Proposed Development of the New 132kV and Expansion of the 400kV Eskom Majuba Substation and associated Infrastructure, Gert Sibande District Municipality, Mpumalanga Province.

MBONENI
ECOLOGICAL SERVICES

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Executive Summary

Introduction and Background

A Terrestrial Biodiversity Assessment was undertaken by Mboneni Ecological Services (Pty) Ltd as part of the Environmental Impact Assessment (EIA) process in order to assess the impacts that the proposed development will have on the receiving environment. The objective of this study was to identify sensitive species and their habitats on the study area. The current ecological status and conservation priority of vegetation on the site were assessed. Potential faunal habitats were investigated in the study area and all mammals, birds, reptiles, amphibians and invertebrates known to occur or seen on site were recorded.

Regional Vegetation

The project site falls within the Grassland biome and this Biome has a high biodiversity, ranked only below the Fynbos biome in terms of biodiversity in South Africa. This Biome is found mainly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal Province and the Eastern Cape Province. Grasslands are dominated by a single layer of grasses. Trees are absent, except in a few localised habitats and geophytes are often abundant. The project site falls within the Amersfoort Highveld Clay Grassland vegetation type, listed as **Vulnerable**. Remnants of this vegetation type still exist within the Power Station, but only within the Nature Reserve.

Terrestrial Threatened Ecosystems

“Ecosystem protection level” is an indicator of how adequately an ecosystem is protected or not. Ecosystems can be classified as not protected, poorly protected, moderately protected or well protected depending on the proportion of each ecosystem that is under conservation management within a protected area, as recognized in the National Environmental Management: Protected Areas Act (Act 57 of 2003) – these protected areas include state or privately-owned protected areas as well a land under biodiversity stewardship agreements.

According to South African National Biodiversity Institute & Department of Forestry, Fisheries and the Environment (2021), there are remnants of the *Least concern* Amersfoort Highveld Clay Grassland terrestrial threatened ecosystem/vegetation type within the proposed development site. However, this ecosystem/vegetation type is listed as **Poorly Protected (PP)** on a national scale. An ecosystem is considered “not protected” if under 5% of its biodiversity target is met within protected areas, “poorly protected” if 5% to 49% of its target is met in protected areas, and “moderately protected” if 50% to 99% of its target is met. If more than 100% of the target is met in protected areas, it is considered “well protected”.

Mpumalanga Biodiversity Sector Plan-2015

The Mpumalanga Biodiversity Sector Plan (MBSP) terrestrial assessment serves as an important land-use decision support tool, and the foundation for the development of any Bioregional plans within Mpumalanga. The broad categories recognised are: Protected Areas (PA), Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), Other Natural Areas (ONA), and Modified Areas. The entire Majuba Power station falls within the **CBA: Optimal, ESA: Protected Area buffers, Heavily Modified, Other Natural Areas and PA: National Parks & Nature Reserves** categories. However, the proposed repositioning of the towers within the same corridor falls within the **PA: National Parks & Nature Reserves**. Accordingly, the guidelines allow for the "Activities relating to the construction of roads, administrative or tourism infrastructure and services (such as water reticulation systems, **power lines** and the likes) that are required to support the primary function of the protected area and its allowable activities, must be subject to at least a basic scoping report, or a full EIA, as specified by National Environmental Management Act (NEMA), and the protected area management plan".

Protected Areas

The proposed development site falls within the Majuba Nature Reserve. This Nature Reserve is declared for the protection of Sungazer Lizard (*Smaug giganteus*). The project development site is situated in an area earmarked as a Priority Focus Area in terms of Protected area expansion.

Methodology

Survey methodology included a comprehensive desktop review, utilising available provincial and national ecological data, relevant literature, Geographic Information System (GIS) databases, topographical maps and aerial photography. This was then supplemented through a ground-truthing phase, where pertinent areas associated with the project area were visited during field survey undertaken on the 16th of May 2024. The survey focused on flora (vegetation) and fauna (mammals, avifauna, reptiles, amphibians and invertebrates). Several Red Listed Data floral and faunal species pertaining to the project area were identified during the desktop review and their habitat suitability were assessed through the ground-truthing phase of the survey.

Results and Discussion – Flora

The anthropogenic activities taking place within the Majuba Power Station entails the existing ash disposal facilities, existing cooling towers, pollution control dams and associated infrastructure such as internal roads and buildings. The expansion of the 400kv Eskom Majuba is within the Majuba Power Station site. Therefore, limited natural vegetation remains inside the Power station, and dominated by alien invasive plant species and weeds. During the field survey, no threatened plant species or protected trees or provincial protected plants were observed within the study area. However, should any plant species of conservation concern be found during construction activities, a search and rescue plan should be developed and suitable habitat for translocation exists within the nature reserve.

Results and Discussion – Fauna

Six mammal species were observed within the project area and all these mammal species were seen within the Majuba Nature Reserve. No mammal Species of Conservation Concern (SCC) were recorded during the survey. Continual habitat destruction, alteration and human disturbances result in the disappearance of the sensitive or secretive mammal species in the Reserve. Therefore, in order to mitigate the impacts of the development within the reserve, the construction personnel must be aware of the threatened animal species, which will then reduce the probability of fauna being harmed unnecessarily and the contractor must ensure that no faunal species are disturbed, trapped, hunted or killed during the pre-and construction phases.

The project is situated in a heavily modified and also within natural vegetation (Majuba Nature Reserve) and only three micro-habitats are found on or near the project site, namely watercourse, grasslands and exotic trees.

Wetlands are of particular importance for birds in the study area, as the area is largely urbanized, however these are very degraded as can be seen below. Water bodies represent sensitive areas because they provide habitat for a wide variety of terrestrial and aquatic species, particularly avifauna. Bird species such as herons, bishops, weavers, cisticolas and warblers will breed in the reeds growing on the banks of the dams/pans and will also feed on insects that live within the reeds. Many of these bird species make use of the thorny nature of these trees to build their nests. The open grassy/weedy river bed is rather frequently visited for very short periods of time by mainly granivorous passerines (Cape Sparrow, Speckled pigeon, Blue waxbill, Laughing Dove etc) in search of prey attracted to moisture and flowering herbs and weeds. The rivers are particularly important for stork species such as Black Stork and Yellow billed Stork and a variety of other waterbirds.

Open grasslands: Open grasslands on site represent a significant feeding area for many bird species. The grassland patches are also a favourite foraging area for game birds such as francolins, Helmeted Guineafowl and Black-shouldered Kite, etc. This in turn may attract raptors because of both the presence and accessibility of prey. Red Data Listed bird species such as Lanner Falcon, Lesser Kestrel, and Martial Eagle, may often hunt in open grassland areas.

Exotic trees often provide roosting and nesting habitat for various bird species, and as such their importance for avifauna should not be under-estimated. Exotic trees provide perching, roosting and nesting habitat for various raptor species, as well as larger birds such as francolins, Guineafowl, Herons and Hadeda ibises. Although stands of *Eucalyptus* spp are invader species, these stands have become important refuges for certain species of raptors including Eagles and Buzzards. Birds such as Lesser Kestrel and Falcons make use of large *Eucalyptus* trees, where they roost in large numbers. Nests identified on the study area should not be unnecessarily destroyed.

Forty (40) bird species were recorded during the field survey. Species recorded were common and widespread and typical of grassland biome. No Red Data bird species associated with the study area were recorded.

The trees, watercourses and grasslands provide suitable habitats for reptile species to occur within the project site. Two reptile species were recorded during the survey, namely Speckled Rock Skink (*Trachylepis punctatissima*) and Cape Skink (*Trachylepis capensis*). No reptile Species of Conservation Concern were recorded on the project development site. According to the anecdotal information, the following reptile species have been sighted in the area, namely Peter's Thread Snake (*Leptotyphlops scutifrons*), Rhombic Skaapsteker (*Psammophylax rhombeatus*), Mole Snake (*Pseudaspis cana*) and Rinkhals (*Hemachatus haemachatus*). The majority of reptile species are sensitive to severe habitat alteration and fragmentation. Species are also very often "expelled" into riparian zones due to transformation of lands for anthropogenic disturbances such as human settlements and agricultural purposes.

Giant girdled lizard (*Smaug giganteus*), formerly known as *Cordylus giganteus*, is found in Highveld Grassland and inhabit flat or sloping Highveld grasslands They live in self-excavated burrows, although they can be opportunistic and inhabit empty burrows. The Majuba Power Station Nature Reserve, of which section of the proposed development site traverses, was declared for the protection of this reptile species. Therefore, in order to protection this species, training of construction personnel to recognise Giant girdled lizard species will reduce the probability of this species being harmed unnecessarily and the contractor must ensure that this species is not disturbed, trapped, hunted or killed during the pre- and construction phases. Sungazers are unique within their family (Cordylidae) in that they rely on self-constructed burrows in specific microhabitats within the grassland matrix as long-term, often permanent, shelter and refuge sites. If any individuals or burrows of *Smaug giganteus* are observed, they must be recorded and the ECO immediately notified. Search and rescue operations should occur before the construction works begin to ensure that any slow moving or burrowing species (such as moles, chameleons, snakes or tortoises) would be moved to adjacent suitable habitats by a qualified Faunal Specialist.

The watercourses within the study area hold water on a temporary basis and are important breeding habitat for most of the frog species which could occur within the study area. During the field survey, two frog species were recorded along the project site, namely Raucous Toad (*Sclerophrys capensis*) and Common River Frog (*Amietia delalandii*). No rivers will be traversed by the proposed development. No frog Species of Conservation Concern were recorded within the project site.

With regards to the invertebrates, during the field survey, the following species were recorded within the proposed development site, namely African Blue Pansy (*Junonia orithya madagascariensis*), African Plain Tiger (*Danaus chrysippus orientis*), Pirate (*Catacroptera cloanthe*), Citrus Swallowtail (*Papilio demodocus demodocus*), Painted Lady (*Vanessa cardui*), Yellow Pansy (*Junonia hierta cebrene*), the Meadow White *(Pontia helice helice*) and

Garden Acraea (*Acraea horta*). No invertebrate Species of Conservation Concern were recorded within the project site.

Terrestrial ecological site sensitivity

According to the Screening report for an Environmental Authorization as required by the 2014 EIA regulations – proposed site environmental sensitivity, the relative animal species theme sensitivity is considered as *High* sensitivity (Medium-High), the relative plant species theme sensitivity is considered as *Medium* (Low-Medium) and the terrestrial biodiversity theme sensitivity is assigned a *Very High Sensitivity* due to the presence of Majuba Nature Reserve, CBA 2, ESA: Protected Area buffer, FEPA Sub catchment and National Protected Area Expansion Strategy (NPAES). The site verification was conducted concurrently with the Terrestrial biodiversity impact assessment and during the survey, it was concluded that the proposed development site falls within *Low* (inside the Power Station) to *High* (within the Nature Reserve) categories in terms of ecological sensitivity. However, the proposed development is situated along the existing servitude and therefore the disturbances to the natural ecosystems and vegetation clearance will be relatively small. The mitigation measures within the Nature Reserve must be enforced.

Conclusion and Recommendations

During the field survey, it was found that the impacts of the proposed development site on flora and fauna can be mitigated to a satisfactory level and as such, the development is deemed acceptable from the ecological perspective and as such should not be prevented from proceeding based on the ecological considerations, provided that the mitigation measures are implemented and adhered to. The methodologies used and results found during the field survey, together with the impacts and mitigation measures provide confidence that the project can go ahead. Once the proposed development has been constructed, rehabilitation process needs to take place and should also ensure that alien plant emergence and erosion do not occur.

Table of Contents

List of Figures

List of Tables

List of Appendices

List of Abbreviations

ADU	Animal Demography Unit
AIPs	Alien Invasive Plant species
BLSA	BirdLife South Africa
BODATSA	Botanical Database of Southern Africa
CBAs	Critical Biodiversity Areas
CARA	Conservation of Agricultural Resources Act
CAR	Coordinated Avifaunal Roadcounts
CWAC	Coordinated Water Bird Counts
EIA	Environnemental Impact Assessment
EMPr	Environnemental Management Programme
ESAs	Ecological Support Areas
GPS	Global Positioning System
GIS	Geographic information system
QDS	Quarter degree Squares
IBA	Important Bird and Biodiversity Area
IUCN	International Union for Conservation of Nature
MTPA	Mpumalanga Tourism and Parks Agency
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
PRECIS	Pretoria Computer Information Systems
SABAP	South African Bird Atlas Project
SAFAP	South African Frog Atlas Project
SANBI	South African National Biodiversity Institute
SARCA	Southern African Reptile Conservation Assessment
SCC	Species of Conservation Concern

1 BACKGROUND AND MOTIVATION

- The 2022 Transmission Development Plan generation assumptions forecasts that 31 095 MW of photovoltaic and wind generation will be required by 2030 of which 16 604 MW will be required as early as 2027.
- With limited or no capacity available in many of the Transmission supply areas, it becomes crucial to attract and enable RE generation connections in the areas where grid capacity remains, especially those areas where minimal network infrastructure is required.
- To this effect, Grid Planning has identified the need for additional transformer capacity at substations that lie within the future areas of interest for RE generation.
- These areas have been identified by analysing applications processed in bid window 5 (BW5) and those received for bid window 6 (BW6) as well as by conducting an industry survey amongst various RE associations (SAWEA, SAIPPA, SAPVIA).
- Due to the enquiries received and the high interest shown for 671 MW of 132kV IPP connections at Majuba MTS, it was strategically determined to install two new fully equipped 400/132kV 500 MVA transformer bays. This will ensure that the total of 950 MW unfirm and 475 MW firm capacity will be made available.

The high-level scope of work is as follows:

- Establishment of a new 132 kV Yard, with 2 x 400/132 kV 500 MVA transformers,
- Extend the 400 kV busbar
- Equip 2 x 400 kV transformer bays
- Equip 2 x 132 kV transformer bays
- Equip 4 x 132 kV feeder bays
- Cater for transformer FCLR's
- Relocate any feeder bays, terminal towers and lines if required
- Relocate any telecoms or secondary plant if required
- Install and commission any required secondary plant

2 STUDY AREA

The proposed Majuba 400/132 kV Substation Extension is situated is located approximately 16 km southwest (SW) of Amersfoort and approximately 40 km north northwest (NNW) of Volksrust in the Mpumalanga Province. The Majuba Power Station is situated on portion 1 of Farm Palmietspruit 68 HS and Farm Majuba Power Station 263 HS, within Dr Pixley Ka Seme Local Municipality, Gert Sibande District Municipality, Mpumalanga Province (**Figures 1, 2** and **3**). A collage of photographs taken within the project site is indicated in **Figure 4.**

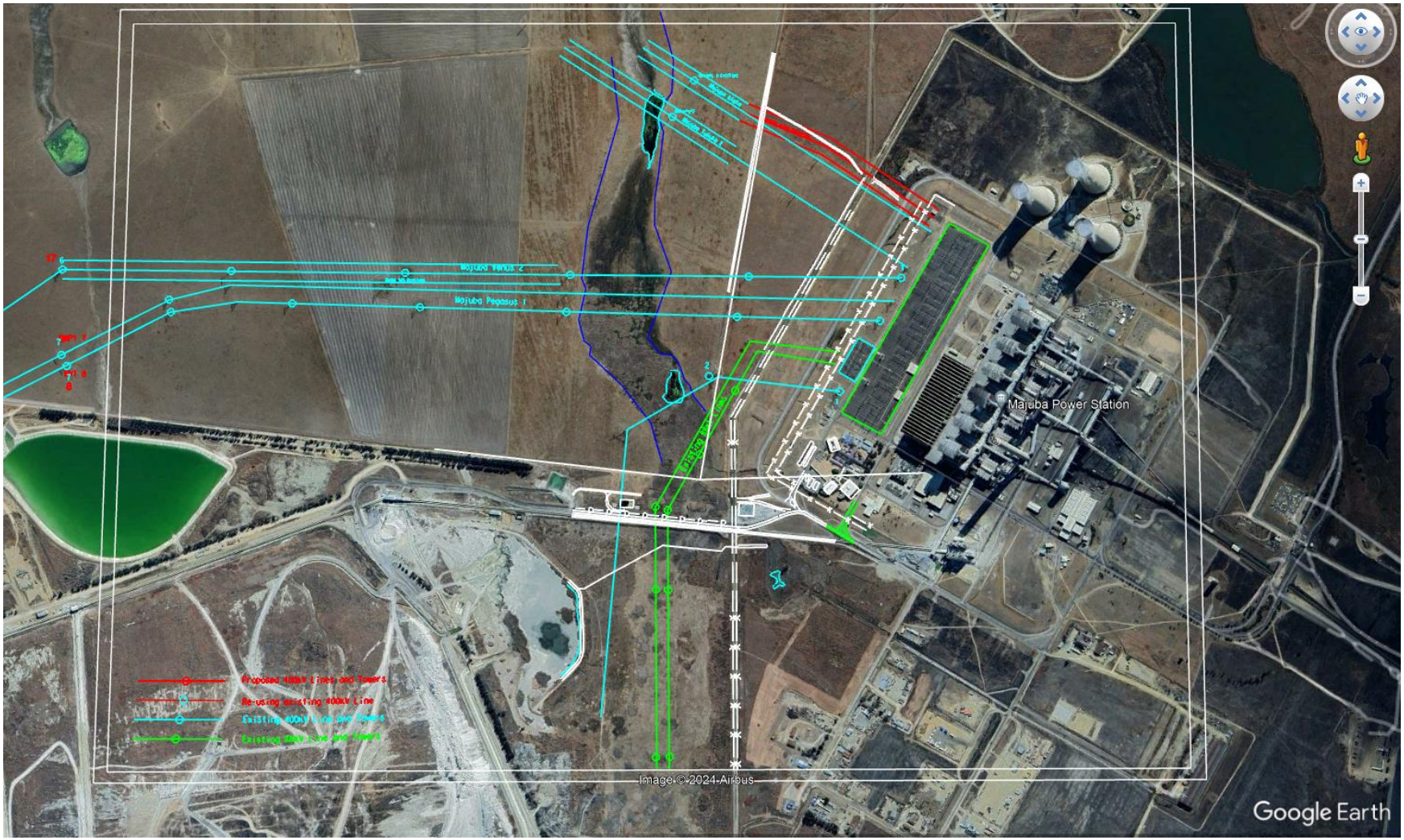

Figure 1. Google Earth image of the project site

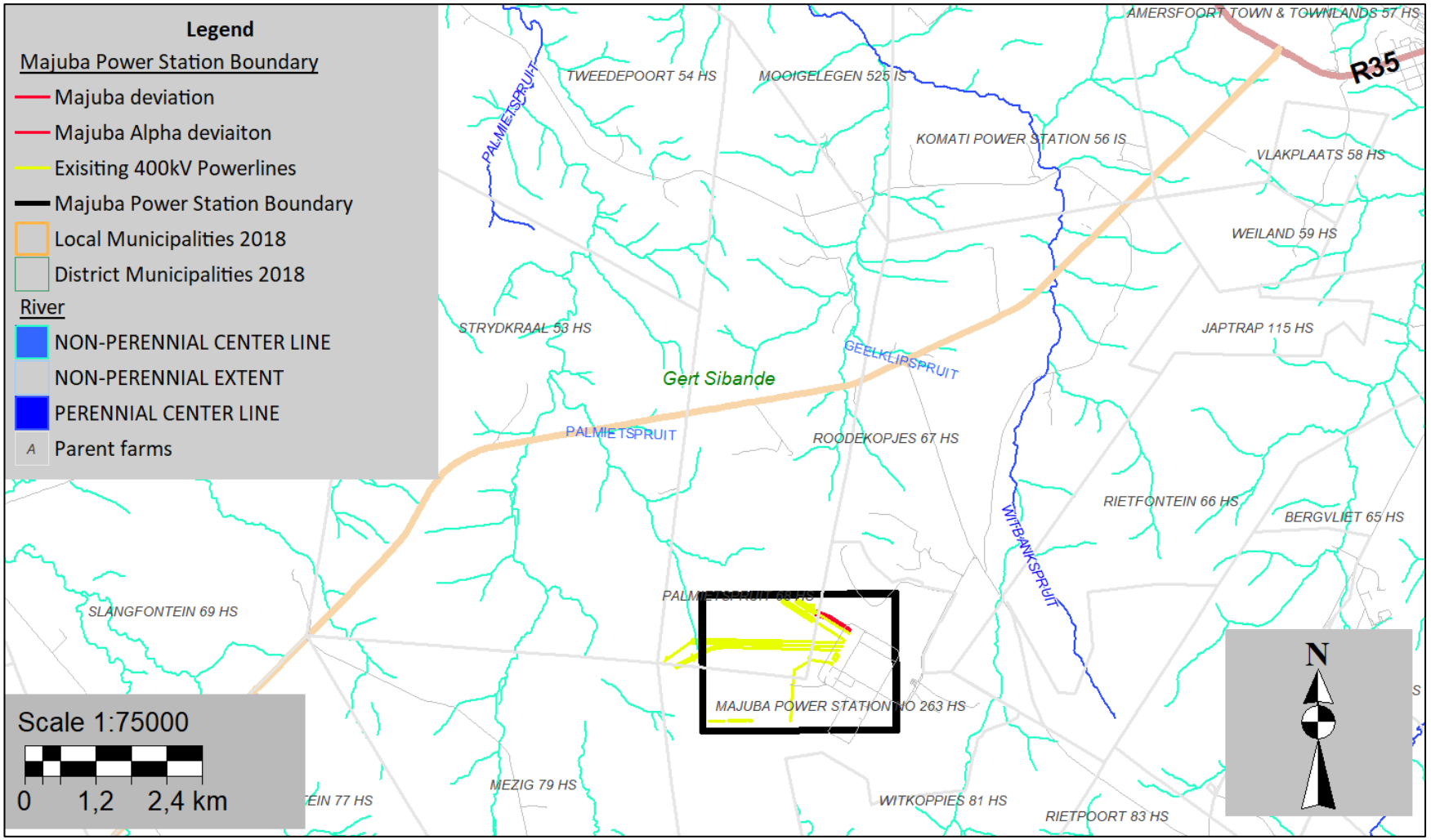

Figure 2. Locality Map

Figure 3. Areas of Extension

Figure 4. Collage of photographs taken within the project site

2.1 Declaration of Independence

I, Avhafarei Phamphe, declare that I –

- Act as the independent specialist;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations 2014;
- Will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the Applicant and there are no circumstances that may compromise my objectivity in performing such work;
- Have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998), regulations and any guidelines that have relevance to the proposed activity;
- Will comply with the Act, regulations and all other applicable legislation;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- Undertake that the report adheres to Appendix 6 of GN No. R 982 of 4 December 2014 (as amended), and
- Will provide the Competent Authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.

Avhafarei Phamphe:

- Holds a M. Sc in Botany from the University of the Pretoria;
- Is registered with South African Council for Natural Scientific Professions (SACNASP) as a Professional Natural Scientist (Pr. Sci.Nat) Ecological Science, (Registration No.: 400349/12), with expertise in floral and faunal ecology;
- Has been actively involved in the environmental consultancy field for over 20 years;
- Is a Professional Member of South African Institute of Ecologists and Environmental Scientists (SAIEES) and
- Is a member of the South African Association of Botanists (SAAB).

Avhafarei Phamphe

Name of Specialist

Mboneni Ecological Services (Pty) Ltd

Name of Company

20 June 2024

Date

Signature

3 RELEVANT LEGISLATION AND GUIDELINES

The legislations that have possible bearing on the proposed project from an ecological perspective are captured below:

- Conservation of Agricultural Resources Act (Act No. 43 of 1983);
- Occupational Health & Safety Act (Act No. 85 of 1993);
- The Constitution of the Republic of South Africa (Act 108 of 1996) –Section 24;
- The white paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (1997);
- National Environmental Management Act (Act No. 107 of 1998);
- The National Environmental Management Act (NEMA) No. 107 of 1998): Environmental Impact Assessment Regulations, 2014 as amended. Specifically, the requirements of the specialist report as per the requirements of Appendix 6;
- National Forests Act (Act 84 of 1998);
- National Environmental Management Protected Areas Act 2003 (Act No 57 of 2003);
- National Environmental Management: Biodiversity Act (Act No.10 of 2004);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) Threatened or Protected Species regulations;
- Guidelines for Involving Specialists in the EIA Processes Series (2005).
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) - Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014;
- Dr Pixley Ka Seme Local Municipality Environmental Management Framework (2011);
- National Biodiversity Assessment (2018) and
- Gert Sibande Bioregional Plan (2023);

4 LIMITATIONS AND GAPS

The following constraints/limitations were applicable to this assessment:

- Survey was undertaken in May 2024, which falls within late flowering season for most plant species. However, the timing of the site visit is not seen to pose a constraint on the results of the study and it is unlikely that any more visits would reveal information that would change the outcome of this assessment both in terms of ecosystems of special conservation concern or suitable habitats of species of particular conservation concern. Site visit which was conducted therefore appear to be sufficient to address the objectives of this study.

- Weather conditions during the survey were favourable for recording both fauna and flora.
- The focus of the survey remains a habitat survey that concentrates on the possibility that species of particular conservation priority occur on the site or not.
- While assessment of the potential occurrence of SCC has been undertaken, and is informed by readily available information, this provides only a surrogate indicator of the likelihood of such species occurring. This is however regarded as appropriate given the level of habitat degradation/transformation across much of the project area.
- Data collection in this study relied heavily on data from representative, homogenous sections of vegetation units, as well as general observations, analysis of satellite imagery from the past until the present, generic data and a desktop analysis.
- The potential of future similar developments in the same geographical area, which could lead to cumulative impacts cannot be meaningfully anticipated.
- The impact descriptions and assessment are based on the author's understanding of the proposed development based on the site visit and information provided. Since ecological impact studies deal with dynamic natural systems additional information may come to light at a later stage and this Specialist can thus not accept responsibility for conclusions and mitigation measures made in good faith-based information gathered or databases consulted at the time of the investigation.

5 METHODOLOGY

5.1 Flora

The flora assessment consisted of two complementary approaches:

- A desktop analysis, which included literature review, local knowledge, topographical maps, and Google Earth imagery; and
- A site visit was conducted on 16th of May 2024.

Satellite imagery of the area was obtained from Google Earth and was studied in order to acquire a three-dimensional impression of the topography and land use and also to identify potential "hot-spots" or specialized habitats such as wetlands, rivers and natural vegetation on or near the project site.

The computerized data storage and retrieval system, called the Botanical Database of Southern Africa (BODATSA), was consulted to retrieve a list of Red Data plants recorded from the 2729BA and 2729BB Quarter Degree Squares (QDS)

(http://posa.sanbi.org/searchspp.php). This list was used to determine which Red Data plant species could potentially occur on the study area. Version 2024 of the Red List of South African plants (http://redlist.sanbi.org/index.php), which is managed as part of South African National Biodiversity Institute (SANBI)'s Threatened Species Programme, was consulted for the current conservation status of each species in the above list. The term "Species of Conservation Concern" (SCC) as defined by Raimondo *et al.* (2009) was followed in this report, namely all species classified as threatened (Critically Endangered, Endangered and Vulnerable), as well as species classified as Near Threatened, Critically Rare and Rare.

The vegetation map published by SANBI (2018) was consulted to identify vegetation type that is found within the study area.

The project site was traversed on foot and species listed as they were encountered. Attention was paid to the occurrence of medicinal, Red data plant species, protected trees, provincially protected plants, alien invasive and declared weed species. Vegetation associations identified during this study are based on the overall similarity in vegetation structure, species composition, and abiotic features such as moistness and rocky areas. However, slight phytosociological differences within each broadly grouped vegetation association are present. Field guides such as van Wyk *et al.* (1997), Pooley (1998), van Oudshoorn (1999) and Manning (2009) were consulted during the field visit to aid in the identification of plant species.

Regulations published for the National Forests Act (Act 84 of 1998) as amended, provide a list of protected tree species for South Africa. The species on this list were assessed in order to determine which protected tree species have a geographical distribution that coincides with the study area and habitat requirements that may be met by available habitat in the study area. The distributions of species on this list were obtained from published sources (e.g., van Wyk & van Wyk, 1997) and from the SANBI Biodiversity Information System website (http://sibis.sanbi.org/) for the quarter degree grid in which species have been previously recorded.

Alien invasive plant species are regulated by the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) - Alien and Invasive Species (AIS) List, 2016 (and the latest revised edition of 2019-02-13) as well as the Conservation of Agricultural Resources Act (CARA) were consulted. The AIS Regulations list different categories of invasive species that must be managed, controlled or eradicated from areas where they may cause harm to the environment, or that are prohibited to be brought into South Africa.

Alien Invasive plant species are divided into four categories, namely:

- Category 1a: Invasive species which must be combatted and eradicated. Any form of trade or planting is strictly prohibited.

- Category 1b: Invasive species which must be controlled and wherever possible, removed and destroyed. Any form or trade or planting is strictly prohibited.
- Category 2: Invasive species, or species deemed to be potentially invasive, in which a permit is required to carry out a restricted activity. Category 2 species include commercially important species such as pine, wattle and gum trees.
- Category 3: Invasive species which may remain in prescribed areas or provinces. Further planting, propagation or trade, is however prohibited.

5.2 Mammals

The Animal Demographic unit website, Mpumalanga Tourism and Parks Agency (MTPA), DFFE Screening report and Skinner & Chaminda (2005) were consulted to draw up a list of mammal species potentially occurring on the study area.

During the site visit, mammals were identified by spoor, burrows and visual sightings through random transect walks and documented. The habitat quality and quantity for Red Listed species potentially present were evaluated. The adjoining properties (approximately 50m) were also scanned for the presence of Red Listed mammal species/habitat. The confirmed list of presences was augmented with anecdotal information provided by the local community residing in the vicinity of the study area.

5.3 Avifauna

The online databases of the Southern African Bird Atlas Project (SABAP 2), MTPA, DFFE Screening report, and previous biodiversity reports were consulted as a means to determine which Red Listed bird species were previously recorded from the area. The conservation status of all bird species occurring in the aforementioned quarter degree squares was determined with the use of The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Barnes, 2000).

The following information sources were consulted to conduct this study:

- Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the University of Cape Town, to ascertain which species occur within the broader area i.e., within a block consisting of 2 pentad grid cells (2705_2940 and 2705_2945) within which the proposed project site is situated. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km (**Figure 5**).
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al*. 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).

- Coordinated Avifaunal Roadcounts (CAR) – The Coordinated Avifaunal Roadcounts (CAR) were pioneered in July 1993 in a joint Cape Bird Club/ADU project to monitor the populations of two threatened species: *Anthropoides paradiseus* (Blue Crane) and *Neotis denhamii* (Denham's Bustard). Presently it monitors 36 species of large terrestrial birds along 350 fixed routes covering over 19 000 km using a standardised method.
- Coordinated Water Bird Counts (CWAC) – The Animal Demography Unit (ADU) launched the Coordinated Waterbird Counts (CWAC) project in 1992 as part of South Africa's commitment to international waterbird conservation. The primary aim of CWAC is to act as an effective long-term waterbird monitoring tool. This is done through a programme of regular mid-summer and mid-winter censuses at several wetlands.
- The global threatened status of all priority species was determined by consulting the (2021.3) International Union for Conservation of Nature (IUCN) Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the habitat in the Project Site was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (Harrison et al. 1997) and the National Vegetation Map (2012 beta2) from the South African National Biodiversity Institute (SANBI) website (Mucina & Rutherford 2006 & http://bgisviewer.sanbi.org). The project site is the area covered by the land parcels where Project will be located.
- The Important Bird Areas of Southern Africa (Marnewick et al. 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2024) was used to view the Project Site on a landscape level and to help identify sensitive bird habitat.
- Priority species were defined as follows:
  - ✓ South African Red Data species: High conservation significance
  - ✓ South African endemics and near-endemics: High conservation significance Raptors: High conservation significance.
  - ✓ Raptors are at the top of the food chain and play a key role in their ecosystems. When populations of birds of prey go down, then the numbers of their prey species go up, creating an imbalance in the ecosystem.
  - ✓ Waterbirds: Evidence indicate that waterbirds may be particularly susceptible to collisions with solar arrays due to the so-called lake effect, caused by the reflection of the sun of the smooth surface of solar panels.
- The SANBI BGIS map viewer was used to determine the locality of the proposed site relative to National Protected Areas and National Protected Areas Expansion Strategy (NPAES) focus areas.
- The Department of Forestry, Fisheries and the Environment (DFFE) National Screening Tool was used to determine the assigned avian sensitivity of the project site.
- The following sources were used to determine the investigation protocol that is required for the site:

- ✓ 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 NEMA when applying for Environmental Authorisation (Gazetted October 2020);
- ✓ Guidelines for the Implementation of the Terrestrial Flora & Terrestrial Fauna Species Protocols for EIAs in South Africa produced by the SANBI on behalf of the Department of Environment, Forestry and Fisheries (2020); and
- ✓ The BirdLife South Africa (BLSA) Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa. BirdLife South Africa by Jenkins, A.R., Ralston-Patton, Smit- Robinson, A.H. 2017 (hereafter referred to as the Solar Guidelines).

During the site visit, this list was audited based on confirmed sightings of Red Listed bird species and the evaluation of suitable habitat for Red Listed bird species potentially present.

The study site, including the adjoining properties within 50 m, were surveyed on foot during random transect walks and all sightings were documented.

Birds were identified through visual identification by using a 10 x 50 Voyager binocular, by call, and from feathers. Where necessary, identifications were verified using field guides such as Sasol birds of Southern Africa (Sinclair *et al.* 2002) and the Chamberlain Guide to Birding Gauteng (Marais & Peacock, 2008).

Walked Transects, Driven Transect and Incidental Observations of Priority Species methodologies were utilised during the field survey.

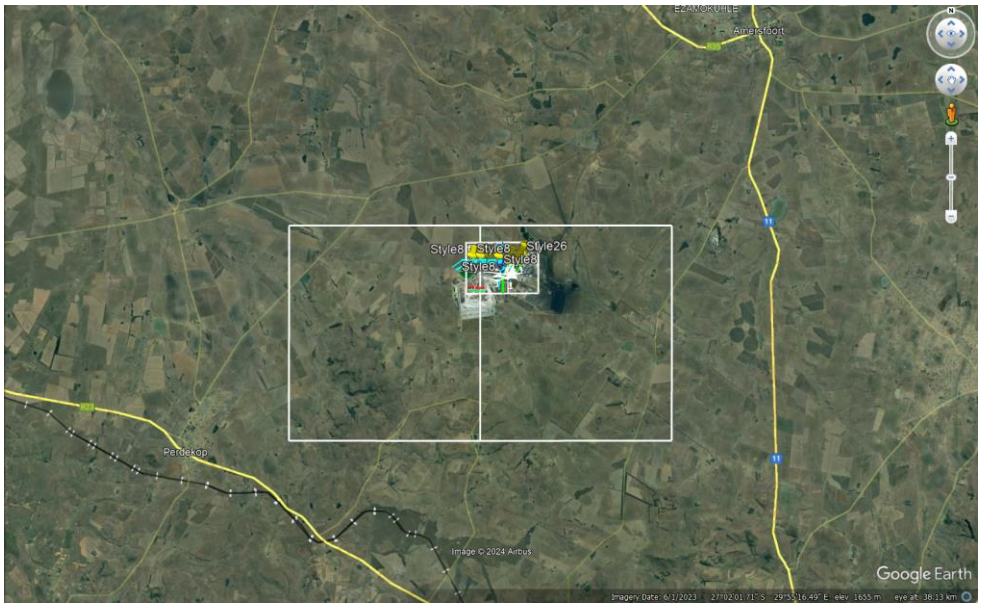

Figure 5. Area covered by the two SABAP2 pentads outlined in white (*i.e.,* the broader area).

5.4 Reptiles

The Animal Demographic Unit website, Mpumalanga Tourism and Parks Agency (MTPA), DFFE Screening report and historic distributions (Alexander & Marais, 2007) of reptile species were consulted in order to draw up list of potential occurrences. During site visit, reptiles were identified by visual sightings during random transect walks. Possible reptile retreats such as burrows were inspected for any inhabitants. The habitat quality and quantity for Red Listed species potentially present were evaluated. The adjoining properties (approximately 20m) were also scanned for sensitive reptile species and habitats. The list of confirmed presences was augmented with anecdotal information provided by the local community residing in the vicinity of the study area.

5.5 Amphibians

ADU (2024), MTPA, the South African Frog Atlas Project (SAFAP) (1999-2003) data and Du Preez & Carruthers (2009) were consulted in order to draw up a list of potential occurrences. A field visit was undertaken in order to document all observed frog species. Potential habitat for Red Listed frog species which were previously recorded in the study area were then identified. Habitat quality and quantity for Red Listed species potentially present were then evaluated. This was then augmented with anecdotal evidence provided by locals. Adjoining properties (approximately 20m) were also scanned for important frog species. Samplings were conducted on the moist to semi-aquatic areas. Frog calls were compared with pre-recorded calls from Du Preez and Carruthers (2009)'s CD and identified from this comparison.

5.6 Invertebrates

Physical ground and rock searches were undertaken in order to identify threatened arachnids, scorpions and various insects which take refuge underground in burrows or under rocks. An insect net with a diameter of 40 cm was used for collecting insects and arachnids. The focus of this assessment was on protected and species of conservation concern. The Field Guide to Insects of South Africa (Picker *et al.,* 2012) and the Field Guide to Butterflies of South Africa (Woodhall, 2005) assisted in species identification.

Selected stones that were lifted to search for Arachnids were put back very carefully resulting in the least disturbance possible. The area was searched for possible signs of trap door spiders or other mygalomorph spiders (for example traces of wafer-lids, cork lids or silk-lined burrows). Investigations by brushing the soil surface with a small brush, scraping or digging into the soil with a spade, were made. All the above actions were accompanied by the least disturbance possible.

Whilst conducting transects through the study area, all insect species visually observed were identified, and where possible photographs taken. It must be noted however that due to the cryptic nature and habits of insects, varied stages of life cycles and seasonal and temporal fluctuations within the environment, it is unlikely that all insect species will have been recorded during the site assessment period. Nevertheless, the data gathered during the assessment along with the habitat analysis provided an accurate indication of which species are likely to occur in the study area at the time of survey. Specific attention was given to insect SCC listed on a regional and national level. Suitable applicable habitat areas (rocky outcrops, sandy areas and fallen dead trees) where spiders and scorpions are likely to reside were searched. Rocks were overturned and inspected for signs of these species. Specific attention was paid to searching for SCC scorpions within the study area.

6 MPUMALANGA BIODIVERSITY SECTOR PLAN-2015

The Mpumalanga Biodiversity Sector Plan (MBSP) terrestrial assessment serves as an important land-use decision support tool, and the foundation for the development of any Bioregional plans within Mpumalanga. The broad categories recognised are; Protected Areas (PA), Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), Other Natural Areas (ONA), and Modified Areas (Lötter, 2015). The classification of map categories used in the Mpumalanga Biodiversity Sector Plan is summarised in **Table 1** below and described in greater detail in **Appendices A** and **B.** The entire project site falls within the **CBA: Optimal, ESA: Protected Area buffers, Heavily Modified, Other Natural Areas and PA: National Parks & Nature Reserves** categories. However, the repositioning of the towers within the same corridor falls within the **PA: National Parks & Nature Reserves** (**Figure 6**). Accordingly, the guidelines allow for the “Activities relating to the construction of roads, administrative or tourism infrastructure and services (such as water reticulation systems, **power lines** and the likes) that are required to support the primary function of the protected area and its allowable activities, must be subject to at least a basic scoping report, or a full EIA, as specified by NEMA, and the protected area management plan”.

Table 1. MBSP terrestrial map categories (Lötter, 2015).

Map Category	Sub-category	Type/Content
Protected areas	PA: National Parks & Nature Reserves	PA: National Parks & Nature Reserves
	PA: Protected Environment: Natural	PA: Protected Environment: Natural
	PA: Protected Environment: Modified	PA: Protected Environment: Modified

Map Category	Sub-category	Type/Content
Critical Biodiversity Areas (CBA)	CBA: Irreplaceable	CBA: Irreplaceable (100%)
		CBA: Irreplaceable (80-99%)
		CBA: Irreplaceable link
		CR threatened ecosystems
	CBA: Optimal	CBA: Optimal
Ecological Support Areas (ESA)	ESA: Landscape corridor	ESA: Landscape corridor
	ESA: Local corridor	ESA: Local corridor
	ESA: Species Specific	ESA: Species Specific
	ESA: Protected Area buffers	ESA: Protected Area buffers
Other Natural Areas (ONA)	Other Natural Areas	Other Natural Areas
Modified	Heavily Modified	Heavily Modified
	Moderately Modified: Old lands	Moderately Modified: Old land

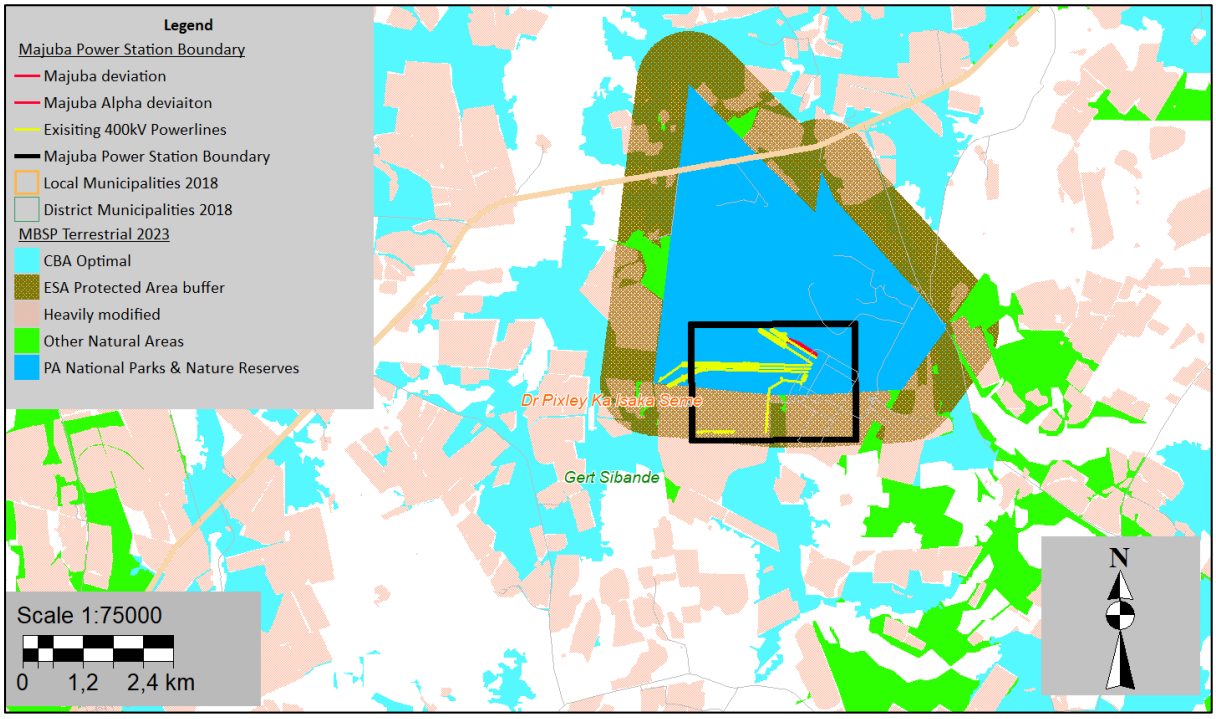

Figure 6. A map indicating the Mpumalanga Biodiversity Sector Plan categories in relation to the project site

7 REGIONAL VEGETATION

The project site falls within the Grassland biome (**Figure 7**) and this Biome has a high biodiversity, ranked only below the Fynbos biome in terms of biodiversity in South Africa (Driver *et al*. 2004). This Biome is found mainly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal Province and the Eastern Cape Province. Grasslands are

dominated by a single layer of grasses. Trees are absent, except in a few localised habitats and geophytes are often abundant (Low and Rebelo, 1996).

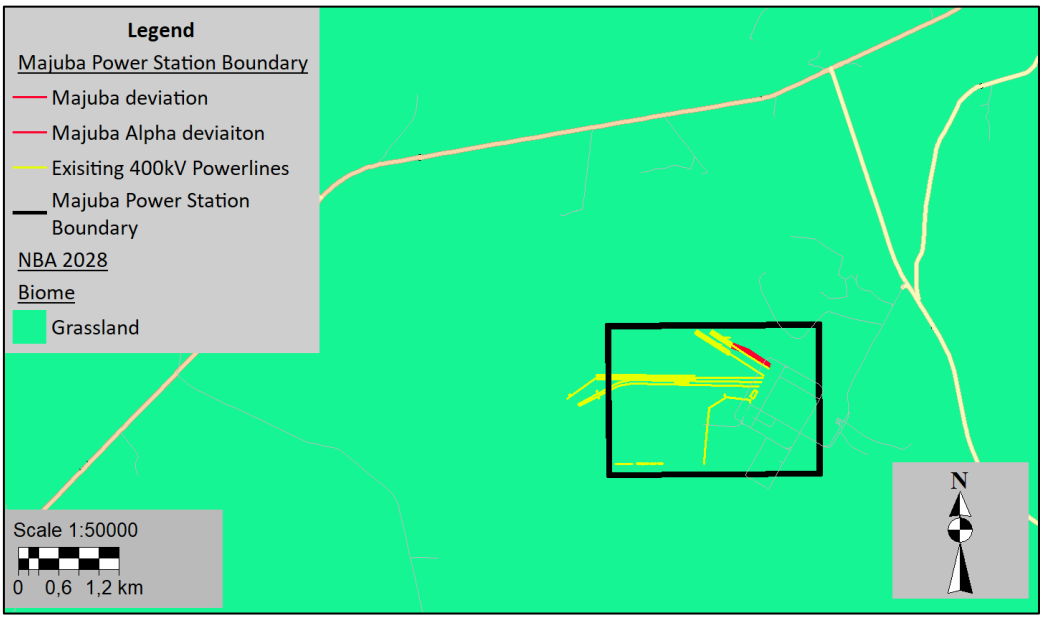

Figure 7. Biome in relation to the project site

SANBI (2018) classified the project site as falling entirely within the Amersfoort Highveld Clay Grassland vegetation type, as indicated in **Figure 6**.

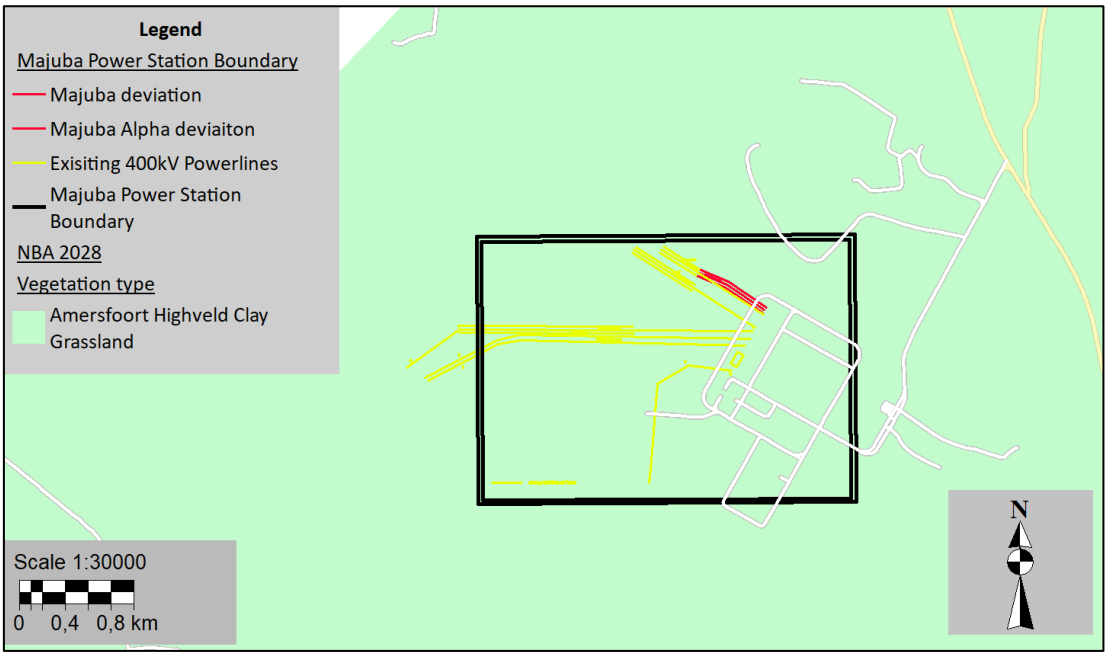

Figure 8. Vegetation type in relation to the project site

The description of the vegetation type follows below:

7.1 Amersfoort Highveld Clay Grassland

This vegetation type is found in Mpumalanga and KwaZulu-Natal Provinces. This unit extends in a north-south band from just south of Ermelo, down through Amersfoort to the Memel area in south. It comprises of undulating grassland plains, with small scattered patches of dolerite outcrops in areas. The vegetation is comprised of a short-closed grassland cover, largely dominated by a dense *Themeda triandra* sward, often severely grazed to form a short lawn.

According to Mucina and Rutherford (2006), the Important Taxa includes:

Graminoids *Andropogon appendiculatus (d), Brachiaria serrata (d), Digitaria monodactyla (d), D. tricholaenoides (d), Elionurus muticus (d), Eragrostis capensis (d), E. chloromelas (d), E. plana (d), E. racemosa (d), Harpochloa falx (d), Heteropogon contortus (d), Microchloa caffra (d), Panicum natalense (d), Setaria nigrirostris (d), S. sphacelata (d), Themeda triandra (d), Trichoneura grandiglumis (d), Tristachya leucothrix (d), Abildgaardia ovata, Andropogon schirensis, Aristida bipartita, A. congesta, A. junciformis* subsp*. galpinii, A. stipitata subsp. graciliflora, Bulbostylis contexta, Chloris virgata, Cymbopogon caesius, C. pospischilii, Cynodon dactylon, Digitaria diagonalis, D. ternata, Diheteropogon amplectens, Eragrostis curvula, Koeleria capensis, Panicum coloratum, Setaria incrassata.*

Herbs: *Berkheya setifera (d), Vernonia natalensis, V. oligocephala (d), Acalypha peduncularis, A. wilmsii, Berkheya insignis, B. pinnatifida, Crabbea acaulis, Cynoglossum hispidum, Dicoma anomala, Haplocarpha scaposa, Helichrysum caespititium, H. rugulosum, Hermannia coccocarpa, H. depressa, H. transvaalensis, Ipomoea crassipes, I. oblongata, Jamesbrittenia silenoides, Pelargonium luridum, Pentanisia prunelloides subsp. latifolia, Peucedanum magalismontanum, Pseudognaphalium luteo-album, Rhynchosia effusa, Salvia repens, Schistostephium crataegifolium, Sonchus nanus, Wahlenbergia undulata.*

Herbaceous climber: *Rhynchosia totta.*

Geophytic Herbs: *Boophone disticha, Eucomis autumnalis subsp. clavata, Hypoxis villosa var. obliqua, Zantedeschia albomaculata subsp. macrocarpa*

Tall Shrubs: *Diospyros austro-africana, D. lycioides* subsp*. guerkei.*

Low shrubs: *Anthospermum rigidum* subsp*. pumilum (d), Helichrysum melanacme (d), Chaetacanthus costatus, Euphorbia striata* var*. cuspidata, Gnidia burchellii, G. capitata, Polygala uncinata, Rhus discolor*

Succulent shrubs: *Euphorbia clavarioides* var*. truncata*

The vegetation type is listed as **Vulnerable**, with a national conservation target of 27% but none is protected. Some 25% of unit is transformed, predominantly by cultivation (22%). The

area is not suited to afforestation. Silver and black wattle (*Acacia* species), and *Salix babylonica* invade drainage areas (Mucina and Rutherford, 2006).

8 THREATENED TERRESTRIAL ECOSYSTEMS

In terms of section 52(1) (a), of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), a national list of ecosystems that are threatened and in need of protection was gazetted on 9 December 2011 (Government Notice 1002 (Driver *et al.* 2004). The list classified all threatened or protected ecosystems in South Africa in terms of four categories; Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or Protected. The purpose of categorising these ecosystems is to prioritise conservation areas in order to reduce the rates of ecosystem and species extinction, as well as preventing further degradation and loss of structure, function, and composition of these ecosystems.

It is estimated that threatened ecosystems make up 9.5% of South Africa, with critically endangered and endangered ecosystems accounting for 2.7%, and vulnerable ecosystems 6.8% of the land area. It is therefore vital that Threatened Terrestrial Ecosystems inform proactive and reactive conservation and planning tools, such as Biodiversity Sector Plans, municipal Strategic Environmental Assessments (SEAs) and Environmental Management Frameworks (EMFs), Environmental Impact Assessments (EIAs) and other environmental applications (Mucina *et al*. 2006).

'Ecosystem protection level' is an indicator of how adequately an ecosystem is protected or not. Ecosystems can be classified as not protected, poorly protected, moderately protected or well protected depending on the proportion of each ecosystem that is under conservation management within a protected area, as recognized in the National Environmental Management: Protected Areas Act (Act 57 of 2003) –these protected areas include state or privately-owned protected areas as well a land under biodiversity stewardship agreements.

According to South African National Biodiversity Institute & Department of Forestry, Fisheries and the Environment (2021), there are remnants of the *Least concern* Amersfoort Highveld Clay Grassland terrestrial threatened ecosystem/vegetation type within the proposed development site (**Figures 9 and 10**). However, according to the Skowno *et al.* (2019), this ecosystem/vegetation type is listed as **Poorly Protected (PP)** on a national scale. According to the Driver *et al.,* (2012), an ecosystem is considered "not protected" if under 5% of its biodiversity target is met within protected areas, "poorly protected" if 5% to 49% of its target is met in protected areas, and "moderately protected" if 50% to 99% of its target is met. If more than 100% of the target is met in protected areas, it is considered "well protected".

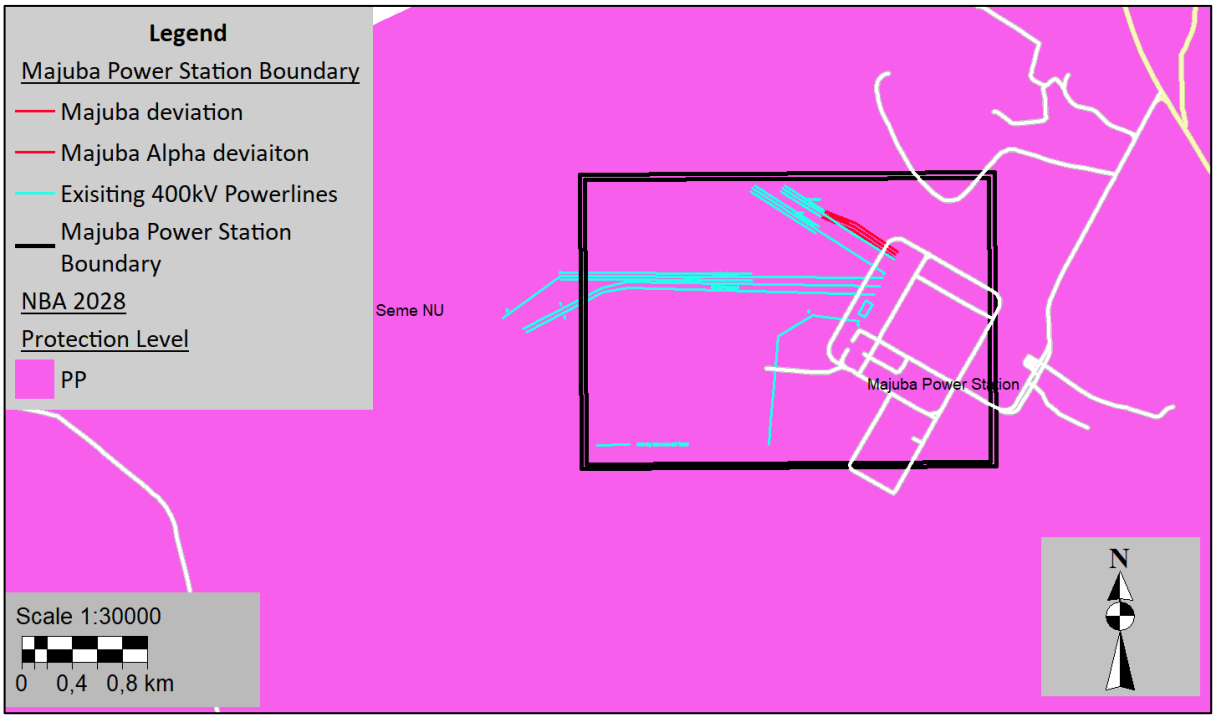

Figure 9. Protection Level of the threatened ecosystem within the project site

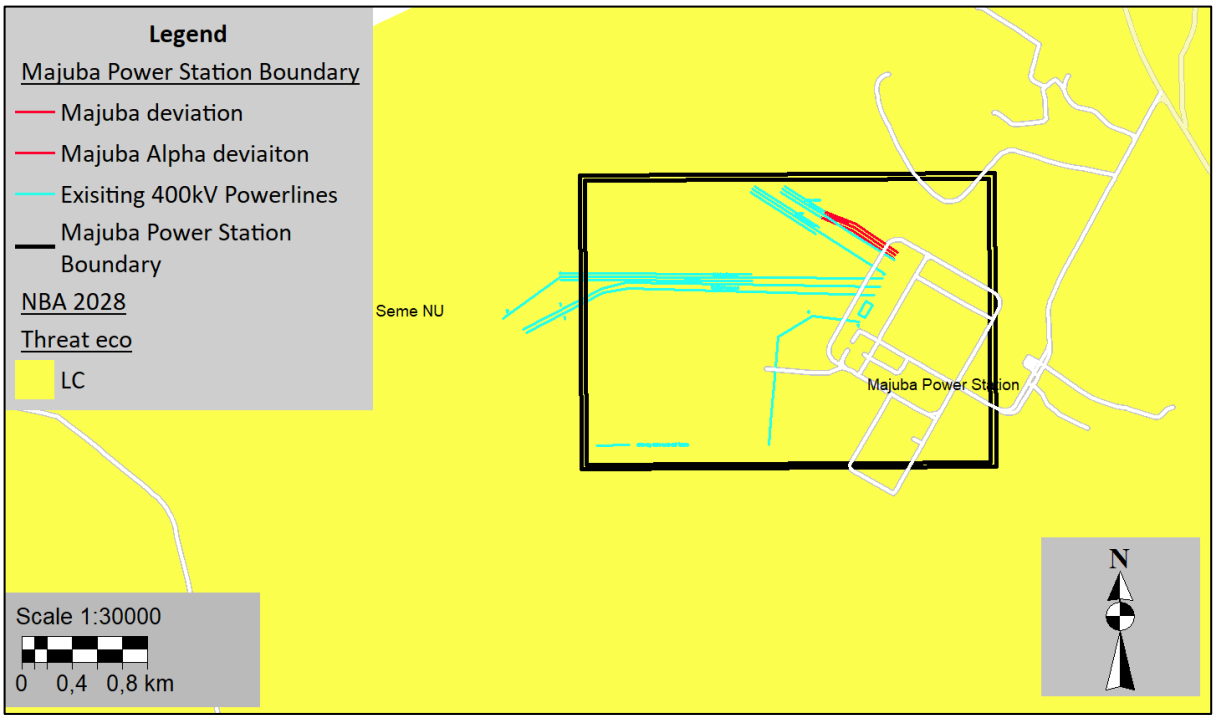

Figure 10. Threatened status within the project area

9 PROTECTED AND CONSERVATION AREAS

The aim of the National Environmental Management: Protected Areas Act (Act No. 57 of 2003) is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural seascapes. The purpose of a Protected Environment is amongst others to protect a specific ecosystem outside a special Nature Reserve World Heritage site or Nature Reserve and also to ensure the use of the natural resources in the area is sustainable.

The proposed development site falls within the Majuba Nature Reserve (SAPAD, 2023) (**Figures 11 and 12**). This Nature Reserve is declared for the protection of Sungazer Lizard (*Smaug giganteus*).

According to National Protected Areas Expansion Strategy (NPAES) (DEA, 2016), its goal is to achieve cost-effective protected area expansion for ecological sustainability and increased resilience to climate change. It sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion. The project area is situated in an area earmarked as a Priority Focus Area in terms of Protected area expansion (**Figure 13**).

Figure 11. An entrance and signage of Majuba Nature Reserve

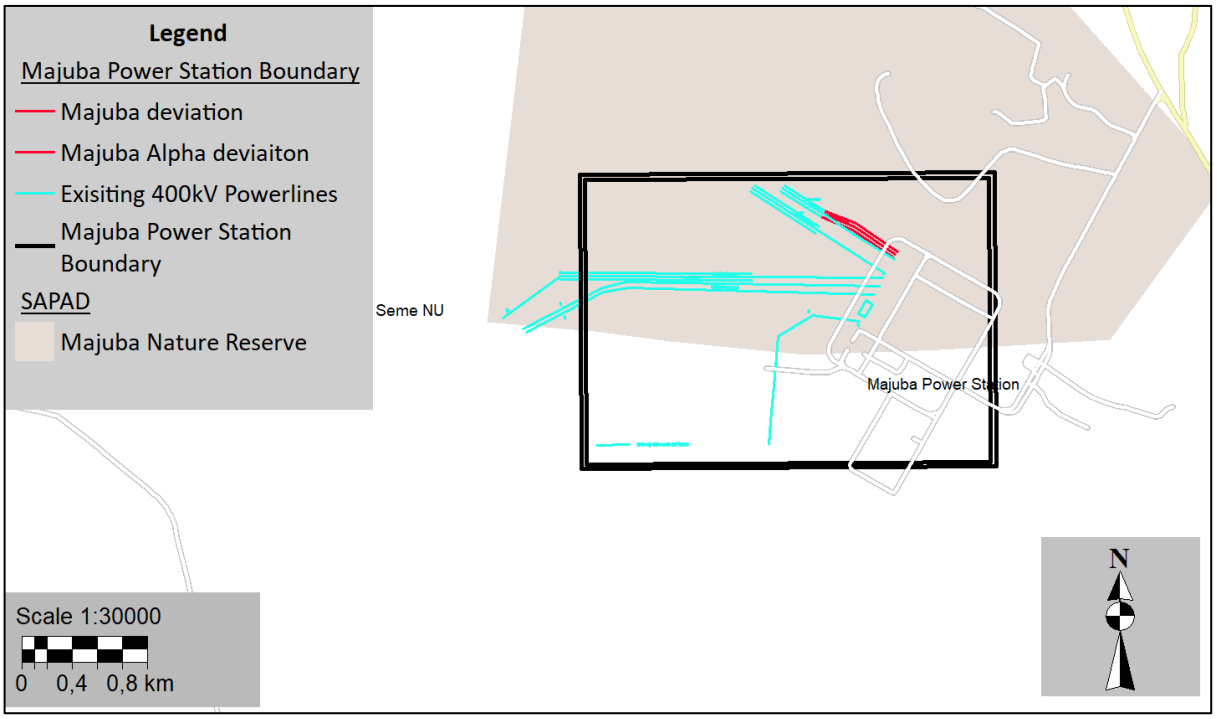

Figure 12. Majuba Nature Reserve in relation to the project site

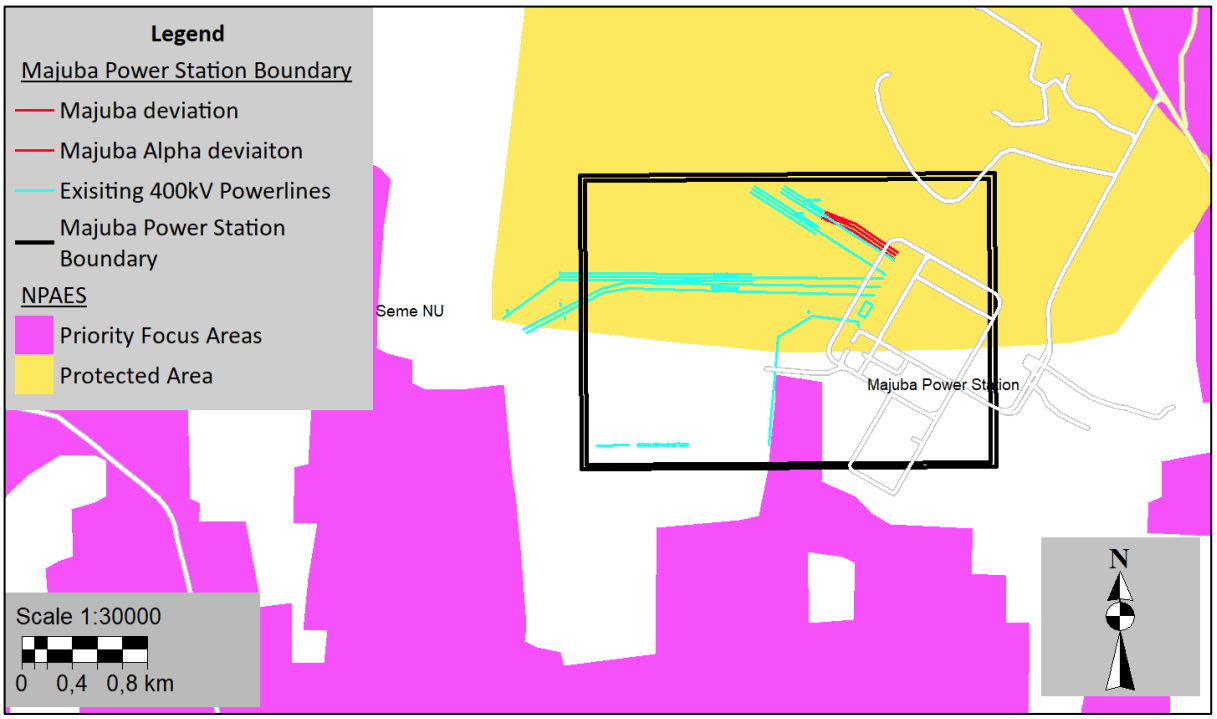

Figure 13. NPAES Priority Focus Areas in relation to the project site

10 NATIONAL FRESHWATER ECOSYSTEM PRIORITY AREAS

The National Freshwater Ecosystem Priority Areas (NFEPA) project aims to:

1. Identify Freshwater Ecosystem Priority Areas (FEPAs) to meet national biodiversity goals for freshwater ecosystems; and
2. Develop a basis for enabling effective implementation of measures to protect FEPAs, including free-flowing rivers (Nel *et al*. 2011).

In order to conserve aquatic ecosystems, South Africa has categorised its river systems according to set ecological criteria (i.e., ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver *et al*. 2011). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act (NEM:BA) biodiversity goals. River FEPAs are sub-quaternary catchments with good condition rivers (A or B Ecological Category) that achieve biodiversity targets for ecosystems and threatened or near-threatened fish species. These rivers should remain in good condition to contribute to the biodiversity targets for the country (Nel *et al*. 2011). All streams, rivers, wetlands are deemed legally sensitive environments in terms of National Water Act (NWA) and National Environmental Management Act (NEMA) and are automatically regarded as highly sensitive areas where they provide ecological connectivity and have at least remnant natural vegetation.

The proposed development site does not fall within any of the NFEPA rivers and wetlands (**Figure 14**).

Figure 14. NFEPA wetlands within the project site

11 RESULTS AND DISCUSSION

11.1 Flora

11.1.1 Desktop study results

According to the information obtained from the Mpumalanga Tourism and Parks Agency (MTPA) (**Table 2**) and the Plants of Southern Africa (POSA, 2024), plant Species of Conservation Concern have been recorded in QDS 2729BA and 2729BB and are known to occur on or near the project area, are indicated in **Table 3** below. The definitions of the conservation status are provided in **Table 3**.

Table 2. Red listed plant species which could potentially occur within the project area (MTPA)

Farm Name/Area	Scientific name	Common Name	Conservation status		Endemic
			RSA	MTPA	
Amersfoort Town and Townlands	*Boophone disticha*	Century plant	LC	LC	NOT
	Hypoxis hemerocallidea	African potato	LC	LC	NOT

Farm Name/Area	Scientific name	Common Name	Conservation status		Endemic
			RSA	MTPA	
	Crinum bulbispermum	Orange river lily	Declining	Declining	FSA
	Gladiolus robertsoniae	Gladiolus robertsoniae	NT	NT	SA
Bergvliet 65 HS	*Eucomis autumnalis*	Autumn pineapple flower	Declining	Declining	FSA
Enon 61 HS	*Boophone disticha*	Century plant	LC	LC	NOT
	Eucomis autumnalis	Autumn pineapple flower	Declining	Declining	FSA
Oudehout kloof 86 HS	*Nerine platypetala*	Cape Flower	VU	VU	SA

Note: LC=Least Concern; NT=Near Threatened; VU=Vulnerable

Table 3. Red data plant species potentially occurring on the project area (POSA)

Family	Taxon	Conservation status	Endemism	Suitable habitat
Asphodelaceae	*Kniphofia typhoides*	Near Threatened	South African endemic	Low lying wetlands and seasonally wet areas in climax *Themeda triandra* grasslands on heavy black clay soils, tends to disappear from degraded grasslands.
Amaryllidaceae	*Nerine platypetala*	Vulnerable	South African endemic	Montane grassland, margins of permanently moist vleis and levees of river banks.

Table 4. Definitions of Red Data status (Raimondo *et al.* 1999)

Symbol	Status	Description
VU	Vulnerable	A taxon is **Vulnerable** when the best available evidence indicates that it meets any of the five International Union for Conservation of Nature (IUCN) criteria for Vulnerable and it is therefore considered to be facing a high risk of extinction in the wild.
NT	Near Threatened	A taxon is **Near Threatened** when available evidence indicates that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future.
LC	Least Concern	A species is **Least Concern** when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.

11.1.2 Plant species recorded on the study area

The anthropogenic activities taking place within the Majuba Power Station entails the existing ash disposal facilities, existing cooling towers, pollution control dams and associated infrastructure such as internal roads and buildings. The expansion of the 400kv Eskom Majuba is within the Majuba power station site (**Figure 15**). Therefore, limited natural vegetation remains inside the Power station, and dominated by alien invasive plant species and weeds. During the field survey, no threatened plant species or protected trees or provincial protected plants were observed within the study area. However, should any plant species of conservation concern be found during construction activities, a search and rescue plan should be developed and suitable habitat for translocation exists within the Nature Reserve. A list of plant species recorded on the study area are listed in **Table 5** below.

Figure 15. The proposed Expansion of the 400kv Eskom Majuba substation site

Table 5. Plant species recorded within the study area

Family	Scientific Name	Common Name	Ecological/Conservation status	Form
Amaranthaceae	*Alternanthera pungens*	Khakhiweed	Weed	Herb
Poaceae	*Aristida congesta* subsp. *congesta*	Buffalo Grass	Least concern	Grass
Poaceae	*Aristida junciformis*	Ngongoni three-awn	Least concern	Grass
Asteraceae	*Berkheya setifera*	Buffalo-tongue	Least concern	Herb
Asteraceae	*Berkheya rigida*	Disseldoring	Least concern	Herb
Asteraceae	*Berkheya pinnatifida* subsp. *ingrata*	Isihlungu	Least concern	Herb
Asteraceae	*Bidens formosa*	Cosmos	Weed	Herb
Asteraceae	*Bidens pilosa*	Common Black-jack	Weed	Herb
Asteraceae	*Cirsium vulgare*	Scotch Thistle	Category 1b AIS	Herb
Chenopodiaceae	*Chenopodium album*	Common lambsquarters	Weed	Herb
Poaceae	*Chloris virgata*	Feather-top chloris	Least concern	Grass
Asteraceae	*Erigeron* (*Conyza*) *bonariensis*	Flaxleaf fleaban	Least concern	Herb
Poaceae	*Cynodon dactylon*	Couch Grass	Least concern	Grass
Solanaceae	*Datura stramonium*	Jimson weed	Category 1b AIS	Herb
Poaceae	*Digitaria eriantha*	Common Finger Grass	Least concern	Grass
Poaceae	*Eragrostis curvula*	Weeping love grass	Least concern	Grass
Poaceae	*Eragrostis plana*	Fan Love Grass	Least concern	Grass
Poaceae	*Eragrostis superba*	Saw-tooth love grass	Least concern	Grass
Asteraceae	*Erigeron* (*Conyza*) *bonariensis*	Hairy fleabane	Least concern	Herb
Paoceae	*Festuca myuros*	Rattail Sixweeks Grass	Least concern	Grass
Apocynaceae	*Gomphocarpus physocarpus*	Balloon milkweed	Least concern/Medicinal	Shrub
Poaceae	*Hyparrhenia hirta*	Common Thatching Grass	Least concern	Grass
Asteraceae	*Hypochaeris radicata*	Hairy wild lettuce	Least concern	Herb
Convolvulaceae	*Ipomoea oblongata*	Boqo morning glory	Least concern	Herb
Poaceae	*Paspalum dilatatum*	Dallas grass	Least concern	Grass
Lamiaceae	*Salvia repens*	Creeping Sage	Least concern	Herb

Family	Scientific Name	Common Name	Ecological/Conservation status	Form
Cyperaceae	*Schoenoplectus corymbosus*	Common Sedge	Least concern	Sedge
Asteraceae	*Senecio inornatus*	Swamp Ragwort	Least concern	Herb
Asteraceae	*Seriphium plumosum*	Silver stoebe	Least concern	Shrub
Poaceae	*Setaria sphacelata* var. *sphacelata*	Common Bristle Grass	Least concern	Grass
Solanaceae	*Solanum sisymbriifolium*	Dense-thorned bitter apple	Category 1b AIS	Herb
Poaceae	*Sporobolus africanus*	Ratstail Dropseed	Least concern	Grass
Asteraceae	*Tagetes minuta*	Tall Khaki Weed	Weed	Herb
Poaceae	*Themeda triandra*	Red grass	Least concern	Grass
Typhaceae	*Typha capensis*	Bulrush	Least concern	Aquatic Herb
Fabaceae	*Verbena brasiliensis*	Brazilian verbena	Category 1b AIS	Herb
Verbenaceae	*Verbena bonariensis*	Tall Verbena	Category 1b AIS	Herb
Verbenaceae	*Verbena rigida*	Slender Vervain	Category 1b AIS	Herb
Campanulaceae	*Wahlenbergia undulata*	African Blue Bell	Least concern	Herb

Note: AIS=Alien Invasive Species

11.1.3 Threatened Species and Species of Conservation Concern on site

According to the South African Red data list categories done by SANBI (**Figure 16**), **threatened species** are species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered, Endangered or Vulnerable is a threatened species whereas **Species of Conservation Concern** (SCC) are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient - Insufficient Information (DDD).

During the field survey, no threatened plant species or protected trees or provincial protected plants were observed within the study area.

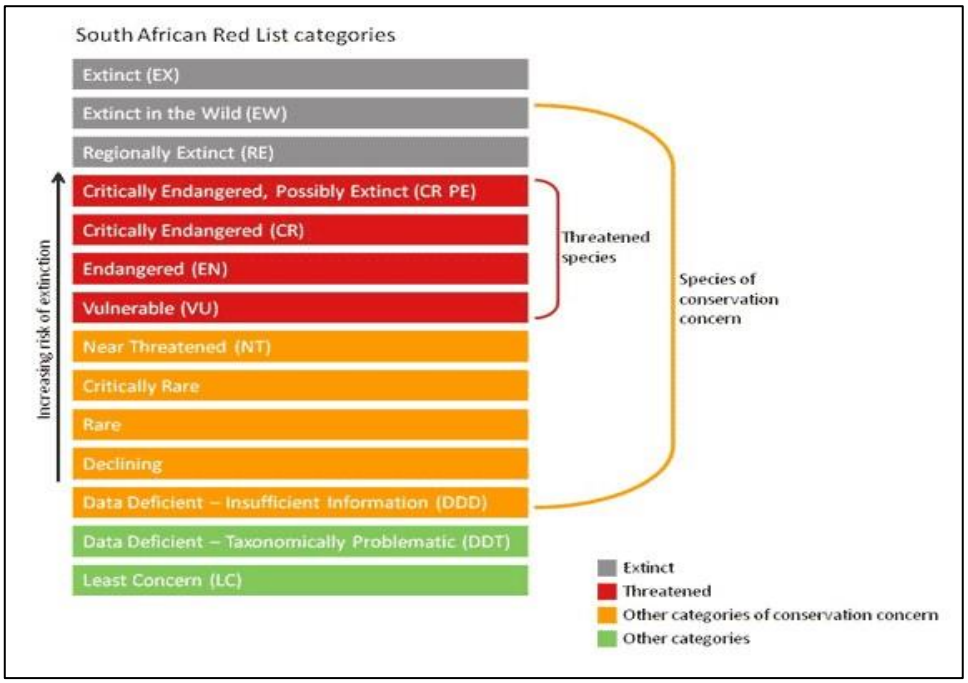

Figure 16. South African Red Data list categories

11.1.4 Alien invasive plant species recorded on the study area

Alien invader plant species (AIS) are species of exotic origin that typically invade undeveloped or disturbed areas (Bromilow, 2010). AIS pose a threat to ecosystems because by nature they grow fast, reproduce quickly and have high dispersal abilities allowing them to replace indigenous species (Henderson, 2001).

Alien invasive plant species on the study area (**Table 5**) were observed to occur in clumps, scattered distributions or as single individuals. Invader and weed species on site must be controlled to prevent further infestation and it is recommended that all individuals of invader and weeds species (especially Category 1b) must be removed and eradicated.

Alien plant species such as *Cirsium vulgare* (**Figure 17**) and *Solanum sisymbriifolium* (**Figure 18**) were recorded in abundance within the study area.

Figure 17. *Cirsium vulgare* recorded on the study area

Figure 18. *Solanum sisymbriifolium* recorded on the study area

11.1.5 Potential occurrence of Red Data plant species

Data sourced from SANBI website (BODATSA) and MTPA indicates there are plant species on the Red Data List that are known to occur in or on areas surrounding the project area. The probability of occurrence is based on suitable habitat and known distribution ranges. The plant species and their probability of occurrence are indicated in **Table 6** below. Only plant species which have higher probability to occur on the study area are shown in the table below.

Table 6. Probability of Occurrence of Red Data plant species which could be found on the project area

Taxon	Conservation status	Suitable habitat	Probability of Occurrence
Kniphofia typhoides	Near Threatened	Low lying wetlands and seasonally wet areas in climax *Themeda triandra* grasslands on heavy black clay soils, tends to disappear from degraded grasslands.	Low
Nerine platypetala	Vulnerable	Montane grassland, margins of permanently moist vleis and levees of river banks.	Low
Boophone disticha	Least Concern	It is widely distributed in all provinces of South Africa and into tropical Africa. It occurs in dry grassland and on rocky slopes	Low-Medium

Taxon	Conservation status	Suitable habitat	Probability of Occurrence
		and occurs mainly in summer rainfall regions.	
Hypoxis hemerocallidea	Least Concern	It occurs in open grassland and woodland and is widespread in South Africa in the eastern summer rainfall provinces (Eastern Cape, Free State, KwaZulu-Natal, Mpumalanga, Gauteng and Limpopo). It also occurs in Botswana, Lesotho and Swaziland.	High
Crinum bulbispermum	Declining	Although this plant is widespread, it occurs naturally mainly on the highveld areas of the eastern hinterland wherever conditions allow. In nature it grows along stream banks and in swampy grasslands that usually dry out during the winter months when these plants are dormant.	Low-Medium
Gladiolus robertsoniae	Near Threatened	Occurs in moist highveld grasslands, found in wet, rocky sites, mostly dolerite outcrops, wedged in rock crevices.	Low
Eucomis autumnalis	Declining	It occurs in damp, open grassland and sheltered places from the coast to 2450 m.	Medium

11.2 Fauna

11.2.1 Mammals

11.2.1.1 Desktop survey results

The potential mammal species that could be found on the study area are those which have been recorded in MTPA database (**Table 7**), the grid cells 2729BA and 2729BB (ADU, 2024) (**Table 8**), DFFE Screening report, and also from distributions based on records documented in Skinner and Chimimba (2005), Monadjem *et al*., (2010) and Stuart & Stuart (2013). Conservation status assessments for each species were obtained from Child *et al*. (2016).

Table 7. Red Data Mammal species potentially occurring on the project area (MTPA)

Farm Name/Area	Scientific name	Common Name	Conservation status	
			RSA	MTPA
Koppies kraal 56 HS	*Ourebia ourebi ourebi*	Oribi	EN	EN
Roodekopjes 67 HS	*Aonyx capensis*	Cape clawless otter	NT	NT
	Leptailurus serval	Serval	NT	NT
	Orycteropus afer	Aardvark	LC	LC
	Proteles cristatus	Aardwolf	LC	LC

Table 8. Red Data Mammal species potentially occurring on the project area (ADU and DFFE Screening report)

Family	Scientific name	Common name	Red list category
Chrysochloridae	*Chrysospalax villosus*	Rough-haired Golden Mole	Vulnerable
Felidae	*Leptailurus serval*	Serval	Near Threatened
Muridae	*Otomys auratus*	Southern African Vlei Rat (Grassland type)	Near Threatened
Mustelidae	*Aonyx capensis*	African Clawless Otter	Near Threatened (2016)
Mustelidae	*Hydrictis maculicollis*	Spotted-necked Otter	Vulnerable

11.2.1.2 Mammals recorded on the study area

Table 9 below indicates seven mammal species observed within the project area. All these mammal species were recorded within the Majuba Nature Reserve. No mammal SCC were recorded during the survey. Continual habitat destruction, alteration and human disturbances result in the disappearance of the sensitive or secretive mammal species in the reserve. Therefore, in order to mitigate the impacts of the development within the reserve, the construction personnel must be trained to recognise threatened animal species, which will then reduce the probability of fauna being harmed unnecessarily and the contractor must

ensure that no faunal species are disturbed, trapped, hunted or killed during the pre-and construction phases.

Table 9. Mammal species recorded on the project area

Scientific name	English name	Conservation Status
Cynictis penicillata	Yellow Mongoose	Least concern
Hystrix africaeaustralis	Porcupine	Least concern
Lepus saxatilis	Scrub Hare	Least concern
Canis mesomelas	Black-backed Jackal	Least concern
Damaliscus pygargus phillipsi	Blesbok (**Figure 19**)	Least concern
Kobus ellipsiprymnus	Waterbuck (**Figure 20**)	Least concern
Connochaetes taurinus	Blue Wildebeest	Least concern

Figure 19. Blesbok recorded on the study area

Figure 20. Waterbuck recorded on the study area

11.2.1.3 Potential occurrence of Red Data mammal species

The desktop assessment indicated that there are Red listed mammal species which are known to occur in the general vicinity of the project site. **Table 10** below indicates these animals' preferred habitat together with their probability of occurrence on the study area. The probability of occurrence was based on the consideration of the following factors:

- Known distribution;
- Overall abundance of a species;
- Availability of suitable habitat on the study area;
- Availability of prey items on the study area and surrounding areas;
- Level of anthropogenic disturbance; and
- Species tolerance to anthropogenic disturbance.

Table 10. Probability of Occurrence of Red Data mammal species which could be found within the project area

Common name	Red list category	Suitable habitat	Probability of occurrence
Rough-haired Golden Mole	Vulnerable	Found on sandy soils in grasslands, meadows and along edges of marshes in Savanna and Grassland biomes of South Africa. Recorded from gardens and parklands, also found in dense stands of Kikuyu grass (*Pennisetum clandestinum*) and marginally on golf courses adjoining natural grasslands.	Medium
Southern African Vlei Rat (Grassland type)	Near Threatened	This species is associated with mesic grasslands and wetlands within alpine, montane and sub-montane regions, typically occurring in dense vegetation in close proximity to water	Medium
African Clawless Otter	Near Threatened (2016)	Cape Clawless Otters are predominantly aquatic and seldom found far from permanent water. Fresh water is an essential habitat requirement, not only for drinking but also for rinsing their fur. Generally, they will only occur in marine habitats provided there is access to fresh water (coastal rivers or estuaries) and rocky shores are preferred for foraging, and otter activity is often found near thick vegetation, abundant food supply and fresh water. Cape Clawless Otters have been found in towns and cities, and can occupy rivers with high pollution and eutrophication levels. In a river ecosystem, otters selected habitat characterised by reed beds, boulders and overhanging vegetation. It has also been found that Cape Clawless Otter activity is usually associated with natural riverine habitat, particularly with rocks covered with dense vegetation and large areas of undisturbed long grasses and dense bushes.	Low
Spotted-necked Otter	Vulnerable	potted-necked Otters are thought to inhabit freshwater habitats where water is not silt-laden, and is unpolluted, and rich in small fishes. However, anecdotal observations suggest they can occur, and can be common, in relatively polluted rivers, such as the Braamfonteinspruit, Jukskei River and Blesbokspruit, Gauteng Province	Low
Oribi	Endangered	Oribi inhabit savannah woodlands, floodplains and other open grasslands, from around sea level to about 2,200 (Mpumalanga Province). They reach their highest density on floodplains and moist tropical grasslands, especially in association with large grazers. They prefer open grassland in good condition	Low

Common name	Red list category	Suitable habitat	Probability of occurrence
		containing a mosaic of both short grass for feeding and long grass for feeding and shelter. However, within these grasslands they avoid feeding within and close to woodland patches even if these patches are small. Within grasslands, they are selective feeders that focus primarily on green leaves and thus maintain high quality intake year-round. For example, they have been found to select patches of *Themeda triandra* grass. Grass makes up most of their diet, with only a minor intake of forbs recorded during the wet season. Key grass species include, *Themeda triandra, Hyparrhenia hirta, Panicum natalense and Andropogon chinensis*	
Serval	Near Threatened	Servals are mostly found in and around marshland, well-watered savannah and long-grass environments, and are particularly associated with reed-beds and other riparian vegetation types. Key vegetation types are thus wetlands, grasslands (with a preference for long, rank grass), and indigenous vegetation that can provide cover and allow dispersal. These can be natural or man-made, although more research needs to be done on the ideal configuration of the latter wetlands	High
Aardvark	Least Concern	Aardvarks occur in a broad range of habitats, including the semi-arid Karoo areas of southern Africa, grasslands, all savannah types, rainforests, woodlands and thickets. They are well-adapted for multiple habitats, including arid regions, as long as sufficient prey is available. They are absent from hyper-arid habitats and avoid very rocky terrain that is difficult to dig in.	Low
Aardwolf	Least Concern	Open, grassy plains constitute the prime habitat of this species. The Aardwolf is entirely absent from forests or pure desert. However, in southern Africa it occupies diverse habitats, ranging from the karroid habitats of the Western Cape and Eastern Cape, the grasslands and scrub of Botswana, the open savannah woodlands of Zimbabwe, to the inland gravel plains of the Namib Desert in Namibia. Throughout their distribution, Aardwolves have been recorded to feed primarily on nasute harvester termites (genus Trinervitermes) and, in any particular region, mainly on one species. They are largely independent of water, obtaining their moisture requirements from termites	Low

11.2.2 Avifauna

11.2.2.1 Desktop survey results

The Important Bird and Biodiversity Areas (IBA) Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that are globally threatened, have a restricted range and are restricted to specific biomes (Barnes, 1998). As shown in **Figure 21**, the southern section of the Majuba Power Station falls within the Grasslands IBA, whereas the proposed repositioning of the towers does not fall within any of the IBAs. This IBA is large area and is centred on the towns of Volksrust, Wakkerstroom and Memel. The southern boundary of the IBA extends to Newcastle and Utrecht, the northern boundary to Amersfoort and the western boundary to about 10 km east of Vrede. The area comprises gentle rolling hills on the South African plateau at an altitude of 1 700–1 800 m a.s.l. The hills are regularly interrupted by parts of the Mpumalanga Drakensberg escarpment, small ranges such as Gemsbokberg (2 095 m a.s.l.), Versamelberg (2 139 m a.s.l.). The area covers several catchments and holds many perennial rivers and wetlands. Five of these wetlands are of international importance and deserve the highest possible conservation attention, namely Wakkerstroom Vlei (27° 22′ S; 30° 07′ E), Seekoeivlei Nature Reserve (27° 35′ S; 29° 35′ E), Heyshope Dam (27° 00′ S; 30° 30′ E), Vanger Natural Heritage Site (27° 52′ S; 29°40′ E) and Blood River Vlei (27° 47′ S; 30° 35′ E). This IBA holds a significant proportion of the small population of the globally endangered White-winged Flufftail (*Sarothrura ayresi*), and various wetland systems hold large numbers of Little Bittern (*Ixobrychus minutus*), Baillon's Crake (*Porzana pusilla*), Red-chested Flufftail (*Sarothrura rufa*) and African Rail (*Rallus caerulescens*), as well as several breeding populations of African Marsh Harrier (*Circus ranivorus*), Grey Crowned Crane (*Balearica regulorum*) and African Grass Owl (*Tyto capensis*) (https://www.birdlife.org.za/iba-directory/grasslands/).

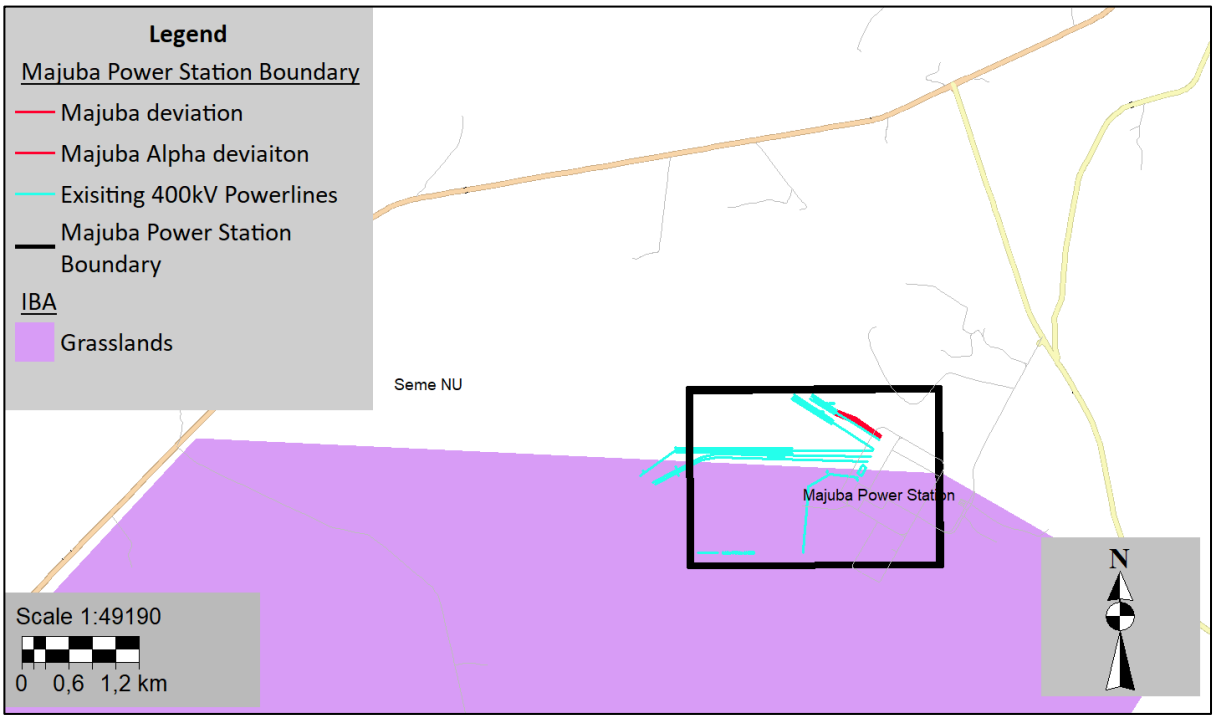

Figure 21. *Grasslands* IBA in relation to the project site

The online database of the Southern African Bird Atlas Project (SABAP2), DFFE Screening report and MTPA were queried for a list of bird species confirmed to occur in the relevant pentads (mapping units) that the project area is located in, namely 2729BA and 2729BB. Taylor *et al*. (2015) was consulted for the most current conservation status of each Species of Conservation Concern on the list.

The list of bird species of conservation importance that are expected to occur in the quarter degree square is indicated in **Table 11**.

Table 11. Red listed bird species which could potentially occur on the project area (MTPA)

Farm Name/Area	Common Name	Scientific name	Conservation status		Endemism
			RSA	MTPA	
Mezig 79 HS	Botha's Lark	*Spizocorys fringillaris*	EN	EN	RSA
Paardekop 76 HS	African Grass-Owl	*Tyto capensis*	VU	VU	
Roodewal 102 HS	White-bellied Korhaan (Barrows)	*Eupodotis senegalensis*	VU	VU	RSA
Slangfontein 69 HS	Blue Crane	*Anthropoides paradiseus*	NT	VU	
	Blue Korhaan	*Eupodotis caerulescens*	LC	NT	RSA

Farm Name/Area	Common Name	Scientific name	Conservation status		Endemism
			RSA	MTPA	
	Southern Bald Ibis	*Geronticus calvus*	VU	VU	RSA
Zwartkop 103 HS	Southern Bald Ibis	*Geronticus calvus*	VU	VU	RSA
Amersfoort town and Townlands 57 HS	Southern Bald Ibis	*Geronticus calvus*	VU	VU	RSA
Bergvliet 65 HS	Blue Crane	*Anthropoides paradiseus*	NT	VU	
	Blue Korhaan	*Eupodotis caerulescens*	LC	NT	RSA
	Secretarybird	*Sagittarius serpentarius*	VU	VU	
	Southern Bald Ibis	*Geronticus calvus*	VU	VU	RSA
Elandsfontein 92 HS	Rudd's Lark	*Heteromirafra ruddi*	EN	EN	RSA
Elandspoort 85 HS	Blue Korhaan	*Eupodotis caerulescens*	LC	NT	RSA
Enon 61 HS	Blue Crane	*Anthropoides paradiseus*	NT	VU	
	Blue Korhaan	*Eupodotis caerulescens*	LC	NT	RSA
	Bothas Lark	*Spizocorys fringillaris*	EN	EN	RSA
	Grey Crowned Crane	*Balearica regulorum*	EN	EN	
Langberg 85 HT	Blue Korhaan	*Eupodotis caerulescens*	LC	NT	RSA
Oudehout kloof 86 HS	Blue Korhaan	*Eupodotis caerulescens*	LC	NT	RSA
Ouhoutkraal 62 HS	Blue Korhaan	*Eupodotis caerulescens*	LC	NT	RSA
	Bothas Lark	*Spizocorys fringillaris*	EN	EN	RSA
Palmietfontein 64 HS	Blue Korhaan	*Eupodotis caerulescens*	LC	NT	RSA
	Grey Crowned Crane	*Balearica regulorum*	EN	EN	
Palmietspruit 68 HS	Denhams Bustard	*Neotis denhami*	VU	VU	
Rietpoort 83 HS	Secretarybird	*Sagittarius serpentarius*	VU	VU	
Roodekopjes 67 HS	Blue Crane	*Anthropoides paradiseus*	NT	VU	
	Rudd's Lark	*Heteromirafra ruddi*	EN	EN	RSA
Schulpspruit 60 HS	Southern Bald Ibis	*Geronticus calvus*	VU	VU	RSA
SchurvepoorT 63 HS	Blue Korhaan	*Eupodotis caerulescens*	LC	NT	RSA
Sterkfontein 93 HS	Southern Bald Ibis	*Geronticus calvus*	VU	VU	RSA

Farm Name/Area	Common Name	Scientific name	Conservation status		Endemism
			RSA	MTPA	
Verkyk 88 HS	Blue Crane	*Anthropoides paradiseus*	NT	VU	
	Grey Crowned Crane	*Balearica regulorum*	EN	EN	
Vlakpoort 89 HS	Blue Korhaan	*Eupodotis caerulescens*	LC	NT	RSA
Witkoppies 81 HS	Bothas Lark	*Spizocorys fringillaris*	EN	EN	RSA
N/A	African Marsh Harrier	*Circus ranivorus*	EN	EN	
	Caspian Tern	*Sterna caspia/ Hydroprogne caspia*	VU	VU	
	Greater Flamingo	*Phoenicopterus roseus*	NT	NT	

11.2.2.2 Field work results and discussion

The project site is situated in a heavily modified and also within natural vegetation (Majuba Nature Reserve) and only three micro-habitats are found on or near the project site, namely watercourse, grasslands and exotic trees.

Wetlands are of particular importance for birds in the study area, as the area is largely urbanized, however these are very degraded as can be seen below. Water bodies represent sensitive areas because they provide habitat for a wide variety of terrestrial and aquatic species, particularly avifauna. Bird species such as herons, bishops, weavers, cisticolas and warblers will breed in the reeds growing on the banks of the dams/pans and will also feed on insects that live within the reeds. Many of these bird species make use of the thorny nature of these trees to build their nests. The open grassy/weedy river bed is rather frequently visited for very short periods of time by mainly granivorous passerines (Cape Sparrow, Speckled pigeon, Blue waxbill, Laughing Dove etc) in search of prey attracted to moisture and flowering herbs and weeds. The rivers are particularly important for stork species such as Black Stork and Yellow billed Stork and a variety of other waterbirds.

Open grasslands: Open grasslands on site represent a significant feeding area for many bird species. The grassland patches are also a favourite foraging area for game birds such as francolins, Helmeted Guineafowl and Black-shouldered Kite, etc. This in turn may attract raptors because of both the presence and accessibility of prey. Red Data Listed bird species such as Lanner Falcon, Lesser Kestrel, and Martial Eagle, may often hunt in open grassland areas.

Exotic trees often provide roosting and nesting habitat for various bird species, and as such their importance for avifauna should not be under-estimated. Exotic trees provide perching, roosting and nesting habitat for various raptor species, as well as larger birds such as

francolins, Guineafowl, Herons and Hadeda ibises. Although stands of *Eucalyptus* spp are invader species, these stands have become important refuges for certain species of raptors including Eagles and Buzzards. Birds such as Lesser Kestrel and Falcons make use of large *Eucalyptus* trees, where they roost in large numbers. Nests identified on the study area should not be unnecessarily destroyed.

Forty (40) bird species (**Table 12**) were recorded during the field survey. Species recorded were common and widespread and typical of grassland biome. No Red Data bird species associated with the study area were recorded. Some of the bird species recorded within the project site are shown in **Figures 22-28.**

Table 12. Bird species recorded on and around the study area

Common name	Scientific name	Conservation status
Cattle Egret	*Bubulcus ibis*	Least concern
Hadeda Ibis	*Bostrychia hagedash*	Least concern
African Sacred Ibis	*Threskiornis aethiopicus*	Least concern
Black-winged Kite	*Elanus caerulus*	Least concern
Swainson's Spurfowl	*Pternistis swainsonii*	Least concern
Helmeted Guineafowl	*Numida meleagris*	Least concern
Speckled Pigeon	*Columba guinea*	Least concern
Laughing Dove	*Streptopelia senegalensis*	Least concern
Common (Indian) Myna	*Acridotheres zeylonus*	Introduced species
House Sparrow	*Passer domesticus*	Least concern
Africa Stonechat	*Saxicola torquatus*	Least concern
Pied Starling	*Lamprotornis bicolor*	Least concern
Red-Breasted Swallow	*Cecropis semirufa*	Least concern
Blacksmith Lapwing (Plover)	*Vanellus armatus*	Least concern
Southern-masked Weaver	*Ploceus velannus*	Least concern
Cape Wagtail	*Motacilla capensis*	Least concern
Pied crow	*Corvus albus*	Least concern
Southern Fiscal	*Lanius collaris*	Least concern
Southern Red Bishop	*Euplectes orix*	Least concern
Common Waxbill	*Estrilda astrild*	Least concern
Long-Tailed Widowbird	*Euplectes progne*	Least concern
Egyptian Goose	*Alopochen aegyptiacus*	Least concern
Red-capped Lark	*Calandrella cinerea*	Least concern
Jackal Buzzard	*Buteo rufofuscus*	Least concern
African Pipit	*Anthus cinnamomeus*	Least concern
Greater Striped Swallow	*Cecropis cucullata*	Least concern
Pied Avocet	*Recurvirostra avosetta*	Least concern
Cape Shoveler	*Anas smithii*	Least concern
Whiskered Tern	*Chlidonias hybrida*	Least concern
Southern Pochard	*Netta erythrophthalma*	Least concern
South African Shelduck	*Tadorna cana*	Least concern
African Swamphen	*Porphyrio madagascariensis*	Least concern
Little Grebe	*Tachybaptus ruficollis*	Least concern
Common Sandpiper	*Actitis hypoleucos*	Least concern

Common name	Scientific name	Conservation status
Glossy Ibis	*Plegadis falcinellus*	Least concern
Red-Billed Teal	*Anas erythrorhyncha*	Least concern
Three-Banded Plover	*Charadrius tricollaris*	Least concern
Ant-eating Chat	*Myrmecocichla formicivora*	Least concern
Cape Longclaw/Orange-throated longclaw	*Macronyx capensis*	Least concern
Red-knobbed coot	*Fulica cristata*	Least concern

Figure 22. Black-winged Kite on site

Figure 23. Male Long-tailed widowbird on site

Figure 24. Helmeted guineafowl on site

Figure 25. Ant-eating Chat on site

Figure 26. African Sacred Ibis on site

Figure 27. Jackal Buzzard on site

Figure 28. Southern Fiscal on site

11.2.2.3 Mortality due to collisions of birds with the overhead powerlines

Although all birds have the potential to be affected by collisions, species groups most at risk of collision impacts are those with heavier bodies and relatively small wingspan, making them less movable and therefore more prone to collisions. These species groups include bustards, storks, cranes, eagles, vultures, ibises, etc. Further groups at risk are fast-flying waterfowl, especially ducks and geese and these bird species are mostly heavy-bodied species, with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines. Collisions are probably the biggest single threat posed by transmission lines to birds in southern Africa. Several factors are thought to influence birds' collisions, including the manoeuvrability of the bird, topography, weather conditions and power line configuration (Van Rooyen, 2004).

The proposed relocation of powerline could pose a limited collision threat to Red Data species. The biggest threat and also a possibility of collisions at pans, dams and wetlands which could potentially affect Ducks and Greater Flamingo and a variety of non-threatened waterbirds (Hadeda Ibis, Black-shouldered Kite, Egyptian Goose, etc).

In order to mitigate these impacts, areas where bird collisions are likely to be high could be ameliorated by marking the lines with bird devices such as "bird diverters" and "flappers" to increase the visibility of the lines.

11.2.2.4 Mortality of birds due to electrocution on the powerlines

According to van Rooyen (2004), electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components. Electrocution of birds on overhead lines is an important cause of unnatural mortality of raptors and storks.

The risk of electrocution is strongly influenced by the power line voltage and the pole structure design, which mainly affects larger, perching species such as vultures, eagles and storks, easily capable of spanning the spaces between energized components. Due to the large size of the clearances on most overhead lines of above 132kV, electrocutions are generally ruled out as even the largest birds cannot physically bridge the gap between dangerous components. Other types of electrocutions happen by means of so-called "bird streamers". This happens when a bird, especially when taking off, excretes and thereby causing a short-circuit through the fluidity excreta (Van Rooyen & Taylor, 1999). This method of electrocution is however a rare phenomenon. Most of these species (vultures, eagles, storks) are uncommon to rare in the study area and the impact is more likely to occur to other species that are prone towards roosting on the pylons such as the Black-headed Heron and Egyptian Goose. "Bird streamers" should be eliminated by fitting the poles with bird guards/spikes above the conductors.

Electrocution is possible on the relocating of 132kV power lines such as those proposed, but is largely dependent on the exact pole structure used. It should be possible to ensure that zero electrocutions take place on the overhead power line. For the purpose of this study, it is assumed that a steel monopole structure will be used and the design of the pylon is an important consideration in preventing bird electrocutions. The height of the towers should allow for unrestricted movement of terrestrial birds between successive pylons. Electrocution of large birds perched on the poles could be a risk and should be mitigated by using the Eskom Bird Perch on all pole tops on the lines. This will provide safe perching area well above the dangerous hardware. The impact of electrocution is seen as being of low significance should the steel monopole be used. The steel monopole is generally a safe design for birds and the fitment of the standard bird perch further increases this safety.

It is therefore recommended from an avifaunal perspective that a "bird friendly" pylon design be used which poses little electrocution risk.

11.2.2.5 Habitat destruction and disturbances due to powerlines

Habitat destruction and alteration will take place during the relocation of power lines, and this happens with the clearing of the site itself and any associated infrastructures. The servitude also has to be maintained free of any natural vegetation, amongst other reasons to minimize the risk of fire. The destruction or alteration of natural habitat has an impact on birds breeding, foraging and roosting in close proximity to the site.

The significance of habitat destruction is influenced by a number of factors, including: Size of area to be affected; sensitivity of receiving habitat; uniqueness of the habitat; degree of habitat specialisation of the bird species utilising the habitat; and the conservation status and sensitivity of the species using the habitat.

The construction and operational activities can impact on birds through disturbance, mainly during bird breeding activities and the activities of concern include heavy earth moving general vehicular movement and any other activities which result in noise or increased human activity in an area. The disturbance of non-breeding birds may simply require them to move further away or adjust their activities during the disturbance. This may be either temporary or permanent. Disturbance of breeding birds may result in lower breeding productivity, failed breeding in the relevant season, and temporary or permanent abandonment of a breeding site. All of these reduce the recruitment of young birds to the population and can have significant implications for Red Listed species in particular, many of which are slow to reach breeding age and breed in small numbers.

Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line which can result in electrical flashovers. These activities could have an impact on birds

breeding, foraging and roosting in or in close proximity of the servitude, through destruction of habitat.

The relocation of a power line can be highly disturbing to birds breeding in the vicinity of the construction activities. Many birds are highly susceptible to disturbance, and should this disturbance take place during a critical time in the breeding cycle, for example when the eggs have not hatched or just prior to the chick fledging, it could lead to temporary or permanent abandonment of the nest or premature fledging. In both instances, the consequences are almost invariably fatal for the eggs or the fledgling. Such a sequence of events can have far reaching implications for certain large, rare species that only breed once a year or once every two years.

There are positive interactions between overhead powerlines and avifauna as well (van Rooyen, 2004):

- Power lines have proven to be partially beneficial to many birds, including species such as Martial Eagles, Tawny Eagles, African White-backed Vultures, and even occasionally Verreaux's Eagles by providing safe nesting and roosting sites in areas where suitable natural alternatives are scarce.
- Pylons can provide a safe nesting and perching sites away from predators. Some Lesser kestrel colonies have been shown to use overhead lines almost exclusively as perching sites. This species has been recorded from the region and has been considered during the survey. Large colonies are not thought to occur within the area, however. Existing overhead wires and towers were noted to be utilised by a small raptor such as Black-winged Kite;
- Pylons can also provide nesting sites within areas devoid of tall trees. This has enabled certain species to expand their range. Large trees were absent throughout the survey area and therefore this is of relevance.

11.2.2.6 Potential occurrence of Red Data bird species

Table 13 below indicates the preferred habitat, together with the probability of occurrence. The probability of occurrence is based on the availability of suitable habitat, known distribution, overall abundance, food availability, disturbance factors, anthropogenic change and the preferred habitats of the species. Only bird species which have higher probability of occurrence on the study area are discussed.

Table 13. Probability of Occurrence of Red Data bird species which could be found on the project area

Common Name	Conservation status		Preferred Habitat	Probability of Occurrence
	RSA	MTPA		
Botha's Lark	Endangered	Endangered	Endemic to South Africa, only occurring in the heavily grazed upland grassland of Mpumalanga and the Free State. It avoids poorly drained areas, long grass in valley bottoms, planted pastures, rocky areas and croplands.	High
African Grass-Owl	Vulnerable	Vulnerable	The species prefers thick grasses around wetlands and rivers which are not present in the project area. Additionally, this species specifically has a preference for nesting in dense stands of the grass species *Imperata cylindrica.*	Low
White-bellied Korhaan	Vulnerable	Vulnerable	It generally prefers fairly tall, dense sour or mixed grassland, either open or lightly wooded, occasionally moving into cultivated or burnt land.	Medium
Blue Crane	Near Threatened	Vulnerable	It generally prefers open grassland, dwarf shrubland and cultivated land.	High
Blue Korhaan	Least Concern	Near Threatened	It is endemic to southern Africa, occurring in the highveld of South Africa surrounding and extending into Lesotho. It generally prefers flat or undulating ground in grassland and Nama Karoo.	High
Southern Bald Ibis	Vulnerable	Vulnerable	It generally prefers high-altitude treeless grassland and recently burnt, ploughed or heavily grazed fields.	High
Secretarybird	Vulnerable	Vulnerable	It generally prefers open grassland with scattered trees, open *Acacia* and bushwillow (*Combretum*) savanna, shrubland, range lands, airstrips and other habitats with short grass.	Medium
Rudd's Lark	Endangered	Endangered	It is extremely habitat specific, preferring Highveld sourveld and North-eastern sandy highveld, on flat areas with dense, short grass. It is absent from old croplands, grassland on slopes and patches where the grass is more then 70cm tall.	Medium
Grey Crowned Crane	Endangered	Endangered	It breeds in marshes, pans and dams with fairly tall vegetation; in the non-breeding season, it generally prefers cultivated habitats, often pastures but also fields of maize, wheat, rice, groundnut, cabbage and cotton. It occasionally wanders	Low

Common Name	Conservation status		Preferred Habitat	Probability of Occurrence
	RSA	MTPA		
			into grasslands and other dry habitats.	
Denhams Bustard	Vulnerable	Vulnerable	It breeds in grassland and lowland fynbos, but in the non-breeding season it also strays into cultivated fields of barley, cotton and clovers. It also occurs in Nama karoo and sparse woodland.	Low
Greater Flamingo	Near Threatened	Near Threatened	It generally prefers coastal mudflats, inland dams, sewage treatment works, small temporary pans and river mouths, while it exclusively breeds at recently flooded, large eutrophic shallow salt pans.	Medium
African Marsh Harrier	EN	EN	In southern Africa, it is locally common in northern Botswana, the Caprivi Strip (Namibia), Zimbabwe, eastern Mozambique and South Africa (excluding the arid Karoo and Kalahari). It generally favours inland and coastal wetlands.	Low
Caspian Tern	VU	VU	It generally prefers sheltered bays, estuaries and large inland water bodies, especially dams and saline pans.	Low

11.2.3 Reptiles

11.2.3.1 Desktop survey results

As previously stated, the project site falls within the grassland biome and this biome houses 22% of South Africa's endemic reptiles (O' Connor and Bredenkamp, 1997). According to the data sourced from the MTPA for the grid cells 2729BA and 2729BB South African Reptile Conservation Assessment (ADU, 2024), DFFE Screening report, and historic distribution (Alexander & Marais, 2007), Red data reptile species are known to occur in the region are shown in **Table 14** below.

Table 14. Red data reptile species which could potentially occur on the study area (MTPA data)

Farm Name/Area	Scientific name	Common Name	Conservation status		SA Endemic
			RSA	MTPA	
Boterfontein 101 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Elandspoort 99 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Goedgenoeg 17 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Grootvley 51 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Holfontein 80 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Holvlei 52 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Kopje Alleen 75 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Leeuwkraal 50 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Mezig 79 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Paardekop 76 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Potfontein 55 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Roodewal 102 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Slangfontein 69 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Strydkraal 53 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Wolvespruit 71 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Wolvespruit 72 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Zandfontein 74 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Zwartkop 103 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Bergvliet 65 HS	*Homoroselaps dorsalis*	Striped harlequin snake	NT	NT	RSA

Farm Name/Area	Scientific name	Common Name	Conservation status		SA Endemic
			RSA	MTPA	
	Smaug giganteus	Giant girdled lizard	VU	VU	RSA
Elandspoort 85 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Oudehout kloof 86 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Palmietfontein 64 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
palmietspruit 68 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Rietfontein 66 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Rietpoort 83 HS	*Homoroselaps dorsalis*	Striped harlequin snake	NT	NT	RSA
	Smaug giganteus	Giant girdled lizard	VU	VU	RSA
Roodekopjes 67 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Tweefontein 97 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Verkyk 88 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Welgedacht 82 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA
Witkoppies 81 HS	*Smaug giganteus*	Giant girdled lizard	VU	VU	RSA

11.2.3.2 Reptiles recorded on and around the study area

The trees, watercourses and grasslands provide suitable habitats for reptile species to occur within the project site. Two reptile species were recorded during the survey, namely Speckled Rock Skink (*Trachylepis punctatissima*) and Cape Skink (*Trachylepis capensis*). No reptile Species of Conservation Concern were recorded on the project development site. According to the anecdotal information, the following reptile species have been sighted in the area, namely Peter's Thread Snake (*Leptotyphlops scutifrons*), Rhombic skaapsteker (*Psammophylax rhombeatus*), Mole Snake (*Pseudaspis cana*) and Rinkhals (*Hemachatus haemachatus*). The majority of reptile species are sensitive to severe habitat alteration and fragmentation. Species are also very often "expelled" into riparian zones due to transformation of lands for anthropogenic disturbances such as human settlements and agricultural purposes.

Giant girdled lizard (*Smaug giganteus*), formerly known as *Cordylus giganteus*, is found in Highveld grassland (Van Wyk, 2000) and inhabit flat or sloping Highveld grasslands They live in self-excavated burrows, although they can be opportunistic and inhabit empty burrows (Bates *et al*. 2014). The Majuba Power Station Nature Reserve, of which section of the proposed development site traverses, was declared for the protection of this reptile species. Therefore, in order to protect this species, training of construction personnel to recognise Giant girdled lizard species will reduce the probability of this species being harmed unnecessarily

and the contractor must ensure that this species is not disturbed, trapped, hunted or killed during the pre-and construction phases. Sungazers are unique within their family (Cordylidae) in that they rely on self-constructed burrows in specific microhabitats within the grassland matrix as long-term, often permanent, shelter and refuge sites. If any individuals or burrows of *Smaug giganteus* are observed, they must be recorded and the ECO immediately notified. Search and Rescue operations should occur before the construction works begin to ensure that any slow moving or burrowing species (such as moles, chameleons, snakes or tortoises) would be moved to adjacent suitable habitats by a qualified Faunal Specialist.

11.2.3.3 Potential occurrence of Red Data reptile species

Data sourced from Virtual Museum of African Mammals (ADU, 2024), MTPA and historical distribution (Skinner and Chimimba. 2005) indicate that there are reptile species which are known to occur in the general vicinity of the site. **Table 15** below indicates the suitable habitat together with the probability of occurrence. The probability of occurrence is based on the presence of suitable habit where the species is likely to occur, known distribution, overall abundance, disturbance factors, anthropogenic change and the habitats of the species.

Table 15. Probability of Occurrence of Red Data reptile species which could be found on the project area

Common Name	Conservation status		Suitable habitat	Probability of occurrence
	RSA	MTPA		
Giant Girdled Lizard	Vulnerable	Vulnerable	This species is found in Highveld grassland. It is unique among the cordylids as it an obligate burrower living in self-excavated burrows. It can be considered a habitat specialist, that is highly philopatric for burrowing sites. Although it is a large lizard, it will not easily disperse across the landscape to make new burrows should its habitat be destroyed. It is diurnal and insectivorous, although plant material may also be consumed	High
Striped harlequin snake	Near Threatened	Near Threatened	Partially fossorial and known to inhabit old termitaria in grassland habitat. Most of its range is at moderately high altitudes, reaching 1,800 m in Mpumalanga and Swaziland, but it is also found at elevations as low as about 100 m in KwaZulu-Natal	Medium

11.2.4 Amphibians

Amphibians are an essential part of South Africa's exceptional biodiversity and are such worthy of both research and conservation. Frogs and tadpoles are good species indicator of water quality, because they have permeable, exposed skins that readily absorb toxic substances. Tadpoles and frogs are aquatic and greatly exposed to aquatic pollutants (Blaustein, 2003).

11.2.4.1 Desktop survey results

MTPA data, DFFE Screening report, FitzPatrick Institute of African Ornithology (2024) (grid cells 2729BA and 2729BB) and du Preez & Carruthers (2009) were consulted in order to draw up a list of potential occurrences and no frog species of conservation concern could potentially be found within the study area (**Table 16**).

Table 16. Frog species which could potentially occur on the study area (QDS 2729BA and 2729BB)

Family	Scientific name	Common name	Red list category
Bufonidae	*Sclerophrys capensis*	Raucous Toad	Least Concern
Bufonidae	*Sclerophrys gutturalis*	Guttural Toad	Least Concern
Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	Least Concern
Hyperoliidae	*Semnodactylus wealii*	Rattling Frog	Least Concern
Pipidae	*Xenopus laevis*	Common Platanna	Least Concern
Ptychadenidae	*Ptychadena porosissima*	Striped Grass Frog	Least Concern
Pyxicephalidae	*Strongylopus fasciatus*	Striped Stream Frog	Least Concern
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	Least Concern
Pyxicephalidae	*Amietia fuscigula*	Cape River Frog	Least Concern
Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	Least Concern
Pyxicephalidae	*Strongylopus grayii*	Clicking Stream Frog	Least Concern
Pyxicephalidae	*Tomopterna cryptotis*	Tremelo Sand Frog	Least Concern
Pyxicephalidae	*Tomopterna natalensis*	Natal Sand Frog	Least Concern

11.2.4.2 Field work results

The watercourses within the study area hold water on a temporary basis and are important breeding habitat for most of the frog species which could occur within the study area. During the field survey, two frog species were recorded along the project site, namely Raucous Toad (*Sclerophrys capensis*) and Common River Frog (*Amietia delalandii*). No rivers will be traversed by the proposed development. No frog Species of Conservation Concern were recorded within the project site.

11.2.5 Invertebrates

11.2.5.1 Desktop survey results

FitzPatrick Institute of African Ornithology (2024) (QDS 2729BA and 2729BB), MTPA, DFFE Screening report and previous biodiversity studies were consulted in order to draw up a list and no Invertebrate Species of Conservation Concern could potentially be found within the study area.

11.2.5.2 Field work results

During the field survey, the following species were recorded within the proposed development site, namely African Blue Pansy (*Junonia orithya madagascariensis*) (**Figure 29**), African Plain Tiger (*Danaus chrysippus orientis*) (**Figure 30**), Pirate (*Catacroptera cloanthe*) (**Figure 31**), Citrus Swallowtail (*Papilio demodocus demodocus*) (**Figure 32**), Painted Lady (*Vanessa cardui*), Yellow Pansy (*Junonia hierta cebrene*), the Meadow White *(Pontia helice helice*) and Garden Acraea (*Acraea horta*). No invertebrate Species of Conservation Concern were recorded within the project site.

Figure 29. African Blue Pansy recorded on the proposed development site

Figure 30. African Plain Tiger recorded on the proposed development site

Figure 31. Pirate recorded within the proposed development site

Figure 32. Citrus Swallowtail recorded within the proposed development site

12 TERRESTRIAL ECOLOGICAL SENSITIVITY ANALYSIS OF THE STUDY AREA

The Screening Tool was accessed to obtain a list of potentially occurring species of conservation concern for the study area. Each of the themes in the Screening Tool consists of theme-specific spatial datasets which have been assigned a sensitivity level namely, “low”, “medium”, “high” and “very high” sensitivity. The four levels of sensitivity are derived and identified in different ways, e.g., for confirmed areas of occupied habitat for SCC a Very High and High Sensitivity is assigned and for areas of suitable habitat where SCC may occur based on spatial models only, a Medium Sensitivity is assigned. The different sensitivity ratings pertaining to the Plant [and Animal] Protocols are described below (**Table 17**).

Table 17. A description of the different screening tool sensitivity ratings

Sensitivity rating	Description of sensitivity rating
Very high	Habitat for species that are endemic to South Africa, where all the known occurrences of that species are within an area of 10 km^2 is considered critical habitat, as all remaining habitat is irreplaceable. Typically, these include species that qualify under the CR, EN, or VU D criteria of the IUCN or species listed as Critically/Extremely Rare under South Africa’s National Red List Criteria. For each species reliant on a critical habitat, all remaining suitable habitat has been manually mapped at a fine scale.
High	Recent occurrence records for all threatened (CR, EN, VU) and/or Rare endemic species are included in the high sensitivity level. Spatial polygons of suitable habitat have been produced for each species by intersecting recently collected occurrence records (those collected since the year 2002) that have a spatial confidence level of less than 250 m with segments of remaining natural habitat. For birds, species distribution models (SDMs) and SABAP2 data (http://sabap2.birdmap.africa/) were combined to delineate the ‘high’ sensitivity areas (
Medium	Model-derived suitable habitat areas for threatened and/or rare species are included in the medium sensitivity level. Two types of spatial models have been included. The first is a simple rule-based habitat suitability model where habitat attributes such as vegetation type and altitude are selected for all areas where a species has been recorded to occur. The second is a species distribution model which uses species occurrence records combined with multiple environmental variables to quantify and predict areas of suitable habitat. The models provide a probability-based distribution indicating a continuous range of habitat suitability across areas that have not been previously surveyed. A probability threshold of 75% for suitable habitat has been used to convert the modelled probability surface and reduce it into a single spatial area which defines areas that fall within the medium sensitivity level.
Low	Areas where no SCC are known or expected to occur.

12.1 Sensitivity Assessment

The evaluation of the terrestrial biodiversity, fauna, flora and vegetation importance of the project site was evaluated according to the procedures for the assessment and reporting of impacts on terrestrial biodiversity, terrestrial fauna and species and flora, for activities requiring environmental authorisation as published under the national Environmental Management Act, 1998 (Act No. 107 of 1998): *Procedures to be followed for the assessment and minimum criteria for reporting of identified environmental themes in terms of section 24 (5)a and (h) of the National Environmental Management Act, 1998, when applying for environmental authorisation (G 42946 – GN 9) and SANBI's Species Protocols for Environmental Impact Assessment in South Africa.*

According to the Screening report for an Environmental Authorization as required by the 2014 EIA regulations – proposed site environmental sensitivity, the relative animal species theme sensitivity is considered as *High* sensitivity (Medium-High) (**Figure 33**), the relative plant species theme sensitivity is considered as *Medium* (Low-Medium) (**Figure 34**) and the terrestrial biodiversity theme sensitivity is assigned a *Very High Sensitivity* (**Figure 35**) due to the presence of Majuba Nature Reserve, CBA 2, ESA: Protected Area buffer, FEPA Sub catchment and National Protected Area Expansion Strategy (NPAES).

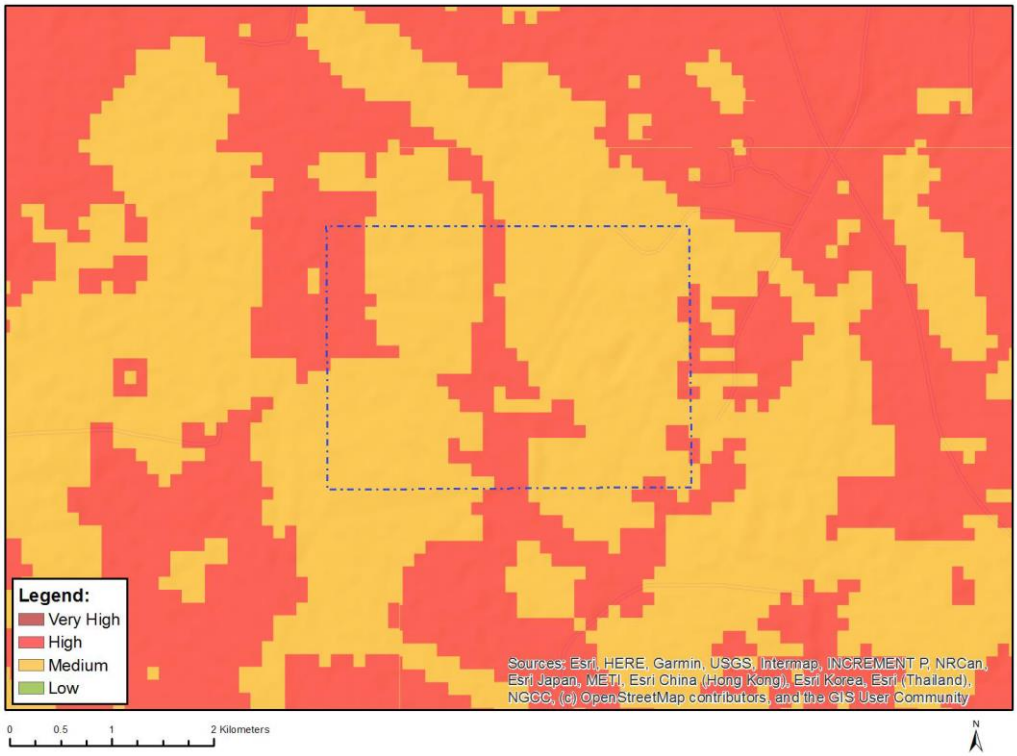

Figure 33. Map of relative Animal species Theme Sensitivity

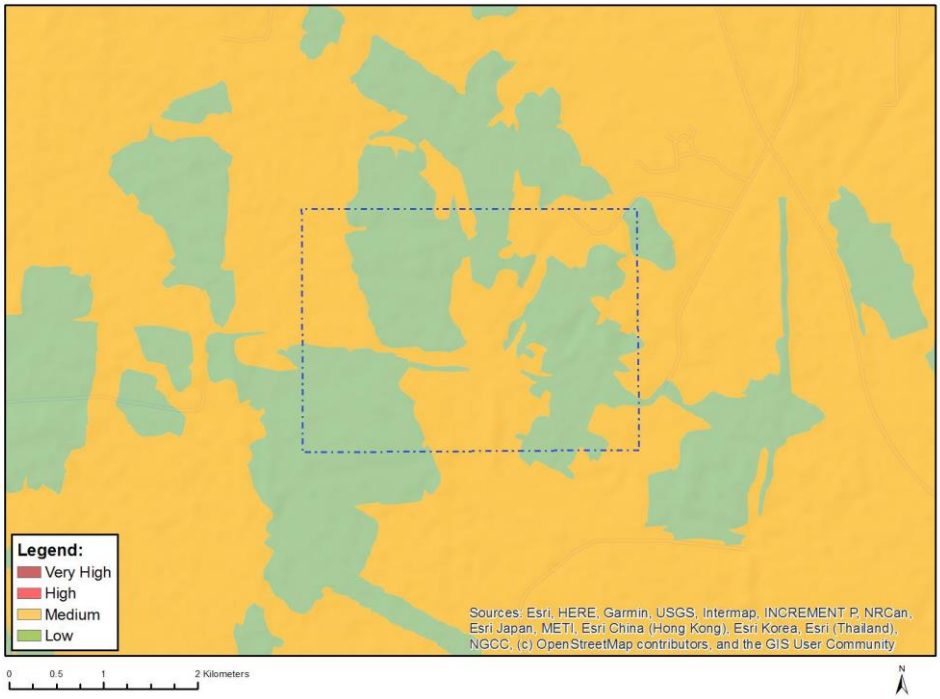

Figure 34. Map of relative Plant species Theme Sensitivity

Figure 35. Map of relative Terrestrial Biodiversity Theme Sensitivity

The Species Environmental Assessment guideline (SANBI, 2020) was applied to assess the Site Ecological Importance (SEI) of the project area. The habitats and the species of conservation concern in the project area were assessed based on their conservation importance, functional integrity and receptor resilience (**Table 18**). The combination of these resulted in a rating of SEI and interpretation of mitigation requirements based on the ratings. The sensitivity map was developed using available spatial planning tools as well as by applying the SEI sensitivity based on the field survey.

Table 18. Criteria for establishing Site Ecological importance and description of criteria

Criteria	Description
Conservation Importance (CI)	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 & NT), Rare, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes
Functional Integrity (FI)	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
Biodiversity Importance (BI) is a function of Conservation Importance (CI) and the Functional Integrity (FI) of a receptor.	
Receptor Resilience (RR)	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
Site Ecological Importance (SEI) is a function of Biodiversity Importance (BI) and Receptor Resilience (RR) (SEI = BI + RR)	

The method used to assess site sensitivity has been described in **Table 18** above. **Tables 19** and **20** below provides a summary of how each site was assessed.

Table 19. Evaluation of Site Ecological Importance (SEI) of habitat, SCC and Project Area of Influence (PAOI)

Habitat	Conservation Importance (CI)	Functional Integrity (FI)	Receptor Resilience (RR)	SEI
Disturbed habitat (Inside the Power Station)	Low	Low	Low	BI = Low RR =Low (=Low)
	No confirmed or highly likely populations of SCC.	Several minor and major current negative ecological impacts.	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	

Habitat	Conservation Importance (CI)	Functional Integrity (FI)	Receptor Resilience (RR)	SEI
			likelihood of: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.	
Majuba Power Station Nature Reserve	High	High	Medium	BI = High RR =Medium (=High)
	Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km2 . IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A.	Only minor current negative ecological impacts, with no signs of major past disturbance and good rehabilitation potential.	Will 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: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.	

Table 20. Guidance for interpreting Site Ecological Importance (SEI) in the context of the proposed development activities

Site Ecological Importance	Interpreting in relation to the proposed development activities
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted, limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.

The site verification was conducted concurrently with the Terrestrial Biodiversity Impact Assessment and during the survey, it was concluded that the proposed development site falls within *Low* (inside the Power Station) to *High* (within the Nature Reserve) categories in terms of ecological sensitivity. However, the proposed development is situated along the existing servitude and therefore the disturbances to the natural ecosystems and vegetation clearance will be relatively small. The mitigation measures within the Nature Reserve must be enforced.

13 ENVIRONMENTAL IMPACT ASSESSMENT

13.1 Impact Assessment Methodology

The impacts and the proposed management thereof are first discussed on a qualitative level and thereafter quantitatively assessed by evaluating the duration, extent, magnitude, probability and ultimately the significance of the impacts (refer to methodology provided below. The assessment considers impacts before and after mitigation measures (**Table 21**).

The duration of the impact

Score	Duration	Description
1	Short term	0 – 1 years
2	Short to medium term	2 – 5 years
3	Medium term	5 – 15 years
4	Medium to long term	15+ years
5	Permanent	Permanent

The extent (spatial scale) of the impact

Score	Extent	Description
1	Site specific	Within the site boundary
2	Local	Affects immediate surrounding areas
3	Regional	Extends substantially beyond the site boundary
4	Provincial	Extends to almost entire province or larger region
5	National	Affects country or possibly world

The magnitude (severe or beneficial) of the impact

Score	Severe/beneficial effect	Description
0	None	No effect – No disturbance/benefit
2	Slight	2 Little effect – negligible disturbance/benefit
4	Slight to moderate	Effects observable – environmental impacts reversible with time
6	Moderate	Effects observable – impacts reversible with rehabilitation
8	Moderate to high	Extensive effects – irreversible alteration to the environment
10	High	Extensive permanent effects with irreversible alteration

The probability of the impact

Score	Rating	Description
1	Very Improbable	Probably won't occur
2	Improbable	Low likelihood of occurring
3	Probable	Distinct possibility of occurring
4	Highly Probable	Very likely to occur
5	Definite	Will occur, regardless of any intervention

Significance of the impact, Degree of Irreversibility, Degree of loss of Resource are rated as follows:

Significance Rating	Description
Low (score of 1-29)	Impact will not significantly change fauna biodiversity and requires no significant mitigation measures.
Moderate (score of 30-60)	Impact will change fauna biodiversity and requires some mitigation measures.
High (Score of 61-100)	Impact will significantly change fauna biodiversity and significant mitigation measures and management is required. Potential fatal flaw.

The Significance = (Magnitude + Spatial Scale + Duration) x Probability

13.1.1 Impacts on Flora and Fauna

Only the ecological issues identified during the appraisal of the receiving environment and potential impacts are assessed below (**Table 21**). Mitigation measures are provided to prevent (first priority), reduce or remediate adverse environmental impacts.

The pre/construction phases of the proposed development are anticipated to have direct impacts on flora and fauna habitats, especially within the Nature Reserve and therefore, site clearing within this section will potentially result in permanent removal of floral habitat and therefore the disturbance of vegetation must be limited to areas of construction only.

Based on the results of the field survey, it is evident that the project site provides habitat to a number of fauna species within the Nature Reserve. Although it is assumed that the majority of fauna species will move to different areas of the reserve as a result of disturbance, many SCC fauna species have a specific habitat requirement and the destruction of their habitats will result in displacement to less optimal habitats, or ultimately may result in their demise. However, the impacts to the section of the reserve can be mitigated.

The potential disturbance of soil and vegetation during construction activities encourages the establishment of pioneer vegetation, in many cases creating an ideal opportunity and optimal conditions for weeds and alien invasive plants to invade both disturbed and undisturbed areas after construction have been completed. Alien Invasive plants can have far reaching detrimental effects on indigenous vegetation and has been widely accepted as being a leading cause of biodiversity loss. The amount of disturbance created during construction will leave the study area and adjacent undeveloped areas vulnerable to alien plant invasion. Failure to manage rehabilitation and landscaping can lead to serious alien invasive plant infestation.

Increased levels of noise, disturbance and human activity during construction may be detrimental to fauna. The risk of illegal hunting/poaching/trapping of wildlife for various uses is likely, especially within the nature reserve. Many species would however become habituated to the existing activities and would return to normal activity after some time. The operational phase of the development will be permanent. Potential impacts on local faunal species as a result of disturbance/displacement has been assessed as significant at a local scale.

If disturbed areas are not rehabilitated/re-vegetated post construction, soil erosion may continue throughout the operational phase of the development. This is likely to be exacerbated by stormwater runoff from any hardened/impermeable surfaces such as compacted soil, etc. Due to the extensive disturbance likely to be created by construction within the project area, this impact is most likely to occur within the project area, but could potentially occur outside the project area as well if suitable avoidance and mitigation measures were not implemented during construction.

The potential impacts associated with the pre-construction, construction and operational activities are discussed in **Table 21**.

13.1.1.1 Pre-construction / Construction Phases

Activities associated with the pre-construction and construction phases, include the following:

- Site establishment, such as construction camps, laydown and storage areas on site;
- Earthmoving activities e.g., excavation and soil stockpiling;
- Vegetation clearance of the site;
- Storage of hazardous and non-hazardous material and wastes; and
- Landscaping and rehabilitation of the site.

Potential impacts to flora and fauna during the pre-/and construction phases, include the following:

- Destruction of indigenous flora during site establishment, especially within the nature reserve;
- Inadvertent killing and injury of fauna species during vegetation clearance and excavation;
- Potential loss of soil due to fuel and chemical spills (soil contamination);
- Encroachment, proliferation and spread of weeds and alien invasive plant species;
- Loss/displacement of fauna species of conservation concern potentially present on site;
- Increased soil erosion due to compaction by vehicles and construction activities, and incorrect storm water management measures;
- Soil contamination from hazardous substance spillages (Fuel) outside their primary and secondary containment during maintenance work and re-fuelling and
- Loss of flora and fauna habitat due to vegetation clearance.

13.1.1.2 Operational Phase

Activities associated with the operational phase, include the following:

- Vegetation management activities; and
- Fauna management activities.

Potential impacts associated with the operational phase, include the following:

- AIPs and weeds
- Disturbance to ecological processes due to altered habitat and disturbance to natural movements/processes;
- Collision of birds with overhead cables;
- Electrocution of birds;
- Disturbance of local faunal communities; and
- Loss of habitat due to operational activities.

Table 21: Potential impacts and recommended mitigation measures with significance rating before and after mitigation

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
Destruction of indigenous flora during site establishment and potential loss of vegetation, especially within the Nature Reserve.	Permanent (5)	Regional (3)	Highly Probable (4)	High (10)	72 (High) Status (-ve)	• Development planning must ensure that loss of vegetation and disturbance are restricted within the recommended site layout footprint. • Clearly demarcate the construction footprint prior to clearing of vegetation. • The area where the construction will occur is a high voltage vicinity. According to the vegetation management Eskom procedure, no vegetation is	Short to medium term (2)	Local (2)	Highly Probable (4)	Slight to moderate (4)	32 Low) Status (-ve)

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	Duration	Extent	Probability	Magnitude	Significance		Duration	Extent	Probability	Magnitude	Significance
						to be planted in this area. • Pre-construction environmental induction must be conducted to all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to conservation and importance of provincially protected plant, Orange listed plants, medicinal plants and plant SCC which have High probability of occurring on site. • Environmental Control					

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
						Officer (ECO) should provide supervision and oversight of vegetation clearing activities. • All laydown, storage areas, site camps etc. should be restricted to within the project area and should preferably be situated within areas of low sensitivity (already disturbed areas). • Building material or ablution facilities should not be stored or kept in areas containing natural vegetation.					

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
						• Surrounding areas with indigenous vegetation should under no circumstances be fragmented or disturbed further or used as an area for dumping of waste. • E					
Loss and displacement of Fauna Species of conservation concern on site due to habitat loss and mortality	Medium to long term (4)	Local (2)	Highly Probable (4)	Moderate (6)	48 (Medium) Status (-ve)	• If any individuals or burrows of *Smaug giganteus* are observed on site, they must be recorded and the ECO immediately notified. • Search and rescue operations should occur before the construction works begin to ensure that	Short to medium term (2)	Site specific (1)	Highly Probable (4)	Slight to moderate (4)	28 Low) Status (-ve)

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
						any slow moving or burrowing species (such as moles, chameleons, snakes or tortoises) would be moved to adjacent suitable habitats by a qualified Faunal Specialist. • If any faunal species are recorded during construction, especially the protected species potentially occurring on site, activities should temporarily cease, and an appropriate specialist should be consulted to identify the correct					

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
						course of action. • Awareness of construction personnel to recognise threatened faunal species will reduce the probability of fauna being harmed unnecessarily. • The contractor must ensure that no faunal species are disturbed, trapped, hunted or killed during the pre-and construction phases. • Vehicles must adhere to the set speed limit. • All construction vehicles must use designated					

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	Duration	Extent	Probability	Magnitude	Significance		Duration	Extent	Probability	Magnitude	Significance
						access roads. Off-road driving should be strictly prohibited. • Fauna (mammals and reptiles) that become trapped in any excavation or in any construction related activity, may not be harmed and must be rescued and relocated by suitably qualified personnel. • Any fauna threatened by the construction activities should be removed to safety by the ECO or any suitable qualified personnel.					

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
Encroachment, proliferation and spread of weeds and alien invasive plant species	Permanent (5)	Regional (3)	Highly Probable (4)	High (10)	72 (High) Status (-ve)	• Alien invasive plants (listed in this study) can be removed manually or with the help of simple tools. This entails damaging or removing the plant by physical action. Different techniques could be used, e.g., uprooting, ring-barking or bark stripping. These control options are only really feasible in sparse infestations or on small scale, and for controlling species that do not coppice after cutting. It would be	Medium to long term (4)	Local (2)	Probable (3)	Moderate to slight (4)	30 (Medium) Status (-ve)

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	Duration	Extent	Probability	Magnitude	Significance		Duration	Extent	Probability	Magnitude	Significance
						preferable to uproot alien vegetation to limit regrowth after cutting. • It should be noted that all infestations cannot be cleared at once, as these plant species do currently play a role in stabilising soils and therefore, the sequence of alien plant removal should be planned, along with re-vegetation of the cleared areas. • Regular monitoring for alien invasive plants within the study area as well as adjacent areas which receive runoff as there are					

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
						also likely to be prone to invasion problems.					
Inadvertent killing and injury of fauna species during vegetation clearance.	Medium to long term (4)	Local (2)	Probable (3)	Moderate to slight (4)	30 (Medium) Status (-ve)	• If possible, the clearance of vegetation should commence during non-breeding season of fauna species (i.e., winter). • Any fauna threatened by the construction activities should be moved to safety by a suitable qualified ECO or an Ecologist. • All personnel should undergo an environmental induction with regards to fauna, in particular awareness about	Short to medium term (2)	Site specific (1)	Improbable (2)	Slight (2)	10 (Low) Status (-ve)

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
						harming or collecting species such as snakes, tortoises. • If trenches are to be dug, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are left open should have places where there are soil ramps, which will allow fauna to escape the trench. • No animals should be intentionally destroyed or killed, and no hunting or poaching of animals is allowed in the					

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
						project site or adjacent areas. • No food or similar waste that may attract wild animals should be disposed of at the site. All food and litter waste should be placed in sealed bins and removed from the site each day. • In order to reduce collisions of vehicles with fauna, animals should have right of way, especially within the nature reserve. In addition, road signs to instruct construction vehicles to adhere to speed limit.					

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
Soil contamination from hazardous substance spillages (Fuel) outside their primary and secondary containment during maintenance work and re-fuelling	Medium (3)	Local (2)	Highly Probable (4)	Moderate (6)	44 (Medium) Status (-ve)	• Where contamination of soil is expected, analysis must be done prior to disposal of excess soil to determine the appropriate disposal site. • Fuel and material storage must be away from stockpiles. • The Environmental Control Officer should be responsible for ensuring that potentially harmful materials are properly stored in a dry, secure, ventilated environment, with concrete or sealed flooring and a means of	Short to medium term (2)	Site specific (1)	Improbable (2)	Slight (2)	10 (Low) Status (-ve)

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
						preventing unauthorised entry. • Cement, concrete and chemicals must be mixed on an impermeable surface and provisions should be made to contain spillages or overflows into the soil. • Any storage tanks containing hazardous materials must be placed in banded containment areas with sealed surfaces. The bund walls must be high enough to contain 110% of the total volume of the stored					

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
						hazardous material. • Contaminated soil must be contained and disposed of offsite at an approved landfill site. • Concrete mixing must be contained within a bunded area and in a designated area.					
Operational phases											
Erosion caused by inadequate/failing stormwater management measures/designs.	Medium (3)	Local (2)	Highly Probable (4)	Moderate (6)	44 (Medium) Status (-ve)	• Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. • All erosion problems observed should be rectified as soon as possible,	Short to medium term (2)	Site specific (1)	Improbable (2)	Slight (2)	10 (Low) Status (-ve)

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
						using the appropriate soil erosion control structures and revegetation techniques. • All cleared areas should be landscaped and/or re-vegetated.					
Disturbance of local fauna populations.	Medium (3)	Local (2)	Highly Probable (4)	Moderate (6)	44 (Medium) Status (-ve)	• Animals residing within the designated area shall not be unnecessarily disturbed. • No hunting, trapping, killing of any animal should be permitted. • Snake and or animal handling should be strictly limited to qualified staff or a dedicated external snake handler.	Short to medium term (2)	Site specific (1)	Improbable (2)	Slight (2)	10 (low) Status (-ve)

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	Duration	Extent	Probability	Magnitude	Significance		Duration	Extent	Probability	Magnitude	Significance
						• When accessing the site, vehicles are to utilise the existing roads. • Ensure that no unnecessary clearing of faunal habitat occurs during maintenance activities. • No fires by maintenance personnel are allowed. • No wild animal may be fed on site. • Ensure that the site is kept clean, tidy and free of rubbish that would attract animal pests. • All vehicles accessing the site should avoid collisions with susceptible species such as snakes					

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
						and small rodents. • All waste generated at the facility should be kept in scavenger proof bins and removed from site at regular intervals.					
Collision of birds with infrastructures	Medium to long term (4)	Local (2)	Probable (3)	Moderate to slight (4)	30 (Medium) Status (-ve)	• Only a bird friendly pylon structure is permissible for the construction of the relocated power line. This will ensure that large birds can perch and roost safely on the hardware. • Fitment of devices on the earth wires to make the lines more visible • All construction and maintenance	Short to medium term (2)	Site specific (1)	Improbable (2)	Slight (2)	10 (low) Status (-ve)

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
						activities should be carried out according to generally accepted environmental best practices.					
Electrocution of birds	Medium to long term (4)	Local (2)	Probable (3)	Moderate to slight (4)	30 (Medium) Status (-ve)	• During operational phase, any nest found on the lines should be managed in accordance with Eskom Distribution Nest Management Guidelines and relevant provincial and national legislation. • In order to prevent the electrocution of any birds, on the poles, all poles should be fitted with a standard type, Eskom approved "bird perch" at the top of the	Short to medium term (2)	Site specific (1)	Improbable (2)	Slight (2)	10 (low) Status (-ve)

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
						pole. This will provide ample safe perching space for any birds well clear of the dangerous hardware.					
Rehabilitation/landscaping of the site after construction activities	Medium to long term (4)	Site specific (1)	Probable (3)	Slight to moderate (4)	27 (Low) Status (-ve)	• The area where the construction will occur is a high voltage vicinity. According to the vegetation management Eskom procedure, no vegetation is to be planted in this area. • Alien plants growing within these lines must be removed. • Take appropriate remedial action where vegetation establishment is unsuccessful	Permanent (5)	Regional (3)	Highly Probable (4)	High (10)	72 (High) Status (+ve)

Potential impact BEFORE mitigation						Mitigation Measures	Potential impact AFTER mitigation				
Nature of the impact	**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**		**Duration**	**Extent**	**Probability**	**Magnitude**	**Significance**
						or erosion is evident. • Indigenous plants naturally growing within the project area, but that would be otherwise destroyed during clearing for development purposes, should be incorporated into rehabilitation areas. •					

13.1.2 Cumulative impacts

Cumulative impacts can be identified by combining the potential environmental implications of the proposed project with the impacts of projects and activities that have occurred in the past, are currently occurring, or are proposed in the future within the project area.

- Land clearing activities and other construction-related disturbances could lead to the proliferation of exotic vegetation.
- Displacement of sensitive floral and faunal species, species of conservation concern and protected trees due to habitat destruction and habitat fragmentation eventually leads to isolation and loss of those species. This is, however, considered to be low within the region.
- Destruction of nesting habitat displaces the affected species eventually leading to loss of those species.
- Cumulative loss of primary vegetation features due to exotic vegetation and vegetation transformation is high at the national level and therefore should be avoided;
- Encroachment of alien vegetation.
- Powerlines represent the largest proportion of established aerial infrastructure throughout the country and collision impacts are of national concern. Fitment of devices on the earth wires to make the lines more visible is reducing this impact at the national level.

13.1.3 Decommissioning

Post to the economic lifespan of the new 132 kV project, decommissioning and rehabilitation will comply with the appropriate environmental legislation and best practices at that time.

14 CONCLUSION AND RECOMMENDATIONS

The anthropogenic activities taking place within the Majuba Power Station entails the existing ash disposal facilities, existing cooling towers, pollution control dams and associated infrastructure such as internal roads and buildings. The expansion of the 400kv Eskom Majuba is within the Majuba power station site. Therefore, limited natural vegetation remains inside the Power station, and dominated by alien invasive plant species and weeds. During the field survey, no threatened plant species or protected trees or provincial protected plants were observed within the study area. However, should any plant species of conservation concern be found during construction activities, a search and rescue plan should be developed and suitable habitat for translocation exists within the nature reserve.

The only fauna species of conservation concern which have higher probability of occurring on site are those which could be found within the nature reserve. Mitigation measures to reduce any potential direct and acute impact on faunal species, especially reptilian and amphibian species, such as conducting phased earthworks over time to allow various fauna to move away from the site of development, must be implemented. If any individuals or burrows of *Smaug giganteus* are observed, they must be recorded and the ECO immediately notified. Search and Rescue operations should occur before the construction works begin to ensure that any slow moving or burrowing species (such as moles, chameleons, snakes or tortoises) would be moved to adjacent suitable habitats by a qualified Faunal Specialist.

Generally, the development activities proposed within the project area will have impact on biodiversity conservation within the nature reserve. In order to conserve the faunal species community structures within the study area, habitat destruction should be limited to an absolute minimum as intact habitat would result in higher faunal and floral species diversity. It is therefore critical that operations are limited to the approved footprint only.

According to the Screening report for an Environmental Authorization as required by the 2014 EIA regulations – proposed site environmental sensitivity, the relative animal species theme sensitivity is considered as *High* sensitivity (Medium-High), the relative plant species theme sensitivity is considered as *Medium* (Low-Medium) and the terrestrial biodiversity theme sensitivity is assigned a *Very High Sensitivity* due to the presence of Majuba Nature Reserve, CBA 2, ESA: Protected Area buffer, FEPA Sub catchment and National Protected Area Expansion Strategy (NPAES). The site verification was conducted concurrently with the Terrestrial Biodiversity Impact Assessment and during the survey, it was concluded that the proposed development site falls within *Low* (inside the Power Station) to *High* (within the Nature Reserve) categories in terms of ecological sensitivity. However, the proposed development is situated along the existing servitude and therefore the disturbances to the natural ecosystems and vegetation clearance will be relatively small. The mitigation measures within the nature reserve must be enforced.

During the field survey, it was found that the impacts of the proposed development site on flora and fauna can be mitigated to a satisfactory level and as such, the development is deemed acceptable from the ecological perspective and as such should not be prevented from proceeding based on the ecological considerations, provided that the mitigation measures are implemented and adhered to. The methodologies used and results found during the field survey, together with the impacts and mitigation measures provide confidence that the project can go ahead. Once the proposed development has been constructed, rehabilitation process needs to take place and should also ensure that alien plant emergence and erosion do not occur.

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Appendix A: Description of Mpumalanga Biodiversity Sector Plan categories

Protected Areas (PAs)

These are protected areas, recognised in terms of the National Environmental Management Protected Areas Act, No 57 of 2003 (hereafter shortened to 'the Protected Areas Act'),that are currently considered to meet biodiversity targets in the MBSP

Critical Biodiversity Areas (CBAs)

Critical Biodiversity Areas are those areas (outside of Protected Areas) that are required to meet biodiversity targets for biodiversity pattern (species and ecosystems) and ecological processes. They should remain in a natural state that is maintained in good ecological condition. CBAs are areas of high biodiversity value, but are often also at risk of being lost through biodiversity-incompatible land-use practices. CBAs include, inter alia, Critically Endangered Ecosystems and critical linkages (corridor pinch-points) to maintain connectivity. Terrestrial CBAs can be classified into two sub-categories:

- CBA Irreplaceable; and,
- CBA Optimal.

Critical Biodiversity Area: Irreplaceable

Irreplaceable CBAs are the most important biodiversity areas in the Province, outside of the protected area network. This sub-category comprises those CBAs considered essential for meeting biodiversity targets to ensure the persistence of species and the functioning of ecosystems. Such areas are often at risk of being lost due to their remaining extent already being near to or lower than the required biodiversity target. For example, the only known nesting sites for certain highly threatened bird species, or areas of high connectivity value which are at high risk of being disrupted (i.e., critical corridor linkages in the landscape). If Irreplaceable CBAs suffer any further loss of habitat or ecological function, it is likely that the biodiversity targets will not be met and species losses and breakdown of ecological functioning will take place.

In the MBSP, the CBA: Irreplaceable category has 4 informants, which are listed in the Type/Content column in Table 14 and are described further below.

- CBA: Irreplaceable (100% irreplaceable): Identified in Marxan, with a common value cost surface and a BLM of zero. •
- CBA: High Irreplaceability (80-100% irreplaceable).
- CBA: Critical linkages: These are areas of the natural landscape that represent the only remaining and highly constrained linkages which, if lost, would result in the disruption of the corridor network as a whole (i.e., they are 'pinch points' in the corridor). These areas are vital for maintaining the linkage and ecological integrity of the corridor and its associated biodiversity-related processes. Critical Linkages were identified using Circuitscape.
- Critically Endangered Threatened Ecosystems (gazetted threatened ecosystems).

Critical Biodiversity Area: Optimal

The CBA Optimal areas (previously referred to as Important & Necessary in the MBCP), are those which represent the best localities (out of a potentially larger selection of available planning units) that are most optimally located to meet biodiversity targets and satisfy other criteria defined by either the Marxan design or cost layers. These areas have an irreplaceability (or frequency selection score) of less than 80%. In Marxan, this is categorised as the "Best" solution, meaning that it is the most spatially

efficient and, therefore, the optimal solution for meeting biodiversity targets whilst avoiding high-cost areas.

Even though these areas have a lower Irreplaceability value (or selection frequency score) than the CBA Irreplaceable category, they collectively reflect the smallest area required to meet the biodiversity targets. There may be options to meet the biodiversity targets elsewhere, but these will require more land or may lead to increasing conflict between competing land uses.

Ecological Support Areas (ESAs)

Ecological support areas are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of critical biodiversity areas or for generating or delivering important ecosystem services. They support landscape connectivity and resilience to climate change adaptation. ESAs need to be maintained in at least an ecologically functional state.

Four sub-categories of ESA are recognised in the MBSP, as described below:

- ESA: Landscape-scale Corridors
- ESA: Local-scale corridors
- ESA: Species Specific
- ESA: Protected Area Buffer

Ecological Support Area: Landscape-scale corridors

These corridors represent the ideal or best route option for supporting the ecological functioning of critical biodiversity areas and for enabling species to adapt to the impacts of climate change. The ecological functioning and connectivity of these corridors needs to be maintained, even if some loss of biodiversity pattern takes place.

Ecological Support Area: Local-scale corridors

These are the fine-scale connectivity pathways identified using Circuitscape. They incorporate all possible routes that contribute to connectivity between climate change focal areas, and they reflect movement routes taken by ‘random walkers’. Circuit models can also highlight alternative pathways for movement, which can lessen the effect of critical linkages and provide networks that are more robust to disturbance. The functionality of these corridors to support biodiversity connectivity needs to be maintained.

Ecological Support Area: Species Specific

These are areas required for the persistence of specific species. Although these areas are frequently modified from the natural state, a change in current land-use to anything other than rehabilitated land would most likely result in a loss of the species from the area. Only one area, an important over-wintering site for Blue Cranes was identified as an ESA: Species Specific (by Gauteng’s ornithologist, Craig Whitting-Jones).This ESA, which is shared with Gauteng, comprises a matrix of natural and cultivated lands.

Ecological Support Area: Protected Area buffers

These are areas around Protected Areas where changes in land use may affect the ecological functioning or tourism potential of the Protected Areas. The purpose of these buffer zones is to mitigate the impacts of biodiversity-incompatible land uses that may have a negative effect on the environment. Changes in land use usually have either direct impacts (such as habitat loss due to cultivating virgin land), or both direct and indirect impacts (such as light and noise pollution), in addition to a change in

land cover. Biodiversity compatible land uses (such as well-managed eco-tourism) within the ESA: Protected Area buffers should be considered, depending on the nature of the land-use and its associated impacts. The buffer distances applied in the MBSP, include:

- *National Parks*: A 10 km buffer applied as indicated in Listing Notice 3. National parks are our nationally important biodiversity and tourism assets and biodiversity-incompatible (i.e., undesirable) land-uses within the ESA protected area buffer must be avoided.
- *Protected Areas (Nature Reserves):* A 5 km buffer distance has been applied around nature reserves as indicated in Listing Notice 3.Nature Reserves have both biodiversity and tourism value, and any undesirable changes in land-use within the buffer zone should be avoided.
- *Protected Environments:* A 1 km buffer is applied around Protected Environments. Protected Environments are often situated in production landscapes in which biodiversity-compatible production and management practices are taking place, according to an agreed management plan.

Other Natural Areas (ONA)

These are natural areas that have not been selected to meet biodiversity pattern or ecosystem process targets, or to support the functioning of Critical Biodiversity Areas. Despite this, they are not without 'value'. ONAs often retain much of their natural character and may contribute significantly to maintenance of viable species populations and natural ecosystem functioning, and may provide important ecological infrastructure and ecosystem services. They are not, however, prioritized for immediate conservation action in the MBSP, unless CBAs or ESAs are lost, or impacting activities within the ONAs impact negatively on other areas.

Modified ('Transformed')

Modified areas (often called 'transformed' areas in other literature, including the MBCP)are those which have lost a significant proportion (or all) of their natural biodiversity and in which ecological processes have broken down (in some cases irretrievably), as a result of biodiversity-incompatible land-use practices such as ploughing, hardening of surfaces, mining, cultivation and the construction of houses or other built infrastructure. Even so, these areas may include small fragments of natural habitat such as the patches or strips of natural vegetation that survive between planted fields or the small, natural open spaces in towns. These disconnected fragments are often biologically impoverished, highly vulnerable to damage and have limited likelihood of being able to persist, though they may retain some residual biodiversity value and ecological function. They are not generally considered a priority for conservation action unless they contain unique features that demand it.

Two sub-categories of Modified are recognised:

Heavily Modified: includes areas that are significantly modified from the natural state, and in which biodiversity pattern and ecological function has been lost to the point that it is not worth considering these areas for any kind of conservation action due to their poor ecological state. It is often recommended that biodiversity-incompatible land uses be located within these areas to avoid negative impacts in other areas that are of greater biodiversity value.

Moderately Modified – Old Lands: includes areas which were modified from the natural state within the last 80 years but where the impacting land uses have been abandoned at some point and the land has been left to re-vegetate. These areas include old mines and old cultivated lands, collectively termed "Old Lands" in the MBSP. These are areas where biodiversity pattern and ecological function have been

seriously compromised, but they may still play an important role in the provisioning of ecosystem services, or may provide important habitats for certain animal species. For example, old cultivated lands can provide important feeding grounds for birds such as blue cranes and disused mine shafts can provide suitable habitats for certain species of bats.

Appendix B: Land-use guidelines for Terrestrial Critical Biodiversity Areas

Map category	Desired management objective	General guidelines	
Protected Areas	According to Protected Area management Plans.	• All operational aspects of managing these areas must be subject to their main purpose, which is to protected and maintain biodiversity and ecological integrity, and should be governed by a formally approved protected area management plan. • The management plan must identify allowable activities, which should be consistent at least with the CBA Irreplaceable category; the location of these allowable activities should be captured in a zonation plan in the management plan. • Activities relating to the construction of roads, administrative or tourism infrastructure and services (such as water reticulation systems, power lines and the likes) that are required to support the primary function of the protected area and its allowable activities, must be subject to at least a basic scoping report, or a full EIA, as specified by NEMA, and the protected area management plan.	
Critical Biodiversity Areas	Maintain in a natural or near-natural state with no further loss of natural habitat.	• Allow low-impact land uses that are compatible with maintaining CBAs in a natural state, with no loss of habitat or species. • Earmark CBAs as priority sites for land care projects such as Working for Water, Working for Wetlands, and Working on Fire and other compatible, conservation activities. • Avoid activities identified in the three Listing Notices (R983, R984 and R985), if at all possible, as they are in conflict with the desired management objectives for terrestrial CBAs. Where they cannot be avoided, the impacts of these activities should be minimised and remedied, and EIA conditions should be strictly applied by the competent authority. • In larger geographically sensitive areas, EMFs (provided for under sections 24 (5)(i) and 44 of NEMA) should be developed and implemented to inform environmental authorisations, promote sustainability, secure biodiversity and ecological functionality and promote co-operative governance. The information and maps of the EBRP should be used to promote and support compilation of any EMFs.	
Sub-categories	**Desired management objective**	**General guidelines**	**Specific guidelines for meeting minimum requirements**
Irreplaceable CBAs	Maintain in a natural or near-natural state with no further loss of natural habitat.	• Biodiversity loss and land-use change in Irreplaceable CBAs should be monitored as a matter of priority, to prevent unauthorized land-use change or degradation by neglect or ignorance. • Where appropriate, these areas should be incorporated into the formal Protected Area system through biodiversity stewardship agreements (contract Nature Reserves or Protected Environments). • Ideally, conservation management activities should be the primary land use in all irreplaceable areas, OR they should	• In general, irreplaceable sites must be avoided in terms of the mitigation hierarchy. • A specialist study must be part of the Basic Assessment, Scoping or EIA process for all land-use applications in these areas, using the services of an experienced and locally knowledgeable biodiversity expert. • Applications for land use of any kind should be referred to the biodiversity specialists in MTPA and DARDLEA for evaluation.

		at least be managed in ways that have no negative impact on species, ecosystems or ecosystem services. • Extensive (widespread, low-intensity) livestock or game ranching, if well-managed, is compatible with the desired management objectives for these areas. These land uses are acceptable if they take into account the specific biodiversity features (e.g., rare species or vegetation remnants) and vulnerabilities (e.g., infestation by invasive alien plants) at each site, if they comply with recommended stocking rates, if any associated infrastructure (required to support the ranching activities) is kept to low levels.	• Degraded areas included in the land parcel, but not the land use proposal, should be restored to natural ecosystem functioning where possible. • Provision of alternative land as a 'biodiversity offset' in exchange for biodiversity loss in these areas CANNOT be considered except in exceptional circumstances and would need to be considered on a case-by-case basis.
Optimal CBAs (referred to as Important and Necessary in MBCP)	Maintain in a natural or near-natural state with no further loss of natural habitat.	• Acceptable land uses are those that are least harmful to biodiversity, such as conservation management, or extensive livestock or game farming (see below). Large-scale cultivation, mining and urban or industrial development are not appropriate. • Extensive (widespread, low-intensity) livestock and game ranching, if well-managed (see above), is compatible with the desired management objectives for these areas.	• If small-scale land-use change is unavoidable, it must be located and designed to be as biodiversity-sensitive as possible. • A specialist study must be part of the Basic Assessment, Scoping or EIA process for all land-use applications in these areas, using the services of an experienced and locally knowledgeable biodiversity expert. • Provision for biodiversity offsets in exchange for biodiversity loss should only be considered as a **last resort** and at a ratio consistent with national policy.
Ecological support areas	The desired management objective for all ESAs is to maintain the land in a near-natural and ecologically functional state, even if some loss of ecosystem composition or structure takes place.		
Landscape and local-scale corridors	Maintain ecological functionality in support of biodiversity connectivity by retaining the existing natural vegetation cover in a healthy ecological state, and restore 'critical-linkages' where necessary.	A greater range of land uses over wider areas is appropriate, subject to an authorisation process that ensures the underlying biodiversity objectives are not compromised.	• Certain activities covered under Listing Notice 3 trigger the EIA process in ESA corridors. • Restoration of corridors is important, particularly in terms of the Working for Water programs. • The impact of land-use proposals on the functionality of ecological corridors must be assessed by the relevant biodiversity specialist as part of the EIA/Scoping report. • Impenetrable fences that restrict animal movement should be discouraged.

Protected Area Buffers	To minimise the impacts of surrounding land uses on the ecological integrity, character and tourism potential of protected areas.	When assessing the impacts of proposed land uses in protected area buffers, consideration needs to be given to both direct (e.g., cultivation and the loss of habitat) and indirect impacts (e.g., light and noise pollution).	• Buffer distances vary according to the nature of the Protected Area, as follows: ○ Nature Reserves: 5 km buffer as indicated in Listing Notice 3. • Land-use change applications within the buffer zone may be referred to the protected area manager or ecologist for evaluation. • A viewshed analysis of the potential visual impact of the proposed land use on adjacent protected areas should be undertaken where necessary.
Other Natural Areas	N/A	• These areas have the greatest flexibility in terms of management objectives and permissible land uses. • Where possible, avoid modifying any remaining natural habitat by locating land uses, including cultivation and plantations, in already-modified areas. • Authorisation may be required for high-impact land uses (such as intensive industry or urban development) and standard application of EIA regulations and other planning procedures is required.	
Heavily or moderately modified areas	N/A	• Areas with no natural habitat remaining are preferred sites for higher-impact land uses, and new projects should be located in these areas before modifying any remaining natural habitat. • Restoration should be prioritised where heavily modified areas occur close to land of high biodiversity value, or are located such that they could potentially serve useful ecological connectivity functions (such as in ecological corridors). • When locating land uses in these modified areas, consider the off-site impacts they may have on neighbouring areas of natural habitat, especially if these are of high biodiversity value. For example, controlling use of pesticides in modified areas, because of the impacts on neighbouring areas of natural habitat. • Encourage landowners and developers to use indigenous plants, especially trees, where aesthetic or functional options exist. • Stabilise ecosystems and manage them to restore ecological functionality, particularly soil carbon and water-related functionality, using indigenous plant cover. Old lands should be burnt and grazed appropriately.	

Appendix C: Structure of the Report

The Terrestrial Biodiversity Specialist Assessment was conducted in accordance with the Terrestrial Biodiversity Protocol (2020). This protocol provides the criteria for the specialist assessment and minimum report content requirements for impacts on Terrestrial biodiversity for activities requiring EA. This protocol replaces the requirements of Appendix 6 of the EIA Regulations 2014, GN R. 982 (as amended), published under NEMA.

The assessment and reporting requirements of this protocol are associated with a level of environmental sensitivity identified by DFFE's national web-based environmental screening tool screening tool. The screening tool identified the site footprint as falling within an area of "Low Sensitivity" for Terrestrial biodiversity theme. The screening tool identified the site footprint as falling within an area of "High" and "Medium" sensitivity for terrestrial animal and plant species diversity, respectively. Table indicates how the assessment complied with the requirements of the Terrestrial Biodiversity Protocol, with reference to specific sections in this report.

Requirement of GN 648 of 10 May 2019 VERY HIGH SENSITIVITY RATING – for Terrestrial Biodiversity Features	**Fulfilment**
The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:	
Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Section 2.1 Annexure D
A signed statement of independence by the specialist;	Section 2.1
A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Chapter 4
A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	Chapter 5
A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Chapter 4
A location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	Not Applicable to this project
Additional environmental impacts expected from the proposed development;	Chapter 13.1
Any direct, indirect and cumulative impacts of the proposed development;	Chapter 13.1.1.3
The degree to which impacts and risks can be mitigated;	Chapter 13.1
The degree to which the impacts and risks can be reversed;	Chapter 13.1
The degree to which the impacts and risks can cause loss of irreplaceable resources	Chapter 13.1
Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	Chapter 13.1
A motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a "low" terrestrial biodiversity sensitivity and that were not considered appropriate;	Not Applicable to this report
A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	Executive summary Chapter 14
Any conditions to which this statement is subjected	Chapters 11,12 and 14

Appendix D: Biodiversity Specialist CV

AVHAFAREI PHAMPHE

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Educational Qualification

University of Pretoria – MSc. Botany.
University of Venda – University Education Diploma (Biological Science))
University of Venda - Bachelor of Science Honours (Botany)
University of Venda – Bachelor of Science (Botany & Chemistry)

Professional Registrations

- South African Council of Natural Scientific Professions (SACNASP) (Ecological Science- 400349/12)
- South African Institute of Ecologists and Environmental scientists (SAIEES)
- South African Green Industries Council (SAGIC AIS)
- South African Association of Botanists (SAAB)

Project Experience (Selected Projects)

- Proposed upgrading of Olifantspoort and Ebenezer Water Supply Schemes, Phase 1, within the Jurisdiction of Capricorn and Mopani District Municipalities, Limpopo Province.
- Proposed Mokolo and Crocodile River (West) Water Augmentation Project (Phase 2A) (MCWAP-2A): Water Transfer Infrastructure
- Proposed Vaal Gamagara Regional Water Supply Phase 2: Upgrading of the existing Scheme
- Terrestrial ecological assessment report. Nketoana Regional Bulk Water Scheme Project Free State province.
- Terrestrial ecological assessment report. Proposed Surface Water Developments for Augmentation of the Western Cape Water Supply System
- Terrestrial ecological assessment report. Eskom Emkhiweni Substation and 400KV Line from Emkhiweni Substation to Silimela, Limpopo and Mpumalanga Provinces
- Botanical survey at Eskom Skaapvlei substation included in the West Coast Group of Battery Energy Storage System (BESS) project, Western Cape province
- Botanical Survey at Eskom Paleisheuwel Substation in the West Coast. Group of Battery Energy Storage System (BESS) Project in Western Cape
- Proposed Matjhabeng Solar PV with Battery Energy Storage Systems Project: Phase 1 and Phase 2 Sites
- Proposed Turffontein sewer upgrade
- Proposed Greater Orange Farm water upgrade
- Proposed sewer pipe replacement in Lorentzville, City of Johannesburg
- Proposed Lanseria outfall sewer

- Proposed desludging and lining of dam 02 within the Northern Wastewater Treatment Works, in Johannesburg, Gauteng province
- Proposed uMkhomazi water project phase 1 – Raw water component
- Proposed roads and stormwater infrastructure for Soshanguve Block L
- Proposed stormwater and sewer infrastructure for the uMhlanga Ridgeside development
- Proposed High altitude training Centre in Belfast
- Flora and fauna assessment, Proposed BG3 pipeline, Vaal River.
- Terrestrial ecological assessment report. New wastewater treatment works at Lanseria, City of Johannesburg.
- Terrestrial ecological assessment report. Proposed 100ml Bronberg reservoir and associated infrastructure
- Ecological Assessment; Proposed Ncwabeni Off-Channel Storage Dam
- Flora and Fauna assessment in Bankfontein farms, Breyten, Mpumalanga
- Flora and Fauna assessment in Vaalbank, Carolina, Mpumalanga.
- Flora and fauna assessment Proposed hydropower plant within Rand Water's hydraulic network at Zoekfontein site.
- Proposed upgrade of O6 pipeline
- Proposed construction of BG3 pipeline near Vaal River
- Proposed construction of S4 pipeline.
- Proposed construction of B16 pipeline.
- Terrestrial ecological assessment report. Proposed Foxwood Dam, Eastern Cape province
- Monitoring reporting for *Warburgia salutaris* in Ithala Game Reserve
- Status report for Black and White rhino in Ithala Game Reserve
- Recovery plan for *Protea comptonii* for Ithala Game Reserve
- Fire monitoring report for Ithala Game Reserve, Vryheid hill Nature Reserve and Pongola bush Nature Reserve
- Mechanical removal of *Dichrostachys cinerea* in Ithala Game Reserve

Work Experience

1. Independent Biodiversity Specialist

June 2020 to present

- Vegetation Surveys
- Fauna surveys
- Development of biodiversity sector plans
- Interpreting conservation plans to inform local and regional planning
- Alien Plant Management Plans
- Search, Rescue and Relocation Plans
- Walk-through surveys
- Development of management plans for important species and habitats
- Undertaking environmental audits

2. Nemai Consulting (Pty) Ltd- Senior Biodiversity Specialist

May 2010-May 2020

- Compile flora and fauna reports
- Compile rehabilitation plans.
- Compile Basic Assessments reports and Environmental Management Programmes.

- Scientific data collection.
- Compile scientific flora and flora reports
- Involved in Public Participation Process
- Project management
- Compile Biodiversity Sector Plans
- Acted as an Environmental Control Officers

3. Digby Wells and Associates- Flora and Fauna Specialist

January 2008-April 2010

- Compile flora and fauna reports
- Compile rehabilitation plans.

4. Ezemvelo KZN Wildlife- Ecologist

March 2004-December 2007

- fire management and reporting,
- GIS mapping,
- Monitoring of endangered species,
- Liaise with neighbouring communities and schools about environmental education,
- Handling budget for the research station,
- Annual game count census,
- Involved in integrated management plans,
- Elephant management plan.
- Compile rehabilitation plans.

5. South African National Biodiversity Institute- Agricultural Development Technician

January 2004-February 2004

- Herbarium database
- Herbarium specimens filling
- Data Quality Controller,

6. South African National Biodiversity Institute- Volunteer and Ad Hoc

January 2002-December 2003

- PRECIS database,
- Mounting of specimens,
- Filing,
- Data quality control

7. University of Pretoria-Zoology Department- African National Biodiversity Institute- Volunteer and Ad Hoc

July 2001-September 2001

- Filing,
- Data quality control

Courses/workshops/conferences attended

- Biodiversity Offset Training October 2019, organized by SANBI and DEFF
- Alien invasive plants workshop, 2016
- South African Association of Botanists Conference in Drakensville, hosted by the University of Kwa-Zulu Natal, January 2013
- South African Association of Botanist's Conference in Rhodes University (Grahamstown 2001)
- South African Association of Botanists' Conference in Pretoria University (2002)
- Distance course (01-03 June 2004)

- Financial policies and procedures (08-10 June 2004)
- Population modeling course (01-04 November 2004)
- Vegetation monitoring (22-24 November 2004)
- Vulture monitoring workshop (19-21 January 2005)
- Grassland ecology course (08-10 March 2005)
- Introduction to geographic information systems (18-26 April 2005)
- Waste management course (13-15 March 2006)
- Elephants of the red volta: earth watch expedition in Ghana (1-18 July 2006)
- 21st international conference of society for conservation biology in nelson Mandela metropolitan university in port Elizabeth (1-5 July 2007)
- Wetlands workshop, organized by GDARD, 2010

Scientific paper reviewed

- J.P. VAN DER LINDEN, D.P. FERREIRA, S.J. SIEBERT, G.J. BREDENKAMP AND F. SIEBERT. 2007. Vegetation dynamics of the woody layer of Zululand coastal thornveld, KwaZulu-Natal.

References

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