BIODIVERSITY IMPACT ASSESSMENT – PROPOSED HARTEBEEST HOEK SOLAR PHOTOVOLTAIC (PV) 1 TRANSMISSION INFRASTRUCTURE PROJECT

Pixley Ka Seme District Municipality, Northern Cape Province

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Prepared by:

The Biodiversity Company

Cell: +27 81 319 1225

Fax: +27 86 527 1965

info@thebiodiversitycompany.com

www.thebiodiversitycompany.com

Report Name	**BIODIVERSITY IMPACT ASSESSMENT – PROPOSED HARTEBEEST HOEK SOLAR PHOTOVOLTAIC (PV) 1 TRANSMISSION INFRASTRUCTURE PROJECT**
Specialist Theme	Terrestrial Biodiversity, Plant and Animal Theme
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Environmental Assessment Practitioner	
Report Writer	Martinus Erasmus (SACNASP 118630)
Reviewer	Andrew Husted (SACNASP 400213/11)
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, Amended. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

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1 Introduction

1.1 Background

Mulilo Renewable Energy (Pty) Ltd is proposing the development of a transmission corridor and associated infrastructure located on the Remainder of the Farm Roode Kraal No. 28, the Remainder of the Farm Riet Fountain No. 6, the Remainder of the Farm Hartebeest Hoek No. 31, and the Remainder of the Farm Wagt en Biettje No. 5, for the proposed Hartebeest Hoek Solar Photovoltaic (PV)1 development near De Aar, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province.

The National Web based Environmental Screening Tool has characterised the Terrestrial Theme Sensitivity of the PAOI as “Very High”. Accordingly, this assessment was conducted in accordance with the amendments to the Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices (GN) 320 (20 March 2020) and GN 1150 (30 October 2020): “Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation” (Reporting Criteria).

The purpose of the specialist assessment is to provide relevant input into the basic assessment process and provide a report for the proposed activities associated with the project. This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological viability of the proposed project.

1.2 Project Description

The following information was provided by SES (2024).

The proposed development will comprise the following:

- The Eskom Switching Station (SS) will be proposed adjacent to the proposed IPP Substation;
- An 132kV Overhead Power Line leading from the proposed Eskom Switching Station to the future Kestral Main Transmission Station (MTS) (previously referred to as the Wag ‘n Bietjie MTS approved through DFFE Ref: 14/12/16/3/3/1/2577/4);
- A 132kV Feeder bay will be constructed at the MTS and the 400kV Busbar at the MTS will be extended; and
- The proposed development will also see to the installation of a new 400/132kV transformer and bay at the MTS.

1.3 Project Area of Influence

The proposed development area, which includes an Eskom Switching Station (SS), 132kV Overhead Power Line, Main Transmission Station (MTS), and 400/132kV transformer was based on the corridors provided by the client and is collectively referred to as the Project Area of Influence (PAOI) from here on.

A map of the PAOI in relation to the local region is presented in Figure 1-1, and a detailed map of the PAOI and associated development footprint is presented in Figure 1-2.

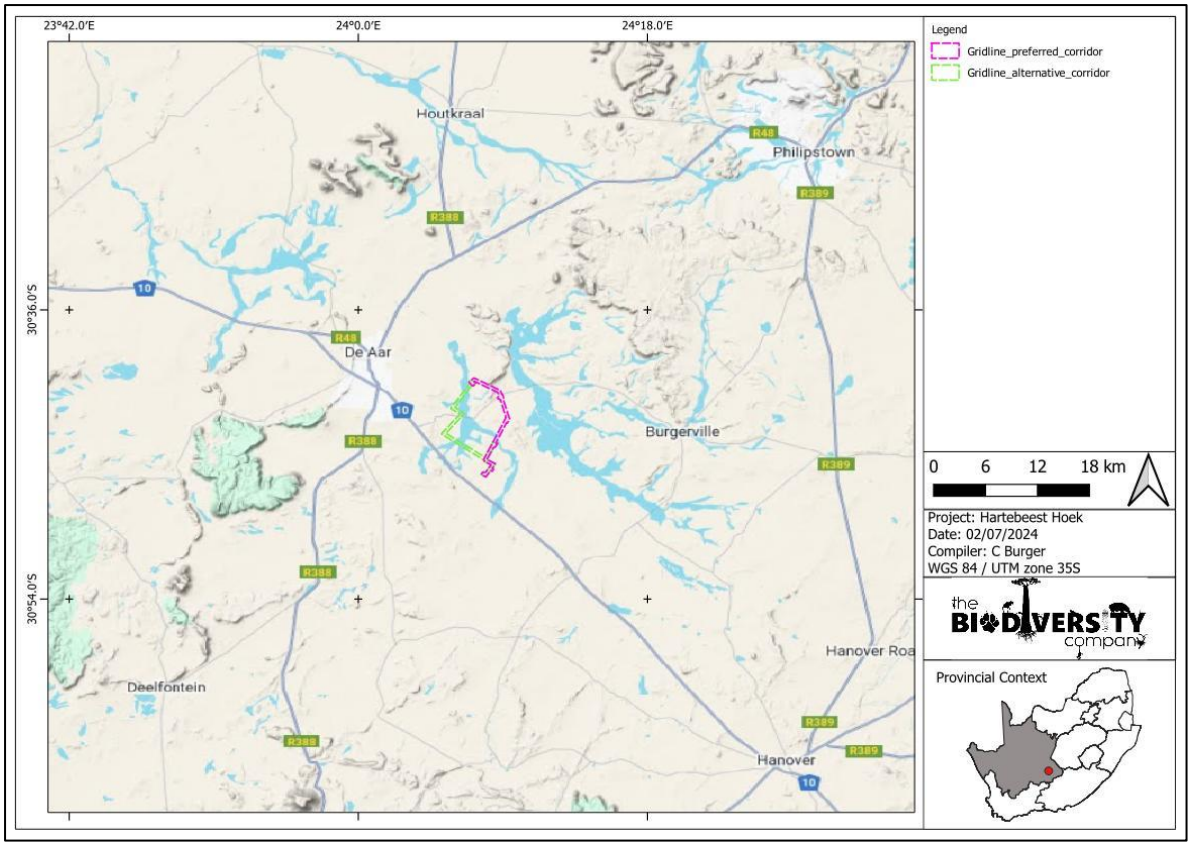


Figure 1-1 Map illustrating the regional context of the PAOI.

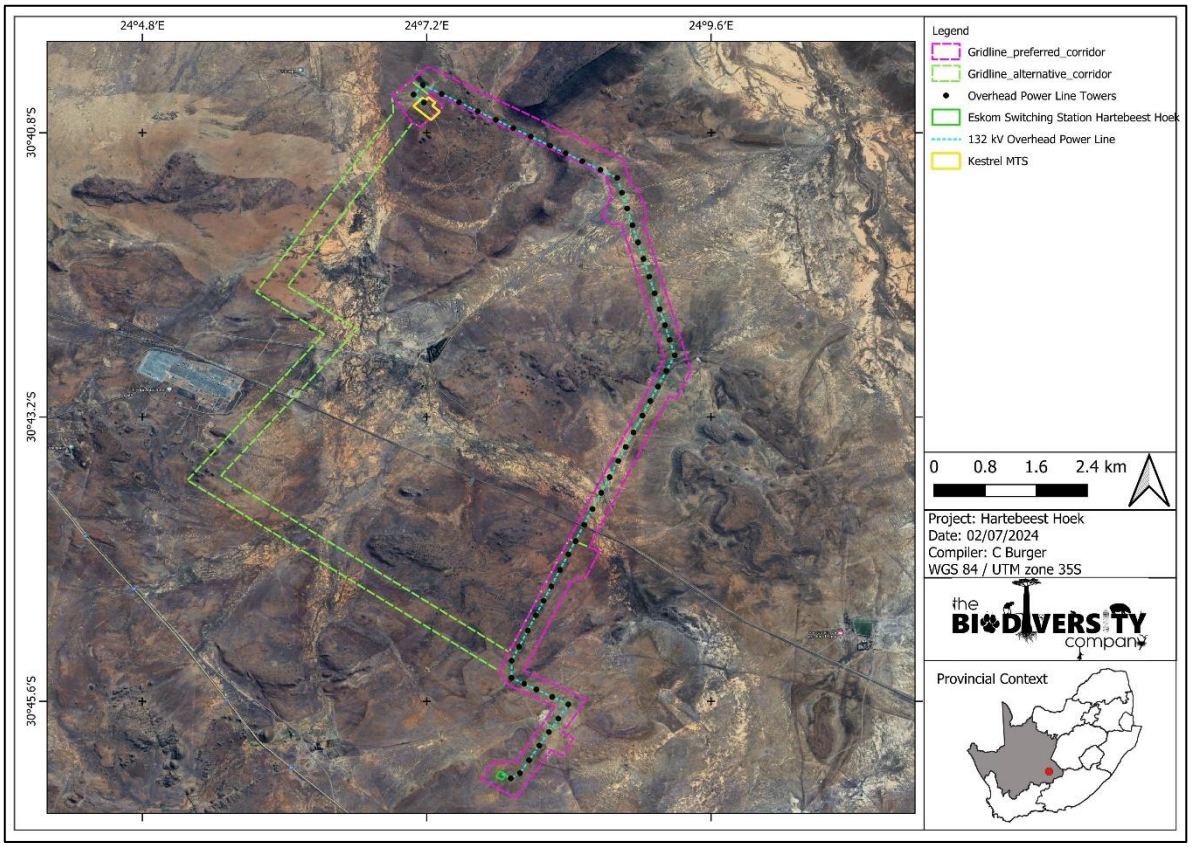


Figure 1-2 Map illustrating the layout of the PAOI.

1.4 Scope of Work

The principal aim of the assessment was to provide information to guide the risk of the proposed development to the flora and fauna communities of the ecosystems associated with the project area. The scope of work for the assessment comprises of the following:

- Desktop assessment to identify the relevant ecologically important geographical features within the Project Area of Influence (PAOI) and surrounding landscape;
- Desktop assessment to compile an expected species list and possible flora and fauna Species of Conservation Concern (SCC) that potentially occur within the proposed PAOI;
- Field survey to ascertain the species composition of the present flora and fauna community within the PAOI;
- Delineate the Site Ecological Importance (SEI) within the PAOI;
- Identify the manner that the proposed development impacts the flora and fauna community and evaluate the level of risk of these potential impacts; and
- The prescription of mitigation measures and recommendations for identified risks.

1.5 Assumptions and Limitations

The following assumptions and limitations are applicable for this assessment:;

- Whilst every effort was made to cover as much of the site as possible, it is possible that some flora and fauna species that are present on site were not recorded during the field survey, especially secretive or rare species;
- With regards to the fauna species assessment, only amphibians, reptiles and non-volant mammal species were considered. The volant mammal impact assessment were undertaken by separate specialists;
- No passive sampling techniques for small non-volant mammals were utilised within the PAOI due to time constraints;
- Only a single scoping survey was undertaken in October (Summer) and hence there is a high probability that not all species of flora will be recorded. Due to time constraints no protected flora were geotagged;
- Any alterations and/or missing GIS information pertaining to the development layout subsequent to this assessment may affect the accuracy and/or outcomes of the assessment; and
- The GPS used in the assessment has an accuracy of 5 m and consequently any spatial features may be offset by 5 m.

1.6 Key Legislative Requirements

The legislation, policies and guidelines listed below in Table 1-1 are applicable to the current project. The list below, although extensive, may not be complete and other legislation, policies and guidelines may apply in addition to those listed below.

Table 1-1 A list of key legislative requirements relevant to biodiversity and conservation in the Northern Cape Province

Region	Legislation / Guideline	Comment
National	The National Environmental Management Act (NEMA) (Act No. 107 of 1998)	Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017), Appendix 6 requirements
	The National Environmental Management: Biodiversity Act (Act No. 10 of 2004), Threatened or Protected Species Regulations	The protection of species and ecosystems that warrant protection
	Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, GNR 320 of Government Gazette 43310 (March 2020)	The minimum criteria for reporting.
	Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, GNR 1150 of Government Gazette 43855 (October 2020)	Protocol for the specialist assessment and minimum report content requirements.
	The National Environmental Management: Waste Act, 2008 (Act 59 of 2008);	The regulation of waste management to protect the environment.
	National Water Act (NWA) (Act No. 36 of 1998)	The regulation of water uses.
	Alien and Invasive Species Regulations and, Alien and Invasive Species List 20142020, published under NEMBA	The regulation and management of alien invasive species.
	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA)	To provide for control over the utilization of the natural agricultural resources including the vegetation and the combating of weeds and invader plants.
Provincial	Northern Cape Planning and Development Act no. 7 of 1998	To provide for the management and conservation of the province's biophysical environment and protected areas. To inform land use planning, environmental assessments, land and water use authorisations, as well as natural resource management,
	Northern Cape Nature Conservation act no. 9 of 2009	

2 Methods

The desktop assessment was principally undertaken using a Geographic Information System (GIS) to access the latest available spatial datasets to develop digital cartographs and species lists. These datasets and their date of publishing are provided below.

2.1 Desktop Baseline

2.1.1 Ecologically Important Landscape Features

Existing ecologically relevant data layers were incorporated into a GIS to establish how the proposed project might interact with any ecologically important entities. Emphasis was placed around the following spatial datasets:

- National Biodiversity Impact Assessment 2018 (Skowno et al, 2019) (NBA) - The purpose of the NBA is to assess the state of South Africa's biodiversity based on best available science, with a view to understanding trends over time and informing policy and decision-making across a range of sectors. The NBA deals with all three components of biodiversity: genes, species and ecosystems; and assesses biodiversity and ecosystems across terrestrial, freshwater, estuarine and marine environments. The two headline indicators assessed in the NBA are:

- Ecosystem Threat Status – indicator of an ecosystem's wellbeing, based on the level of change in structure, function or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Least Concern (LC), based on the proportion of the original extent of each ecosystem type that remains in good ecological condition. The revised red list of threatened ecosystems was developed between 2016 and 2021 incorporating the best available information on terrestrial ecosystem extent and condition, pressures and drivers of change. The revised list (known as the Red List of Ecosystems (RLE) 2022) is based on assessments that followed the International Union for Conservation of Nature (IUCN) Red List of Ecosystems Framework (version 1.1) and covers all 456 terrestrial ecosystem types described in South Africa (Mucina and Rutherford 2006; with updates described in Dayaram et al., 2019). The revised list identifies 120 threatened terrestrial ecosystem types (55 Critically Endangered, 51 Endangered and 14 Vulnerable types). The revised list was published in the Government Gazette (Gazette Number 47526, Notice Number 2747) and came into effect on 18 November 2022.

- Ecosystem Protection Level – indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. NP, PP or MP ecosystem types are collectively referred to as under-protected ecosystems.

- Protected areas:

  - South Africa Conservation Areas Database (SACAD) and South Africa Protected Areas Database (SAPAD) (DFFE, 2021a) – The South African Protected Areas Database (SAPAD) contains spatial data for the conservation of South Africa. It includes spatial and attribute information for both formally protected areas and areas that have less formal protection. SAPAD is updated on a continuous basis and forms the basis for the Register of Protected Areas which is a legislative requirement under the National Environmental Management: Protected Areas Act, Act 57 of 2003.

  - National Protected Areas Expansion Strategy (NPAES) (DFEE, 2021b) – The National Protected Area Expansion Strategy (NPAES) provides spatial information on areas that are suitable for terrestrial ecosystem protection. These focus areas are large, intact and unfragmented and are therefore, of high importance for biodiversity, climate resilience and freshwater protection.

- Northern Cape Critical Biodiversity Areas (CBAs) (SANBI, 2016) - The identification of Critical Biodiversity Areas for the Northern Cape was undertaken using a Systematic Conservation Planning approach. Available data on biodiversity features (incorporating both pattern and process, and covering terrestrial and inland aquatic realms), their condition, current Protected Areas and Conservation Areas, and opportunities and constraints for effective conservation were collated. Priorities from existing plans such as the Namakwa District Biodiversity Plan, the Succulent Karoo Ecosystem Plan, National Estuary Priorities, and the National Freshwater Ecosystem Priority Areas were incorporated. Targets for terrestrial ecosystems were based on established national targets, while targets used for other features were aligned with those used in other provincial planning processes. CBA categories are based on their biodiversity characteristics, spatial configuration and requirement for meeting targets for both biodiversity pattern and ecological processes:

- Critical Biodiversity Area (CBA) – An area that must be maintained in a good ecological condition (natural or near-natural state) in order to meet biodiversity targets. CBAs collectively meet biodiversity targets for all ecosystem types as well as for species and ecological processes that depend on natural or near-natural habitat, that have not already been met in the protected area network (SANBI, 2016).

- Ecological Support Area (ESA) – An area that must be maintained in at least fair ecological condition (semi-natural/moderately modified state) in order to support the ecological functioning of a CBA or protected area, or to generate or deliver ecosystem services, or to meet remaining biodiversity targets for ecosystem types or species when it is not possible or no necessary to meet them in natural or near-natural areas (SANBI, 2016).

- Other Natural Area (ONA) – An area in good or fair ecological condition (natural, near-natural or semi-natural) that is not required to meet biodiversity targets for ecosystem types, species or ecological processes (SANBI, 2016).

- Hydrological Setting:

  - South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Van Deventer *et al,* 2018) – A South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was established during the National Biodiversity Impact Assessment of 2018. It is a collection of data layers that represent the extent of river and inland wetland ecosystem types as well as pressures on these systems.

  - Strategic Water Source Areas (SWSAs) (Le Maitre *et al*, 2021) – SWSAs are defined as areas of land that supply a quantity of mean annual surface water runoff in relation to their size and therefore, contribute considerably to the overall water supply of the country. These are key ecological infrastructure assets and the effective protection of surface water SWSAs areas is vital for national security because a lack of water security will compromise national security and human wellbeing.

  - National Freshwater Ecosystem Priority Area (NFEPA) (Nel *et al.,* 2011) – The NFEPA database provides strategic spatial priorities for conserving the country's freshwater ecosystems and associated biodiversity as well as supporting sustainable use of water resources.

2.1.2 Environmental Screening Tool

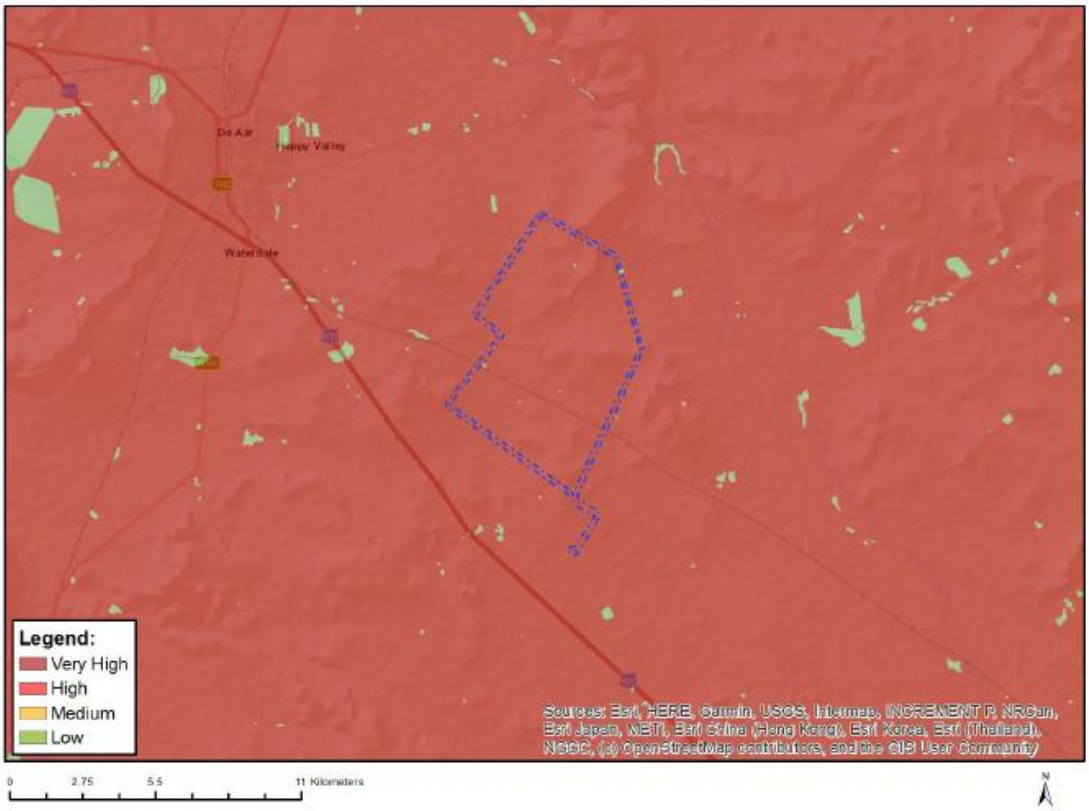
According to the Screening Tool Report generated (Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended), the following sensitivity classifications were extracted from the National Web-based Environmental Screening Tool (Figure 2-1 to Figure 2-3):

- Combined Terrestrial Biodiversity Theme is Very High, due to overlap with ESA features;

- Plant Species Theme is Low; and

- Animal Species Theme is High.

MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY



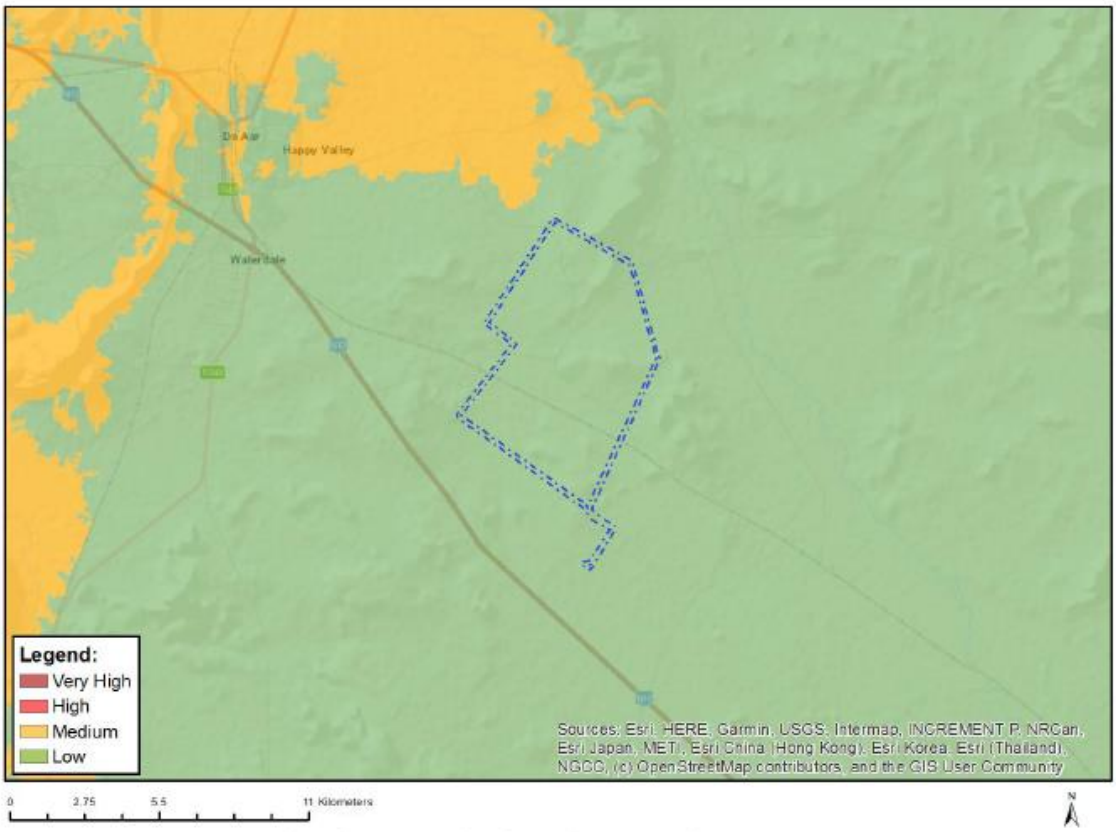
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Very High	ESA

Figure 2-1 Relative Terrestrial Biodiversity Theme Sensitivity for the proposed PAOI

MAP OF RELATIVE PLANT SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

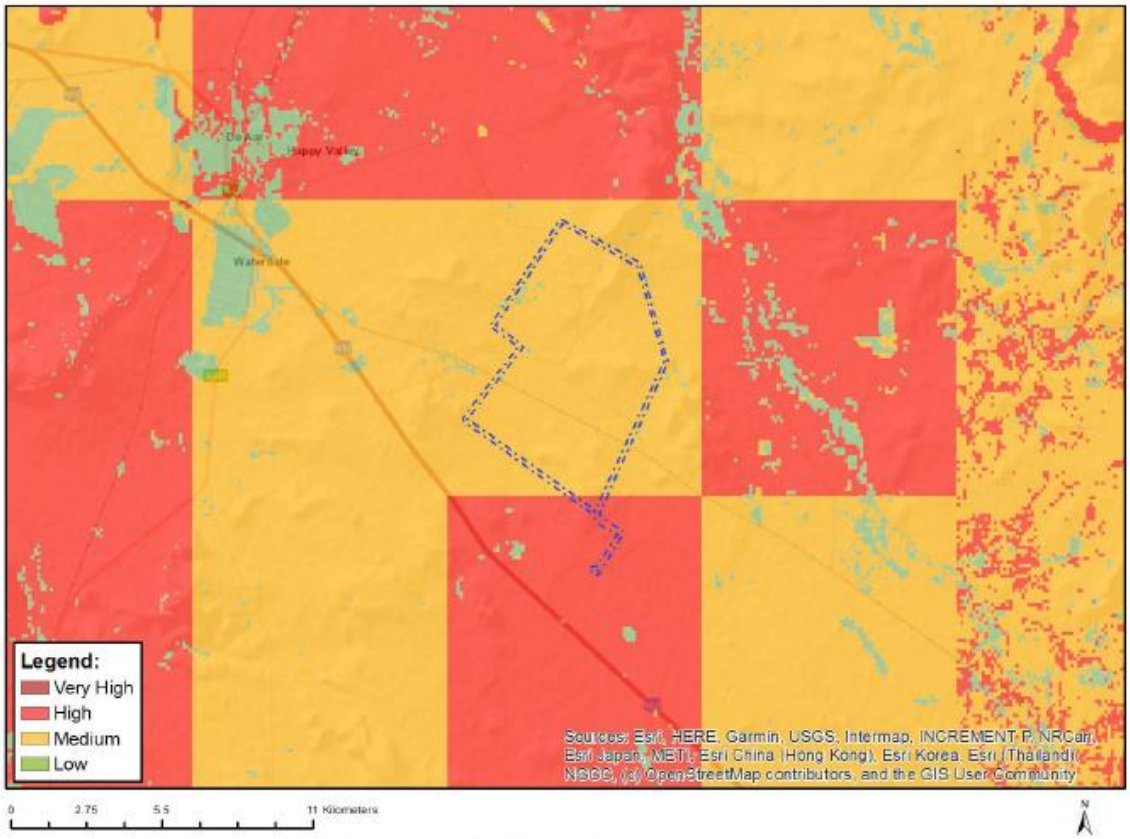
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity

Figure 2-2 Relative Plant Species Theme Sensitivity for the PAOI

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Neotis ludwigii
Low	Subject to confirmation
Medium	Aves-Aquila rapax
Medium	Aves-Aquila verreauxii
Medium	Aves-Neotis ludwigii

Figure 2-3 Relative Animal Species Theme Sensitivity for the proposed PAOI.

2.1.3 Desktop Flora Baseline

The Vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006) and SANBI (2019) was used to identify the vegetation type that would have occurred under natural or pre-anthropogenically altered conditions. Furthermore, the Plants of Southern Africa (POSA) database was accessed to compile a list of expected flora species within the project area (Figure 2-4). The Red List of South African Plants (Raimondo *et al.,* 2009; SANBI, 2020) was utilized to provide the most current national conservation status of flora species.

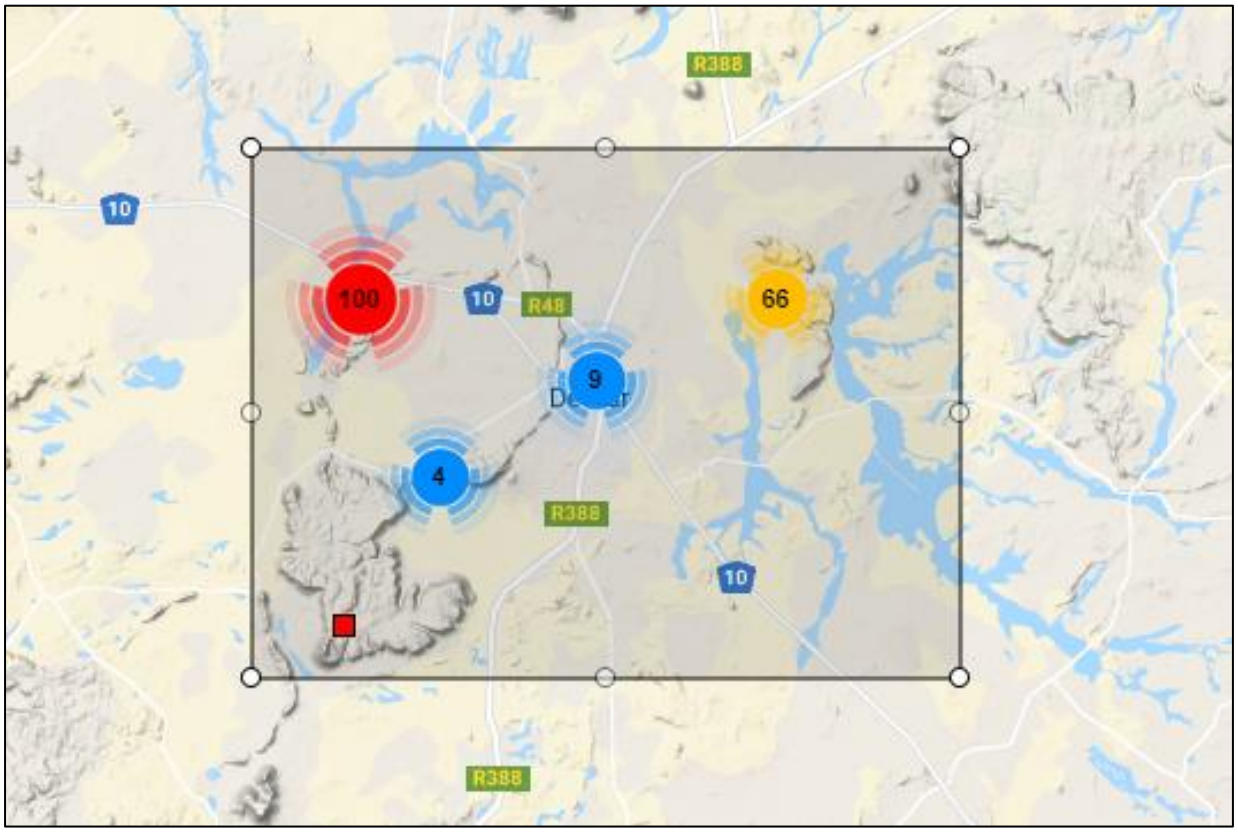


Figure 2-4 Map illustrating extent of area used to obtain the expected flora species list from the Plants of South Africa (POSA) database

2.1.4 Desktop Fauna Baseline

The faunal desktop assessment comprised of the following:

- Compiling an expected Amphibian list, generated from the IUCN spatial dataset (2017) and AmphibianMAP database (Fitzpatrick Institute of African Ornithology, 2022a), using the 3024CA quarter degree square;
- Reptile list, generated from the IUCN spatial dataset (2017) and ReptileMAP database (Fitzpatrick Institute of African Ornithology, 2022b), using the 3024CA quarter degree square; and
- Mammal list from the IUCN spatial dataset (2017) and MammalMAP database (Fitzpatrick Institute of African Ornithology, 2022c), using the 3024CA quarter degree square.

2.2 Field Assessment

A single field survey was undertaken during the 17th – 21st of October 2022 (Summer), which constitutes a wet-season survey, to determine the presence of Species of Conservation Concern (SCC) and to ascertain an overview of the ecological condition of the PAOI. Effort was made to cover the different habitat types within the limits of time and access. The fieldwork was placed within targeted areas perceived as ecologically sensitive based on the preliminary interpretation of satellite imagery (Google Corporation) and GIS analysis (which included the latest applicable biodiversity datasets) available prior to the fieldwork. Fauna species observed adjacent to, but not necessarily within the PAOI were also recorded as species occupying open habitats or arid regions tend to exhibit larger home ranges than those inhabiting wooded or high rainfall areas (Ofstad *et al*, 2016).

2.2.1 Flora Survey

The timed random meander method is a highly efficient method for conducting floristic analysis, specifically in detecting flora SCC and maximising floristic coverage (Goff *et al*, 1982). In addition, the method is time and cost effective and highly suited for compiling flora species lists and therefore gives a rapid indication of flora diversity.

Homogenous vegetation units were subjectively identified using satellite imagery and existing land cover maps. The floristic diversity and search for flora SCC was conducted through meanders within representative habitat units.

During the survey, notes were made regarding current impacts, subjective recording of dominant vegetation species and any sensitive features (e.g., wetlands, outcrops etc.).

Relevant field guides and texts consulted for identification purposes in the field during the survey included the following:

- Identification Guide to Southern African Grasses: An Identification Manual with Keys, Descriptions, and Distributions (Fish *et al,* 2015);
- iNaturalist;
- Flowering Plants of the Southern Kalahari (Van Rooyen and Van Rooyen, 2019);
- Problem Plants and Alien Weeds of South Africa (Bromilow, 2010);
- Field Guide to Succulents in Southern Africa (Smith *et al,* 2017);
- Guide to the Aloes of South Africa (Van Wyk & Smith, 2014);
- Medicinal Plants of South Africa (Van Wyk *et al.,* 2013).

2.2.2 Fauna Survey

The faunal field survey comprised of the following active and passive techniques:

- Visual and auditory searches - This typically comprised of meandering and using binoculars to view species from a distance without them being disturbed; and listening to species calls;
- Active hand-searches - are used for species that shelter in or under particular micro-habitats (typically rocks, exfoliating rock outcrops, fallen trees, leaf litter, bark etc.); and
- Utilization of local knowledge
    - Ian Horn (Farm Owner) (pers. comm, 18/10/2022);

Relevant field guides and texts consulted for identification purposes included the following:

- Field Guide to Snakes and other Reptiles of Southern Africa (Branch, 1998);

- A Complete Guide to the Snakes of Southern Africa (Marais, 2004);
- Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates *et al,* 2014);
- A Complete Guide to the Frogs of Southern Africa (du Preez and Carruthers, 2009);
- Stuarts' Field Guide to Mammals of Southern Africa including Angola, Zambia & Malawi (Stuart and Stuart, 2015); and
- Mammals of Southern Africa and their Tracks & Signs (Gutteridge & Liebenberg, 2021).

2.3 Site Ecological Importance

The different habitat types within the assessment area were delineated and identified based on observations during the field assessment as well as available satellite imagery. These habitat types were assigned Site Ecological Importance (SEI) categories based on their ecological integrity, conservation value, the presence of species of conservation concern and their ecosystem processes. The determination of the SEI was in accordance with the method described in the Species Environmental Assessment Guideline (SANBI, 2020).

Site Ecological Importance (SEI) is a function of the Biodiversity Importance (BI) of the receptor (e.g., SCC, the vegetation/fauna community or habitat type present on the site) and Receptor Resilience (RR) (its resilience to impacts).

BI is a function of Conservation Importance (CI) and the Functional Integrity (FI) of the receptor as follows. The criteria for the CI and FI ratings are provided in Table 2-1 and Table 2-2, respectively.

Table 2-1 Summary of Conservation Importance (CI) criteria

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

Table 2-2 Summary of Functional Integrity (FI) criteria

Functional Integrity	Fulfilling Criteria
Very High	Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types.

Functional Integrity	Fulfilling Criteria
	High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches. No or minimal current negative ecological impacts with no signs of major past disturbance.
High	Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches. Only minor current negative ecological impacts with no signs of major past disturbance and good rehabilitation potential.
Medium	Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types. Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. Mostly minor current negative ecological impacts with some major impacts and a few signs of minor past disturbance. Moderate rehabilitation potential.
Low	Small (> 1 ha but < 5 ha) area. Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential. Several minor and major current negative ecological impacts.
Very Low	Very small (< 1 ha) area. No habitat connectivity except for flying species or flora with wind-dispersed seeds. Several major current negative ecological impacts.

BI can be derived from a simple matrix of CI and FI as provided in Table 2-3

Table 2-3 Matrix used to derive Biodiversity Importance (BI) from Functional Integrity (FI) and Conservation Importance (CI)

Biodiversity Importance (BI)		Conservation Importance (CI)				
		Very high	**High**	**Medium**	**Low**	**Very low**
Functional Integrity (FI)	**Very high**	Very High	Very High	High	Medium	Low
	High	Very High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very Low
	Low	Medium	Medium	Low	Low	Very Low
	Very low	Medium	Low	Very Low	Very Low	Very Low

The fulfilling criteria to evaluate RR are based on the estimated recovery time required to restore an appreciable portion of functionality to the receptor as summarised in Table 2-4.

Table 2-4 Summary of Resource Resilience (RR) criteria

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

Very Low	Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed.

Subsequent to the determination of the BI and RR, the SEI can be ascertained using the matrix as provided in Table 2-5.

Table 2-5 Matrix used to derive Site Ecological Importance from Receptor Resilience (RR) and Biodiversity Importance (BI)

Site Ecological Importance		Biodiversity Importance (BI)				
		Very High	**High**	**Medium**	**Low**	**Very Low**
Receptor Resilience (RR)	Very Low	Very High	Very High	High	Medium	Low
	Low	Very High	Very High	High	Medium	Very Low
	Medium	Very High	High	Medium	Low	Very Low
	High	High	Medium	Low	Very Low	Very Low
	Very High	Medium	Low	Very Low	Very Low	Very Low

Interpretation of the SEI in the context of the proposed development activities is provided in Table 2-6.

Table 2-6 Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities (SANBI, 2020)

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

The SEI evaluated for each taxon can be combined into a single multi-taxon evaluation of SEI for the assessment area. Either a combination of the maximum SEI for each receptor should be applied, or the SEI may be evaluated only once per receptor but for all necessary taxa simultaneously. For the latter, justification of the SEI for each receptor is based on the criteria that conforms to the highest CI and FI, and the lowest RR across all taxa.

3 Results & Discussion

3.1 Desktop Assessment

3.1.1 Ecologically Important Landscape Features

The GIS analysis pertaining to the relevance of the proposed project to ecologically important landscape features are summarised in Table 3-1.

Table 3-1 Summary of relevance of the proposed project to ecologically important landscape features

Desktop Information Considered	Relevant/Irrelevant	Section
Ecosystem Threat Status	Relevant – Overlaps with a Least Concern ecosystem	3.1.1.1
Ecosystem Protection Level	Relevant – Overlaps with a Poorly Protected and Not Protected Ecosystem	3.1.1.2
Critical Biodiversity Area	Relevant – The entire PAOI overlaps with ESA	3.1.1.3
Important Bird and Biodiversity Areas	Relevant – Located within the Platberg-Karoo Conservancy IBA	3.1.1.4
Powerline Corridor	Relevant – The PAOI falls within the Central corridor	3.1.1.5
Renewable Energy EIA Application Database (REEA)	Relevant – Overlaps with “Approved” areas	3.1.1.6
South African Inventory of Inland Aquatic Ecosystems	Relevant - The PAOI’s 500m Regulated Area overlaps with an unclassified wetland and one CR Wetland.	3.1.1.7.1
National Freshwater Priority Area and Inland Water	Relevant – The PAOI’s 500m Regulated Area overlaps with unclassified wetlands and a FEPA Code 1 River which is a Freshwater Ecosystem Priority Area	3.1.1.7.2
Strategic Water Source Areas	Irrelevant- The PAOI is 270 km from the closest SWSA	-
Protected Areas	Irrelevant – 10 km from the closest Protected Area	-
Renewable Energy Development Zones	Irrelevant – The PAOI doesn’t fall within any REDZ	-
National Protected Areas Expansion Strategy	Irrelevant – The PAOI isn’t close to any NPAES	-

3.1.1.1 Ecosystem Threat Status

The Ecosystem Threat Status is an indicator of an ecosystem’s wellbeing, based on the level of change in structure, function or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Concern (LC), based on the proportion of the original extent of each ecosystem type that remains in good ecological condition. According to the spatial dataset the proposed project overlaps with LC ecosystems (Figure 3-1).

Figure 3-1 Map illustrating the ecosystem threat status associated with the proposed PAOI

3.1.1.2 Ecosystem Protection Level

This is an indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. NP, PP or MP ecosystem types are collectively referred to as under-protected ecosystems. The PAOI overlaps with NP and PP ecosystems (Figure 3-2).

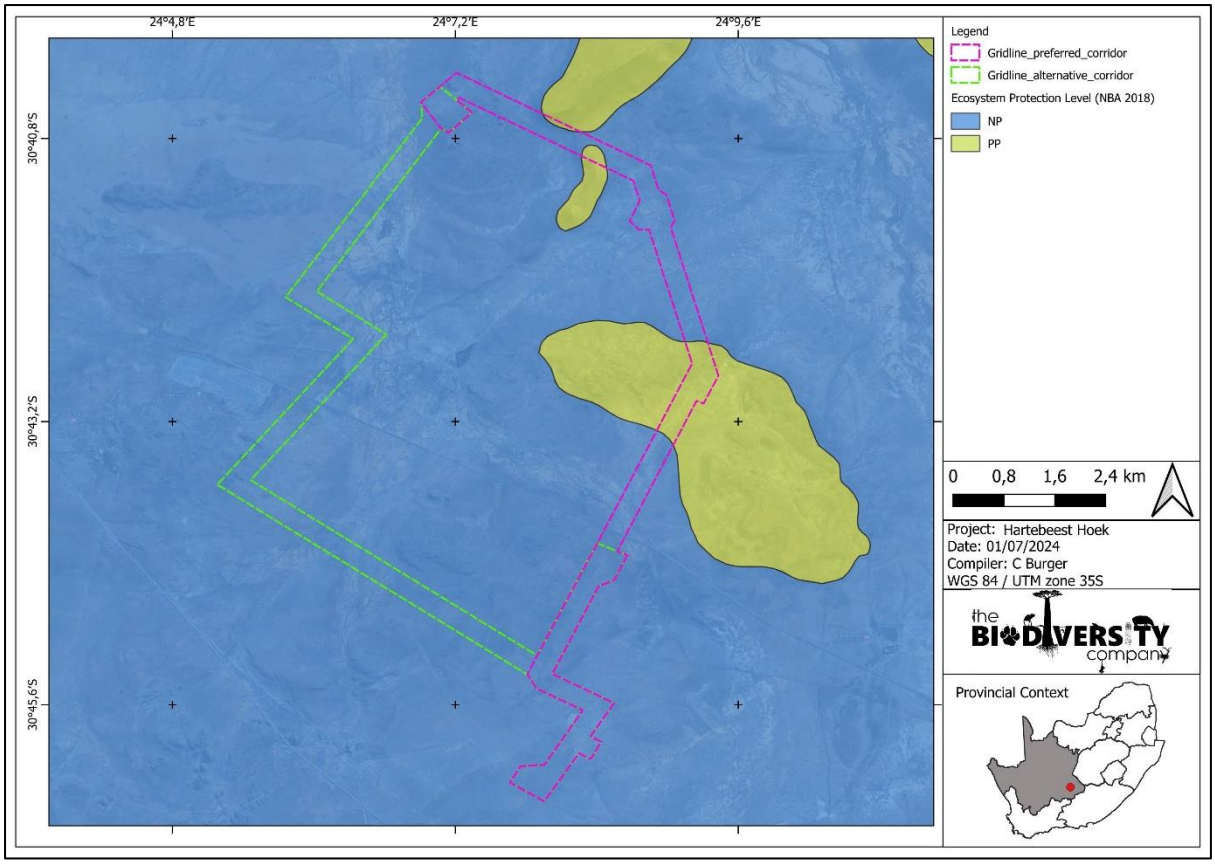


Figure 3-2 Map illustrating the ecosystem protection level associated with the proposed PAOI

3.1.1.3 Northern Cape Critical Biodiversity Areas

Figure 3-3 illustrates that the PAOI predominantly overlaps with an Ecological Support Area. ESAs area that must be maintained in at least fair ecological condition (semi-natural/moderately modified state) in order to support the ecological functioning of a CBA or protected area, or to generate or deliver ecosystem services, or to meet remaining biodiversity targets for ecosystem types or species when it is not possible or no necessary to meet them in natural or near-natural areas (SANBI, 2016).

Figure 3-3 Map illustrating the proposed PAOI in relation to the Northern Cape Critical Biodiversity Areas

3.1.1.4 Important Bird & Biodiversity Areas

Important Bird & Biodiversity Areas (IBAs) are the sites of international significance for the conservation of the world's birds and other conservation significant species as identified by BirdLife International. These sites are also all Key Biodiversity Areas; sites that contribute significantly to the global persistence of biodiversity (Birdlife, 2017).

According to Birdlife International (2017), the selection of IBAs is achieved through the application of quantitative ornithological criteria, grounded in up-to-date knowledge of the sizes and trends of bird populations. The criteria ensure that the sites selected as IBAs have true significance for the international conservation of bird populations and provide a common currency that all IBAs adhere to, thus creating consistency among, and enabling comparability between, sites at national, continental and global levels. Figure 3-4 shows the project area overlaps with the Platberg-Karoo Conservancy IBA.

Platberg–Karoo Conservancy IBA can be found in the districts of De Aar, Philipstown and Hanover. This IBA falls across two biomes, the Nama Karroo and the Grassland Biome, which contributes to its diversity of species. In total 289 bird species have been recorded here. Threats in this IBA include overgrazing, erosion and encroachment by Karoo shrubs, all of which result in the loss of habitat and a decrease in available food for large terrestrial birds.

Large terrestrial birds and raptors found here includes: Blue Crane (*Anthropoides paradiseus*), Ludwig's Bustard (*Neotis ludwigii*), Kori Bustard (*Ardeotis kori*), Blue Korhaan (*Eupodotis caerulescens*), Black Stork (*Ciconia nigra*), Secretarybird (*Sagittarius serpentarius*), Martial Eagle (*Polemaetus bellicosus*), Verreauxs' Eagle (*Aquila verreauxii*) and Tawny Eagle (*A. rapax*).

Biome-restricted species found here include Karoo Lark (*Calendulauda albescens)*, Karoo Long-billed Lark (*Certhilauda subcoronata)*, Karoo Chat (*Cercomela schlegelii)*, Tractrac Chat (*C. tractrac)*, Sickle-winged Chat (*C. sinuata)*, Namaqua Warbler (*Phragmacia substriata)*, Layard's Tit-Babbler (*Sylvia layardi)*, Pale-winged Starling (*Onychognathus nabouroup)* and Black-headed (*Canary Serinus alario)*. Two congregatory species found here are the Lesser Kestrel and the Amur Falcon.

Other biodiversity species of importance found here include Aardwolf (*Proteles cristatus)*, Aardvark (*Orycteropus afer)*, Bat-eared Fox (*Otocyon megalotis)* and Black-footed Cat (*Felis nigripes)* (Vulnerable) (Birdlife, 2015).

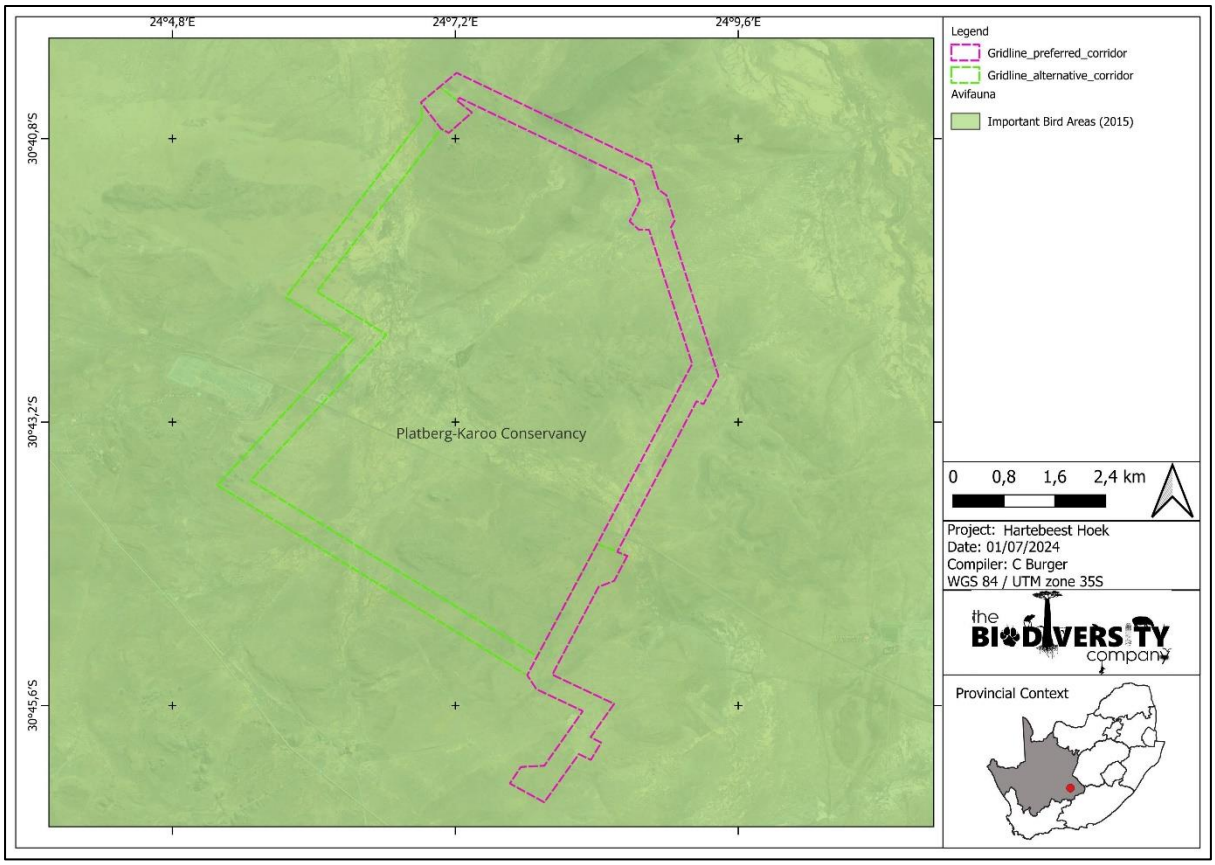


Figure 3-4 Map illustrating the locations of IBAs in the PAOI

3.1.1.5 Strategic Transmission Corridors (EGI)

On the 16 February 2018 minister Edna Molewa published Government Notice No. 113 in Government Gazette No. 41445 which identified 5 strategic transmission corridors important for the planning of electricity transmission and distribution infrastructure as well as procedure to be followed when applying for environmental authorisation for electricity transmission and distribution expansion when occurring in these corridors.

On 29 April 2021, Minister Barbara Dallas Creecy published Government Notice No. 383 in Government Gazette No. 44504, which expanded the eastern and western transmission corridors and gave notice of the applicability of the application procedures identified in Government Notice No. 113, to these expanded corridors. More information on this can be obtained from https://egis.environment.gov.za/egi.

Figure 3-5 shows the project overlaps with the Central EGI corridor.

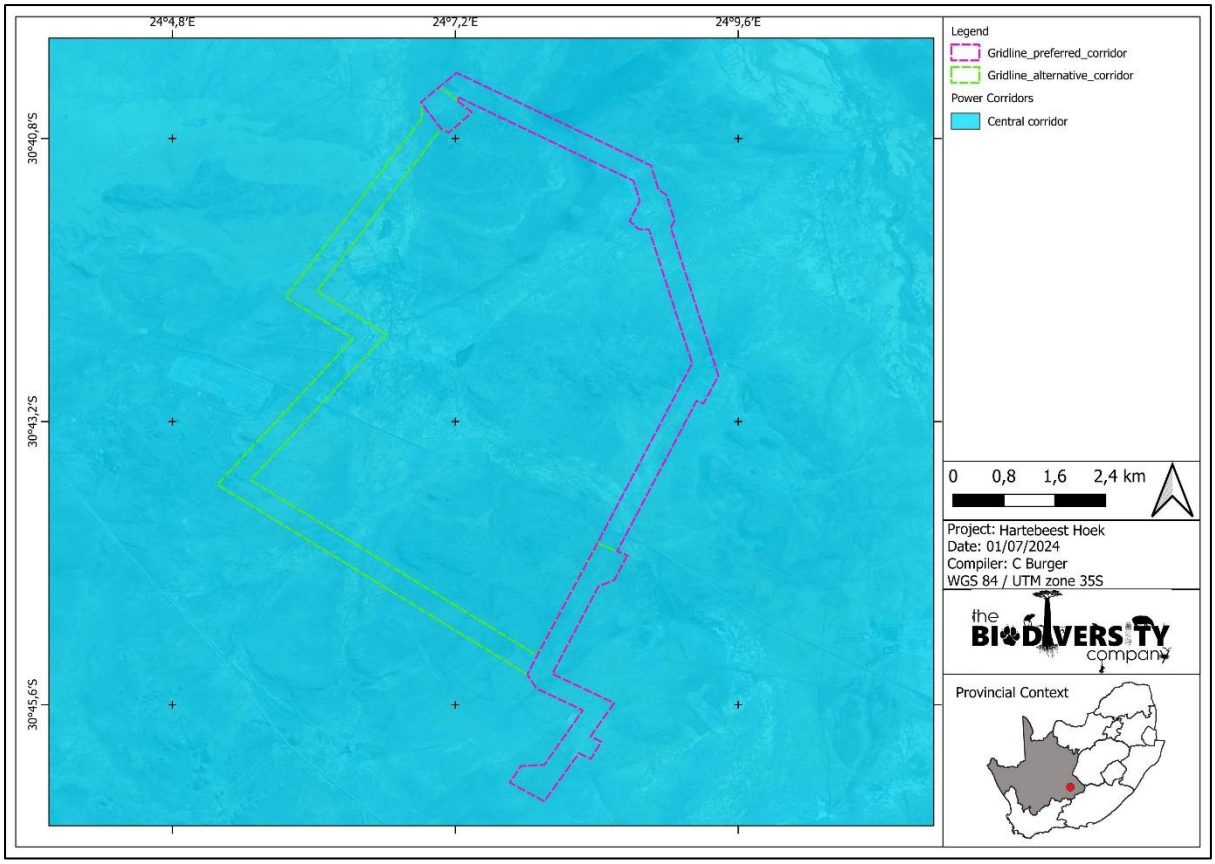


Figure 3-5 The PAOI in relation to the strategic transmission corridors

3.1.1.6 Renewable Energy EIA Application Database

The Renewable Energy Database (http://egis.environment.gov.za/), shows that the PAOI overlaps with "Approved" areas and that there are several other "Approved" projects in the near vicinity (Figure 3-6). This increases the overall impact on the habitats in the area. Several "approved" projects occur in the vicinity of the PAOI.

Figure 3-6 The project area in relation to the renewable energy database projects in the area.

3.1.1.7 Hydrological Context

3.1.1.7.1 The South African Inventory of Inland Aquatic Ecosystems (SAIIAE)

The SAIIAE was released with the NBA 2018. Ecosystem threat status (ETS) of river and wetland ecosystem types are based on the extent to which each river ecosystem type had been altered from its natural condition. Ecosystem types are categorised as CR, EN, VU or LT, with CR, EN and VU ecosystem types collectively referred to as 'threatened' (Van Deventer *et al.,* 2019; Skowno *et al.,* 2019). The PAOI's 500m Regulated Area overlaps with an unclassified wetland and one CR Wetland, that were assessed as part of the SAIIAE (Figure 3-7).

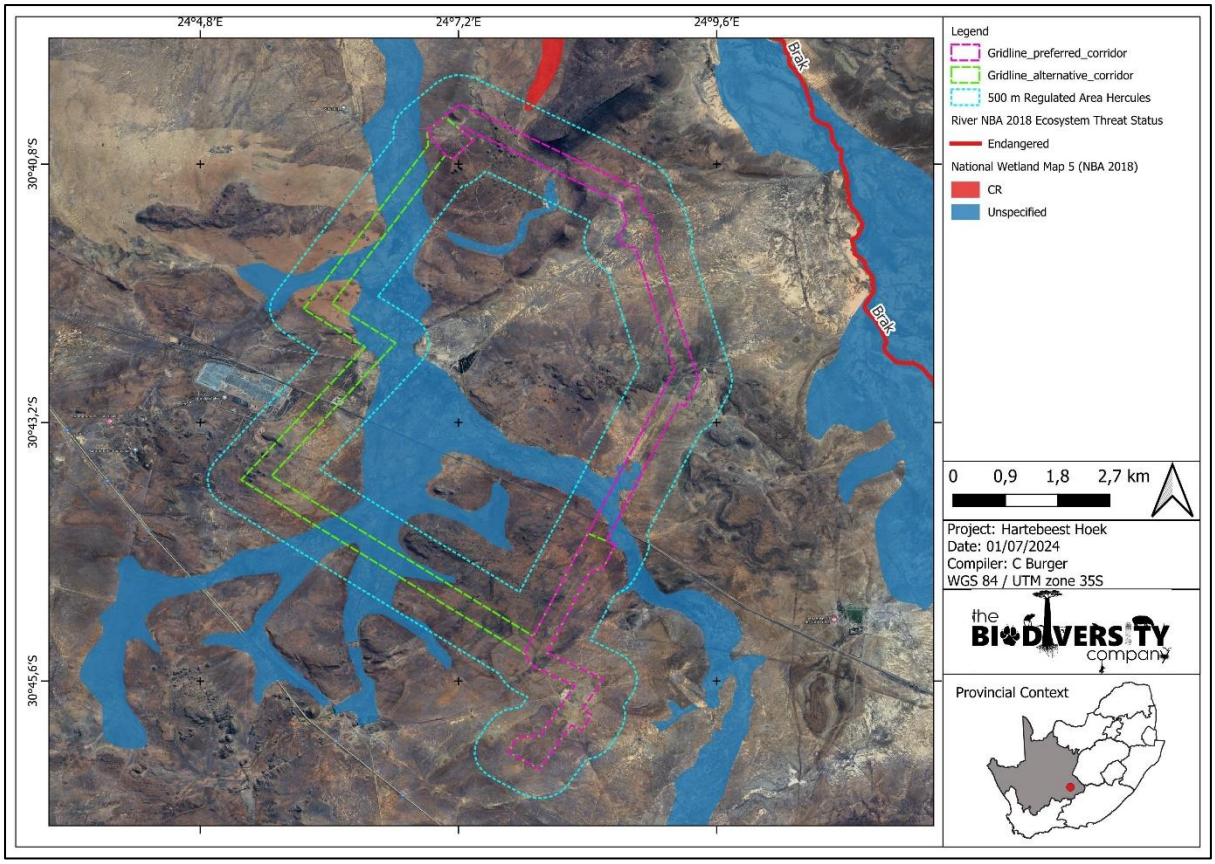


Figure 3-7 Map illustrating the hydrological context of the proposed PAOI.

3.1.1.7.2 National Freshwater Ecosystem Priority Area Status

In an attempt to better 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's (NEM:BA) biodiversity goals (Nel *et al.,* 2011).

Figure 3-8 shows the PAOI's 500m Regulated Area overlaps with unclassified wetlands and a FEPA Code 1 River which is a Freshwater Ecosystem Priority Area.

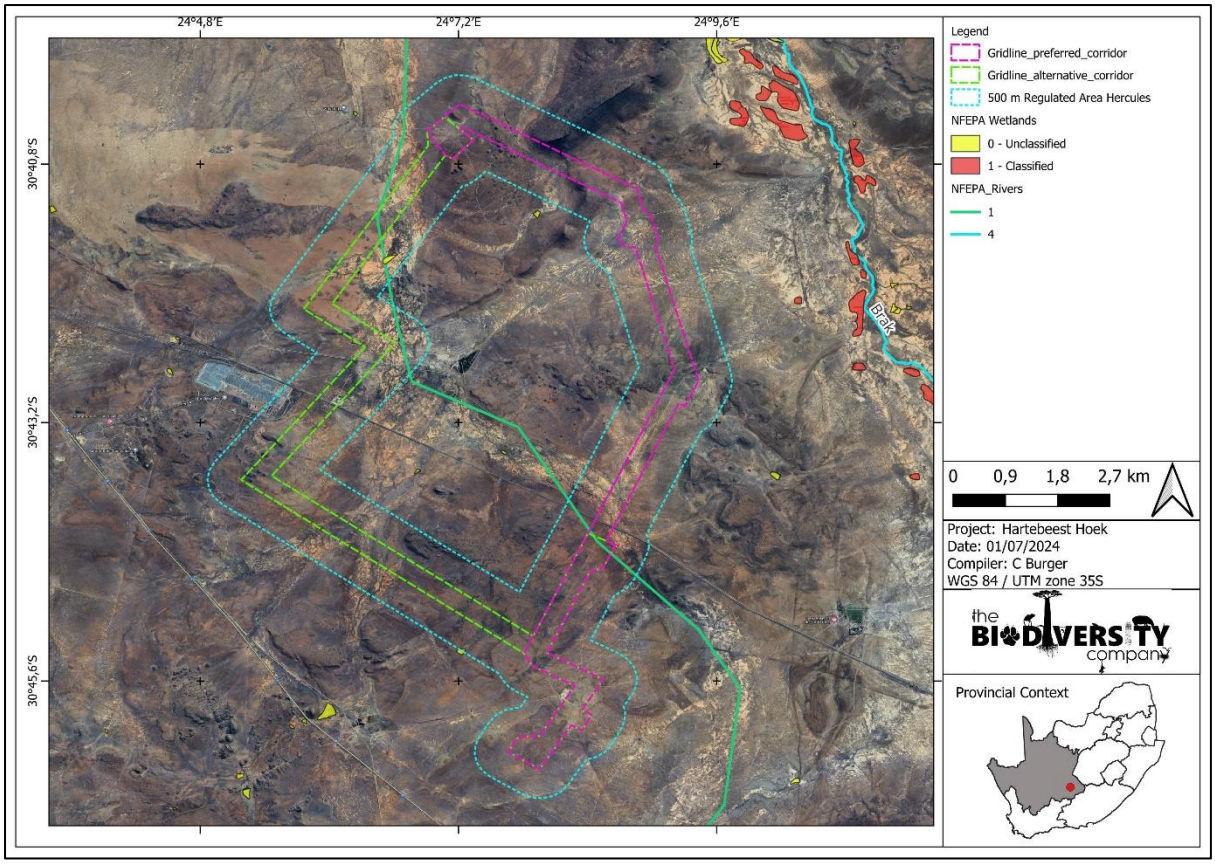


Figure 3-8 The project area in relation to the National Freshwater Ecosystem Priority Areas, River lines and Inland water areas

3.1.2 Flora Assessment

This section is divided into a description of the vegetation type expected under natural conditions and the expected flora species.

3.1.2.1 Vegetation Type

The proposed PAOI is situated within two biomes, the Grassland and Nama Karoo biomes.

The Nama Karoo Biome, which is a large, landlocked region on the central plateau of the western half of South Africa and extends into south-eastern Namibia. This is an arid biome with majority of the river systems being non-perennial. Apart from the Orange River and the few permanent streams in the southwest that originate in higher-rainfall neighbouring areas, the limited number of perennial streams that originate in the Nama-Karoo are restricted to the more mesic east. The low precipitation is unreliable (coefficient of variation of annual rainfall up to 40%) and droughts are unpredictable and prolonged. The unpredictable rainfall impedes the dominance of leaf succulents and is too dry in summer for dominance by perennial grasses alone, and the soils are generally too shallow, and the rainfall is too low for trees. Unlike other biomes of southern Africa, local endemism is very low and consequently, the Nama-Karoo Biome does not contain any centre of endemism. Despite relatively low floristic diversity, the Nama-Karoo vegetation has a high diversity of plant life forms. These include co-occurring ephemerals, annuals, geophytes, C3 and C4 grasses, succulents, deciduous and evergreen chamaephytes and trees. This is probably a consequence of an ecotonal and climatically unstable nature of the region.

Scattered rocky hills, mesas and inselbergs are distinctive features of an otherwise relatively homogeneous landscape. These features are either capped by or wholly comprised of dolerite, which

is a fine- to medium-grained dark, intrusive igneous rock. The surrounding plains and lowland habitats are dominated by shale and sandstone, which is a fine- to medium-grained sedimentary rock. Due to their structure, these features provide greater heterogeneity in habitat and microclimate than the surrounding plains and therefore, support higher species richness and diversity (Petersen *et al*, 2020). Species richness and relative cover of the varying plant growth forms are driven by gradients of a combination soil, environmental and climatic parameters. Unlike other biomes of southern Africa, local endemism is very low and consequently, the Nama-Karoo Biome does not contain any centre of endemism.

The Grassland biome is centrally located in southern Africa, and adjoins all except the desert, fynbos and succulent Karoo biomes (Mucina & Rutherford, 2006). Major macroclimatic traits that characterise the grassland biome include:

- Seasonal precipitation; and
- The minimum temperatures in winter (Mucina & Rutherford, 2006).

The grassland biome is found chiefly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. The topography is mainly flat and rolling but includes the escarpment itself. Altitude varies from near sea level to 2 850 m above sea level.

Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. The grassland biome experiences summer rainfall and dry winters with frost (and fire), which are unfavourable for tree growth. Thus, trees are typically absent, except in a few localized habitats. Geophytes (bulbs) are often abundant. Frosts, fire and grazing maintain the grass dominance and prevent the establishment of trees. On a fine-scale vegetation type, the project area overlaps with Besemkaree Koppies Shrubland and Northern Upper Karoo (Figure 3-9).

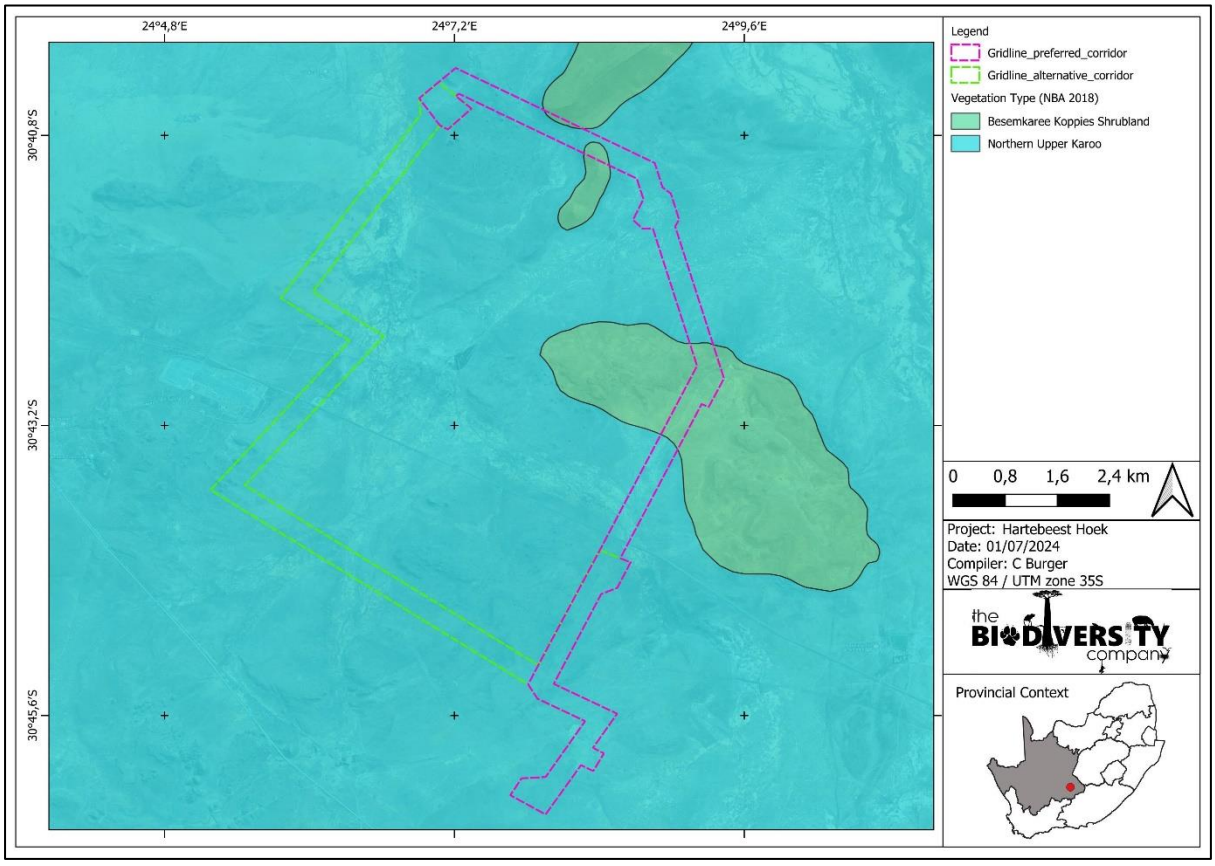


Figure 3-9 Map illustrating the vegetation types associated with the PAOI

3.1.2.1.1 Northern Upper Karoo

The Northern Upper Karoo is restricted to the Northern Cape and Free State Provinces, specifically in the northern regions of the Upper Karoo plateau from Prieska, Vosburg and Carnarvon in the west to Philipstown, Petrusville and Petrusburg in the east. In the north, it is bordered by the towns of Niekerkshoop, Douglas and Petrusburg and in the south by Carnarvon, Pampoenpoort and De Aar. Additionally, there are a few patches in Griqualand West. Altitude varies mostly from 1000 to 1500 m (Mucina & Rutherford, 2006).

Its main vegetation feature is a shrubland dominated by dwarf karoo shrubs, grasses and *Senegalia mellifera* subsp. *detinens* and some other low trees (especially on sandy soils in the northern parts and vicinity of the Orange River). In terms of landscape features, it is flat to gently sloping, with isolated hills of Upper Karoo Hardeveld in the south and Vaalbos Rocky Shrubland in the northeast and with many interspersed pans (Mucina & Rutherford, 2006).

Important Plant Taxa in Northern Upper Karoo

Based on Mucina and Rutherford's (2006) vegetation classification, important plant taxa are those species that have a high abundance, a frequent occurrence (not being particularly abundant) or are prominent in the landscape within a particular vegetation type. They note that the following species are important taxa in the Northern Upper Karoo vegetation type:

Small Trees: *Senegalia mellifera* subsp. *detinens*, *Boscia albitrunca*.

Tall Shrubs: *Lycium cinereum*, *L. horridum*, *L. oxycarpum*, *L. schizocalyx*, *Rhigozum trichotomum*.

Low Shrubs: *Chrysocoma ciliata*, *Gnidia polycephala*, *Pentzia calcarea*, *P. globosa*, *P. incana*, *P. spinescens*, *Rosenia humilis*, *Amphiglossa triflora*, *Aptosimum marlothii*, *A. spinescens*, *Asparagus glaucus*, *Barleria rigida*, *Berkheya annectens*, *Eriocephalus ericoides* subsp. *ericoides*, *E. glandulosus*, *E. spinescens*, *Euryops asparagoides*, *Felicia muricata*, *Helichrysum lucilioides*, *Hermannia spinosa*, *Leucas capensis*, *Limeum aethiopicum*, *Melolobium candicans*, *Microloma armatum*, *Osteospermum leptolobum*, *O. spinescens*, *Pegolettia retrofracta*, *Pentzia lanata*, *Phyllanthus maderaspatensis*, *Plinthus karooicus*, *Pteronia glauca*, *P. sordida*, *Selago geniculata*, *S. saxatilis*, *Tetragonia arbuscula*, *Zygophyllum lichtensteinianum*.

Succulent Shrubs: *Hertia pallens*, *Salsola calluna*, *S. glabrescens*, *S. rabieana*, *S. tuberculata*, *Zygophyllum flexuosum*.

Semiparasitic Shrub: *Thesium hystrix*.

Herbs: *Chamaesyce inaequilatera*, *Convolvulus sagittatus*, *Dicoma capensis*, *Gazania krebsiana*, *Hermannia comosa*, *Indigofera alternans*, *Lessertia pauciflora*, *Radyera urens*, *Sesamum capense*, *Sutera pinnatifida*, *Tribulus terrestris*, *Vahlia capensis*.

Succulent Herb: *Psilocaulon coriarium*.

Geophytic Herb: *Moraea pallida*.

Graminoids: *Aristida adscensionis*, *A. congesta*, *A. diffusa*, *Enneapogon desvauxii*, *Eragrostis lehmanniana*, *E. obtusa*, *E. truncata*, *Sporobolus fimbriatus*, *Stipagrostis obtusa, Eragrostis bicolor*, *E. porosa*, *Fingerhuthia africana*, *Heteropogon contortus*, *Stipagrostis ciliata*, *Themeda triandra*, *Tragus berteronianus*, *T. koelerioides*, *T. racemosus*.

Conservation Status

The conservation target is 21%, with none being conserved in statutory conservation areas and about 4% has already been cleared for cultivation (the highest proportion of any type in the Nama-Karoo) or

irreversibly transformed by building of dams (Houwater, Kalkfontein and Smart Syndicate Dams). *Prosopis glandulosa*, one of the 12 agriculturally most important invasive alien plants in South Africa, is widely distributed in this vegetation type. Erosion ranges from very low to moderate.

3.1.2.1.2 Besemkaree Koppies Shrubland

The Besemkaree Koppies Shrubland is restricted to the Northern Cape, Free State and Eastern Cape Provinces. Within these provinces, it can be found on plains of Eastern Upper Karoo (between Richmond and Middelburg in the south and the Orange River) and within dry grasslands of the southern and central Free State. Additionally, there are also extensive dolerite-dominated landscapes along the upper Orange River that belong to this unit as well. It extends northwards to around Fauresmith in the northwest and to the Wepener District in the northeast. Altitude varies from 1 120 to 1 680 m (Mucina & Rutherford, 2006).

In terms of vegetation and landscape features, this vegetation type is characterised by slopes of koppies, butts and tafelbergs covered with two-layered karroid shrublands. The lower closed-canopy layer is dominated by dwarf small-leaved shrubs and, especially in precipitation-rich years, also by abundant grasses, while the upper loose canopy layer is dominated by tall shrubs, including several *Rhus* species, *Euclea crispa* subsp. *ovata*, *Diospyros austro-africana* and *Olea europaea* subsp. *africana* (Mucina & Rutherford, 2006).

Important Plant Taxa in Besemkaree Koppies Shrubland

Mucina and Rutherford (2006) note that the following species are important taxa in the Besemkaree Koppies Shrubland:

Small Trees: *Cussonia paniculata*, *Ziziphus mucronata*.

Tall Shrubs: *Diospyros austro-africana*, *Euclea crispa* subsp. *ovata*, *Olea europaea* subsp. *africana*, *Rhus burchellii*, *R. ciliata*, *R. erosa*, *Buddleja saligna*, *Diospyros lycioides* subsp. *lycioides*, *Ehretia rigida*, *Grewia occidentalis*, *Gymnosporia polyacantha*, *Tarchonanthus minor*.

Low Shrubs: *Asparagus suaveolens*, *Chrysocoma ciliata*, *Amphiglossa triflora*, *Aptosimum elongatum*, *Asparagus striatus*, *Diospyros pallens*, *Eriocephalus ericoides*, *E. spinescens*, *Euryops empetrifolius*, *Felicia filifolia* subsp. *filifolia*, *F. muricata*, *Helichrysum dregeanum*, *H. lucilioides*, *Hermannia multiflora*, *H. vestita*, *Lantana rugosa*, *Limeum aethiopicum*, *Lycium cinereum*, *Melolobium candicans*, *M. microphyllum*, *Nenax microphylla*, *Pegolettia retrofracta*, *Pentzia globosa*, *Rhigozum obovatum*, *Selago saxatilis*, *Stachys linearis*, *S. rugosa*, *Sutera halimifolia*, *Wahlenbergia albens*.

Succulent Shrubs: *Aloe broomii*, *Chasmatophyllum musculinum*, *C. verdoorniae*, *Cotyledon orbiculata* var. *dactylopsis*, *Pachypodium succulentum*.

Graminoids: *Aristida adscensionis*, *A. congesta*, *A. diffusa*, *Cenchrus ciliaris*, *Cymbopogon caesius*, *Cynodon incompletus*, *Digitaria eriantha*, *Eragrostis curvula*, *E. lehmanniana*, *Heteropogon contortus*, *Setaria lindenbergiana*, *Themeda triandra*, *Tragus koelerioides*, *Cymbopogon pospischilii*, *Enneapogon scoparius*, *Eragrostis chloromelas*, *E. obtusa*, *Eustachys paspaloides*, *Fingerhuthia africana*, *Hyparrhenia hirta*, *Sporobolus fimbriatus*.

Herbs: *Convolvulus sagittatus*, *Dianthus caespitosus* subsp. *caespitosus*, *Gazania krebsiana* subsp. *krebsiana*, *Hibiscus pusillus*, *Indigofera alternans*, *I. rhytidocarpa*, *Lepidium africanum* subsp. *africanum*, *Pollichia campestris*.

Herbaceous Climber: *Argyrolobium lanceolatum*.

Geophytic Herbs: *Albuca setosa*, *Asplenium cordatum*, *Cheilanthes bergiana*, *C. eckloniana*, *Freesia andersoniae*, *Haemanthus humilis* subsp. *humilis*, *Oxalis depressa*, *Pellaea calomelanos*.

Succulent Herbs: *Aloe grandidentata*, *Crassula nudicaulis*, *Duvalia caespitosa*, *Euphorbia pulvinata*, *Huernia piersii*, *Stapelia grandiflora*, *S. olivacea*, *Tridentea gemmiflora*.

Conservation Status

The conservation target is 28% and about 5% statutorily conserved in the Rolfontein, Tussen Die Riviere, Oviston, Gariep Dam, Caledon and Kalkfontein Dam Nature Reserves. Additionally, there is a small patch that is protected in the private Vulture Conservation Area. About 3% of the area has been transformed due to dams. Erosion varies from low to high (Mucina & Rutherford, 2006).

3.1.2.2 Expected Flora Species of Conservation Concern

The POSA database indicates that 116 species of indigenous plants are expected to occur within the project area and surrounding landscape. Appendix B provides the list of species and their respective conservation status and endemism. None of the species expected are SCC.

3.1.3 Fauna Assessment

3.1.3.1 Expected Amphibian Species of Conservation Concern

Based on the IUCN Red List Spatial Data and AmphibianMap database, 13 amphibian species are expected to occur within the project area (Appendix C). One of the species is regarded as a SCC (Table 3-2).

Table 3-2 Amphibian Species of Conservation Concern (SCC) that are expected to occur within the PAOI

Family	Scientific Name	Common Name	Conservation Status		Likelihood of Occurrence
			Regional	Global	
Pyxicephalidae	*Pyxicephalus adspersus*	Giant Bullfrog	NT	LC	Moderate

The Giant Bull Frog (*Pyxicephalus adspersus*) is listed as LC on a global scale (IUCN SSC Amphibian Specialist Group, 2013), but NT on a regional scale (Minter *et al*, 2004). The species is widely distributed in arid sub-saharan Africa, mainly at higher elevations. Within South Africa, it occurs in the north-eastern part of the Western Cape, central and southern Eastern Cape, northern, central and eastern parts of Northern Cape, northern KwaZulu-Natal (except the low-lying parts), Free State, North West, Gauteng and Limpopo provinces, and at only a few localities in Mpumalanga Province. It typically breeds in seasonal, shallow, grassy pans in flat, open areas but also utilises non-permanent vleis and shallow water on the margins of waterholes and dams. Although they sometimes inhabit clay soils, they prefer sandy substrates. Habitat loss due to crop agriculture and urbanisation is a major threat to this species. Adults migrating to, and juveniles dispersing from, breeding sites are often killed on roads. The use of insecticides and herbicides may also have a negative impact on breeding success but requires further investigation. Although there are no records of the species within the PAOI, there are several reports within the proximal surrounding landscape.

3.1.3.2 Expected Reptile Species of Conservation Concern

Based on the IUCN Red List Spatial Data and the ReptileMAP database, 32 reptile species are expected to occur within the area (Appendix D). One (1) is regarded as a SCC (Table 3-3).

Table 3-3 Reptile Species of Conservation Concern (SCC) that are expected to occur within the PAOI

Family	Scientific Name	Common Name	Conservation Status		Likelihood of Occurrence
			Regional	Global	
Testudinidae	*Psammobates tentorius verroxii*	Verrox's Tent Tortoise	NT	NT	High

Psammobates tentorius verroxii (Verrox's Tent Tortoise) is widely distributed throughout the Nama Karoo in the Northern Cape and penetrates the Western Cape and possibly the Eastern Cape peripherally. The species has been exhibiting declines and is therefore regarded as NT (Hofmeyer *et al*, 2018). There is no estimate on the total global population. Threats include road mortality, veld fires, electrocution by livestock/game fences, overgrazing from domestic livestock, uncontrolled harvesting of natural products and irresponsible tourism activities in sensitive areas. Available information indicates that Pied Crow (*Corvus albus*) predation on this is increasingly severe, with anthropogenic facilitation of Pied Crow range expansion having led to increased predation rates (Hofmeyr *et al*, 2018). Although there are no records of the species within the PAOI, there are several reports within the proximal surrounding landscape.

3.1.3.3 Expected Mammal Species of Conservation Concern

The IUCN Red List Spatial Data lists 46 non-volant mammal species that could be expected to occur within the area (Appendix E). This list excludes large mammal species that are limited to protected areas. Three (3) of these expected species are regarded as SCC (Table 3-4).

Table 3-4 Mammal Species of Conservation Concern (SCC) that are expected to occur within the PAOI

Family	Scientific Name	Common Name	Conservation Status		Likelihood of Occurrence
			Regional	Global	
Felidae	*Felis nigripes*	Black-footed Cat	VU	VU	Low
Felidae	*Panthera pardus*	Leopard	VU	VU	Low
Hyaenidae	*Parahyaena brunnea*	Brown Hyaena	NT	NT	Low
Mustelidae	Aonyx capensis	Cape Clawless Otter	NT	NT	Low
Felidae	Leptailurus serval	Serval	NT	LC	Low
Mustelidae	Poecilogale albinucha	African Striped Weasel	NT	LC	Low

3.2 Field Assessment

The following sections provides the results from the field survey for the proposed development that was undertaken during October 2022.

3.2.1 Flora Assessment

3.2.1.1 Indigenous Flora

A total of 91 species, were recorded within the PAOI during the survey period (Table 3-5, Figure 3-10). None of the species recorded are regarded as SCC. Nevertheless, twenty of the species recorded are protected by provincial legislation and if granted authorisation, it is imperative that a Plant Search and Rescue be undertaken prior to clearing and development. A permit from the relevant authority must be obtained to remove and relocate individuals of these species to proximal surrounding natural areas. N.B. due to time constraints individuals of these flora were not geotagged.

During the field assessment 1 species of protected tree was observed: *Boscia Albitrunca* (Shepard's Tree). The protected trees observed are protected by the List of Protected Tree Species under the National Forests Act, 1998 (Act No. 84 of 1998) (NFA). In terms of the NFA, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate, or in any other manner acquire or dispose of any protected tree or any product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. Contravention of this declaration is regarded as a first category offence. The tree was observed within the Hills, Outcrops and Sills habitat, rated Very High sensitivity, thus avoiding the habitat should result in no destruction of the species/specimen.

Table 3-5 Summary of indigenous flora recorded within the PAOI during the survey period. Protected species are highlighted in bold. LC = Least Concern and NE = Not Evaluated

Family	*Species Name*	Conservation Status	Endemism
Acanthaceae	*Barleria rigida*	LC	
Aizoaceae	***Ruschia intricata***	**LC**	**Endemic**
Aizoaceae	***Stomatium latifolium***	**LC**	**Endemic**
Aizoaceae	***Titanopsis calcarea***	**LC**	**Endemic**
Aizoaceae	***Mesembryanthemum sp***		
Amaranthaceae	*Atriplex vestita var. appendiculata*		
Amaranthaceae	*Salsola calluna*	LC	Endemic
Amaryllidaceae	***Ammocharis coranica***	**LC**	
Anacampserotaceae	***Anacampseros filamentosa subsp. filamentosa***	**LC**	**Endemic**
Anacardiaceae	*Searsia erosa*	LC	
Apocynaceae	*Gomphocarpus tomentosus subsp. tomentosus*		
Asparagaceae	*Albuca simulans*		
Asparagaceae	*Asparagus striatus*	LC	Endemic
Asparagaceae	*Asparagus suaveolens*	LC	
Asphodelaceae	***Aloe broomii***	**LC**	
Asphodelaceae	*Haworthiopsis tessellata*	LC	
Asphodelaceae	*Kniphofia linearifolia*	LC	
Asteraceae	*Amphiglossa triflora*	LC	
Asteraceae	*Chrysocoma ciliata*	LC	
Asteraceae	*Eriocephalus ericoides subsp. ericoides*	LC	
Asteraceae	*Felicia filifolia subsp. filifolia*	LC	
Asteraceae	*Felicia muricata subsp. muricata*	LC	
Asteraceae	*Gazania jurineifolia subsp. jurineifolia*	LC	
Asteraceae	*Gazania krebsiana subsp. arctotoides*	LC	
Asteraceae	*Geigeria burkei*	LC	
Asteraceae	*Helichrysum dregeanum*	LC	
Asteraceae	*Helichrysum sp.*		
Asteraceae	*Helichrysum zeyheri*	LC	
Asteraceae	*Osteospermum sinuatum var. sinuatum*	LC	
Asteraceae	*Pegolettia retrofracta*	LC	
Asteraceae	*Pentzia incana*	LC	
Asteraceae	*Phymaspermum parvifolium*	LC	
Asteraceae	*Rosenia humilis*	LC	
Bignoniaceae	*Rhigozum trichotomum*	LC	
Boraginaceae	*Heliotropium ciliatum*	LC	
Brassicaceae	*Heliophila minima*	LC	

Family	*Species Name*	Conservation Status	Endemism
Capparaceae	***Boscia albitrunca***	**LC-Nationally Protected**	
Celastraceae	*Gymnosporia polyacantha*	LC	
Crassulaceae	***Crassula corallina subsp. corallina***	**LC**	
Cucurbitaceae	*Cucumis hirsutus*	LC	
Cyperaceae	*Afroscirpoides dioeca*	LC	
Cyperaceae	*Cyperus usitatus*	LC	
Ebenaceae	*Diospyros austroafricana var. microphylla*	LC	
Ebenaceae	*Diospyros lycioides*	LC	
Euphorbiaceae	***Euphorbia arida***	**LC**	**Endemic**
Fabaceae	*Indigofera alternans var. alternans*	LC	
Fabaceae	*Lessertia annularis*	LC	
Fabaceae	*Melolobium candicans*	LC	
Geraniaceae	*Monsonia angustifolia*	LC	
Hyacinthaceae	***Dipcadi crispum***	**LC**	
Hyacinthaceae	***Dipcadi viride***	**LC**	
Hyacinthaceae	***Ledebouria apertiflora***	**LC**	
Iridaceae	***Freesia andersoniae***	**LC**	**Endemic**
Iridaceae	***Moraea pallida***	**LC**	
Iridaceae	***Moraea simulans***	**LC**	
Malvaceae	*Hermannia coccocarpa*	LC	
Malvaceae	*Hermannia comosa*	LC	
Melianthaceae	***Melianthus comosus***	**LC**	
Oxalidaceae	***Oxalis obliquifolia***	**LC**	
Pedaliaceae	*Sesamum triphyllum*	LC	
Poaceae	*Aristida adscensionis*	LC	
Poaceae	*Aristida congesta subsp. barbicollis*	LC	
Poaceae	*Cenchrus ciliaris*	LC	
Poaceae	*Chloris virgata*	LC	
Poaceae	*Cynodon dactylon*	LC	
Poaceae	*Enneapogon scaber*	LC	
Poaceae	*Eragrostis lehmanniana*	LC	
Poaceae	*Eragrostis obtusa*	LC	
Poaceae	*Eragrostis truncata*	LC	
Poaceae	*Fingerhuthia africana*	LC	
Poaceae	*Melinis nerviglumis*	LC	
Poaceae	*Panicum impeditum*	LC	
Poaceae	*Puccinellia acroxantha*	LC	
Poaceae	*Sporobolus fimbriatus*	LC	

Family	*Species Name*	Conservation Status	Endemism
Poaceae	*Sporobolus ioclados*	LC	
Poaceae	*Sporobolus tenellus*	LC	
Poaceae	*Stipagrostis ciliata var. capensis*	LC	
Poaceae	*Stipagrostis namaquensis*	LC	
Poaceae	*Stipagrostis obtusa*	LC	
Poaceae	*Tragus berteronianus*	LC	
Poaceae	*Tragus racemosus*	LC	
Pteridaceae	*Cheilanthes eckloniana*	LC	
Rubiaceae	*Kohautia amatymbica*	LC	
Scrophulariaceae	***Jamesbrittenia aurantiaca***	**LC**	
Scrophulariaceae	***Jamesbrittenia tysonii***	**LC**	**Endemic**
Scrophulariaceae	*Selago albida*	LC	
Scrophulariaceae	*Aptosimum indivisum*	LC	Endemic
Scrophulariaceae	*Selago geniculata*	LC	Endemic
Solanaceae	*Lycium horridum*	LC	
Solanaceae	*Withania somnifera*	LC	
Thymelaeaceae	*Lasiosiphon polycephalus*	LC	
Zygophyllaceae	*Roepera lichtensteiniana*	NE	Endemic

Figure 3-10 ***Photographs illustrating a portion of the indigenous flora which are protected recorded within the PAOI during the survey period. A) Crassula corallina subsp. corallina, B) Titanopsis calcarea, C) Mesembryanthemum sp, D) Moraea simulans, E) Stomatium latifolium and F) Euphorbia arida.***

3.2.1.2 Invasive Alien Plants

Invasive Alien Plants (IAPs) tend to dominate or replace indigenous flora, thereby transforming the structure, composition and functioning of ecosystems. Therefore, it is important that these plants are controlled by means of an eradication and monitoring programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species.

NEMBA is the most recent legislation pertaining to alien invasive plant species. In August 2014, the list of Alien Invasive Species was published in terms of the NEMBA. The Alien and Invasive Species Regulations were published in the Government Gazette No. 44182, 24th of February 2021. The legislation calls for the removal and / or control of IAP species. In addition, unless authorised thereto in terms of the NWA, no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within proximity to a watercourse. Below is a brief explanation of the three categories in terms of the NEMBA:

- Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
- Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.
- Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.
- Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

Note that according to the regulations, a person who has under his or her control a category 1b listed invasive species must immediately:

- Notify the competent authority in writing
- Take steps to manage the listed invasive species in compliance with:
    - Section 75 of the Act;
    - The relevant invasive species management programme developed in terms of regulation 4; and
    - Any directive issued in terms of section 73(3) of the Act.

Plants listed as Category 1 alien or invasive species under the National Environmental Management: Biodiversity Act (NEMBA) appear in green text (Table 3-6). Plants listed in Category 2 or as ‘not indigenous’ or ‘naturalised’ according to NEMBA, appear in blue text. Four (4) Category 1b species of invasive plants were observed within the PAOI. Any species are listed under the Alien and Invasive Species List 2020, Government Gazette No. GN1003 as Category 1b. Category 1b species must be controlled by implementing an IAP Management Programme, in compliance of section 75 of the NEMBA, as stated above.

Table 3-6 AIP recorded in the PAOI.

Family	*Scientific Name*	Alien Category
Cactaceae	*Opuntia ficus-indica*	NEMBA Category 1b
Myrtaceae	*Eucalyptus sp*	NEMBA Category 1b
Papaveraceae	*Argemone ochroleuca*	NEMBA Category 1b
Solanaceae	*Datura ferox*	NEMBA Category 1b

3.2.2 Fauna Assessment

3.2.2.1 Amphibians

Four amphibian species were recorded within the PAOI as indicated by the species calls (Table 3-7, Figure 3-11). Based on the presence of ephemeral ecosystems within the PAOI additional species are expected, but the species assemblage is not expected to be very diverse.

Table 3-7 Summary of amphibian species recorded within the PAOI during the survey period. LC = Least Concern

Family	Scientific Name	Common Name	Conservation Status	
			Regional	Global
Bufonidae	*Poyntonophrynus vertebralis*	Pygmy Toad	LC	LC
Bufonidae	*Vandijkophrynus gariepensis*	Karoo Toad	LC	LC
Pipidae	*Xenopus laevis*	Common Platanna	LC	LC
Pyxicephalidae	Cacosternum boettgeri	Common Caco	LC	LC
Pyxicephalidae	*Tomopterna tandyi*	Tandy's Sand Frog	LC	LC

3.2.2.2 Reptiles

Ten (10) species of reptile were recorded within the PAOI during the survey period, (Table 3-8, Figure 3-11). None of the species recorded are regarded as SCC. The. Considering the heterogenous structure of the PAOI in terms of habitat structure, it is likely to support a highly diverse species assemblage. Notably, *Stigmochelys pardalis* (Leopard Tortoise), is regarded as a keystone species within the Nama Karoo biome. The species possesses a relatively large home range between 40.53 and 258.52 ha and therefore, are vital seed dispersers.

Table 3-8 Summary of reptile species recorded within the PAOI during the survey period. LC = Least Concern

Family	Scientific Name	Common Name	Conservation Status	
			Regional	Global
Agamidae	*Agama aculeata aculeata*	Common Ground Agama	LC	LC
Agamidae	*Agama atra*	Southern Rock Agama	LC	LC
Cordylidae	*Karusasaurus polyzonus*	Karoo Girdled Lizard	LC	LC
Elapidae	*Naja nivea*	Cape Cobra	LC	LC
Gekkonidae	*Pachydactylus capensis*	Cape Gecko	LC	LC
Lacertidae	*Pedioplanis namaquensis*	Namaqua Sand Lizard	LC	LC
Lacertidae	Pedioplanis lineoocellata	Spotted Sand Lizard	LC	LC
Scincidae	*Trachylepis sulcata sulcata*	Western Rock Skink	LC	LC
Scincidae	*Trachylepis variegata*	Variegated Skink	LC	LC

Family	Scientific Name	Common Name	Conservation Status	
			Regional	Global
Testudinidae	*Stigmochelys pardalis*	Leopard Tortoise	LC	LC

Figure 3-11 ***Photographs illustrating individuals of a portion of the reptile species recorded within the proposed PAOI during the survey period. A) Karusasaurus polyzonus (Karoo Girdled Lizard) B) Pachydactylus capensis (Cape Gecko), C) Agama atra (Southern Rock Agama), D) Trachylepis sulcata sulcata (Western Rock Skink), E) Cacosternum boettgeri (Common Caco), F) Tomopterna tandyi (Tandy's Sand Frog), G) Pedioplanis namaquensis (Namaqua Sand Lizard) And H) Stigmochelys pardalis (Leopard Tortoise)***

3.2.2.3 Mammals

Seventeen (17) mammal species were recorded during the survey based on either direct observation or the presence of visual tracks and signs (Table 3-9). Due to the presence of anthropogenic activities, especially fragmentation caused by fences, a high diversity of large mammal species is not expected. Nevertheless, due to the diversity of habitats on a broad and fine scale, there is a high likelihood of occurrence of other small mammal species occurring within the PAOI.

The species *Orycteropus afer afer* (Southern Aardvark) is regarded as a keystone species within the Nama Karoo biome. The burrows they create are also utilised as shelter by an array of faunal species, which is pertinent in the thermally variable and semi-arid environment of the PAOI and surrounding landscape. In addition, they are ecosystem engineers as their foraging behaviour plays a role in vegetation dynamics. *Orycteropus afer afer* feed on the Formicidae species, *Messor capensis*, which is a major seed predator within the Karoo bioregion. During foraging by *O.afer afer*, the nests are damaged but usually not destroyed, and the seed stores are frequently distributed with the mound soils over a larger area. The seeds are usually buried within the mound soil and germinate during favourable conditions. A portion of the seeds may also be ingested by *O. afer afer* while feeding on the ants and these are distributed with the faeces. Consequently, the species inadvertently also plays a role in seed dispersal and germination.

Through personal communication with a Farm Owner (Ian Horn) (pers. comm, 18/10/2022), the presence of the Mountain reedbuck was confirmed. *Redunca fulvorufula* (Mountain Reedbuck) is listed as EN both regionally and globally. The South African population has undergone a decline of 61-73% in the last three generations (15 years) (IUCN, 2017). Mountain Reedbuck live on ridges and hillsides in broken rocky country and high-altitude grasslands (often with some tree or bush cover). The PAOI contains these habitats, as there are a number of valleys and rocky ridges that this species may utilise and as such, this has attributed to the SEI of these habitats (Figure 3-12).

Table 3-9 Summary of mammal species recorded within the proposed PAOI during the survey period. EN = Endangered, LC = Least Concern

Family	Scientific Name	Common Name	Conservation Status	
			Regional	Global
Bathyergidae	*Cryptomys hottentotus*	Common Molerat	LC	LC
Bovidae	*Antidorcas marsupialis*	Springbok	LC	LC
Bovidae	*Raphicerus campestris campestris*	Southern Steenbok	LC	LC
Bovidae	***Redunca fulvorufula***	**Mountain Reedbuck**	**EN**	**EN**
Canidae	*Canis mesomelas mesomelas*	Southern Black-backed Jackal	LC	LC
Canidae	*Otocyon megalotis*	Bat-eared Fox	LC	LC
Felidae	*Caracal caracal caracal*	Southern and Eastern Caracal	LC	LC
Herpestidae	*Cynictis penicillata penicillata*	Southern Yellow Mongoose	LC	LC
Herpestidae	*Herpestes pulverulentus*	Cape Grey Mongoose	LC	LC
Herpestidae	*Suricata suricatta*	Meerkat	LC	LC
Hyaenidae	*Proteles cristatus cristatus*	Southern Aardwolf	LC	LC
Hystricidae	*Hystrix africaeaustralis africaeaustralis*	Southern Porcupine	LC	LC
Leporidae	*Lepus capensis*	Cape Hare	LC	LC
Leporidae	*Pronolagus saundersiae*	Hewitt's Red Rock Rabbit	LC	LC
Mustelidae	*Ictonyx striatus*	Striped Polecat	LC	LC

Family	Scientific Name	Common Name	Conservation Status	
			Regional	Global
Orycteropodidae	*Orycteropus afer*	Aardvark	LC	LC
Procaviidae	*Procavia capensis*	Rock Hyrax	LC	LC
Sciuridae	*Xerus inauris*	South African Ground Squirrel	LC	LC
Viverridae	*Genetta genetta*	Small-spotted Genet	LC	LC

Figure 3-12 Photographs illustrating a Mountain reedbuck observed within the region

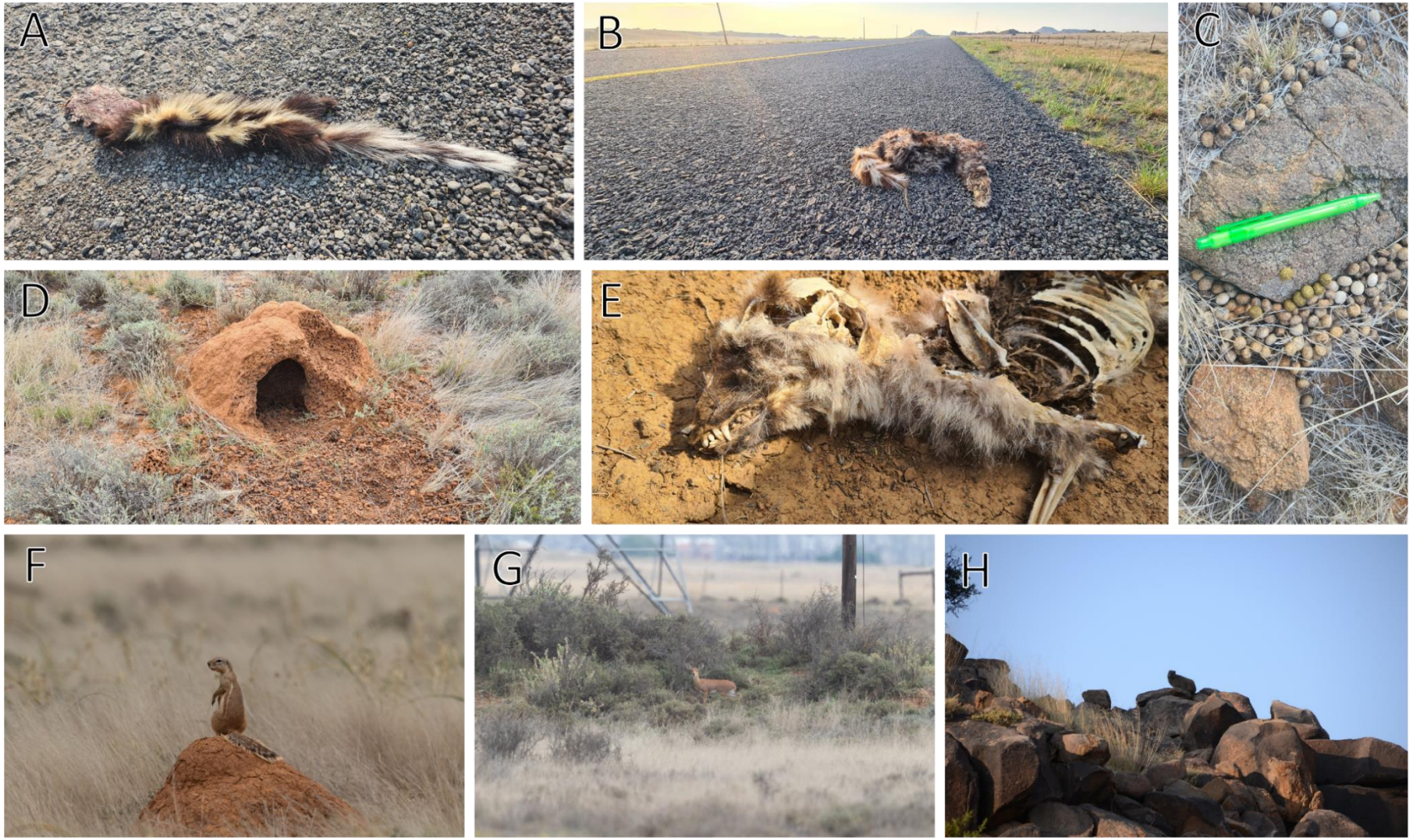


Figure 3-13 ***Photographs illustrating a portion of the mammal species recorded within the proposed PAOI during the survey period. A) Ictonyx striatus (Striped Polecat), B) Genetta genetta (Small-spotted Genet), C) Pronolagus saundersiae (Hewitt's Red Rock Rabbit), D) Orycteropus afer (Aardvark) Diggins, E) Otocyon megalotis (Bat-eared Fox), F) Xerus inauris (South African Ground Squirrel), G) Raphicerus campestris campestris (Southern Steenbok) and H) Procavia capensis (Rock Hyrax)***

4 Habitats, Site Ecological Importance and Ecosystem Processes

4.1 Habitat Assessment

The main habitat types identified across the project area were initially identified largely based on aerial imagery. These main habitat types were refined based on the field coverage and data collected during the survey. Emphasis was placed on limiting timed meander searches along the proposed project area within the natural habitats and therefore habitats with a higher potential of hosting SCC. The habitats observed, coincide with the vegetation types as described by Mucina & Rutherford in 2006 and SANBI (2019) due to the lack of large-scale transformation, these are discussed in detail in the sections that follow. A summary of habitat types delineated within the project area can be seen in Table 4-1.

Table 4-1 Summary of habitat types delineated within the project area

Habitat Type	Description	Ecosystem Processes and Services	Habitat Sensitivity
Degraded Northern Upper Karoo Shrubland	Semi-natural shrubland, but slightly disturbed due to the grazing by livestock, mismanagement and also human infringement. Terrain consists of a low to zero slope with deep soils in comparison to the sloped habitats. Variable in the presence or absence of grass species and shrub density.	Provides grazing for organisms. Aids in filtration of water permeating through the soil into drainage lines. Acts as corridor for fauna dispersion within the landscape. Acts as buffer for high sensitivity areas. The unit acts as a greenland which supports viable plant species populations and is also used for foraging by fauna.	Medium
Hills, Outcrops and Sills	Low slopes and rocky hills/outcrops which are disconnected from Mountains and Ridges. Distinctive features within the relatively homogeneous Upper Karoo region.	Provides grazing for livestock. Acts as refuge for fauna away from more accessible areas the landscape. Acts as buffer for high sensitivity areas. Capture and filter precipitation and run-off. Provides unique habitat for species. Provides greater heterogeneity in regional habitat and microclimate.	High
Drainage features and washes (Alluvial Shrubland)	Low to no slope with alluvial soils. Ephemeral systems were both considered for this habitat type. Channels through which surface water naturally collates and flows. Perennial and ephemeral systems were both considered for this habitat type. All the prominent features were identified, as there are numerous inconspicuous drainages features throughout.	Water Paths, functions as important Water resources. Provides refuge and grazing areas, especially during the dry seasons Provides surface water within the landscape. Aids in trapping sediment and nutrients derived from land runoff.	Medium
Transformed	Homesteads and associated infrastructure as well as prominent roads	N/A	Very Low

4.1.1 Degraded Northern Upper Karoo Shrubland

This habitat is the remainder of the shrubland that has been disturbed by the historic and current grazing (Figure 4-1 and Figure 4-2). This habitat type is regarded as semi-natural shrubland, but slightly disturbed due to the grazing by livestock, mismanagement and also human infringement.

The current ecological condition of this habitat with regard to the main driving forces, are intact, which is evident in the amount of, and importance of the species recorded in the flora and faunal assessment, and also to the type of plant species recorded corresponding to the vegetation type as described by Mucina (2006). Even though this habitat is partly disturbed, it supports largely intact vegetation and has a rehabilitation potential. This habitat type acts as a corridor for fauna dispersion within the landscape as well as a buffer for high sensitivity areas. Its current state is functional ESA. The unit acts as a greenland which supports viable plant species populations and is also used for foraging by fauna.

Figure 4-1 Degraded Northern Upper Karoo Shrubland

Figure 4-2 Degraded Northern Upper Karoo Shrubland

4.1.2 Hills, Outcrops and Sills

This habitat includes areas that are rocky outcrops, stony and rocky ridges/hills with varying slopes, bedrock protruding from the soil layer with the associated boulders and large rocks that occur within the shrubland habitat (Figure 4-5 and Figure 4-4). The habitat is used by faunal species as fine-scale habitats and is important for several lifestages. These habitats can be considered as ecological hotspots being an important habitat for fauna and flora, especially plants as well as reptiles. The habitat has been infringed upon by livestock, which has had an impact on this habitat, although minor. This habitat type has undergone impacts associated with human activity especially due to the use of the area for grazing. This habitat forms part of a unique landscape within the region and provides refugia, food and a more natural environment.

Figure 4-3 Hills, Outcrops and Sills

Figure 4-4 Koppies shrubland

4.1.3 Water resources (Drainage features/Alluvial Shrubland)

This habitat is regarded as areas where intermittent rivers sporadically flow and exists as well as the drainage flats/floodplains connected to these areas. This habitat is shrubland that has been disturbed mainly by the historic and current grazing (Figure 4-6 and Figure 4-5). This habitat type is regarded as semi-natural shrubland, but slightly disturbed due to the grazing by livestock the associated human infringement and use (dams). Current human infringement still occurs throughout, especially in areas close to roads. The current ecological condition of this habitat with regard to the main driving forces, are intact, which is evident in the amount of, and importance of the species recorded in the flora and faunal assessment, and also to the type of plant species recorded corresponding to the vegetation type as described by Mucina (2006).

The drainage lines and within the project area can be regarded as non-perennial and possess surface flow only briefly during and following a period of rainfall (ephemeral), which is a feature of semi-arid/arid regions. These seasonal streams create an ecological link between the stream and its surrounding terrestrial landscape and has the same function albeit on a smaller scale than a river. These habitats, jointly, is important as a movement corridor as it creates a link between the system and its surrounding terrestrial landscape for several faunal species, especially birds and mammals, and plays a vital role as a water resource not only for the biodiversity but also the local community. These units act as greenlands which supports viable plant species populations and is also used for foraging by fauna. The unit also serves as a movement corridor for fauna within a landscape fragmented. This habitat unit can be regarded as highly important, not only within the local landscape, but also regionally.

Figure 4-5 Stream/drainage feature.

Figure 4-6 Washes (Alluvial shrubland)

4.1.4 Transformed

This habitat unit has previously been impacted upon and shows a change from their natural state, with little to no remaining natural vegetation due to land transformation. The transformed habitat predominantly comprised of roads, railway tracks and homesteads.

4.2 Site Ecological Importance

Based on the criteria provided in section 2.3 of this report, all habitats within the PAOI were assigned a sensitivity category, i.e., a SEI category. The PAOI was categorised as possessing habitats possessing areas of 'Very Low', 'Medium' and 'High' SEI. (Table 4-2). This indicates that the findings of this assessment are congruent with the Screening Tool with respect to the Combined Terrestrial and Animal Species Theme sensitivity.

The guidelines for interpreting the SEI category within the context of the proposed development are provided in Table 4-2.

Table 4-2 Summary of the PAOI Site Ecological Importance

Habitat Type	Conservation Importance (CI)	Functional Integrity (FI)	Biodiversity Importance (BI)	Receptor Resilience (RR)	Site Ecological Importance (SEI) Guidelines for interpreting SEI in the context of the proposed development activities
Hills, Outcrops and Sills	**Medium** > 50% of receptor contains natural habitat with potential to support SCC	**High** Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type. Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches. Only minor current negative ecological impacts with no signs of major past disturbance and good rehabilitation potential.	**Medium**	**Low** Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality.	**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. The nature of specific impacts to the topsoil is key in Karoo habitats. Mitigations such as retaining vegetation and topsoil layers is applicable, as well as avoiding certain areas and planning infrastructure layouts accordingly.
Shrubland	**Medium** > 50% of receptor contains natural habitat with potential to support SCC.	**Medium** Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type. Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches. Only minor current negative ecological impacts with no signs of major past disturbance and good rehabilitation potential.	**Medium**	**Medium** 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.	**Medium** Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.

Habitat Type	Conservation Importance (CI)	Functional Integrity (FI)	Biodiversity Importance (BI)	Receptor Resilience (RR)	Site Ecological Importance (SEI) Guidelines for interpreting SEI in the context of the proposed development activities
Water Resources	**Medium** > 50% of receptor contains natural habitat with potential to support SCC.	**Medium** Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status Only narrow corridors of good habitat connectivity. Mostly minor current negative ecological impacts with some major impacts and a few signs of minor past disturbance.	**Medium**	**Medium** 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.	**Medium** Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Transformed	**Very Low** No natural habitat remaining.	**Very Low** No habitat connectivity except for flying species or flora with wind-dispersed seeds.	**Very Low**	**Low** Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality.	**Very Low** Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

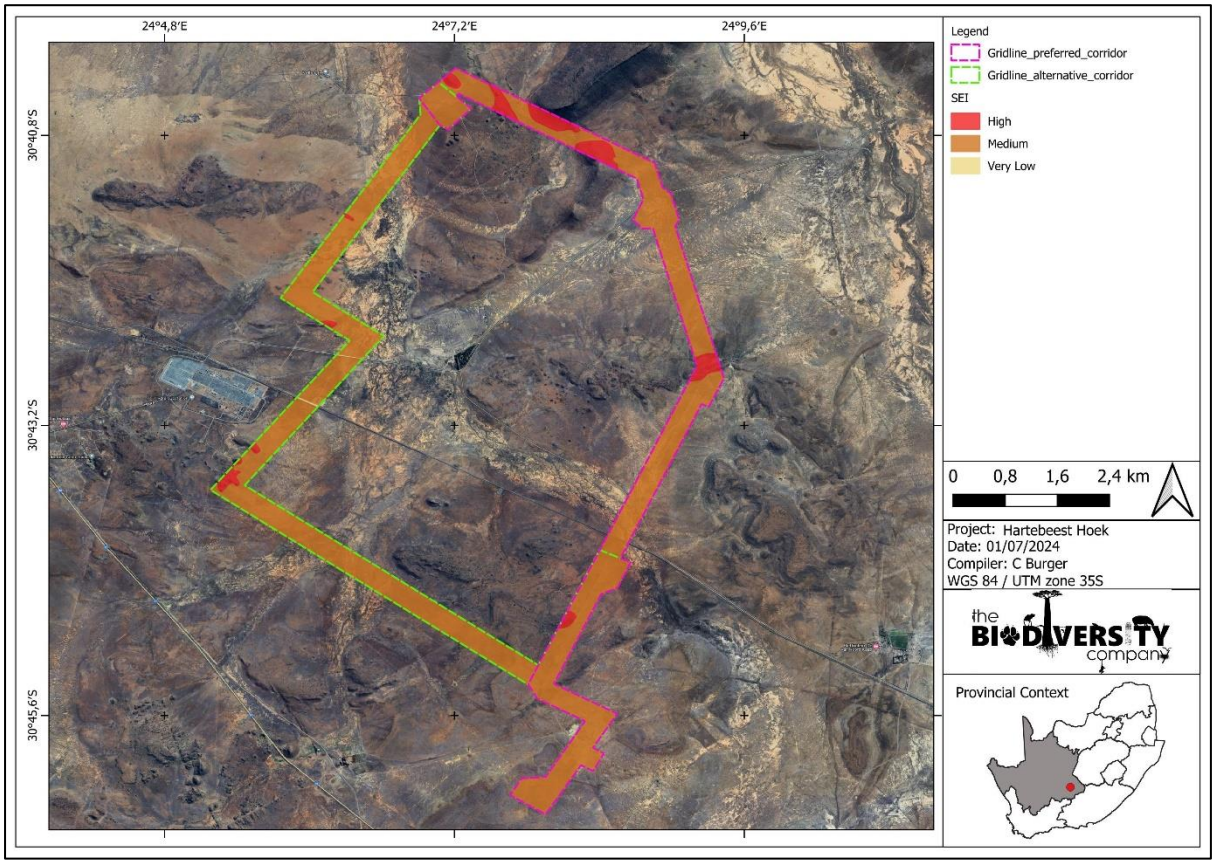


Figure 4-7 Map illustrating the Site Ecological Importance of the PAOI.

4.2.1 Screening Tool Comparison

The allocated sensitivities for each of the relevant themes are either disputed or validated for the assessed areas in Table 4-3 below. A summative explanation for each result is provided as relevant. The specialist-assigned sensitivity ratings are based largely on the SEI process followed in the previous section, and consideration is given to any observed or likely presence of SCC or protected species.

Table 4-3 Summary of the screening tool vs specialist assigned sensitivities.

Screening Tool Theme	Screening Tool	Habitat	Specialist	Tool Validated or Disputed by Specialist - Reasoning
Animal Theme	**High**	**-**	**High**	Validated – Habitat is intact and capable of supporting recorded and some expected SCCs.
Plant Theme	**Low**	**-**	**Low**	Validated: No SCC was recorded.
Terrestrial Theme	**Very High**	**Hills, Outcrops and Sills**	**High**	Disputed – Habitat remains in good condition and delivers important ecological functions. Some minor disturbance evident in the form of grazing pressure.
		Shrubland Water Resources	**Medium**	Disputed – Habitat remains in good condition and delivers important ecological functions. Some minor disturbance evident in the form of grazing pressure.
		Transformed	**Very Low**	Disputed – Habitat is entirely transformed.

4.3 Ecosystem Processes

The area provides an array of ecosystem services due to its inherent processes from its biotic components as well as its high level of functional integrity. Apart from the hydrological provisioning services, additional ecosystem processes and concomitant services observed during the field survey are described below.

The Formicidae species *Messor capensis* (Figure 4-8) influences soil characteristics and plant growth via its tunnelling activity. The major physical change to the soils is the drier mound than inter-mound spaces, as although they permit greater water infiltration, they dry out faster due to less compaction and higher organic content. The chemical properties between mounds and inter-mound spaces also differ significantly, with mounds containing approximately 50% more phosphorous, potassium and nitrogen. This spatial discrepancy in soil physico-chemical properties therefore influences vegetation heterogeneity.

Mounds are also not static, with new mounds being developed around replacement entrances after disturbance by rainfall or feeding *O. afer afer*, thereby affecting wide areas. As aforementioned, the foraging activity of *O. afer afer* inadvertently distributes the nest seed stores with mound soil and considering that the mound soil possesses elevated nutrient content, it is likely to provide an improved germination material.

Figure 4-8 Photograph illustrating individuals of Messor capensis within the PAOI

Pollination is a critical ecosystem process that is required for the necessary recruitment levels of flora in order to maintain diversity and its concomitant ecosystem functioning. Pollination by several taxonomic groups was observed within the PAOI, with numerous interactions observed.

Dung beetles play an important role in natural ecosystems. The most of them use the faecal material of various animals for food and to provide balls for the larvae, which live in chambers or burrows in the ground. They assist in aerating and mixing the soil by burrowing, increasing the organic matter content of the soil by burying of dung. Ultimately their presence assists the ecosystem by improving the water holding capacity as well as nutrient availability of the soil, with associated benefits to plants. They also provide an important food source for decomposers.

During favourable weather conditions within the Nama Karoo biome, accelerated and elevated plant growth leads to the substantial increases in the abundance of ‘outbreak’ herbivorous insects. This population explosion of herbivorous insects, particularly Orthopterans and *Loxostele frustalis* (Lepidoptera: Crambidae), can lead to extensive areas of vegetation being defoliated. Studies of Orthopteran outbreaks revealed that they are cyclical, with peak outbreaks occurring at 17.3 years increments. Peak swarm irruptions are correlated with warm El Niño/Southern Oscillation (ENSO)

climate events, which drives wet and dry cycles within southern Africa. Swarm outbreaks was linked to the amount of precipitation over the 12 months prior to the outbreak. Personal communication with property owners and residents of De Aar had indicated that higher than average rainfall was experienced prior to the survey period with flooding of the plains occurring. However, this higher-than-average rainfall was vital as it had occurred subsequent to a prolonged drought period. Consequently, there was a substantial increase in plant growth with a concomitant population explosion of herbivorous insects encompassing several taxonomic groups.

The larvae of the diverse family Meloidae (Coleoptera) are important predators of Acrididae locust egg pods, including plague locusts, and during an outbreak their abundance increases considerably. The adults are plant-associated and feed on nectar, flowers or foliage. Meloidae usually lay their eggs close to where the first instar larvae are able to rapidly find a host by smell. Meloidae were ubiquitous within the PAOI.

Consequently, the PAOI provides important ecosystem services within the landscape. Therefore, any negative impacts to the community within the PAOI will have cascading ecosystem affects (Figure 4-9).

Figure 4-9 ***Photographs illustrating examples of the ecosystem processes contributors recorded within the PAOI. A) Meloidae (Coleoptera)(Predation), B) Rhiniidae (Diptera)(Pollination), C) Scarabaeidae (Coleoptera)(Fertilisation), D) Apis mellifera scutellata (Pollination), E) Camponotus cinctellus nectaring (Inadvertent Pollination) and F) Pamphagini (Herbivorous insect)***

5 Impact Risk Assessment

The section below and associated tables serve to indicate and summarise the significance of perceived impacts on the terrestrial ecology of the project area.

5.1 Biodiversity Risk Assessment

Potential impacts were evaluated against the data captured during the desktop assessment to identify relevance to the project area. The relevant impacts associated with the proposed development were then subjected to a prescribed impact assessment methodology which is provided below.

The significance of the identified impacts will be determined using an accepted methodology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998. As with all impact methodologies, the impact is defined in a semi-quantitative way and will be assessed according to methodology prescribed in the following section (Table 5-1 and Table 5-2) the significance matrix can be seen in **Error! Reference source not found.**

Scale utilised for the evaluation of the Environmental Risk Ratings:

Table 5-1 Likelihood Descriptors

Probability of impact	Rating
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Sensitivity of receiving environment	**Rating**
Ecology not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ /important	3
Ecology highly sensitive /important	4
Ecology critically sensitive /important	5

Table 5-2 Consequence Descriptors

Severity of impact	Rating
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful/ ecosystem structure and function largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	**Rating**
Activity specific/ < 5 ha impacted / Linear features affected < 100m	1
Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear features affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear features affected > 3000m	5

Duration of impact	Rating
One day to one month: Temporary	1
One month to one year: Short Term	2
One year to five years: Medium Term	3
Life of operation or less than 20 years: Long Term	4
Permanent	5

Table 5-3 Significance Rating Matrix

	CONSEQUENCE (Severity + Spatial Scope + Duration)															
LIKELIHOOD (Frequency of activity + Frequency of impact)	0	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Absent
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	Low
	3	6	9	12	15	18	21	24	27	301	33	36	39	42	45	
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	Moderate
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	Moderately High
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	High
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	Critical
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	

5.2 Present Impacts to Biodiversity

Considering the anthropogenic activities and influences within the landscape, several negative impacts to biodiversity were observed within the PAOI and the surrounding landscape. These include:

- Livestock grazing land-use;
- Damming of water resources;
- Persecution and trapping;
- Roads and associated vehicle traffic and road kills;
- Railway line;
- Existing Renewable Energy Facilities in the surrounding landscape; and
- Fencelines and predator-proof fences.

While all these impacts were not necessarily within the PAOI, they would still affect species occupancy within the landscape.

Figure 5-1 ***Photographs illustrating impacts to biodiversity within the PAOI and surrounding landscape. A) Existing pylons energy distribution infrastructure and fencelines, B) Animal trapping, C) Damming of water resources D) Road and associated vehicle traffic and fauna mortality, E) Livestock agriculture and F) Active railway with noise, vibration and probable collisions.***

5.3 Alternatives considered

Two alternative powerline options were proposed: the preferred option and the alternative. Given that both powerlines traverse similar habitats, a separate assessment for each was deemed unnecessary. An evaluation of the suitability of these alternatives can be found in Section 6.2.

5.4 Loss of Irreplaceable Resources

- An ESA; and
- Potentially occurring SCC will also be lost.

5.5 Identification of Additional Potential Impacts

Anthropogenic activities drive habitat destruction causing displacement of fauna and flora and possibly direct mortality. Land clearing destroys local wildlife habitat and can lead to the loss of local breeding grounds, nesting sites and wildlife movement corridors such as rivers, streams and drainage lines, or other locally important features. The removal of natural vegetation may reduce the habitat available for fauna species and may reduce animal populations and species compositions within the area.

The ecosystem processes and biotic components influencing vegetation heterogeneity and wellbeing have been described in this report. The proposed development will lead to a loss in habitat for these biotic components and therefore, cause a negative shift in the wellbeing of the vegetation within the development footprint and proximal surrounding landscape.

Within southern Africa, a proportion of biomes, and the associated vegetation types, are dependent on the dynamics of fire to maintain ecosystem functioning and wellbeing. In contrast, fire in the western arid region of the Nama Karoo is extremely rare. Occasional fires may occur after successive years of good rainfall in combination with light grazing, resulting in an increased fuel load. Fire is potentially more common in the east along the southwestern edge of the Grassland Biome including the interface with this biome on the eastern mountains. The grasslands bordering the Nama Karoo biome are regarded as Dry Highveld Grassland. Inappropriate burning regimes are likely to have detrimental consequences to ecosystem structure and functioning. An appropriate fire management plant must therefore be developed and implemented. As rainfall and productivity are unpredictable, it is difficult to set out burning frequency rules for Dry Highveld Grassland; in general, and in the absence of more specific information, the following guidelines can be applied (SANBI, 2013):

- A burning interval of approximately 10 years should be applied; and
- Burning should take place in late winter, and only in seasons that have been wet enough to ensure enough biomass to support an intense fire.

Accidental fires from the proposed development that are not in accordance with these guidelines will lead to a negative shift in the wellbeing of the vegetation.

Information on the influence of habitat fragmentation on the pollinator community within the Nama Karoo Biome is lacking. However, it is known that fragmentation of other shrub- or graminoid-dominated vegetation communities leads to a loss in pollinator diversity and change in behaviour (Donaldson *et al*, 2002; Rusterholz & Baur, 2010; Zschokke *et al*, 2000). This leads to negative alterations in the reproductive success in terms of fruit set of particular plant species, or a group of plant species, thereby causing a negative shift in the flora species composition and diversity. Therefore, it is postulated that if the proposed development drives habitat fragmentation, it will lead to a negative shift in the diversity of the pollinator community. In addition, the use of pesticides will lead to substantial declines in the

diversity of the pollinator community, leading to a considerable negative shift in the levels of flora recruitment and overall ecosystem functioning.

The potential impacts during the construction and operation phases of the proposed development are summarised in Table 5-4.

Table 5-4 Potential impacts to biodiversity associated with the proposed Project.

Main Impact	**Project activities that can cause loss of habitat**	**Secondary impacts anticipated**
Habitat Destruction	Physical removal of vegetation and surface grading for construction of the transmission infrastructure.	• Displacement/loss of flora & fauna (including SCC) • Increased potential for soil erosion • Habitat fragmentation • Increased potential for establishment of alien & invasive vegetation
Main Impact	**Project activities that can cause the spread and/or establishment of alien and/or invasive species**	**Secondary impacts anticipated**
Spread and/or establishment of alien and/or invasive species into disturbed areas	Vegetation removal	• Habitat loss for indigenous flora & fauna (including potential SCC) • Spreading of potentially dangerous diseases due to invasive and pest species • Increased potential for soil erosion • Alteration of fauna assemblages due to habitat modification
	Vehicles potentially spreading seed	
	Unsanitary conditions surrounding infrastructure promoting the establishment of pest rodents	
Main Impact	**Project activities that can cause the direct mortality of fauna**	**Secondary impacts anticipated**
	Roadkill due to vehicle collision	• Loss of ecosystem services
	Intentional killing of fauna for food (hunting and persecution)	
Main Impact	**Project activities that can cause reduced dispersal/migration of fauna**	**Secondary impacts anticipated**
Reduced dispersal/migration of fauna	Loss of landscape used as corridor	• Loss of ecosystem services • Reduced plant seed dispersal • Reduced gene flow
	Removal of vegetation	
Main Impact	**Project activities that can cause emigration of fauna**	**Secondary impacts anticipated**
Emigration of fauna	Operation of machinery (Large earth moving machinery, generators)	• Loss of ecosystem services
	Heavy vehicle use	
	Outside lighting	

5.6 Assessment of Impact Significance

The assessment of impact significance considers pre-mitigation as well as implemented post-mitigation scenarios. Three phases were considered for the impact assessment:

- Construction Phase: This phase refers to the period during construction when the proposed features are constructed; and is considered to have the largest direct impact on biodiversity. The main anticipated impact includes the clearing of vegetation, proliferation of alien plant species along the roads and cleared areas as well as the severing of movement corridors for fauna, and the fragmentation of habitat. The actual footprint of the overhead powerline pylon infrastructure has a small localised, impact. It is the clearance for the areas utilised for the creation off access and service roads that is a more important aspect to consider.
    - Destruction, further loss and fragmentation of the habitats, ecosystems and vegetation community;
    - Introduction of alien species, especially plants; and

- Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, dust, vibration and poaching)

- Operational Phase: The operational phase of the impact of daily activities is anticipated to further spread the IAP, as well as the deterioration of the habitats due to the increase of dust and edge effect impacts. Dust reduces the ability of plants to photosynthesize and thus leads to degradation/retrogression of the veld. Moving maintenance vehicles don't only cause sensory disturbances to fauna, affecting their life cycles and movement, but will lead to direct mortalities due to collisions.

    - Continued encroachment and displacement of the natural vegetation community due to alien invasive plant species, erosion and edge effects.;

    - Continued displacement and fragmentation of the faunal community, particularly the disruption of natural faunal movement corridors; and

    - Erosion created from surface run-off due to increase in impervious surfaces.

- Decommissioning Phase; this phase refers to the scaling down of activities ahead of temporary or permanent closure is initiated. During this phase, the operational phase impacts will persist until of the activity reduces and the rehabilitation measures are implemented;

    - Decommissioning activity will likely lead to direct mortality of fauna due to earthworks, vehicle collisions and persecution. Encroachment and displacement of the natural vegetation community due to alien invasive plant species, erosion and edge effects; and

    - Disturbance created during decommissioning will leave the development area vulnerable to erosion and alien plant invasion for several years.

5.6.1 Construction Phase

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Destruction, further loss and fragmentation of the habitats, ecosystems and vegetation community, including protected species.	5	3	4	4	4		2	2	3	4	3	
	Permanent	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Highly likely	**Moderately High**	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Likely	**Low**

- All 'High' SEI areas should be cautiously considered. Should development take place in the high SEI areas, the pylon placement should be considered to reduce the number of pylons in these areas.
- The footprint area must be minimised and clearing must also be restricted to the direct impact area.
    - Demarcate work areas during the construction phase to avoid affecting outside areas. Use physical barriers e.g., safety tape, not painted lines, and use signage.
- Existing access routes, particularly roads must be made use of, especially in the High SEI areas.
- Water resources must be avoided for pylon placement and access roads as far as possible, and a no-go buffer as per the aquatic assessment must be applied around them.
- Once the final line and associated pylon have been confirmed, a walkthrough is required for these areas, to ensure that sensitive areas are excluded for construction of pylons, through 'micro siting' of the proposed pylon locations.
- Do not clear areas of indigenous vegetation outside of the direct development footprint within the PAOI.
- Minimise vegetation clearing to the minimum required.
- Any individual of the SCC/protected plants that was observed needs a relocation or destruction permit in order for any individual that may be removed or destroyed due to the development. High visibility flags must be placed near any protected plants in order to avoid any damage or destruction of the species. If left undisturbed the sensitivity and importance of these species needs to be part of the environmental awareness program.
- Consult a fire expert and compile and implement a fire management plan to minimise the risk of veld fires around the Project site.
- Compile and implement a rehabilitation plan from the onset of the Project.
- Rehabilitate areas as soon as they are no longer impacted by construction.
- The rehabilitated areas must be revegetated with indigenous vegetation.
- Dust-reducing mitigation measures must be put in place and must be strictly adhered to, for all roads and bare (unvegetated) areas.
- Reduce the dust generated by operational vehicles and earth moving machinery, through wetting the soil surface and putting up signs to enforce speed limits to enforce reduced speeds.
- No non-environmentally friendly suppressants may be used as this could result in pollution of water sources.
- Progressive rehabilitation will enable topsoil to be returned more rapidly, thus ensuring more recruitment from the existing seedbank. Surplus rehabilitation material can be applied to other others in need of stabilisation and vegetation cover.

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
• Vegetation clearing to commence only after the necessary permits have been obtained. • Environmental Officer (EO) to provide supervision and oversight of vegetation clearing activities.												
Introduction of alien spp, especially plants	4 Life of operation or less than 20 years: Long Term	3 Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	3 Significant / ecosystem structure and function moderately altered	4 Ecology highly sensitive /important	4 Highly likely	**Moderately High**	3 One year to five years: Medium Term	2 Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	2 Small / ecosystem structure and function largely unchanged	2 Ecology with limited sensitivity/importance	2 Possible	**Low**
• Compile and implement an alien vegetation management plan from the onset of construction. The plan must identify areas for action (if any) and prescribe the necessary removal methods and frequencies to be applied. This plan must be also prescribing a monitoring plan and be updated as/when new data is collated. • Implementation of a waste management plan, this plan must be also prescribe a monitoring plan and be updated as/when new data is collated. Waste management must be a priority and all waste must be collected, stored and disposed of adequately. It is recommended that all waste be removed from site on a weekly basis (as a minimum) to prevent rodents and pests entering the site. • Refuse bins will be emptied and secured. • Temporary storage of domestic waste shall be in covered waste skips. • Maximum domestic waste storage period will be 7 days. • A pest control plan must be put in place and implemented; it is imperative that poisons not be used.												
Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, dust, vibration and poaching	4 Life of operation or less than 20 years: Long Term	3 Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	3 Significant / ecosystem structure and function moderately altered	4 Ecology highly sensitive /important	4 Highly likely	**Moderately High**	3 One year to five years: Medium Term	2 Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	3 Significant / ecosystem structure and function moderately altered	3 Ecology moderately sensitive/ /important	2 Possible	**Low**

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
• Demarcate work areas during the construction phase to avoid affecting outside areas. Use physical barriers e.g., safety tape, not painted lines, and use signage. • Prior to vegetation clearing activities, the area to be cleared should be walked on foot by 1-2 individuals to create a disturbance in order for fauna to move off. Sites should be disturbed only prior to the area having to be cleared, not more than 1 day in advance. • Any fauna threatened by the construction activities should be removed safely by an appropriately qualified environmental officer or removal specialist. • All construction vehicles should adhere to a speed limit of maximum 40 km/h to avoid collisions. Appropriate speed control measures and signs must be erected. • Minimise vegetation clearing to the minimum required. Areas should be cleared and disturbed on a need's basis only, as opposed to clearing and disturbing a number of sites simultaneously. • Provide All personnel and contractors to undergo Environmental Awareness Training to all personnel and contractors. A signed register of attendance must be kept for proof. Discussions The training must include. • The timing between clearing of an area and subsequent development must be minimized to avoid fauna from re-entering the site to be disturbed. • Any holes/deep excavations must be done in a progressive manner on a needs basis only. No holes/excavations may be left open overnight. In the event holes/excavations are required to remain open overnight, these areas must be covered to prevent fauna falling into these areas and subsequently inspected prior to backfilling • Where possible, work should be restricted to one area at a time and be systematic. This is to reduce the number and extent of on-site activities, allowing fauna to move off as the Project progresses. This will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories. • Considering that many of the mammal fauna recorded within the project area are nocturnal, no construction activity is to occur at night.												

5.6.2 Operational Phase

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Continued encroachment and displacement of the natural vegetation community due to alien invasive plant species, erosion and edge effects.	4	3	4	4	5		2	2	2	2	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Definite	**Moderately High**	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Likely	**Low**
• Avoid the further disturbance or destruction of High SEI areas, as far as possible.												

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
• It should be made an offence for any staff to /take bring any plant species into/out of any portion of the PAOI. No plant species whether indigenous or exotic should be brought into/taken from the PAOI, to prevent the spread of exotic or invasive species or the illegal collection of plants. (Apart from rehabilitation activities). • Implementation of an alien vegetation management plan. o Regular monitoring for IAP encroachment during the operation phase to ensure that no alien invasion problems have developed as result of the disturbance. This should be every 3 months during the first two years of the operation phase and every six months for the life of the project. o All IAP species must be removed/controlled using the appropriate techniques as indicated in the IAP management plan • Compile and implement a Solid Waste Management Plan. Waste management must be a priority and all waste must be collected, stored and disposed of adequately. It is recommended that all waste be removed from site on a weekly basis as a minimum. • A Rehabilitation Plan must be written for the development area and ensured that it be adhered to. • Access roads should have run-off control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. • All erosion observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • There should be follow-up rehabilitation and re-vegetation of any remaining denuded areas with local indigenous perennial shrubs and succulents from the area.												
Continued displacement and fragmentation of the faunal community, particularly the disruption of natural faunal movement corridors	4 Life of operation or less than 20 years: Long Term	3 Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	3 Significant / ecosystem structure and function moderately altered	3 Ecology moderately sensitive/ /important	3 Likely	**Moderate**	2 One month to one year: Short Term	2 Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	2 Small / ecosystem structure and function largely unchanged	2 Ecology with limited sensitivity/importance	3 Likely	**Low**
• Minimise traffic and the use of vehicle lights of the road during the night. • Noise must be kept to a minimum from dusk to dawn to minimize all possible disturbances to amphibian species and nocturnal mammals • All personnel and contractors must undergo Environmental Awareness Training and must include awareness about not harming or collecting species. • Any fauna threatened by the maintenance and operational activities should be removed to a safe location by an appropriate individual. • All vehicles accessing the site should adhere to a max 40 km/h max to avoid collisions. Appropriate signs must be erected. • If any excavations are to be dug these must not be left open for more than a few hours without ramps for trapped fauna to leave and must be filled at night.												
Erosion created from surface run-off due to increase in	4 Life of operation or less than 20	3 Local area/ within 1 km of the site boundary /	3 Significant / ecosystem structure and function	3 Ecology moderately sensitive/ /important	4 Highly likely	**Moderate**	2 One month to one year:	2 Development specific/ within the site boundary / <	2 Small / ecosystem structure and function	3 Ecology moderately sensitive/ /important	3 Likely	**Low**

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
impervious surfaces	years: Long Term	< 5000ha impacted / Linear features affected < 1000m	moderately altered				Short Term	100 ha impacted / Linear features affected < 100m	largely unchanged			

- Access roads should have run-off control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.
- All erosion observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
- There should be follow-up rehabilitation and re-vegetation of any remaining denuded areas with local indigenous perennial shrubs and succulents from the area.
- Speed limits must be put in place to reduce erosion.
- Reducing the dust generated by the listed activities above, especially the earthmoving machinery, through wetting the soil surface; putting up signs to enforce speed limit; and speed bumps built to force slow speeds.
- Signs must be put up to enforce this.
- A stormwater management plan must be compiled and implemented.

5.6.3 Decommissioning/Rehabilitation Phase

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Decommissioning activity will likely lead to direct mortality of fauna due to earthworks, vehicle collisions and persecution. Destruction of vegetation, encroachment and displacement of the natural vegetation community due to alien invasive plant species, erosion and edge effects.	4	3	3	4	5		3	2	2	2	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Definite	**Moderately High**	One year to five years: Medium Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Likely	**Low**

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
• All personnel should undergo environmental induction with regards to fauna and awareness about not harming or collecting species. • Prior to commencing work each day, two individuals should traverse the working area in order to disturb any fauna and so they have a chance to vacate. • Any fauna threatened by the construction activities should be removed safely by an appropriately qualified environmental officer or removal specialist. • All construction vehicles should adhere to a speed limit of maximum 40 km/h to avoid collisions. Appropriate speed control measures and signs must be erected. • All hazardous materials, if any, should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner. • Any excavations should not be left open for extended periods of time as fauna may fall in and become trapped in them. Excavations should only be dug when they are required and should be used and filled shortly thereafter. Limiting the closure and rehabilitation activities to the footprint areas only. Avoid entry/access to previously undisturbed or already rehabilitated areas. • Areas other than the footprint areas and existing surface infrastructure areas, should be declared as 'no-go' areas to vehicles (only). All essential operational staff – machinery must be limited to development area (no need to go outside the authorised area). • The rehabilitated areas must be revegetated with indigenous vegetation. • Reduce the dust generated by operational vehicles and earth moving machinery, through wetting the soil surface and putting up signs to enforce speed limits to enforce reduced speeds. • Implementation of rehabilitation plan. • Implementation of an alien vegetation management plan.												
Disturbance created during decommissioning will leave the development area vulnerable to erosion and alien plant invasion for several years.	4 Life of operation or less than 20 years: Long Term	3 Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	4 Great / harmful/ ecosystem structure and function largely altered	4 Ecology highly sensitive /important	3 Likely	**Moderately High**	2 One month to one year: Short Term	2 Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	2 Small / ecosystem structure and function largely unchanged	2 Ecology with limited sensitivity/importance	3 Likely	**Low**
• Rehabilitation in accordance with the Rehabilitation Plan for the development must be undertaken in areas disturbed during the decommissioning phase. • Monitoring of the rehabilitated area must be undertaken at quarterly intervals for 3 years after the decommissioning phase. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous flora.												

5.7 Unplanned Events

The planned activities will have known impacts as discussed above; however, unplanned events may occur on any project and may have potential impacts which will need mitigation and management.

Table 5-5 is a summary of the findings of an unplanned event assessment from a terrestrial ecology perspective. Note, not all potential unplanned events may be captured herein, and this must therefore be managed throughout all phases according to recorded events.

Table 5-5 Summary of unplanned events for terrestrial biodiversity

Unplanned Event	Potential Impact	Mitigation
Hydrocarbon spills into the surrounding environment from heavy machinery during the construction phase	Contamination of soil leading to mortality of flora and fauna.	A spill response kit must always be available. The incident must be reported on and if necessary, a biodiversity specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Fire	Uncontrolled/unmanaged fire that spreads to surrounding natural habitats that result in habitat destruction and fauna mortality. Although fires are a feature of savannah habitats, incorrect timing of the fire can have considerably negative effects.	Appropriate/Adequate fire management plan needs to be implemented.

5.8 Mitigations

The following mitigation measures are applicable in general. The following measures must be incorporated into the Environmental Management Programme (EMPr):

- All ‘High’ SEI areas should be cautiously considered. Should development take place in the ‘High’ SEI areas, the pylon placement should be considered to reduce the number of pylons in these areas.
- The footprint area must be minimised and clearing must also be restricted to the direct impact area.
    - Demarcate work areas during the construction phase to avoid affecting outside areas. Use physical barriers e.g., safety tape, not painted lines, and use signage.
- Water resources must be avoided for pylon placement and access roads as far as possible, and a no-go buffer as per the aquatic assessment must be applied around them;
- Once the final line and associated pylon have been confirmed, a walkthrough is required for these areas, to ensure that sensitive areas are excluded for construction of pylons, through ‘micro siting’ of the proposed pylon locations;
- Do not clear areas of indigenous vegetation outside of the direct development footprints within the PAOI;
- Minimise vegetation clearing to the minimum required. Areas should be cleared and disturbed on a needs basis only, as opposed to clearing and disturbing a number of sites simultaneously;
- Demarcate work areas during the construction phase to avoid affecting outside areas. Use physical barriers e.g., safety tape, not painted lines, and use signage;
- Collect and dump waste only in designated areas;
- Use hand cutting for vegetation clearing and avoid heavy machinery, as far as possible;
- Use existing access routes and paths wherever possible;

  - Existing roads/servitudes should be considered first option over the construction of new roads/servitudes and must only be made where necessary;

- Any holes/deep excavations must be done in a progressive manner on a needs basis only. No holes/excavations may be left open overnight. In the event holes/excavations are required to remain open overnight, these areas must be covered to prevent fauna falling into these areas;
- Where possible, work should be restricted to one area at a time and be systematic. This is to reduce the number and extent of on-site activities, allowing fauna to move off as the Project progresses. This will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories;
- Prior to vegetation clearing activities, the area to be cleared should be walked on foot by 1-2 individuals to create a disturbance in order for fauna to move off. Sites should be disturbed only prior to the area having to be cleared, not more than 1 day in advance;
- Minimise the number (and size) of laydown, storage and staff facilities for the duration of the Project;
- Consult a fire expert and compile and implement a fire management plan to minimise the risk of veld fires around the Project site;
- Compile and implement a rehabilitation plan from the onset of the Project. Progressive rehabilitation will enable topsoil to be returned more rapidly, thus ensuring more recruitment from the existing seedbank. Surplus rehabilitation material can be applied to other others in need of stabilisation and vegetation cover;
- Rehabilitate areas as soon as they are no longer impacted by construction;
- Ensure that all remaining construction materials are removed from the PAOI once the construction phase ends;
- Use preferably prefabricated buildings or those constructed of re-usable/recyclable materials;
- Ensure that staff do not bring onto or remove from the site any plants, to prevent the spread of exotic or invasive species or the illegal collection of plants;
- Store topsoil stockpiles on flat ground with minimal run-off and use bunds and/or other stabilisation methods (e.g., netting) if required to avoid erosion;
- Obtain relocation or destruction permits before any protected plants are destroyed, if destruction cannot be avoided;
- Provide Environmental Awareness Training to all personnel and contractors. A signed register of attendance must be kept for proof. The training must include:
  - Sensitive environmental receptors within the PAOI;
  - Management requirements in the Environmental Authorisation and the EMPr;
  - How to deal with any fauna species encountered during the construction process;
- Compile and implement a hydrocarbon spill management plan;
- Compile and implement an alien vegetation management plan from the onset of construction. The plan must identify areas for action (if any) and prescribe the necessary removal methods and frequencies to be applied. This plan must be also prescribe a monitoring plan and be updated as/when new data is collated;
- It should be made an offence for any staff to /take bring any plant species into/out of any portion of the PAOI. No plant species whether indigenous or exotic should be brought into/taken from the PAOI, to prevent the spread of exotic or invasive species or the illegal collection of plants. (Apart from rehabilitation activities).

- Implementation of a waste management plan, this plan must be also prescribing a monitoring plan and be updated as/when new data is collated. Waste management must be a priority and all waste must be collected, stored and disposed of adequately. It is recommended that all waste be removed from site on a weekly basis (as a minimum) to prevent rodents and pests entering the site;
    - Refuse bins will be emptied and secured;
    - Temporary storage of domestic waste shall be in covered waste skips; and
    - Maximum domestic waste storage period will be 7 days.
    - A pest control plan must be put in place and implemented; it is imperative that poisons not be used.;
- The timing between clearing of an area and subsequent development must be minimized to avoid fauna from re-entering the site to be disturbed;
- Minimise traffic of the road during the night;
- Limiting the closure and rehabilitation activities to the footprint areas only. Avoid entry/access to previously undisturbed or already rehabilitated areas;
- The rehabilitated areas must be revegetated with indigenous vegetation;
- Areas other than the footprint areas and existing surface infrastructure areas, should be declared as 'no-go' areas to vehicles (only). All essential operational staff - machinery must be limited to development area (no need to go outside the authorised area);
- Prohibit the intentional killing, trapping or poisoning of any animals on site, including snakes, lizards, birds or other animals;
- Outside lighting should be designed and limited to minimize impacts on fauna. Lighting fixtures should be fitted with baffles, hoods or louvres and directed downward. Outside lighting should be directed away from highly sensitive areas such as the wetland. Fluorescent and mercury vapor lighting should be avoided and sodium vapor (yellow) lights should be used wherever possible;
- Where feasible, motion detection lighting must be used to minimise the unnecessary illumination of areas;
- Noise must be kept to a minimum from dusk to dawn to minimize all possible disturbances to amphibian species and nocturnal mammals;
- Speed limits must be enforced to ensure that road killings and erosion is limited;
- Dust-reducing mitigation measures must be put in place and must be strictly adhered to, for all roads and bare (unvegetated) areas;
- Reduce the dust generated by operational vehicles and earth moving machinery, through wetting the soil surface and putting up signs to enforce speed limits to enforce reduced speeds; and
- No non-environmentally friendly dust suppressants may be used as this could result in pollution of water sources.

6 Conclusion and Impact Statement

6.1 Conclusion

The aim of this Biodiversity Impact Assessment was to provide information to guide the risk of the proposed Project and associated grid connection infrastructure to the ecosystems affected by its development and their inherent fauna and flora.

The study area has been altered both currently and historically. The present land use had a direct impact on both the fauna and the flora in the area, which is evident in the transformed habitats. Historically, grazing from livestock and mismanagement has led to the deterioration of most of the area albeit very limited. The degraded shrubland habitat, hills, outcrops and sills and water resource habitats in the PAOI can be regarded as important, not only within the local landscape, but also regionally; as they are used for habitat, foraging and movement corridors for fauna within a landscape fragmented by development.

The habitat sensitivity of these habitats is regarded as medium to high, due to the species recorded and the role of this intact unique habitat to biodiversity within a very fragmented local landscape, not to mention the sensitivity according to various ecological datasets. The habitats still:

- Functions as ESA's as per the Northern Cape Critical Biodiversity Areas spatial database;
- Act as a Freshwater Ecosystem Priority Area according to the NFEPA database; and
- Support various organisms and may play an important role in the ecosystem, if left to recover from the superficial impacts.

The ecological integrity, importance and functioning of these terrestrial biodiversity areas provide a variety of ecological services considered beneficial, with one key service being the maintenance of biodiversity. The preservation of these systems is the most important aspect to consider for the proposed project.

The habitat physiognomy within the PAOI is diverse and, based on the fauna components recorded within the PAOI and proximal landscape, the area provides important ecosystem services, particularly with regards to the maintenance of dynamic soil properties and pollination services. The SEI of the PAOI was determined to vary from 'Very Low' to 'High', the extent of the area considered and its connectivity to natural areas within the landscape, and the low resilience of the vegetation type.

6.2 Impact Statement

The main expected impacts of the proposed Project will be the loss of habitat and emigration of fauna. Based on the outcomes of the SEI determination, there are areas within the PAOI that possess a 'High' SEI. This denotes that avoidance mitigation wherever possible must be implemented. This includes changes to project infrastructure design to limit the amount of habitat impacted. Moreover, the avoidance and minimisation mitigation measures are the most important with respect to the mitigation hierarchy (Figure 6-1).

Two alternative transmission routes were evaluated for this assessment. From a terrestrial ecological perspective, both routes are considered viable, provided that the High SEI area is avoided to the greatest extent possible. This can be achieved by spanning the transmission line across these areas with minimal pylon construction. IF one had to be decided on, the preferred alternative is preferred, as it overlaps with less high SEI area.

Taking into account that the proposed project entails the development of transmission infrastructure, the anticipated area of disturbance is relatively small, making it feasible to implement avoidance mitigation measures. As such it is the opinion of the specialist that the authorisation of the proposed project may be favourably considered, under condition that all mitigation and impact management

actions provided within this report are implemented. It is recommended that should any future developments be proposed for the remaining extent of any 'Very High' or 'High' SEI areas within the associated properties, that offset strategies be required for these authorisations.

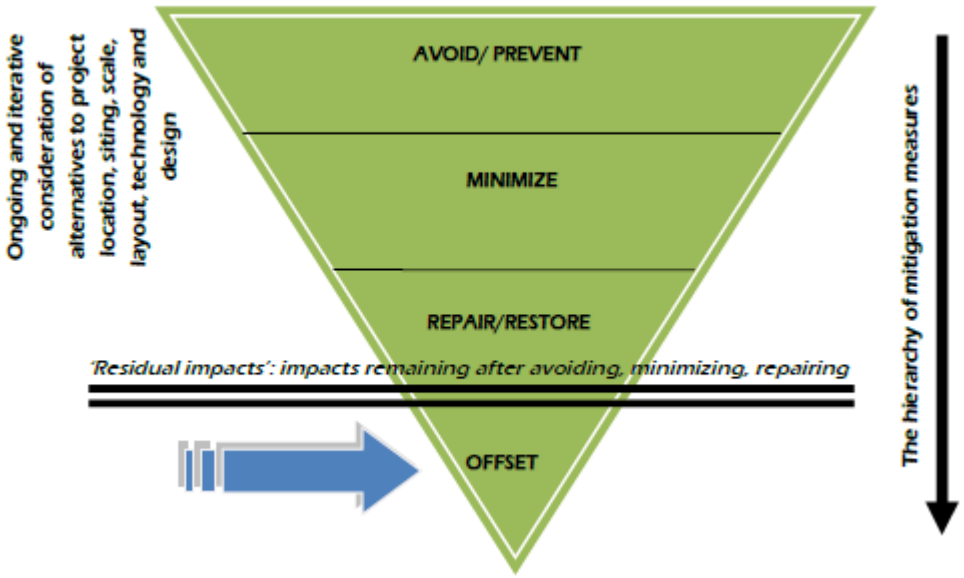


Figure 6-1 Schematic diagram illustrating the mitigation hierarchy indicating where residual impacts are considered. Source: (DFFE, 2021d)

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8 Appendix Items

8.1 Appendix A – Flora species expected to occur in the project area

Family	Species Name	Conservation Status	Endemism
Aizoaceae	*Mesembryanthemum coriarium*	LC	
Aizoaceae	*Oscularia deltoides*	LC	Endemic
Aizoaceae	*Tetragonia fruticosa*	LC	
Amaranthaceae	*Atriplex vestita var. appendiculata*	LC	
Amaranthaceae	*Bassia salsoloides*	LC	
Amaranthaceae	*Salsola calluna*	LC	Endemic
Amaryllidaceae	*Brunsvigia radulosa*	LC	
Apocynaceae	*Microloma armatum var. armatum*	LC	
Apocynaceae	*Pachypodium succulentum*	LC	Endemic
Apocynaceae	*Stapelia grandiflora var. grandiflora*	LC	
Asparagaceae	*Asparagus striatus*	LC	Endemic
Asparagaceae	*Asparagus suaveolens*	LC	
Asphodelaceae	*Haworthiopsis tessellata*	LC	
Asphodelaceae	*Haworthiopsis tessellata var. tessellata*	LC	
Asteraceae	*Arctotis leiocarpa*	LC	
Asteraceae	*Athanasia minuta subsp. minuta*	LC	
Asteraceae	*Berkheya eriobasis*	LC	Endemic
Asteraceae	*Chrysocoma ciliata*	LC	
Asteraceae	*Dimorphotheca cuneata*	LC	
Asteraceae	*Dimorphotheca zeyheri*	LC	
Asteraceae	*Felicia burkei*	LC	
Asteraceae	*Felicia filifolia subsp. filifolia*	LC	
Asteraceae	*Felicia muricata subsp. muricata*	LC	
Asteraceae	*Gazania jurineifolia subsp. jurineifolia*	LC	Endemic
Asteraceae	*Gazania krebsiana subsp. arctotoides*	LC	
Asteraceae	*Geigeria filifolia*	LC	
Asteraceae	*Geigeria ornativa subsp. ornativa*	LC	
Asteraceae	*Helichrysum asperum var. asperum*	LC	Endemic
Asteraceae	*Helichrysum dregeanum*	LC	
Asteraceae	*Helichrysum zeyheri*	LC	
Asteraceae	*Hertia kraussii*	LC	Endemic
Asteraceae	*Hertia pallens*	LC	
Asteraceae	*Leysera tenella*	LC	
Asteraceae	*Oedera humilis*	LC	
Asteraceae	*Osteospermum leptolobum*	LC	Endemic
Asteraceae	*Osteospermum scariosum var. scariosum*	NE	
Asteraceae	*Osteospermum spinescens*	LC	
Asteraceae	*Othonna pavonia*	LC	Endemic
Asteraceae	*Pentzia calcarea*	LC	
Asteraceae	*Pentzia elegans*	LC	Endemic
Asteraceae	*Pentzia incana*	LC	
Asteraceae	*Pentzia spinescens*	LC	
Asteraceae	*Phymaspermum parvifolium*	LC	Endemic

Family	Species Name	Conservation Status	Endemism
Asteraceae	*Pteronia glauca*	LC	
Asteraceae	*Pteronia glaucescens*	LC	Endemic
Asteraceae	*Pteronia sordida*	LC	
Asteraceae	*Senecio niveus*	LC	
Boraginaceae	*Heliotropium lineare*	LC	
Brassicaceae	*Erucastrum strigosum*	LC	
Campanulaceae	*Wahlenbergia nodosa*	LC	Endemic
Caryophyllaceae	*Dianthus micropetalus*	LC	
Colchicaceae	*Colchicum asteroides*	LC	Endemic
Colchicaceae	*Ornithoglossum vulgare*	LC	
Crassulaceae	*Crassula corallina subsp. corallina*	LC	
Cucurbitaceae	*Cucumis africanus*	LC	
Cucurbitaceae	*Cucumis heptadactylus*	LC	Endemic
Cucurbitaceae	*Cucumis myriocarpus subsp. leptodermis*	LC	
Euphorbiaceae	*Euphorbia arida*	LC	Endemic
Euphorbiaceae	*Euphorbia juttae*	LC	
Fabaceae	*Calobota spinescens*	LC	
Fabaceae	*Cullen tomentosum*	LC	
Fabaceae	*Leobordea platycarpa*	LC	
Fabaceae	*Lessertia annularis*	LC	
Fabaceae	*Melolobium candicans*	LC	
Gentianaceae	*Sebaea pentandra var. pentandra*	LC	
Geraniaceae	*Monsonia salmoniflora*	LC	
Geraniaceae	*Pelargonium tragacanthoides*	LC	
Gisekiaceae	*Gisekia pharnaceoides var. pharnaceoides*	LC	
Hyacinthaceae	*Daubenya comata*	LC	Endemic
Hyacinthaceae	*Dipcadi viride*	LC	
Hyacinthaceae	*Ornithogalum nanodes*	LC	
Iridaceae	*Gladiolus permeabilis subsp. edulis*	LC	
Kewaceae	*Kewa salsoloides*	LC	
Lamiaceae	*Stachys cuneata*	LC	Endemic
Leucobryaceae	*Campylopus robillardei*	LC	
Malvaceae	*Hermannia burkei*	LC	
Malvaceae	*Hermannia cuneifolia var. cuneifolia*	LC	
Malvaceae	*Hermannia erodioides*	LC	
Malvaceae	*Hermannia pulchella*	LC	
Malvaceae	*Radyera urens*	LC	
Poaceae	*Cenchrus ciliaris*	LC	
Poaceae	*Enneapogon scaber*	LC	
Poaceae	*Eragrostis bergiana*	LC	
Poaceae	*Eragrostis bicolor*	LC	
Poaceae	*Eragrostis curvula*	LC	
Poaceae	*Eragrostis homomalla*	LC	
Poaceae	*Eragrostis procumbens*	LC	
Poaceae	*Eragrostis truncata*	LC	
Poaceae	*Oropetium capense*	LC	

Family	Species Name	Conservation Status	Endemism
Poaceae	*Panicum impeditum*	LC	
Poaceae	*Puccinellia acroxantha*	LC	
Poaceae	*Sporobolus ioclados*	LC	
Poaceae	*Stipagrostis namaquensis*	LC	
Poaceae	*Stipagrostis obtusa*	LC	
Poaceae	*Tragus berteronianus*	LC	
Poaceae	*Tragus racemosus*	LC	
Polygalaceae	*Polygala ephedroides*	LC	
Polygonaceae	*Rumex lanceolatus*	LC	
Pteridaceae	*Cheilanthes eckloniana*	LC	
Ruscaceae	*Sansevieria aethiopica*	LC	
Santalaceae	*Osyris lanceolata*	LC	
Scrophulariaceae	*Aptosimum procumbens*	LC	
Scrophulariaceae	*Aptosimum spinescens*	LC	
Scrophulariaceae	*Jamesbrittenia tysonii*	LC	Endemic
Scrophulariaceae	*Manulea fragrans*	LC	Endemic
Scrophulariaceae	*Nemesia linearis*	LC	
Scrophulariaceae	*Peliostomum leucorrhizum*	LC	
Scrophulariaceae	*Peliostomum origanoides*	LC	Endemic
Scrophulariaceae	*Selago albida*	LC	
Scrophulariaceae	*Selago paniculata*	LC	Endemic
Scrophulariaceae	*Zaluzianskya karrooica*	LC	Endemic
Solanaceae	*Lycium horridum*	LC	
Solanaceae	*Lycium pumilum*	LC	
Tecophilaeaceae	*Cyanella lutea*	LC	
Thymelaeaceae	*Lasiosiphon polycephalus*	LC	
Zygophyllaceae	*Tetraena microcarpa*	LC	

8.2 Appendix B – Amphibian species expected to occur in the project area

Family	Scientific Name	Conservation Status	
		Regional	Global
Bufonidae	*Poyntonophrynus vertebralis*	LC	LC
Bufonidae	*Sclerophrys gutturalis*	LC	LC
Bufonidae	*Sclerophrys capensis*	LC	LC
Bufonidae	*Vandijkophrynus gariepensis*	LC	LC
Hyperoliidae	*Kassina senegalensis*	LC	LC
Pipidae	*Xenopus laevis*	LC	LC
Pyxicephalidae	*Amietia delalandii*	LC	LC
Pyxicephalidae	*Amietia poyntoni*	LC	LC
Pyxicephalidae	*Cacosternum boettgeri*	LC	LC
Pyxicephalidae	*Pyxicephalus adspersus*	NT	LC
Pyxicephalidae	*Strongylopus grayii*	LC	LC
Pyxicephalidae	*Tomopterna cryptotis*	LC	LC
Pyxicephalidae	*Tomopterna tandyi*	LC	LC

8.3 Appendix C – Reptile species expected to occur in the project area

Family	Scientific Name	Common Name	Conservation Status	
			Regional	Global
Typhlopidae	*Agama aculeata aculeata*	Common Ground Agama	LC	LC
Agamidae	*Agama atra*	Southern Rock Agama	LC	LC
Agamidae	*Aspidelaps lubricus lubricus*	Coral Shield Cobra	LC	LC
Elapidae	*Bitis arietans arietans*	Puff Adder	LC	LC
Viperidae	*Boaedon capensis*	Brown House Snake	LC	LC
Gekkonidae	*Chondrodactylus bibronii*	Bibron's Gecko	LC	LC
Testudinidae	*Dasypeltis scabra*	Rhombic Egg-eater	LC	LC
Cordylidae	*Homopus femoralis*	Greater Padloper	LC	LC
Lamprophiidae	*Karusasaurus polyzonus*	Karoo Girdled Lizard	LC	LC
Leptotyphlopidae	*Lamprophis aurora*	Aurora House Snake	LC	LC
Lamprophiidae	*Lycophidion capense capense*	Cape Wolf Snake	LC	LC
Amphisbaenidae	*Monopeltis capensis*	Cape Worm Lizard	LC	LC
Elapidae	*Naja nivea*	Cape Cobra	LC	LC
Gekkonidae	*Pachydactylus capensis*	Cape Gecko	LC	LC
Gekkonidae	*Pachydactylus mariquensis*	Marico Gecko	LC	LC
Lacertidae	*Pedioplanis laticeps*	Cape Sand Lizard	LC	LC
Lacertidae	*Pedioplanis lineoocellata*	Spotted Sand Lizard	LC	LC
Lacertidae	*Pedioplanis namaquensis*	Namaqua Sand Lizard	LC	LC
Pelomedusidae	*Pelomedusa galeata*	South African Marsh Terrapin	LC	LC
Testudinidae	*Psammobates tentorius verroxii*	Verrox's Tent Tortoise	NT	LC
Testudinidae	*Psammophis leightoni*	Cape Sand Snake	LC	LC
Testudinidae	*Psammophis notostictus*	Karoo Sand Snake	LC	LC
Lamprophiidae	*Pseudaspis cana*	Mole Snake	LC	LC
Typhlopidae	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	LC	LC
Testudinidae	*Stigmochelys pardalis*	Leopard Tortoise	LC	LC
Scincidae	*Trachylepis capensis*	Cape Skink	LC	LC
Scincidae	*Trachylepis occidentalis*	Western Three-striped Skink	LC	LC
Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	LC	LC
Scincidae	*Trachylepis sulcata sulcata*	Western Rock Skink	LC	LC
Scincidae	*Trachylepis variegata*	Variegated Skink	LC	LC
Varanidae	*Varanus albigularis albigularis*	Rock Monitor	LC	LC
Varanidae	*Varanus niloticus*	Water Monitor	LC	LC

8.4 Appendix D – Mammal species expected to occur within the project area

Family	Scientific Name	Conservation Status	
		Regional	Global
Bathyergidae	*Cryptomys hottentotus*	LC	LC
Bovidae	*Antidorcas marsupialis*	LC	LC
Bovidae	*Raphicerus campestris*	LC	LC
Canidae	*Canis mesomelas*	LC	LC
Canidae	*Otocyon megalotis*	LC	LC
Canidae	*Vulpes chama*	LC	LC
Cercopithecidae	*Papio ursinus*	LC	LC
Felidae	*Caracal caracal*	LC	LC
Felidae	*Felis nigripes*	VU	VU
Felidae	*Felis silvestris*	LC	LC
Felidae	*Leptailurus serval*	NT	LC
Felidae	*Panthera pardus*	VU	VU
Herpestidae	*Atilax paludinosus*	LC	LC
Herpestidae	*Cynictis penicillata*	LC	LC
Herpestidae	*Herpestes pulverulentus*	LC	LC
Herpestidae	*Suricata suricatta*	LC	LC
Hyaenidae	*Parahyaena brunnea*	NT	NT
Hyaenidae	*Proteles cristata*	LC	LC
Hystricidae	*Hystrix africaeaustralis*	LC	LC
Leporidae	*Lepus capensis*	Not listed	LC
Leporidae	*Lepus saxatilis*	LC	LC
Leporidae	*Pronolagus saundersiae*	LC	LC
Macroscelididae	*Elephantulus edwardii*	LC	LC
Macroscelididae	*Elephantulus myurus*	LC	LC
Macroscelididae	*Elephantulus rupestris*	LC	LC
Macroscelididae	*Macroscelides proboscideus*	LC	LC
Molossidae	*Tadarida aegyptiaca*	LC	LC
Muridae	*Aethomys namaquensis*	LC	LC
Muridae	*Desmodillus auricularis*	LC	LC
Muridae	*Gerbilliscus brantsii*	LC	LC
Muridae	*Gerbillurus paeba*	LC	LC
Muridae	*Mastomys coucha*	LC	LC
Muridae	*Mus musculus*	Not listed	LC
Muridae	*Otomys unisulcatus*	LC	LC
Muridae	*Parotomys brantsii*	LC	LC
Muridae	*Parotomys littledalei*	LC	LC
Muridae	*Rattus rattus*	Not listed	LC

Family	Scientific Name	Conservation Status	
		Regional	Global
Muridae	*Rhabdomys pumilio*	LC	LC
Mustelidae	*Aonyx capensis*	NT	NT
Mustelidae	*Ictonyx striatus*	LC	LC
Mustelidae	*Mellivora capensis*	LC	LC
Mustelidae	*Poecilogale albinucha*	NT	LC
Nesomyidae	*Malacothrix typica*	LC	LC
Orycteropodidae	*Orycteropus afer*	LC	LC
Pedetidae	*Pedetes capensis*	LC	LC
Procaviidae	*Procavia capensis*	LC	LC
Pteropodidae	*Rousettus aegyptiacus*	Not listed	LC
Rhinolophidae	*Rhinolophus darlingi*	LC	LC
Sciuridae	*Xerus inauris*	LC	LC
Soricidae	*Suncus varilla*	LC	LC
Suidae	*Phacochoerus africanus*	LC	LC
Suidae	*Sylvicapra grimmia*	LC	LC
Vespertilionidae	*Eptesicus hottentotus*	LC	LC
Vespertilionidae	*Neoromicia capensis*	LC	LC
Vespertilionidae	*Neoromicia zuluensis*	LC	LC
Viverridae	*Genetta genetta*	LC	LC

8.5 Appendix E – Specialists Declarations

I, Martinus Erasmus, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Martinus Erasmus

Terrestrial Ecologist

The Biodiversity Company

July 2024

I, Andrew Husted, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Andrew Husted

Terrestrial Ecologist

The Biodiversity Company

July 2024