogonus* sp. millipede was recorded in a pitfall trap in the far north of the study area (S25 44.985 E30 05.863) during the wet season field survey. As it was a juvenile, it is not possible to confirm its identity to species-level (Pers. Comms. M. Hamer). However, is possible that this individual is the more widespread and common *Doratogonus rugifrons* millepede (Pers. Comms. M. Hamer). This notwithstanding, considering the extent of open grassland habitat in the study area, it is considered possible that the Badplaas Black Millipede is present.

The OdonataMAP platform published by the FitzPatrick Institute of African Ornithology (2022) documents the presence of the three threatened dragonfly species in the QDS that encompasses the study area. The ecology of these taxa, along with a habitat suitability assessment, is provided below:

- Balinsky's Sprite (*Pseudagrion inopinatum*) - Near Threatened, is a dragonfly species. It is known from sizeable populations at localities in Mpumalanga and KwaZulu-Natal, and is not immediately threatened. This species favours meandering open rivers and streams with abundant marginal vegetation (Samways, 2017a). These habitats are present in the study area, and it is possible that the Balinsky's Sprite is present.
- Harlequin Sprite (*Pseudagrion newtoni*) – Vulnerable, is a range-restricted dragonfly species that is known from only one location where it is considered abundant. Samways (2017b) indicates that this species is expected to occur elsewhere in the area. It favours tall grass riparian habitats at 1 300 m asl (above sea level) (Samways, 2017b). These habitats are present in the study area, and it is possible that the Harlequin Sprite is present.
- Dwarf Percher (*Diplacodes pumila*) – Endangered. Little information about this dragonfly species is available. Samways (2017c) indicates that it is known from occasional records in KwaZulu-Natal and Limpopo Province, but no details are provided as to its presence in Mpumalanga Province. Its preferred habitat is listed as 'swamps or marshy pools' (Samways, 2017c). Notwithstanding the paucity of additional information, such habitats are present in the study area and following the precautionary principle, it is considered possible that the Dwarf Percher is present.

# 7. Key Ecological Attributes

## 7.1. Habitat Corridors, Resources and Refugia

Despite localised areas of modified and disturbed habitat (mostly associated with cultivation and alien tree plantations), and the presence of linear infrastructure, such as farm roads, powerline servitudes, railways and farm fences, habitat connectivity in the study area and across the broader landscape remains relatively high. This is evident by the presence of medium-sized, free roaming antelope, such as Grey Rhebok (Near Threatened), Southern Reedbuck and Mountain Reedbuck (Endangered).

Key habitats associated with the high levels of landscape-scale connectivity include the large areas of grassland, rocky areas and wetland habitats that span the study area (Figure 28). These areas not only provide a large network of dispersal and movement corridors for fauna, but the associated topographically-linked productivity gradients also provide important and functionally generic foraging resources that will sustain varied fauna communities. Considering the relative uniform distribution of natural grassland and wetland habitat patches across the study area, the distribution of most assessed fauna taxa across the study area is also likely to be fairly uniform.

A noteworthy consideration with respects to any proposed activity in the study area and maintaining local habitat connectivity, is the potential presence of additional linear infrastructure, particularly fences, that may restrict or impede the free movement of fauna.

The area of forested gorge habitat is also considered a site of importance in the study area. Considering the overall dominance of grasslands and modified habitats, the presence of this small patch of indigenous forest flanked by vegetated rocky cliffs, is unique within the context of the study area and increases local-scale habitat heterogeneity, which will reflect in overall fauna diversity.

It is further noted that, although alien tree plantations are considered a modified habitat type, these densely wooded areas do provide a form of refuge or sheltering habitat within the grassland dominated habitat-matrix, and these areas are likely to be used by sensitive and/or persecuted fauna species. For example, mammals such as Serval (Near Threatened) and Common Duiker frequently favour areas in close proximity to wooded habitat in which they can quickly take shelter if disturbed (Pers. Obs.). Similarly, a species like Vervet Monkey is unlikely to be consistently present in the study area without large areas of woodland-type habitat being readily available.

*Figure 28: Typical view across the study area, showing a complex mosaic of open grassland, drainage valleys, rocky sites, and alien tree plantations that contribute to maintaining on-site fauna diversity and abundance.*

## 7.2. Key Ecological Processes and Drivers of Change

The following notes summarise the key processes and drivers of change that are present in the landscape and their possible influence on the character of terrestrial fauna communities, and in particular SCC, in the study area:

### 7.2.1. Wildfire – Grassland Burning

Fire is considered a natural, albeit often human initiated disturbance agent in grassland ecosystems. Both Mesic Highveld Grassland and High-altitude Grassland, which characterise Mpumalanga's grassland ecosystems, are considered fire-prone and fire-dependent landscapes, and fire is essential in the maintenance of their biodiversity patterns and ecological processes (SANBI, 2013). Key ecological benefits of fire, with respect to fauna communities, include *inter alia*:

- Removes moribund vegetation and enhances plant primary productivity and palatability, which improves grazing for wild herbivores;
- Controls the encroachment of both alien and indigenous woody plant species and weeds; and
- Increases overall habitat heterogeneity by creating a structural mosaic of tall- and short grassland.

Large portions of the study area were burnt prior to the wet-season field visit and it is likely these fires were intentionally set by local farmers (see Figure 29). Regular seasonal fires are an important ecological process, as they maintain grassland habitats in a good condition and enhances grass palatability. This will favour herbivores like the grazing Mountain Reedbuck and the mixed feeding Grey Rhebok that require healthy grasslands. Fire is therefore considered an important ecological process and driver of change in the study area for fauna communities, including SCC.

*Figure 29: Recently burnt portion of the study area observed during the wet season field survey.*

### 7.2.2. Subsistence Bushmeat Hunting

Small and medium sized antelope were recorded in the study area, and these species, amongst others, are frequently the target of subsistence bushmeat hunting. Common subsistence hunting techniques include the use of snares (which is essentially indiscriminate) and hunting dogs (which is partly discriminate). No obvious signs of bushmeat hunting were observed in the study area during the field programme, although it is likely that some hunting does occur.

Any escalation of bush-meat hunting is likely to negatively affect local fauna communities, with species such as the Mountain Reedbuck and the Grey Rhebok particularly at risk. Subsistence bushmeat hunting is therefore regarded as a potential driver of change in the study area, which could have possible serious implications for mammals of conservation concern.

### 7.2.3. Herbivory – Grazing by Livestock

Livestock rearing is a common faming activity in the study area, with cattle and sheep farming observed during the field survey (Figure 30).

High levels of grazing (overgrazing) by domestic livestock is a common cause of dryland degradation (Scholes, 2009). Overgrazing occurs when herbivores (both wildlife and domestic) are kept at excessive stocking rates and/or are able to concentrate their grazing to a limited foraging area, without suitable rest periods. A common degradation syndrome that can be linked to overgrazing, at least in part, is a change in plant species composition. In grassland habitats, this typically manifests as a reduction in palatable grasses and grass productivity (Scholes, 2009).

Livestock grazing, particularly by cattle, which unlike sheep farming, occurs throughout the study area, is considered an important ecosystem driver. However, at its current levels it is considered unlikely to impact herbivore SCC.

*Figure 30: Cattle grazing is common and widespread practice in the study area.*

### 7.2.4. Alien Invasive Species Colonisation

Significant portions of the study area are dominated by stands of alien invasive woody species. The two wattle species (*Acacia dealbata* and *Acacia mearnsii*) are particularly aggressive invaders and have formed dense infestations throughout the study area.

If not actively controlled, wattle trees will continue to spread into adjacent natural habitat, where they will shade-out and competitively exclude many indigenous woody and herbaceous species. This will have several deleterious impacts on the integrity and function of these habitats, such as *inter alia*:

- A loss of natural habitat and floristic diversity, with the resulting habitat patches unable to support diverse fauna communities;
- A reduction in grass productivity for grazing herbivores (e.g., Mountain Reedbuck), and
- Increased exposed soil surfaces and incidences of erosion.

The spread of alien invasive vegetation is therefore considered a significant driver of change in the study area and surrounding landscape, and one capable of negatively impacting SCC.

# 8. Combined Assessment of Site Ecological Importance

Table 7 presents summary comment on the ecological importance of identified vegetation communities in the study area, as per the SANBI (2020) protocol. It is informed by the combined findings of both the Terrestrial Animal Species Specialist Assessment (i.e., this report) and the Terrestrial Biodiversity and Plant Species Specialist Assessment for the proposed Project.

A summary matrix is presented in Table 8, while corresponding maps for the Alternative 1 and Alternative 2 infrastructure layout are presented in Figure 31 and Figure 32**Error! Reference source not found.**.

*Table 7: Analysis discussion on the ecological importance of vegetation communities identified in the study area.*

| Vegetation Community | Analysis |
|---|---|
| Cultivated Fields | A modified vegetation community, that has been heavily impacted by anthropogenic activity. Typically characterised by high-levels of ongoing disturbance and either denuded of vegetation (recently ploughed) and/or dominated by non-indigenous flora species. The ecological importance of this vegetation community is rated very low. |
| Alien Tree Plantations | A modified vegetation community, that is characterised by an almost complete dominance of alien invasive tree species. Little indigenous flora is present.<br>It is noted that plantations do however, provide refuge habitat for sensitive fauna species. Notwithstanding this functional attribute, the ecological importance of the alien tree plantations vegetation community is rated very low. |
| Dry Mixed Grassland | This is a large and variable vegetation community, that ranges from undisturbed to localised sites of disturbance and alien wattle colonisation. Dry mixed grassland constitutes important natural habitat for a variety of flora and fauna species, including many SCC. This community also plays an important role in maintaining landscape connectivity, and in buffering rocky grassland and moist grassland/wetland habitats.<br><br>The conservation importance and functional integrity of this vegetation community are both rated high, resulting in a high biodiversity importance score. Receptor resilience is rated high-medium, resulting in an ecological importance rating of medium. |
| Disturbed Grassland | Disturbed grassland is a subclimax vegetation community that has regenerated following past disturbance. Habitat is stable and essentially retains the functional attributes of undisturbed grassland habitat.<br><br>This community is rated as having a medium functional integrity, but low conservation importance. The biodiversity importance of disturbed grassland community is thus low. Receptor resilience is rated high, resulting in an ecological importance rating of low. |
| Rocky Grassland | Rocky grassland is a natural vegetation community, that is confined to ridge areas and localised sites embedded within the broader habitat matrix. The prominence of large rock outcrops and the presence of scattered indigenous woody flora species, increases local-scale habitat heterogeneity, and flora and fauna diversity. Several flora and fauna SCC have been recorded in this community, or have a high probability of occurrence.<br><br>The functional integrity and conservation importance of the rocky grassland are both rated high, resulting in a high biodiversity importance score. Receptor resilience is rated medium, and accordingly ecological importance is rated high. |
| Moist Grassland and Wetland | The moist grassland and wetland maintains several important ecological functions / traits, including its role in local hydrological patterns, providing linear and largely intact movement and |

| Vegetation Community | Analysis |
|---|---|
| | dispersal corridors for fauna and flora, and promoting local-scale habitat heterogeneity. Moreover, several flora and fauna SCC have been recorded in this community, or have a high probability of occurrence.<br><br>The functional integrity and conservation importance of the moist grassland and wetland are both rated high, resulting in a high biodiversity importance score. Receptor resilience is rated medium, and accordingly ecological importance is rated high. |
| Forested Gorge Habitat | In the context of the study area, this is a small, but unique community, that is characterised by well-developed indigenous forest, flanked by tall vegetated rocky cliffs. The complex topographical template supports numerous microhabitats, which significantly contribute to local-scale habitat heterogeneity and the flora and fauna diversity of the study area. Several flora SCC also have a high probability of occurrence in this community.<br><br>The functional integrity and conservation importance of this community are rated high. The biodiversity importance of disturbed grassland community is thus high. Receptor resilience is rated low, and accordingly ecological importance is rated very high. |

*Table 8: Summary matrix of the ecological importance of vegetation communities.*

| Habitat Unit | Conservation Importance | Functional Integrity | Biodiversity Importance | Receptor Resilience | Ecological Importance |
|---|---|---|---|---|---|
| Cultivated Fields | Very Low | Very Low | Very Low | High | Very Low |
| Alien Tree Plantations | Very Low | Low | Very Low | High | Very Low |
| Dry Mixed Grassland | High | High | High | High - medium | Medium |
| Disturbed Grassland | Low | Medium | Low | High | Low |
| Rocky Grassland | High | High | High | Medium | High |
| Moist Grassland and Wetland | High | High | High | Medium | High |
| Forested Gorge Habitat | High | High | High | Low | Very High |

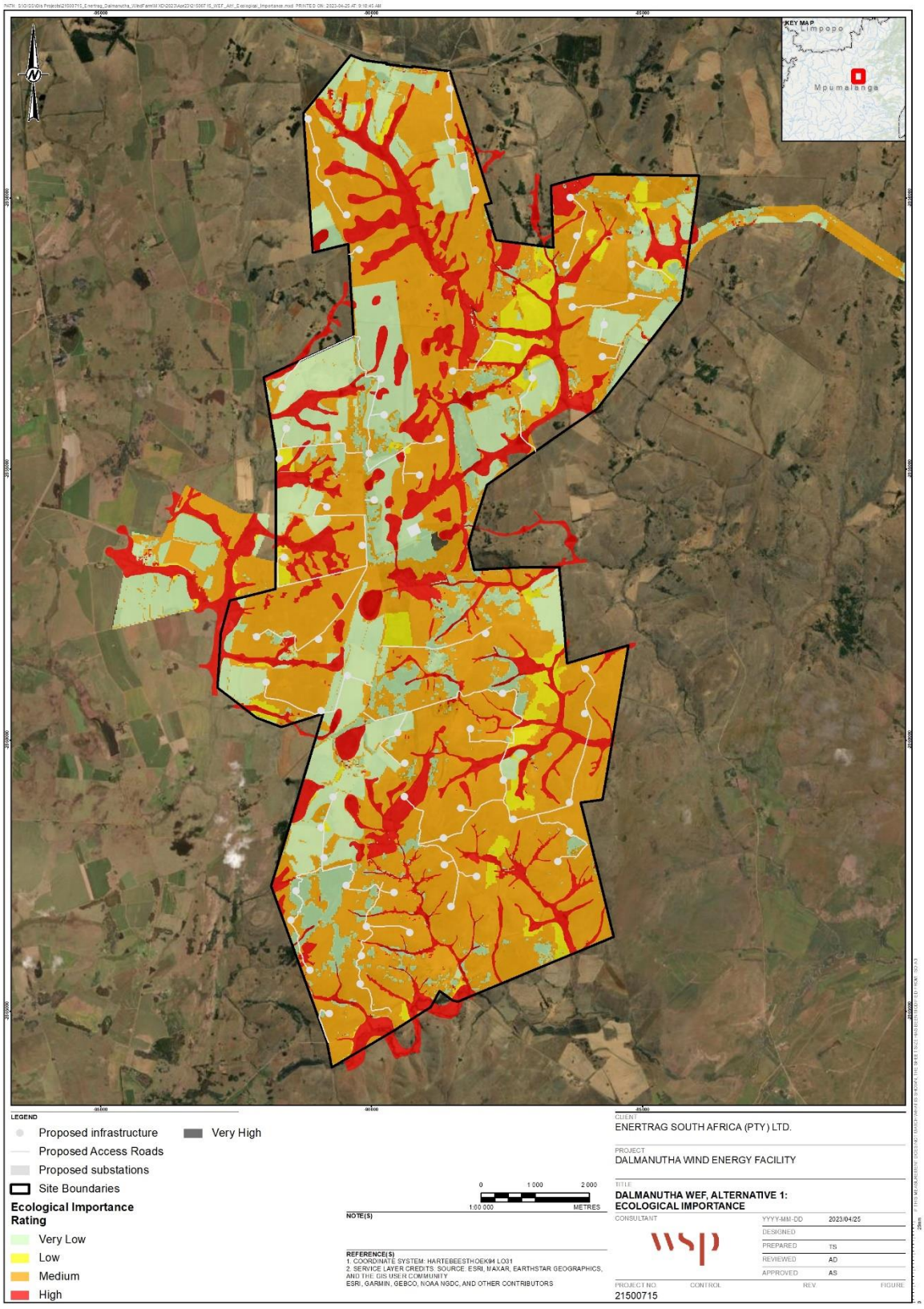


*Figure 31: Alternative 1 infrastructure layout and the Ecological Importance of vegetation communities in the study area.*

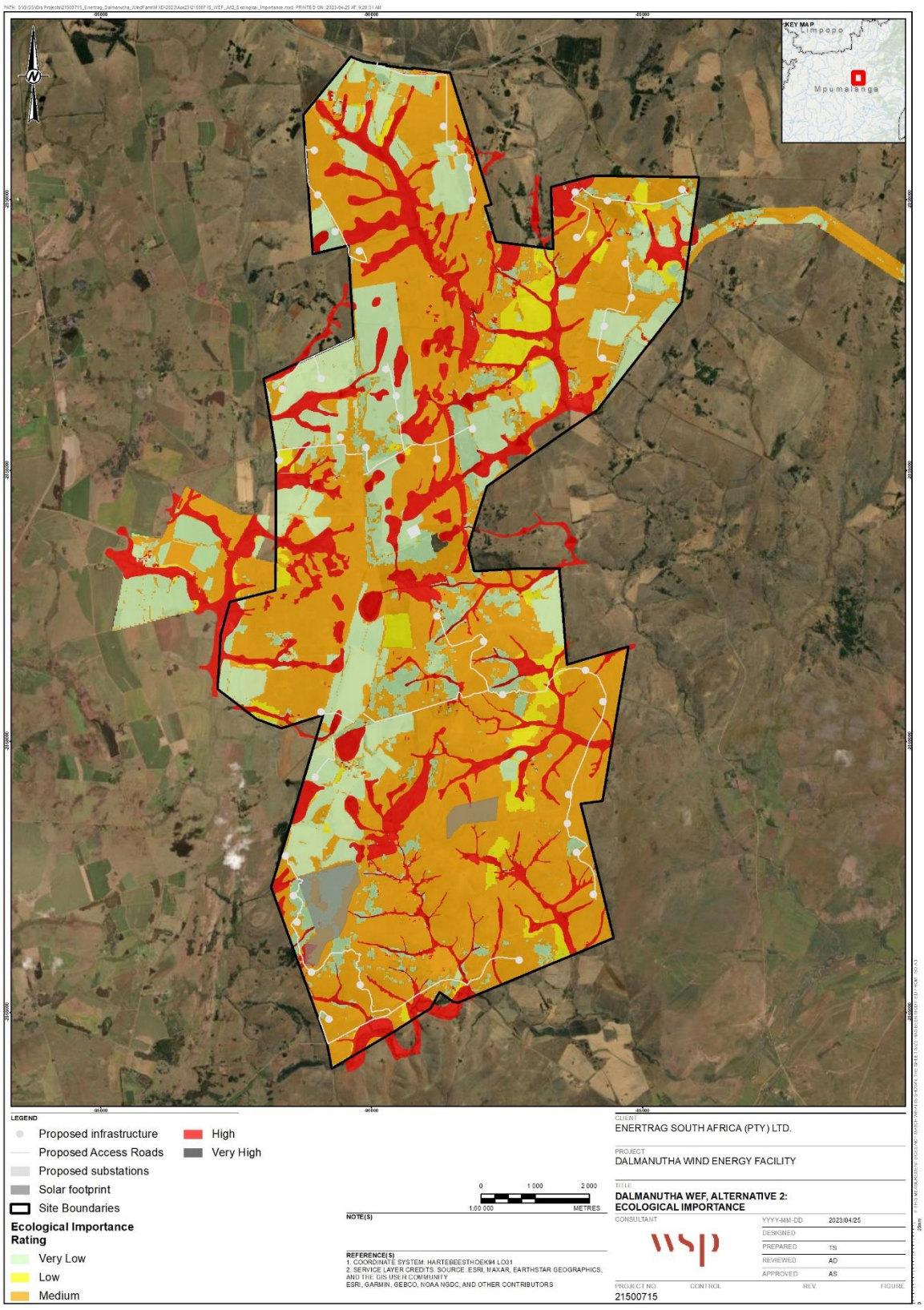


*Figure 32: Alternative 2 infrastructure layout and the Ecological Importance of vegetation communities in the study area.*

# 9. Impact Assessment

## 9.1. Impact Methodology

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[11], indirect[12], secondary[13] as well as cumulative[14] impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e., residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[15] presented in Table 9.

*Table 9: Impact Assessment Criteria and Scoring System*

| CRITERIA | SCORE 1 | SCORE 2 | SCORE 3 | SCORE 4 | SCORE 5 |
|---|---|---|---|---|---|
| **Impact Magnitude (M)** The degree of alteration of the affected environmental receptor | Very low: No impact on processes | Low: Slight impact on processes | Medium: Processes continue but in a modified way | High: Processes temporarily cease | Very High: Permanent cessation of processes |
| **Impact Extent (E)** The geographical extent of the impact on a given environmental receptor | Site: Site only | Local: Inside activity area | Regional: Outside activity area | National: National scope or level | International: Across borders or boundaries |
| **Impact Reversibility (R)** The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change | Reversible: Recovery without rehabilitation | | Recoverable: Recovery with rehabilitation | | Irreversible: Not possible despite action |
| **Impact Duration (D)** The length of permanence of the | Immediate: On impact | Short term: 0-5 years | Medium term: 5-15 years | Long term: Project life | Permanent: Indefinite |

[11] Impacts that arise directly from activities that form an integral part of the Project.
[12] Impacts that arise indirectly from activities not explicitly forming part of the Project.
[13] Secondary or induced impacts caused by a change in the Project environment.
[14] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects
[15] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

| CRITERIA | SCORE 1 | SCORE 2 | SCORE 3 | SCORE 4 | SCORE 5 |
|---|---|---|---|---|---|
| impact on the environmental receptor | | | | | |
| **Probability of Occurrence (P)** The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation | Improbable | Low Probability | Probable | Highly Probability | Definite |
| **Significance (S)** is determined by combining the above criteria in the following formula: | $[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$ | | | | |
| **IMPACT SIGNIFICANCE RATING** | | | | | |
| **Total Score** | **4 to 15** | **16 to 30** | **31 to 60** | **61 to 80** | **81 to 100** |
| **Environmental Significance Rating (Negative (-))** | **Very low** | **Low** | **Moderate** | **High** | **Very High** |
| **Environmental Significance Rating (Positive (+))** | **Very low** | **Low** | **Moderate** | **High** | **Very High** |

## 9.2. Impact Mitigation

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full

destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in Figure 33 below.

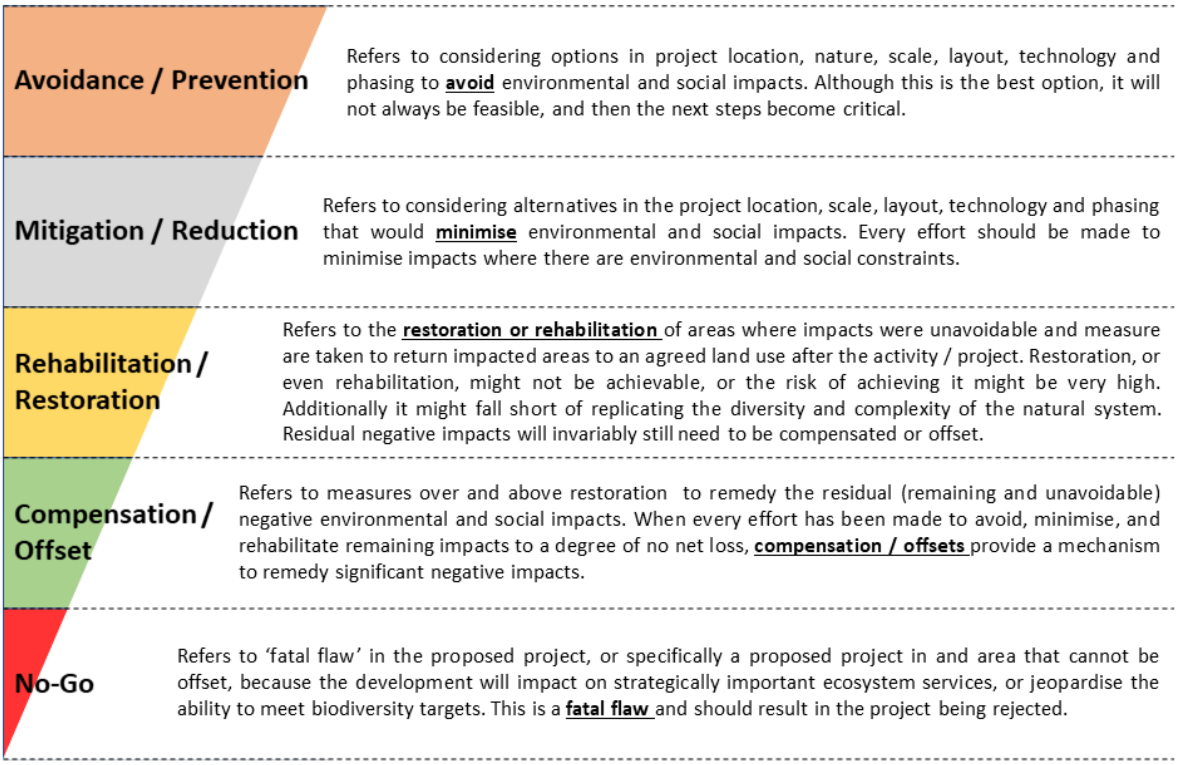


*Figure 33: Mitigation Sequence/Hierarchy*

A discussion on assessed impacts for each phase (i.e., Construction Operational and Decommissioning) of the proposed Project is provided in Section 9.3, with a summary table presented in Table 11.

## 9.3. Assessment of Impacts on Terrestrial Fauna

### 9.3.1. Construction Phase

#### *9.3.1.1.1. Loss and Disturbance of Fauna Habitat*

Habitat loss refers to the physical removal of natural habitat. Habitat disturbance refers to the modification of habitat to the extent that it loses important functionality. These impacts can negatively impact the viability of all fauna populations occurring in the study area, including SCC.

Construction activities will include vegetation clearing and bulk earth works, which will take place in the footprints of proposed Project infrastructure. This will result in the direct loss of habitat available to fauna, some of which is designated as Critical Biodiversity Areas[16] (CBA) by the MPTA.

Based on the available infrastructure layout plans for the proposed Project, a breakdown of the approximate extent of direct habitat loss and disturbance associated with the two proposed Project

[16] Refer to the Terrestrial Biodiversity and Plant Species Specialist Assessment report for additional information on Critical Biodiversity Areas in the context of the proposed Project.

alternatives are presented in Table 10. Alternative 1 will result in approximately 66.37 ha of natural habitat loss, whereas Alternative 2 will result in approximately 1412.06 ha of natural habitat.

*Table 10: Approximate extent of direct habitat loss associated with the proposed Project alternatives.*

| Habitat Type | Vegetation Community | Approximate Extent of Loss (ha) | |
|---|---|---|---|
| | | Alternative 1 | Alternative 2 |
| Modified Habitats | Cultivated Fields | 24.82 | 29.56 |
| | Alien Tree Plantations | 5.67 | 66.43 |
| | Sub-Total | 30.56 | 95.99 |
| Natural Habitat | Dry Mixed Grassland | 58.51 | 132.26 |
| | Disturbed Grassland | 4.21 | 1.77 |
| | Rocky Grassland | 1.33 | 6.19 |
| | Moist Grassland and Wetland | 2.32 | 1.84 |
| | Forested Gorge Habitat | 0.0 | 0.0 |
| | Subtotal | 66.37 | 142.06 |

**Alternative 1**: The impact prior to mitigation is considered to be of high magnitude, permanently affecting vegetation within and potentially adjacent to the development footprints (local). It is also considered to have a definite probability, resulting in an impact of "high" significance (Score 70). Considering the development nature of the proposed Project, this impact is difficult to avoid, however measures can be taken to minimise the significance. With mitigation, the magnitude of the impact can be lowered to high, and it can be confined to the site scale. Duration can be reduced to the long-term, and probability to high. This results in an after-mitigation impact of "medium" significance (Score 44).

**Alternative 2**: As substantial more natural habitat will be lost compared to Alternative 1, the impact prior to mitigation is considered to be of very high magnitude, permanently affecting vegetation within and potentially adjacent to the development footprints (local). It is also considered to have a definite probability, resulting in an impact of "high" significance (Score 75). With mitigation, the magnitude of the impact can be lowered to medium, and it can be confined to the site scale. Duration can be reduced to the long-term, and probability to high. This results in an after-mitigation impact of "medium" significance (Score 48).

#### *9.3.1.2.Fragmentation of Habitat and a Disruption of Fauna Movement/Dispersal*

Habitat fragmentation occurs when habitat loss results in the partitioning of natural habitat into smaller, discontinuous and often isolated habitat patches. This can negatively affect various landscape-scale ecological processes, such as fauna movement and dispersal.

Vegetation clearing associated with proposed linear infrastructure (access roads) will cause fragmentation of habitat in the study area, which could potentially negatively impact fauna movement and dispersal. Owing to the higher number of proposed turbines, the access road network associated with Alternative 1 will be more extensive than that for Alternative 2. The significance of habitat fragmentation is therefore assessed separately for the two alternatives:

**Alternative 1**: Before mitigation, impact magnitude is very high, while duration is permanent and it has a high probability. The spatial extent of is local. Prior to mitigation, the fragmentation of fauna habitat is rated an impact of "moderate" significance (Score 60). With mitigation, this impact can be

reduced to a moderate magnitude, with a long-term duration. Spatial extent will be retained at the local scale and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of “low” significance (Score 24).

**Alternative 2**: Before mitigation, impact magnitude is high, while duration is permanent and it has a high probability. The spatial extent of is local. Prior to mitigation, the fragmentation of fauna habitat is rated an impact of “moderate” significance (Score 56). With mitigation, this impact can be reduced to a low magnitude, with a long-term duration. Spatial extent will be retained at the local scale and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of “low” significance (Score 22).

#### *9.3.1.3.Injury, Mortality and Disturbance of Fauna*

Large and mobile fauna will move off to avoid disturbances caused by construction activities. However, smaller and less mobile species may be trapped, injured and killed during vegetation clearing and earth works. Susceptible fauna includes *inter alia*, burrowing mammals (e.g., rodents), reptiles and amphibians. Other common potential causes of fauna death, injury and disturbance during the construction phase may include:

- Vehicle collisions along construction and access roads;
- Hunting and snaring by construction workers;
- Trapping of fauna in excavations and trenches; and
- Excessive dust and noise from construction machinery may cause sensory disturbances.

This impact is likely to be the same for both alternatives. The impact prior to mitigation is considered to be of medium magnitude, and will permanently impact affected fauna. The spatial scale is local. It is also considered to have a high probability, resulting in an impact of “medium” significance (Score 60).

With mitigation, which includes *inter alia*, the active and correct management of all human-animal interactions, magnitude is reduced to low and probability of the impact can be reduced to low, and scale to the site only. This results in an after-mitigation impact of “low” significance (Score 12).

#### *9.3.1.4.Loss of fauna species of conservation concern*

Three mammal SCC were recorded in the study area during the field programme (Mountain Reedbuck, Grey Rhebok and Serval), and it is possible that several additional fauna SCC may also be present, based on habitat suitability. Proposed Project activities may lead to the loss/disturbance of fauna SCC through the loss of functional habitat or direct mortality (e.g., hunting). This is of particular concern for the Mountain Reedbuck (Endangered), which has experienced a significant population decline in South Africa in recent years (Child *et al*., 2016).

This impact is likely to be the same for both alternatives. The impact prior to mitigation is considered to be of very high magnitude, and will permanently impact affected fauna SCC. The spatial scale is local. It is also considered to have a high probability, resulting in an impact of “high” significance (Score 68). With mitigation, which includes a suite of measures to *inter alia*, limit habitat loss, reduce direct mortality/disturbance, and conduct further surveying (e.g., for Mountain Reedbuck) to inform adaptive management, impact magnitude is reduced to high and probability of the impact can be

reduced to low, and scale to the site only. This results in an after-mitigation impact of “low” significance (Score 16).

#### *9.3.1.5.Establishment and Spread of Alien Invasive Species Resulting in Degradation of Fauna Habitat.*

Disturbances caused by vegetation clearing and earth works during the construction phase will facilitate the establishment and spread of alien invasive vegetation. Areas that are likely to be particularly vulnerable to AIS colonisation include grassland and wetland habitats in close proximity to existing wattle stands and construction footprints. Alien plant infestations can spread exponentially, suppressing or replacing indigenous vegetation. This may result in a loss of functional fauna habitat and an attendant reduction in fauna diversity.

This impact is likely to be the same for both alternatives. Before mitigation, impact magnitude is high, while duration is long term and it has a high probability. The spatial extent of alien invasive species spread is local. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of “moderate” significance (Score 52).

With the implementation of active control during the construction phase, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of “low” significance (Score 12).

### 9.3.2. Operational Phase

#### *9.3.2.1.Injury, Mortality and Disturbance of Fauna, including SCC*

Key potential causes of terrestrial fauna death and injury during the operational phase include:

- Vehicle collisions along access roads during day-to-day maintenance activities; and
- Increased hunting and snaring as a result of improved accessibility associated with the proposed access road network.

This impact is likely to be the same for both alternatives. The impact prior to mitigation is considered to be of very high magnitude, and will permanently impact affected fauna. The spatial scale is local. It is also considered to have a moderate probability, resulting in an impact of “medium” significance (Score 51). With mitigation, magnitude is reduced to moderate and probability of the impact can be reduced to low, and scale to the site only. This results in an after-mitigation impact of “low” significance (Score 18).

#### *9.3.2.2.Establishment and Spread of Alien Invasive Species Resulting in Degradation of Fauna Habitat.*

Th spread of alien invasive species from disturbed sites into areas of natural habitat will continue to be an impact of concern during the operational phase.

Before mitigation, impact magnitude is high, while duration is long term and it has a medium probability. The spatial extent of alien invasive species spread is local. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of “moderate” significance (Score 39).

With the implementation of active control during the operational phase, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of “low” significance (Score 16).

#### *9.3.2.3.Vibration from Operating Wind Turbines*

Ground vibrations caused by operating wind turbines has been noted to potentially cause disturbance to ground-dwelling species, such as moles and the mole-rats, and this may reduce the extent of suitable habitat for these species. It is noted however, that overall impact vibrations on fauna remain poorly understood and additional research focusing on the South African context is required to develop a better understanding of the type and significance of potential impacts, identify particularly sensitive species, and identify effective mitigation measures. Pursuant to the above, an adaptive approach is recommended, with the Project proponent committing to keep abreast with research and developments in this field, and revise and implement additional mitigation measures as they become available.

Before mitigation, impact magnitude is high, while duration is permanent and it has a medium probability. The spatial extent is local. Prior to mitigation, this is rated an impact of “moderate” significance (Score 36).

With the adoption of adaptive management approach, this impact can be reduced to a low magnitude, with a medium-term duration. Spatial extent will remain local and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of “low” significance (Score 16).

### 9.3.3. Decommissioning Phase

#### *9.3.3.1.Injury, Mortality and Disturbance of Fauna, including SCC*

The dismantling and removal of Project infrastructure during decommissioning may result in increased incidences of fauna death and injury. Common causes may include, *inter alia*:

- Vehicle and machinery collisions along access roads and at infrastructure sites where decommissioning activities are occurring; and
- Increased hunting and snaring by workers involved in decommissioning activities are occurring.

The impact prior to mitigation is considered to be of very high magnitude, and will permanently impact affected fauna. The spatial scale is local. It is also considered to have a moderate probability, resulting in an impact of “medium” significance (Score 51). With mitigation, magnitude is reduced to moderate and probability of the impact can be reduced to low, and scale to the site only. This results in an after-mitigation impact of “low” significance (Score 18).

#### *9.3.3.2.Establishment and Spread of Alien Invasive Species Resulting in Degradation of Fauna Habitat.*

Decommissioning activities, such as the dismantling and clearing away of infrastructure are likely to disturb vegetation and soils, which may facilitate the establishment and spread of alien invasive flora species.

Before mitigation, impact magnitude is high, while duration is long term and it has a high probability. The spatial extent of alien invasive species spread is local. Prior to mitigation, the establishment and spread of alien invasive species is rated an impact of “moderate” significance (Score 52).

With the implementation of active control, this impact can be reduced to a low magnitude, with a short-term duration. Spatial extent will be reduced to the site only and the probability of the impact occurring as predicted would be reduced to low. After mitigation, this impact is rated to be of “low” significance (Score 16).

*Table 11: Impact rating table for the Construction, Operational and Decommissioning Phases.*

| CONSTRUCTION | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Impact number** | **Receptor** | **Description** | **Stage** | **Character** | **Ease of Mitigation** | **Pre-Mitigation** | | | | | | | **Post-Mitigation** | | | | | |
| | | | | | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | **Rating** | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | **Rating** |
| **Impact 1.1:** | Fauna habitat | Loss and disturbance of fauna habitat - **Alternative 1** | Construction | Negative | Low | 4 | 2 | 3 | 5 | 5 | **70** | **N3** | 3 | 1 | 3 | 4 | 4 | **44** | **N2** |
| | **Significance** | | | | | **N3 - High** | | | | | | | **N2 - Medium** | | | | | | |
| **Impact 1.2:** | Fauna habitat | Loss and disturbance of fauna habitat - **Alternative 2** | Construction | Negative | Low | 5 | 2 | 3 | 5 | 5 | **75** | **N3** | 4 | 1 | 3 | 4 | 4 | **48** | **N2** |
| | **Significance** | | | | | **N3 - High** | | | | | | | **N2 - Medium** | | | | | | |
| **Impact 2.1:** | Fauna habitat and fauna species | Fragmentation of habitat and disruption of fauna movement/dispersal - **Alternative 1** | Construction | Negative | Low | 5 | 2 | 3 | 5 | 4 | **60** | **N2** | 3 | 2 | 3 | 4 | 2 | **24** | **N1** |
| | **Significance** | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **Impact 2.2:** | Fauna habitat and fauna species | Fragmentation of habitat and disruption of fauna movement/dispersal - **Alternative 2** | Construction | Negative | Low | 4 | 2 | 3 | 5 | 4 | **56** | **N2** | 2 | 2 | 3 | 4 | 2 | **22** | **N1** |
| | **Significance** | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **Impact 3:** | Fauna species | Injury, mortality and disturbance of fauna | Construction | Negative | High | 3 | 2 | 5 | 5 | 4 | **60** | **N2** | 2 | 1 | 1 | 2 | 2 | **12** | **N1** |
| | **Significance** | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **Impact 4:** | Fauna SCC | Loss of fauna species of conservation concern | Construction | Negative | High | 5 | 2 | 5 | 5 | 4 | **68** | **N3** | 4 | 1 | 1 | 2 | 2 | **16** | **N1** |
| | **Significance** | | | | | **N3 - High** | | | | | | | **N1 - Low** | | | | | | |
| **Impact 5:** | Fauna habitat | Establishment and spread of alien invasive species resulting in degradation of fauna habitat. | Construction | Negative | High | 4 | 2 | 3 | 4 | 4 | **52** | **N2** | 2 | 1 | 1 | 2 | 2 | **12** | **N1** |
| | | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **OPERATIONAL** | | | | | | | | | | | | | | | | | | |
| **Impact number** | **Receptor** | **Description** | **Stage** | **Character** | **Ease of Mitigation** | **Pre-Mitigation** | | | | | | | **Post-Mitigation** | | | | | |
| | | | | | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | |
| **Impact 1:** | Fauna SCC | Injury and mortality of fauna, including SCC | Operational | Negative | High | 5 | 2 | 5 | 5 | 3 | **51** | **N2** | 3 | 1 | 3 | 2 | 2 | **18** | **N1** |
| | **Significance** | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **Impact 2:** | Fauna habitat | Establishment and spread of alien invasive species resulting in degradation of fauna habitat. | Operational | Negative | High | 4 | 2 | 3 | 4 | 3 | **39** | **N2** | 2 | 1 | 3 | 2 | 2 | **16** | **N1** |
| | **Significance** | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **Impact 3:** | Fauna SCC | Vibration from operating wind turbines | Operational | Negative | Moderate | 4 | 2 | 1 | 5 | 3 | **36** | **N2** | 2 | 2 | 1 | 3 | 2 | **16** | **N1** |
| | **Significance** | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DECOMISSIONING** | | | | | | | | | | | | | | | | | | |
| **Impact number** | **Receptor** | **Description** | **Stage** | **Character** | **Ease of Mitigation** | **Pre-Mitigation** | | | | | | | **Post-Mitigation** | | | | | |
| | | | | | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | | **(M+** | **E+** | **R+** | **D)x** | **P=** | **S** | |
| **Impact 1:** | Fauna habitat | Establishment and spread of alien invasive species resulting in degradation of fauna habitat. | Decommissioning | Negative | High | 4 | 2 | 3 | 4 | 4 | **52** | **N2** | 2 | 1 | 3 | 2 | 2 | **16** | **N1** |
| **Significance** | | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |
| **Impact 2:** | Fauna habitat | Establishment and spread of alien invasive species resulting in degradation of fauna habitat. | Decommissioning | Negative | High | 4 | 2 | 3 | 4 | 4 | **52** | **N2** | 2 | 1 | 3 | 2 | 2 | **16** | **N1** |
| **Significance** | | | | | | **N2 - Medium** | | | | | | | **N1 - Low** | | | | | | |

# 10. Proposed Mitigation Measures

The following section presents the proposed impact management actions to avoid, minimise and/or manage the potential impacts/risks which were assessed Section 9.

As with the assessment of potential impacts/risks, the impact management actions have been arranged according to the following main Project phases:

- Construction, incl. Pre-Construction;
- Operational; and
- Decommissioning.

For each impact management action, the following information is provided:

- Category: The category within which the potential impact/risk occurs;
- Potential impact/risk: Identified potential impact/risk resulting from the pre-construction, construction, operation, and decommissioning of the proposed Project;
- Description: Description of the possible impact management action;
- Prescribed standards or practices: Prescribed environmental standards or practices with which the impact management action must comply. Note that only key standards or practices have been listed;
- Mitigation type: The type of mitigation measure. This includes the following:
    - Avoidance;
    - Minimisation;
    - Rehabilitation or restoration;
    - Offsetting;
- Time period: The time period when the impact management actions must be implemented; and
- Responsible persons: The persons who will be responsible for the implementation of the impact management actions.

Table 12**Error! Reference source not found.** presents a summary of the proposed impact mitigation actions during the construction, operational, and decommissioning phases of the proposed Project.

*Table 12: Recommended mitigation and management measures for terrestrial fauna*

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| **1. Pre-construction phase** | | | | | | | |
| 1.1 | Terrestrial Fauna - Habitats | Loss and disturbance of fauna habitat | Avoidance<br><br>Where practically possible, areas of natural habitat should be avoided:<br><br>• All temporary construction footprints, including, but not limited to, laydown areas, portable toilets, cement batching plants, wind tower factory etc., should only be located in areas of modified habitat (e.g., cultivated fields and alien tree plantations);<br>• Where feasible, permanent proposed Project infrastructure should be located on land that is already modified/disturbed. This should be guided by a micro-siting exercise, prior to construction; and<br>• Proposed Project access roads should be aligned with existing district and farm roads and tracks. | N/A | Avoidance | Prior to Construction Phase (i.e., during Pre-construction) | Project Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| **2. Construction phase** | | | | | | | |
| 2.1 | Terrestrial Fauna – Habitats | Loss and disturbance of fauna habitat | <u>Minimisation</u><br>• Vegetation clearing should be restricted to the proposed Project footprints only, with no clearing permitted outside of these areas;<br>• The footprints to be cleared should be clearly demarcated prior to construction to prevent unnecessary clearing outside of these areas; and<br>• No heavy vehicles should travel beyond the marked works zone.<br><br><u>Rehabilitation</u><br>A rehabilitation/landscaping protocol should be developed and implemented on-site. The protocol should include, *inter alia*, the following provisions:<br>• Stockpiling of topsoil from development footprints during site preparation;<br>• Post-construction, the land form should be correctly contoured to limit potential | N/A | Minimisation, Rehabilitation and Offsetting | During and after Construction Phase | Project Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | erosion and compacted soils should be ripped and loosened to facilitate vegetation establishment;<br>• Topsoil removed during construction should be applied to all non-operational sites that were disturbed during construction and require revegetation; and<br>• Locally occurring indigenous grasses species should be used to revegetate all areas disturbed during construction.<br><br><u>Offsetting</u><br><br>To offset the loss of land designated as CBA Irreplaceable and CBA Optimal, a biodiversity offsetting strategy should be developed, under consultation with the local conservation authority (i.e., Mpumalanga Parks and Tourism Agency). On completion of the micro-siting exercise and finalisation of the infrastructure layout, the offsetting strategy should be revised to account for any changes. (Refer to the Terrestrial Biodiversity and Plant Specialist Assessment report for discussion on CBA's). | | | | |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| 2.2 | Terrestrial Fauna – Habitats | Fragmentation of habitat and disruption of fauna movement/dispersal | <u>Minimisation</u><br>• *See mitigation measures for Impact 1: Loss and Disturbance of Fauna Habitat*; and<br>• Limit the erection of fences or other linear artificial movement barriers to the minimum required to meet facility safety/security requirements.<br><br><u>Rehabilitation</u><br>• *As per Mitigation Actions for Impact 1: Loss and Disturbance of Fauna Habitat*. | N/A | Minimisation and Rehabilitation | During and after Construction Phase | Project Manager |
| 2.3 | Terrestrial Fauna - SCC | Injury, mortality and disturbance of fauna. | <u>Avoidance and Minimisation</u><br>• An Environmental Control Officer (ECO) should be on-site during vegetation clearing to monitor and manage any wildlife-human interactions;<br>• As appropriate, barriers should be erected around construction trenches and excavations to prevent fauna being trapped in these features; | N/A | Avoidance and Minimisation | During Construction Phase | Project Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | • Any fauna species trapped in construction areas should be safely and correctly relocated to an adjacent area of natural habitat;<br>• A low-speed limit (recommended 20-40 km/h) should be enforced on site to reduce wildlife collisions;<br>• The handling, poisoning and killing of on-site fauna by contractors must be strictly prohibited;<br>• General noise abatement equipment should be fitted to construction machinery and vehicles;<br>• Dust suppression using water bowsers should be undertaken on all roads and other sites where dust entrainment occurs;<br>• The rules and regulations concerning fauna should be communicated to contractors through on-site signage and awareness training. These include a total restriction on hunting, trapping, killing, handling or harassing fauna; and<br>• An incidence register should be maintained throughout all phases of the | | | | |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | Project detailing any fauna mortalities/injuries caused by on-site activities. The register should be used to identify additional biodiversity management requirements. | | | | |
| 2.4 | Terrestrial Fauna - SCC | Loss of fauna of conservation concern | <u>Avoidance and Minimisation</u><br>• *See mitigation measures for Impact 3: Injury, Mortality and Disturbance of Fauna*;<br>• A Mountain Reedbuck (EN) surveying programme should be conducted by a qualified fauna specialist to determine the population size and spatial use (i.e., territorial configuration) of the study area. These data should then be used to identify additional and adaptive conservation and management interventions for Mountain Reedbuck for inclusion in the Project's Biodiversity Action Plan (BAP);<br>• The on-site ECO should be trained in *inter alia*, the preliminary identification of fauna SCC; | N/A | Avoidance and Minimisation | During Construction Phase | Project Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | ○ In the event that millipedes are encountered during construction, the ECO should collect a suitable specimen and submit it to a millipede expert for identification. If it is found to be *Doratogonus furculifer,* construction activities at the relevant site should cease immediately, and the ECO should consult the millipede expert and the MPTA with respects to implementing an avoidance / management programme for this species. | | | | |
| 2.5 | Terrestrial Fauna - Habitats | Establishment and spread of alien invasive species | <u>Minimisation</u><br><br>An Alien Invasive Species (AIS) Control and Eradication Plan must be developed for the Project. It is recommended that the plan include: | Guidelines for Monitoring, Control and Eradication of AIS (DEA, 2015) | Minimisation | During Construction Phase | Project Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | • A combined approach using both chemical and mechanical control methods;<br>• Periodic follow-up treatments, informed by regular monitoring;<br>• A specific focus on:<br>  ○ All sites disturbed by construction; and<br>  ○ Areas of wetland/stream vegetation. | | | | |
| **3. Operational phase** | | | | | | | |
| 3.1 | Terrestrial Fauna - SoC | Injury, mortality disturbance of fauna, including SCC | <u>Avoidance and Minimisation</u><br>• No off-road driving is permitted for vehicles and mobile machinery used during operations and for maintenance purposes.<br>• A low-speed limit (recommended 20-40 km/h) should be enforced on site to reduce wildlife collisions;<br>• The handling, poisoning and killing of on-site fauna by maintenance personnel must be strictly prohibited; | N/A | Avoidance and Minimisation | During Operational Phase | Facility Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | • The rules and regulations concerning fauna should be communicated to maintenance personnel through on-site signage and awareness training. These include a total restriction on hunting, trapping, killing, handling or harassing fauna | | | | |
| 3.2 | Terrestrial Fauna - Habitats | Establishment and spread of alien invasive species | <u>Minimisation</u><br><br>Active alien invasive species control should continue throughout the operational phase, as per the Project's AIS Control and Eradication Plan. | Guidelines for Monitoring, Control and Eradication of AIS (DEA, 2015) | Minimisation | During Operational Phase | Facility Manager |
| 3.3 | Terrestrial Fauna - SoC | Vibration from operating wind turbines | <u>Minimisation</u><br><br>• Project proponent must keep actively informed about new research in the field of vibration impacts on fauna and potential mitigation options;<br>• Based on the findings of new research, the biodiversity management plan for the proposed Project should be updated to include additional mitigation | N/A | Minimisation | During Operational Phase | Facility Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | measures and these should be implemented on-site. | | | | |
| **4. Decommissioning phase** | | | | | | | |
| 4.1 | Terrestrial Fauna - SCC | Injury, mortality disturbance of fauna, including SCC | <u>Avoidance and Minimisation</u><br>• No off-road driving is permitted for vehicles and mobile machinery used during decommissioning phases activities;<br>• A low-speed limit (recommended 20-40 km/h) should be enforced on site to reduce wildlife collisions;<br>• The handling, poisoning and killing of on-site fauna by on-site workers must be strictly prohibited;<br>• The rules and regulations concerning fauna should be communicated to maintenance personnel through on-site signage and awareness training. | N/A | Avoidance and Minimisation | During Decommissioning Phase | Facility Manager |
| 4.2 | Terrestrial Fauna - Habitats | Establishment and spread of alien invasive species | <u>Minimisation</u> | Guidelines for Monitoring, | Minimisation and Rehabilitation | During Decommissioning phase, and | Facility Manager |

| Ref No. | Category | Potential impact/risk | Description | Prescribed standards or practices | Mitigation type | Time period | Responsible person |
|---|---|---|---|---|---|---|---|
| | | | Active alien invasive species control, as per the AIS Control and Eradication Plan, should continue during the decommissioning phase and follow up control should be carried out annually for a five- year period following decommissioning.<br><br><u>Rehabilitation</u><br><br>• All project infrastructure should be dismantled and removed from site;<br>• All sites disturbed during the decommissioning phase should be stabilised and rehabilitated, as per the rehabilitation/landscaping protocol. | Control and Eradication of AIS (DEA, 2015) | | annually for a five-year period after decommissioning. | |

# 11. Monitoring Measures

The following section presents the proposed monitoring actions for monitoring and reporting on the implementation of the impact mitigation actions presented in the preceding Section 10.

The content of this section is largely based on the monitoring requirements outlined in Appendix 4 of the EIA Regulations, 2014.

For each monitoring action, the following information is provided:

- Category: The category within which the potential impact and/or risk occurs
- Potential impact/risk: Identified potential impact/risk resulting from the pre-construction, construction, operation, and closure of the proposed Project
- Method for monitoring : The method for monitoring the implementation of the recommended mitigation measures
- Time period: The time period over which the monitoring actions must be implemented
- Frequency of monitoring: The frequency of monitoring the implementation of the recommended mitigation measures
- Mechanism for monitoring compliance: The mechanism for monitoring compliance with the impact management actions
- Responsible persons: The persons who will be responsible for the implementation of the monitoring actions

As with the impact management actions, the proposed monitoring actions have been arranged according to the following project phases:

- Pre-construction
- Construction
- Operational
- Decommissioning

Table 13 presents a summary of the proposed monitoring actions during the construction, operational, decommissioning phases.

*Table 13: Recommended monitoring measures*

| Ref. No. | Category | Method for monitoring | Time period | Frequency of monitoring | Mechanism for monitoring compliance | Responsible person |
|---|---|---|---|---|---|---|
| **1. Construction phase** | | | | | | |
| 1.1 | Alien Invasive Species Monitoring | • Annual on-site alien invasive species monitoring should be conducted. Monitoring should focus on:<br>  ○ All sites disturbed during the construction phase;<br>  ○ Riparian/wetland areas adjacent to construction sites;<br>• Monitoring should assess species type and density, and these data should inform the scope of ongoing alien invasive species control. | Wet/growing season | Annual | Annual Monitoring Report | Facility Manager |
| 1.2 | Rehabilitation Monitoring | • Monitoring of rehabilitated and revegetated sites should be conducted annually until such as time as rehabilitation of disturbed sites has proved successful;<br>• Key aspects that should be monitored include:<br>  ○ Successful establishment and coverage of vegetation;<br>  ○ Sites of erosion; | Wet/growing season | Annual | Annual Monitoring Report | Facility Manager |

| Ref. No. | Category | Method for monitoring | Time period | Frequency of monitoring | Mechanism for monitoring compliance | Responsible person |
|---|---|---|---|---|---|---|
| | | • The findings of monitoring should be used to inform the need for additional rehabilitation and/ or corrective actions. | | | | |
| **2. Operational phase** | | | | | | |
| 2.1 | Alien Invasive Species Monitoring | • Annual on-site alien invasive species monitoring should be conducted. Monitoring should focus on:<br>o All sites disturbed during the construction phase;<br>o Riparian/wetland areas adjacent to construction sites;<br>• Monitoring should assess species type and density, and these data should inform the scope of ongoing alien invasive species control. | Wet/growing season | Annual | Annual Monitoring Report | Facility Manager |
| **3. Decommissioning phase** | | | | | | |
| 3.1 | Alien Invasive Species Monitoring | • Alien invasive species monitoring should be conducted on a annual basis during decommissioning and annually for a five- | Wet/growing season | Annually during decommissioning & annually for a five-year period | Annual Monitoring Report(s) | Facility Manager |

| Ref. No. | Category | Method for monitoring | Time period | Frequency of monitoring | Mechanism for monitoring compliance | Responsible person |
|---|---|---|---|---|---|---|
| | | year period following decommissioning.<br>Monitoring should focus on:<br>○ All sites disturbed during decommissioning;<br>○ Riparian/wetland areas adjacent to former development sites;<br>• Monitoring should assess species type and density, and these data should inform the scope of future alien invasive species control. | | after decommissioning | | |
| 3.2 | Rehabilitation Monitoring | • Monitoring of rehabilitated and revegetated sites should be conducted annually during decommissioning and for a two-year period after decommissioning;<br>• Key aspects that should be monitored include:<br>○ Successful establishment and coverage of vegetation;<br>○ Sites of erosion;<br>○ The findings of monitoring should be used to inform the need for | Wet/growing season | Annually during decommissioning & for a two-year period after decommissioning | Annual Monitoring Reports | Facility / Closure Manager |

| Ref. No. | Category | Method for monitoring | Time period | Frequency of monitoring | Mechanism for monitoring compliance | Responsible person |
|---|---|---|---|---|---|---|
| | | additional rehabilitation and/ or corrective actions. | | | | |

# 12. Cumulative Impacts

Large portions of the study area and the surrounding landscape are modified and fragmented as a consequence of various anthropogenic land uses, most notably agriculture. Moreover, coal mining, although not present in the study area itself, is prevalent across the surrounding landscape. These anthropogenic activities, amongst others, have caused and continue to cause, ongoing habitat loss, disturbance and fragmentation, and this is placing additional pressure on the functioning and integrity of remaining patches of natural and semi-natural habitat in the landscape.

The proposed Project will have a direct negative impact on terrestrial fauna, primarily through habitat loss, disturbance and fragmentation. The cumulative loss of fauna habitat in the region is a concern with respect to the preservation of local fauna populations, particularly fauna SCC.

In comparison to other anthropogenic land uses in the landscape (such as mining), the impacts associated with the proposed Project are limited in extent and can be effectively mitigated through correct on-site management. Prior to any form of mitigation, the cumulative impacts on terrestrial fauna linked to the proposed Project are rated High. However, provided the management and mitigation measures presented in this report are implemented, the cumulative impacts on terrestrial fauna can be reduced to Low significance.

# 13. Biodiversity Action Plan

All recommended mitigation and monitoring measures related to terrestrial fauna, as well as all additional measures relating to biodiversity as stipulated in the respective specialist study reports, should be collated and presented in a Biodiversity Action Plan (BAP) for the proposed Project. This should be compiled upon completion of micro-siting and finalisation of the Project layout.

The plan should provide an integrated and practical framework that encompasses, aligns and guides all aspects of biodiversity management throughout the various life-cycle phases of the Project.

# 14. Environmental Impact Statement

## 14.1. Summary of Main Findings

The following section presents a summary of the key findings of the Terrestrial Animal Species Specialist Assessment:

The study area is large and characterised by a mosaic of natural and modified habitats. Areas of natural habitat not only provide key- and functionally generic sheltering, foraging and breeding areas for a variety of fauna, but they also act as important dispersal and movement corridors across the local landscape. All vegetation communities in the study area that constitute natural habitat therefore contribute to maintaining the integrity of local fauna communities.

Twenty-eight mammal, four reptile and six amphibian species were recorded in the study area during the field programme. Of the recorded species, three mammals are on the regional Red List, namely Serval (Near Threatened), Mountain Reedbuck (Endangered) and Grey Rhebok (Near Threatened). Three other recorded mammals are listed as protected, at either or both a national or provincial level (i.e., Southern Reedbuck, Steenbok and Aardvark). Considering the extent and

character of on-site natural habitats, it is anticipated that several additional fauna SCC may also be present.

The development of the proposed Project infrastructure in areas of natural habitat will have negative impacts on terrestrial fauna. Key amongst these, is the direct loss and disturbance of habitat during construction. This will occur for both proposed alternatives – although to different extents. Due to the presence of the large solar facility footprints, a substantially larger area of habitat will be lost/disturbed as a result of Alternative 2, compared to Alternative 1. As a consequence, although both alternatives have the same significance rating for this impact (i.e., 'high' before mitigation and 'medium' after mitigation), the impact significance score for Alternative 2 was higher than for Alternative 1. Accordingly, of the two Project alternatives, Alternative 1 is the preferred option from a terrestrial fauna perspective.

Several mitigation measures have been recommended to avoid and minimise identified impacts (presented in Section 10). The loss of natural habitat, particularly land designated as CBA by the MPTA, remains a residual impact of concern ('medium' significance) for both alternatives. It is therefore recommended that a biodiversity offset initiative should be identified and implemented for the proposed Project.

### 14.2. Conditions to be Included in the Environmental Authorisation

In addition to the impact mitigation and monitoring measures presented in Section 10 and Section 11, in line with NEMBA's Draft National Biodiversity Offset Policy (2017) a biodiversity offset initiative should be identified and implemented under agreement with Mpumalanga Parks and Tourism Agency.

### 14.3. Specialist Opinion

In accordance with the outcomes of the impact assessment (Section 9) and taking cognisance of the baseline conditions as presented in Section 5 through to Section 7, as well as the impact management measures (Section 10 and Section 11), the proposed Project, is not deemed to present significant negative environmental issues or impacts, and it should thus be authorised.

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Report Compiled by:

Andrew Zinn (*Pr.Sci.Nat*.)

Terrestrial Ecologist

Hawkhead Consulting

# Appendix A: Curricula vitae for Andrew Zinn

# Hawkhead Consulting

# Curriculum Vitae of Andrew Zinn (Pr.Sci.Nat.)

## Details

Andrew David Zinn
Terrestrial Ecologist
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South Africa
Date of birth: 14 July 1982
Nationality: South African

## Profile

I am an ecologist with an M.Sc. Degree in Resource Conservation Biology and 15 years of experience working in biodiversity consulting and ecological research. I am registered with the South African Council of Natural Scientific Professions as a Professional Natural Scientist. I currently work as an independent consulting ecologist, with Hawkhead Consulting. During my career I have worked on projects in remote areas in several African countries including South Africa, Botswana, Democratic Republic of the Congo, Ethiopia, Ghana, Mozambique, Tanzania and Zambia. I have also previously worked in the United Kingdom and the United Arab Emirates.

## Education and Qualifications

- University of the Witwatersrand, M.Sc. Resource Conservation Biology (2013).
- University of KwaZulu-Natal, BSc. Hons. Ecology and Conservation Biology (2005).
- University of KwaZulu-Natal, BSc. Zoology and Grassland Science (2004).
- Bryanston High School, Johannesburg. Matric Exemption. (2000).

## Affiliations

- Member of the South African Wildlife Management Association
- Member of the South African Council of Natural Scientific Professions – Professional Natural Scientist (400687/15).

## Work Experience

1. **Independent Ecologist**

**Hawkhead Consulting, South Africa**
**September 2020 – Present**

Consulting ecologist focusing on terrestrial ecology. I specialise in conducting baseline flora and fauna surveys, ecological impact assessments, and developing mitigation and management programmes for projects and operations in various industry sectors. Core services and responsibilities include, amongst others:

- Biodiversity study design and implementation;
- Biodiversity baseline and impact assessment reporting;
- Mitigation measure design and application;
- Vegetation surveys and vegetation community mapping;
- Fauna surveys for mammals, birds, reptiles and amphibians;
- Development of biodiversity management plans;
- Development of rehabilitation and revegetation plans; and
- Alien invasive species control and eradication plans.

2. **Ecologist**

**Golder Associates Africa, South Africa**
**June 2011 – September 2020**
Ecologist responsible for the management and implementation of baseline biodiversity studies and ecological impact assessments for development projects in the mining, power generation, transport, land development and industrial development sectors throughout sub-Saharan Africa. Role responsibilities included project management, technical review, biodiversity study design and implementation, flora and fauna surveys, biodiversity baseline and impact assessment reporting, development of biodiversity management plans, rehabilitation plans and alien invasive species control and eradication plans. These studies were conducted to satisfy national environmental regulations and/or international financing requirements, including the International Finance Corporation's (IFC) Performance Standard 6 (PS6)

3. **Independent Ecologist**

**Subcontracted to KPMG, United Arab Emirates**
**March – April 2011**
Subcontracted to KPMG as a subject matter expert (ecology) on the internal audit of Sir Bani Yas Island's Conservation Department (United Arab Emirates). The audit focused on evaluating the efficacy of the island's various conservation practices, including game management, feed provisioning, carnivore breeding and monitoring, veterinary care and vegetation maintenance.

4. **Environmental Consultant**

**WSP Environment and Energy, South Africa**
**August 2008 – March 2011**
Environmental consultant, responsible for a range of environmental projects and services including managing environmental authorisation processes (BAs and EIAs), facilitating stakeholder engagement processes,
conducting compliance audits, developing environmental management programmes and conducting specialist ecological studies.

5. **Research Technician**

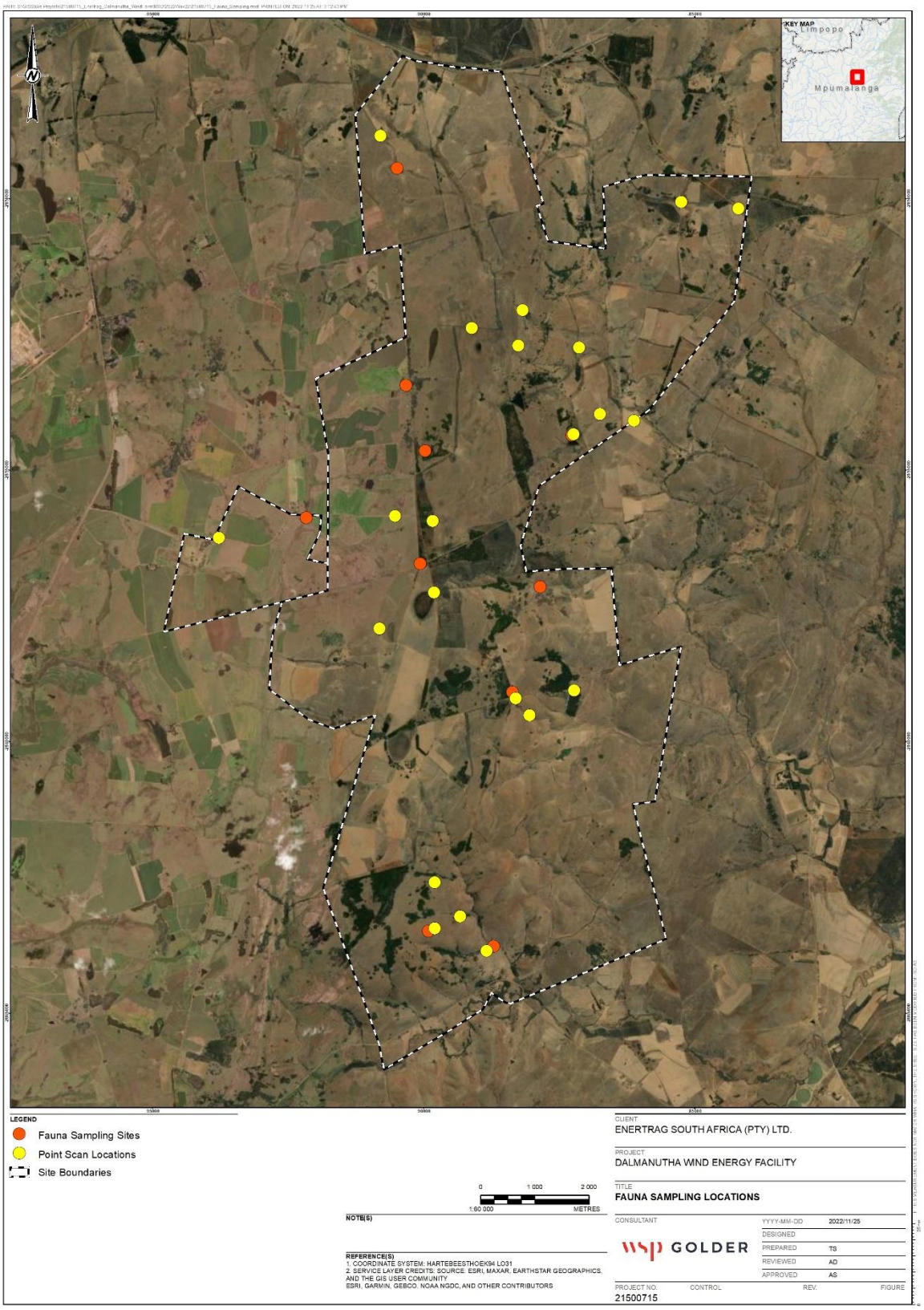
**Yale University, Kruger National Park, South Africa**
**October 2007 – May 2008**
Research technician on the Savanna Convergence Experiment (SCE). The SCE project was a long-term cross-continental study that investigated the role of mega-herbivores in fire-grazing interactions and their influence on vegetation dynamics. Responsible for collecting and analysing vegetation composition and productivity data, as well as herbivore distribution data.

## Publications

- Zinn, A.D., D.E., Burkepile and D.I. Thompson (In prep). Impacts of fire and herbivores on tree seedling establishment in a South African savanna.
- Burkepile, D.E., C.E. Burns, E. Amendola, G.M. Buis, N. Govender, V. Nelson, C.J. Tambling, D.I. Thompson, A.D. Zinn and M.D. Smith (2013). Habitat selection by large herbivores in a southern African savanna: the relative roles of bottom-up and top-down forces. Ecosphere, 4(11):139.
- Knapp, A.K., D.L. Hoover, J.M. Blair, G. Buis, D.E. Burkepile, A. Chamberlain, S.L. Collins, R.W.S Fynn, K.P. Kirkman, M.D. Smith, D. Blake, N. Govender, P. O'Neal, T. Schreck and A. Zinn (2012). A test of two mechanisms proposed to optimize grassland aboveground primary productivity in response to grazing. Journal of Plant Ecology, 5, 357-365.
- Zinn, A.D., D. Ward and K. Kirkman (2007). Inducible defences in *Acacia sieberiana* in response to giraffe browsing. African Journal of Range and Forage Science, 24, 123-129.
- Zinn, A.D. (2007). Exploitation vs. Conservation: A Burgeoning Fifth Column. African Wildlife, 61, 9-11.
- Andrew Zinn (2006). Conflict Resolution. Africa Birds and Birding. Vol. 11, No. 5, 12-13.

# Appendix B: Methodology Supplement:

## Appendix B (1): Location of fauna surveying locations.



## Appendix B (2): Rating criteria for Conservation Importance, Functional Integrity and Receptor Resilience and the scoring matrices, as per (SANBI, 2020).

The ecological sensitivity of habitats in the study area was determined using the protocol for evaluating site ecological importance (SEI) as published in SANBI's Species Assessment Guideline (SANBI, 2020). SEI is considered to be a function of the biodiversity importance (BI) of a receptor and its resilience to impacts (receptor resilience, RR), as per:

$$SEI = BI + RR.$$

Biodiversity importance is a function of conservation importance (CI) and the functional integrity (FI) of the receptor, as per:

$$BI = CI + FI$$

- **Conservation Importance** is defined as "the importance of a site for supporting biodiversity features of conservation concern present, e.g., populations of IUCN threatened and Near Threatened species (CR, EN, VU and NT), Rare species, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystems types, through predominantly natural processes" (SANBI, 2020).
- **Functional Integrity** is defined as "A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts" (SANBI, 2020).
- **Receptor Resilience** is defined as "the intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention" (SANBI, 2020).

**Table 1: Conservation Importance (CI) criteria.**

| Conservation Importance (CI) | Fulfilling Criteria |
|---|---|
| **Very High** | • Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species that have a global EOO of < 10km$^2$;<br>• Any area of natural habitat of a CR ecosystem type or large area (>0.1 % of the total ecosystem type extent) of natural habitat of an EN ecosystem type; and<br>• Globally significant populations of congregatory species (>10% of global population). |
| **High** | • Confirmed of highly likely occurrence of CR, EN, VU species that have a global EOO of > 10km$^2$, IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining;<br>• Small area (>0.01% but <0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (>0.1%) of natural habitat of VU ecosystem type;<br>• Presence of Rare species;<br>• Globally significant populations of congregatory species (>1% but < 10% of global population). |
| **Medium** | • Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals;<br>• Any area of natural habitat of threatened ecosystem type with status of VU;<br>• Presence of range-restricted species; and<br>• >50% of receptor contains natural habitat to support SCC. |
| **Low** | • No confirmed or highly likely populations of SCC;<br>• No confirmed or highly likely populations of range-restricted species; and<br>• <50% of receptor contains natural habitat with limited potential to support SCC. |
| **Very Low** | • No confirmed and highly unlikely populations of SCC;<br>• No confirmed and highly unlikely populations of range-restricted species; and<br>• No natural habitat remaining. |

**Table 2: Functional Integrity (FI) criteria.**

| Functional Integrity (FI) | Fulfilling Criteria |
|---|---|
| **Very High** | • Very large (>100 ha) intact area for any conservation status of ecosystem type or >5a ha for CR ecosystem type;<br>• High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches;<br>• No or minimal current negative ecological impacts with no signs of major disturbance (e.g., ploughing) |
| **High** | • Large (>5 ha but < 100 ha) intact area for any conservation status ecosystem types;<br>• Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches; and<br>• Only minor current negative ecological impacts (e.g., few livestock utilising area) with no signs of major past disturbance (e.g., ploughing) and good rehabilitation potential. |
| **Medium** | • Medium (>5ha but< 20 ha) semi-intact area for any conservation status ecosystem type or >20 ha for VU ecosystem type;<br>• Only narrow corridors of good connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches;<br>• Mostly minor current negative ecological impacts with some major impacts (e.g., established population of alien invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential. |
| **Low** | • Small (> 1 ha but <5ha) area;<br>• Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential; and<br>• Several minor and major current negative ecological impacts. |
| **Very Low** | • Very small (<1 ha) area;<br>• No habitat connectivity except for flying species or flora with wind-dispersed seeds;<br>• Several major current negative ecological impacts. |

**BI = CI + FI**

**Biodiversity Importance (BI) Rating Matrix**

| **Biodiversity Importance (BI)** | | **Conservation Importance** | | | | |
|---|---|---|---|---|---|---|
| | | **Very High** | **High** | **Medium** | **Low** | **Very Low** |
| **Functional Integrity** | **Very High** | Very High | Very High | High | Medium | Low |
| | **High** | Very High | High | Medium | Medium | Low |
| | **Medium** | High | Medium | Medium | Low | Very Low |
| | **Low** | Medium | Medium | Low | Low | Very Low |
| | **Very Low** | Medium | Low | Very Low | Very Low | Very Low |

**Table 3: Receptor Resilience criteria (RR)**

| Resilience | Fulfilling Criteria |
|---|---|
| **Very High** | Habitat that can recover rapidly (˜less than 5 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed. |
| **High** | Habitat that can recover relatively quickly (˜ 5-10 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed. |
| **Medium** | Habitat that can recover slowly (˜ more than 10 years) to restore >75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed. |
| **Low** | Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ˜less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impacts occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed. |
| **Very Low** | Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed. |

**SEI = BI + RR**

**Site Ecological Importance (SEI) Rating Matrix**

| Site Ecological Importance | | Biodiversity Importance | | | | |
|---|---|---|---|---|---|---|
| | | **Very High** | **High** | **Medium** | **Low** | **Very Low** |
| **Receptor Resilience** | **Very Low** | Very High | Very High | High | Medium | Low |
| | **Low** | Very High | Very High | High | Medium | Very Low |
| | **Medium** | Very High | High | Medium | Low | Very Low |
| | **High** | High | Medium | Low | Very Low | Very Low |
| | **Very High** | Medium | Low | Very Low | Very Low | Very Low |

**Table 4: Guidelines for interpreting SEI in the context of the proposed development activities.**

| Site Ecological Importance | Interpretation in relation to proposed development activities |
|---|---|
| **Very High** | Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains. |
| **High** | Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities. |
| **Medium** | Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities. |
| **Low** | Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities. |
| **Very Low** | Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required. |

# Appendix C: List of Mammals Recorded and Potentially Occurring in the Study Area

| Family | Scientific Name | Common Name | National Red List Status (2016) | NEMBA ToPS List (2007) | Mpumalanga Status | Study Area Record |
|---|---|---|---|---|---|---|
| Bathyergidae | *Cryptomys hottentotus* | Common Mole-rat | Least Concern | - | - | X(?) |
| Bathyergidae | *Georychus capensis* | Cape Mole-rat | Data Deficient | - | Data Deficient | |
| Bovidae | *Connochaetes gnou* | Black Wildebeest | Least Concern | Protected | - | |
| Bovidae | *Damaliscus pygargus phillipsi* | Blesbok | Least Concern | - | - | X |
| Bovidae | *Ourebia ourebi ourebi* | Oribi | Endangered | Endangered | Endangered / Protected | |
| Bovidae | *Pelea capreolus* | Grey Rhebok | Near Threatened | - | Protected | X |
| Bovidae | *Raphicerus campestris* | Steenbok | Least Concern | - | Protected | X |
| Bovidae | *Redunca arundinum* | Southern Reedbuck | Least Concern | Protected | Protected | X |
| Bovidae | *Redunca fulvorufula fulvorufula* | Mountain Reedbuck | Endangered | - | Protected | X |
| Bovidae | *Sylvicapra grimmia* | Common Duiker | Least Concern | - | - | X |
| Canidae | *Canis adustus* | Side-striped Jackal | Least Concern | - | - | |
| Canidae | *Canis mesomelas* | Black-backed Jackal | Least Concern | - | - | X |
| Canidae | *Otocyon megalotis* | Bat-eared Fox | Least Concern | - | - | |
| Canidae | *Vulpes chama* | Cape Fox | Least Concern | Protected | - | |
| Cercopithecidae | *Chlorocebus pygerythrus* | Vervet Monkey | Least Concern | - | - | X |
| Chrysochloridae | *Amblysomus robustus* | Robust Golden Mole | Vulnerable | Endangered | Vulnerable | |
| Chrysochloridae | *Amblysomus septentrionalis* | Highveld Golden Mole | Near Threatened | - | Near Threatened | |
| Chrysochloridae | *Chrysospalax villosus* | Rough-haired Golden Mole | Vulnerable | Critically Endangered | - | |

| Family | Scientific Name | Common Name | National Red List Status (2016) | NEMBA ToPS List (2007) | Mpumalanga Status | Study Area Record |
|---|---|---|---|---|---|---|
| Erinaceidae | *Atelerix frontalis* | South African Hedgehog | Near Threatened | Protected | Near Threatened / Protected | |
| Felidae | *Caracal caracal* | Caracal | Least Concern | - | - | |
| Felidae | *Felis nigripes* | Black-footed Cat | Vulnerable | Protected | Near Threatened | |
| Felidae | *Felis silvestris* | African Wildcat | Least Concern | - | - | |
| Felidae | *Leptailurus serval* | Serval | Near Threatened | Protected | Near Threatened | X |
| Felidae | *Panthera pardus* | Leopard | Vulnerable | Vulnerable | Near Threatened | |
| Gliridae | *Graphiurus murinus* | Woodland Dormouse | Least Concern | - | - | |
| Gliridae | *Graphiurus rupicola* | Stone Dormouse | Near Threatened | - | - | |
| Herpestidae | *Atilax paludinosus* | Water Mongoose | Least Concern | - | - | X |
| Herpestidae | *Cynictis penicillata* | Yellow Mongoose | Least Concern | - | - | X |
| Herpestidae | *Herpestes sanguineus* | Slender Mongoose | Least Concern | - | - | X |
| Herpestidae | *Ichneumia albicauda* | White-tailed Mongoose | Least Concern | - | - | X |
| Herpestidae | *Mungos mungo* | Banded Mongoose | Least Concern | - | - | |
| Herpestidae | *Suricata suricatta* | Suricate | Least Concern | - | - | X |
| Hyaenidae | *Parahyaena brunnea* | Brown Hyaena | Near Threatened | Protected | Near Threatened / Protected | |
| Hyaenidae | *Proteles cristata* | Aardwolf | Least Concern | - | Protected | |
| Hystricidae | *Hystrix africaeaustralis* | Cape Porcupine | Least Concern | - | - | X |
| Leporidae | *Lepus saxatilis* | Scrub Hare | Least Concern | - | - | X |
| Leporidae | *Pronolagus saundersiae* | Hewitt's Red Rock Rabbit | Least Concern | - | - | X |

| Family | Scientific Name | Common Name | National Red List Status (2016) | NEMBA ToPS List (2007) | Mpumalanga Status | Study Area Record |
|---|---|---|---|---|---|---|
| Macroscelididae | *Elephantulus brachyrhynchus* | Short-snouted Sengi | Least Concern | - | - | |
| Macroscelididae | *Elephantulus myurus* | Eastern Rock Sengi | Least Concern | - | - | |
| Molossidae | *Tadarida aegyptiaca* | Egyptian Free-tailed Bat | Least Concern | - | - | |
| Muridae | *Aethomys chrysophilus* | Red Veld Rat | Least Concern | - | - | |
| Muridae | *Dasymys incomtus* | African Marsh Rat | Near Threatened | - | Near Threatened | |
| Muridae | *Gerbilliscus brantsii* | Highveld Gerbil | Least Concern | | | X(?) |
| Muridae | *Gerbilliscus leucogaster* | Bushveld Gerbil | Least Concern | | | |
| Muridae | *Lemniscomys rosalia* | Single-striped Mouse | Least Concern | - | - | |
| Muridae | *Mastomys coucha* | Multimammate Mouse | Least Concern | - | - | X |
| Muridae | *Micaelamys namaquensis* | Namaqua Rock Mouse | Least Concern | - | - | |
| Muridae | *Mus minutoides* | Pygmy Mouse | Least Concern | - | - | |
| Muridae | *Otomys angoniensis* | Angoni Vlei Rat | Least Concern | - | - | |
| Muridae | *Otomys auratus* | Vlei Rat (Grassland type) | Near Threatened | - | - | |
| Muridae | *Rhabdomys pumilio* | Xeric Four-striped Mouse | Least Concern | - | - | X |
| Muridae | *Thallomys nigricauda* | Black-tailed Tree Rat | Least Concern | - | - | |
| Muridae | *Thallomys paedulcus* | Tree Rat | Least Concern | - | - | |
| Mustelidae | *Aonyx capensis* | Cape Clawless Otter | Near Threatened | Protected | Protected | |
| Mustelidae | *Hydrictis maculicollis* | Spotted-necked Otter | Vulnerable | Protected | Near Threatened / Protected | |
| Mustelidae | *Ictonyx striatus* | Striped Polecat | Least Concern | - | - | |

| Family | Scientific Name | Common Name | National Red List Status (2016) | NEMBA ToPS List (2007) | Mpumalanga Status | Study Area Record |
|---|---|---|---|---|---|---|
| Mustelidae | *Mellivora capensis* | Honey Badger | Least Concern | Protected | Near Threatened / Protected | |
| Nesomyidae | *Dendromus melanotis* | Grey Climbing Mouse | Least Concern | - | - | |
| Nesomyidae | *Dendromus mesomelas* | Brant's Climbing Mouse | Least Concern | - | - | |
| Nesomyidae | *Dendromus mystacalis* | Chestnut Climbing Mouse | Least Concern | - | - | X |
| Nesomyidae | *Mystromys albicaudatus* | White-tailed Rat | Vulnerable | - | - | |
| Nesomyidae | *Saccostomus campestris* | Pouched Mouse | Least Concern | - | - | |
| Nesomyidae | *Steatomys pratensis* | Fat Mouse | Least Concern | - | - | |
| Orycteropodidae | *Orycteropus afer* | Aardvark | Least Concern | - | Protected | X |
| Pedetidae | *Pedetes capensis* | Springhare | Least Concern | - | - | X |
| Procaviidae | *Procavia capensis* | Rock Hyrax | Least Concern | - | - | X |
| Soricidae | *Crocidura cyanea* | Reddish-grey Musk Shrew | Least Concern | - | - | |
| Soricidae | *Crocidura flavescens* | Greater Red Musk Shrew | Least Concern | - | - | |
| Soricidae | *Crocidura maquassiensis* | Maquassie Musk Shrew | Vulnerable | - | Vulnerable | |
| Soricidae | *Crocidura mariquensis* | Swamp Musk Shrew | Near Threatened | - | Near Threatened | |
| Soricidae | *Myosorex varius* | Forest Shrew | Least Concern | - | - | X |
| Soricidae | *Suncus infinitesimus* | Least Dwarf Shrew | Least Concern | - | - | |
| Soricidae | *Suncus varilla* | Lesser Dwarf Shrew | Least Concern | - | - | |
| Suidae | *Potamochoerus larvatus* | Bushpig | Least Concern | - | - | X |

| Family | Scientific Name | Common Name | National Red List Status (2016) | NEMBA ToPS List (2007) | Mpumalanga Status | Study Area Record |
|---|---|---|---|---|---|---|
| Thryonomyidae | *Thryonomys swinderianus* | Greater Cane Rat | Least Concern | - | - | |
| Viverridae | *Civettictis civetta* | African Civet | Least Concern | - | - | |
| Viverridae | *Genetta genetta* | Small-spotted Genet | Least Concern | - | - | |
| Viverridae | *Genetta maculata* | Rusty-spotted Genet | Least Concern | - | - | X |
| Source: Master list based on the distribution maps presented in Stuart and Stuart (2007). | | | | | | |

# Appendix D: List of Herpetofauna Recorded and Potentially Occurring in the Study Area

Reptiles

| Family | Scientific Name | Common Name | National Red List Status | NEMBA ToPS List (2007) | Mpumalanga Status | Endemic Status | Study Area Record |
|---|---|---|---|---|---|---|---|
| Agamidae | *Acanthocercus atricollis atricollis* | Southern Tree Agama | Least Concern | - | - | - | |
| Agamidae | *Agama aculeata distanti* | Eastern Ground Agama | Least Concern | - | - | Endemic | |
| Agamidae | *Agama atra* | Southern Rock Agama | Least Concern | - | - | Near Endemic | |
| Amphisbaenidae | *Monopeltis infuscata* | Dusky Worm Lizard | Least Concern | - | - | - | |
| Chamaeleonidae | *Bradypodion transvaalense* | Northern Dwarf Chameleon | Least Concern | - | Vulnerable | Endemic | |
| Chamaeleonidae | *Chamaeleo dilepis* | Flap-neck Chameleon | Least Concern | - | - | - | |
| Colubridae | *Crotaphopeltis hotamboeia* | Red-lipped Snake | Least Concern | - | - | - | |
| Colubridae | *Dasypeltis inornata* | Southern Brown Egg-eater | Least Concern | - | Near Threatened | Endemic | |
| Colubridae | *Dasypeltis scabra* | Rhombic Egg-eater | Least Concern | - | - | - | |
| Colubridae | *Dispholidus typus* | Boomslang | Least Concern | - | - | - | |
| Colubridae | *Philothamnus natalensis occidentalis* | Western Natal Green Snake | Least Concern | - | - | Endemic | |
| Colubridae | *Philothamnus semivariegatus* | Spotted Bush Snake | Least Concern | - | - | - | |
| Colubridae | *Telescopus semiannulatus semiannulatus* | Eastern Tiger Snake | Least Concern | - | - | - | |
| Cordylidae | *Chamaesaura aenea* | Coppery Grass Lizard | Least Concern | - | Near Threatened | Endemic | |
| Cordylidae | *Chamaesaura macrolepis* | Large-scaled Grass Lizard | Least Concern | Protected | Near Threatened | Endemic | |
| Cordylidae | *Cordylus vittifer* | Common Girdled Lizard | Least Concern | - | - | Near Endemic | |

| Family | Scientific Name | Common Name | National Red List Status | NEMBA ToPS List (2007) | Mpumalanga Status | Endemic Status | Study Area Record |
|---|---|---|---|---|---|---|---|
| Cordylidae | *Platysaurus orientalis orientalis* | Sekhukhune Flat Lizard | Least Concern | - | Near Threatened | Endemic | |
| Cordylidae | *Pseudocordylus melanotus melanotus* | Common Crag Lizard | Least Concern | - | - | Endemic | |
| Cordylidae | *Smaug vandami* | Van Dam's Dragon Lizard | Least Concern | - | - | Endemic | |
| Elapidae | *Elapsoidea sundevallii* | Sundevall's Garter Snake | Least Concern | - | - | - | |
| Elapidae | *Hemachatus heamachatus* | Rinkhals | Least Concern | - | - | Near Endemic | X (anecdotal) |
| Elapidae | *Naja annulifera* | Snouted Cobra | Least Concern | - | - | - | |
| Elapidae | *Naja mossambica* | Mozambique Spitting Cobra | Least Concern | - | - | - | |
| Gekkonidae | *Homopholis wahbergii* | Wahlberg's Velvet Gecko | Least Concern | - | - | - | |
| Gekkonidae | *Lygodactylus capensis capensis* | Common Dwarf Gecko | Least Concern | - | - | - | |
| Gekkonidae | *Lygodactylus nigropunctatus* | Black-spotted Dwarf Gecko | Least Concern | - | - | Endemic | |
| Gekkonidae | *Lygodactylus ocellatus ocellatus* | Spotted Dwarf Gecko | Least Concern | - | - | Endemic | |
| Gekkonidae | *Pachydactylus affinis* | Transvaal Gecko | Least Concern | - | - | Endemic | |
| Gekkonidae | *Pachydactylus capensis* | Cape Gecko | Least Concern | - | - | - | |
| Gekkonidae | *Pachydactylus vansoni* | Van Son's Gecko | Least Concern | - | - | Near Endemic | |
| Gerrhosauridae | *Gerrhosaurus flavigulari* | Yellow-throated Plated Lizard | Least Concern | - | - | - | |
| Gerrhosauridae | *Tetradactylus breyeri* | Breyer's Long-tailed Seps | Least Concern | - | Vulnerable | Endemic | |

| Family | Scientific Name | Common Name | National Red List Status | NEMBA ToPS List (2007) | Mpumalanga Status | Endemic Status | Study Area Record |
|---|---|---|---|---|---|---|---|
| Lacertidae | *Nucras lalandii* | Delalande's Sandveld Lizard | Least Concern | - | - | Endemic | |
| Lacertidae | *Nucras ornata* | Ornate Sandveld Lizard | Least Concern | - | - | - | |
| Lacertidae | *Pedioplanis lineoocellata lineoocellata* | Spotted Sand Snake | Least Concern | - | - | - | |
| Lamprophiidae | *Amplorhinus multimaculatus* | Many-spotted Snake | Least Concern | - | Near Threatened | Near Endemic | |
| Lamprophiidae | *Aparallactus capensis* | Cape Centipede-eater | Least Concern | - | - | - | |
| Lamprophiidae | *Atractaspis bibronii* | Bibron's Stiletto Snake | Least Concern | - | - | - | |
| Lamprophiidae | *Boaedon capensis* | Common House Snake | Least Concern | - | - | - | |
| Lamprophiidae | *Duberria lutrix lutrix* | South African Slug Eater | Least Concern | - | - | Endemic | |
| Lamprophiidae | *Gonionotophis capensis capensis* | Common Field Snake | Least Concern | - | - | - | |
| Lamprophiidae | *Homoroselaps dorsalis* | Striped Harlequin Snake | Least Concern | - | Near Threatened | Endemic | |
| Lamprophiidae | *Homoroselaps lacteus* | Spotted Harlequin Snake | Least Concern | - | Near Threatened | Endemic | |
| Lamprophiidae | *Lamprophis aurora* | Aurora Snake | Least Concern | - | - | Endemic | |
| Lamprophiidae | *Lamprophis guttatus* | Spotted Rock Snake | Least Concern | - | - | Near Endemic | |
| Lamprophiidae | *Lycodonomorphus inornatus* | Olive Ground Snake | Least Concern | - | - | Endemic | |
| Lamprophiidae | *Lycodonomorphus rufulus* | Brown Water Snake | Least Concern | - | - | - | |
| Lamprophiidae | *Lycophidion capense* | Cape Wolf Snake | Least Concern | - | - | - | |
| Lamprophiidae | *Lycophidion variegatum* | Variegated Wolf Snake | Least Concern | - | - | - | |
| Lamprophiidae | *Psammophis angolensis* | Dwarf Sand Snake | Least Concern | - | - | - | |

| Family | Scientific Name | Common Name | National Red List Status | NEMBA ToPS List (2007) | Mpumalanga Status | Endemic Status | Study Area Record |
|---|---|---|---|---|---|---|---|
| Lamprophiidae | *Psammophis brevirostris* | Short-snouted Grass Snake | Least Concern | - | - | - | |
| Lamprophiidae | *Psammophis crucifer* | Montane Grass Snake | Least Concern | - | - | Near Endemic | |
| Lamprophiidae | *Psammophis trinasalis* | Four-marked Sand Snake | Least Concern | - | - | - | |
| Lamprophiidae | *Psammophylas tritaeniatus* | Striped Grass Snake | Least Concern | - | - | - | |
| Lamprophiidae | *Psammophylax rhombeatus* | Spotted Grass Snake | Least Concern | - | - | - | X |
| Lamprophiidae | *Pseudaspis cana* | Mole Snake | Least Concern | - | - | - | |
| Pythonidae | *Python natalensis* | South African Python | Least Concern | Protected | - | - | |
| Scincidae | *Acontias breviceps* | Short-headed Legless Skink | Least Concern | - | Vulnerable | Endemic | |
| Scincidae | *Acontias gracilicauda* | Thin-tailed Legless Skink | Least Concern | - | - | Endemic | |
| Scincidae | *Acontias occidentalis* | Savanna Legless Skink | Least Concern | - | - | - | |
| Scinidae | *Acontias plumbeus* | Giant Legless Skink | Least Concern | - | Near Threatened | - | |
| Scincidae | *Afroablepharus maculicollis* | Spotted-neck Snake-eyed Skink | Least Concern | - | - | - | |
| Scincidae | *Afroablepharus wahlbergii* | Wahlberg's Snake-eyed Skink | Least Concern | - | - | - | |
| Scincidae | *Mochlus sundevallii sundevallii* | Sundevall's Writhing Skink | Least Concern | - | - | - | |
| Scincidae | *Scelotes mirus* | Montane Dwarf Burrowing Skink | Least Concern | - | - | Endemic | |
| Scincidae | *Trachylepis capensis capensis* | Cape Skink | Least Concern | - | - | - | |
| Scincidae | *Trachylepis margaritifer* | Rainbow Skink | Least Concern | - | - | - | |

| Family | Scientific Name | Common Name | National Red List Status | NEMBA ToPS List (2007) | Mpumalanga Status | Endemic Status | Study Area Record |
|---|---|---|---|---|---|---|---|
| Scincidae | *Trachylepis punctatissima* | Speckled Rock Skink | Least Concern | - | - | - | X |
| Scincidae | *Trachylepis varia* | Variable Skink | Least Concern | - | - | - | |
| Testudinidae | *Kinixys lobatsiana* | Lobatse Hinged-back Tortoise | Least Concern | - | - | Near Endemic | |
| Testudinidae | *Kinixys spekii* | Speke's Hinged-back Tortoise | Least Concern | - | - | - | |
| Testudinidae | *Stigmochelys pardalis* | Leopard Tortoise | Least Concern | - | - | - | |
| Typhlopidae | *Afrotyphlops bibronii* | Bibron's Blind Snake | Least Concern | - | - | Near Endemic | |
| Typhlopidae | *Megatyphlops schlegelii* | Schlegel's Giant Blind Snake | Least Concern | - | - | - | |
| Typhlopidae | *Rhinotyphlops lalandei* | Delalande's Beaked Blind Snake | Least Concern | - | - | - | |
| Leptotyphlopidae | *Leptotyphlops distanti* | Distant's Thread Snake | Least Concern | - | - | Near Endemic | |
| Leptotyphlopidae | *Leptotyphlops incognitus* | Incognito Thread Snake | Least Concern | - | - | - | |
| Leptotyphlopidae | *Leptotyphlops nigricans* | Black Thread Snake | Least Concern | - | - | Endemic | |
| Leptotyphlopidae | *Leptotyphlops scutifrons* | Peter's Thread Snake | Least Concern | - | - | - | |
| Varanidae | *Varanus niloticus* | Water Monitor | Least Concern | - | - | - | |
| Viperidae | *Bitis arietans arietans* | Puff Adder | Least Concern | - | - | - | X (anecdotal) |
| Viperidae | *Bitis atropos* | Berg Adder | Least Concern | - | - | Near Endemic | |
| Viperidae | *Causus defilippii* | Snouted Night Adder | Least Concern | - | - | - | |
| Viperidae | *Causus rhombeatus* | Rhombic Night Adder | Least Concern | - | - | - | |
| Source: Master list based on the distribution maps presented in Bates *et al.,* (2014). | | | | | | | |

Amphibians

| Family | Scientific Name | Common Name | Red List Status (2013) | NEMBA ToPS List (2007) | Mpumalanga Status | Study Area Record |
|---|---|---|---|---|---|---|
| Breviceptidae | *Breviceps adspersus* | Bushveld Rain Frog | Least Concern | - | - | |
| Bufonidae | *Sclerophrys gutturalis* | Guttural Toad | Least Concern | - | - | X |
| Bufonidae | *Sclerophrys maculatus* | Flat-backed Toad | Least Concern | - | - | |
| Bufonidae | *Sclerophrys rangeri* | Raucous Toad | Least Concern | - | - | |
| Hyperoliidae | *Hyperolius marmoratus* | Painted Reed Frog | Least Concern | - | - | |
| Hyperoliidae | *Kassina senegalensis* | Bubbling Kassina | Least Concern | - | - | |
| Hyperoliidae | *Semnodactylus wealii* | Rattling Frog | Least Concern | - | - | |
| Phrynobatrachidae | *Phrynobatrachus natalensis* | Snoring Puddle Frog | Least Concern | - | - | |
| Pipidae | *Xenopus laevis* | Common Platanna | Least Concern | - | - | X |
| Ptychadenidae | *Ptychadena porosissima* | Striped Grass Frog | Least Concern | - | - | |
| Pyxicephalidae | *Amietia angolensis* | Common River Frog | Least Concern | - | - | X |
| Pyxicephalidae | *Amietia fuscigula* | Cape River Frog | Least Concern | - | - | X |
| Pyxicephalidae | *Cacosternum boettgeri* | Common Caco | Least Concern | - | - | X |
| Pyxicephalidae | *Cacosternum nanum* | Bronze Caco | Least Concern | - | - | |
| Pyxicephalidae | *Pyxicephalus adspersus* | Giant Bullfrog | Least Concern | - | Vulnerable / Protected | |
| Pyxicephalidae | *Strongylopus fasciatus* | Striped Stream Frog | Least Concern | - | - | X |
| Pyxicephalidae | *Strongylopus grayii* | Clicking Stream Frog | Least Concern | - | - | |
| Pyxicephalidae | *Tomopterna cryptotis* | Tremolo Sand Frog | Least Concern | - | - | |
| Pyxicephalidae | *Tomopterna natalensis* | Natal Sand Frog | Least Concern | - | - | |
| Pyxicephalidae | *Tomopterna tandyi* | Tandy's Sand Frog | Least Concern | - | - | |
| Source: Master list based on the distribution maps presented in Du Preez and Carruthers (2009) | | | | | | |