Scoping Assessment for the proposed Hercules Photovoltaic (PV) Self Generation Project

De Aar, Emthanjeni Local Municipality, Northern Cape

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CLIENT

Prepared by:

The Biodiversity Company

Cell: +27 81 319 1225

Fax: +27 86 527 1965

info@thebiodiversitycompany.comww

w.thebiodiversitycompany.com

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1 Introduction

1.1 Background

The Biodiversity Company was appointed to undertake a scoping assessment for the proposed Hercules Solar Photovoltaic (PV) Energy Facility near De Aar, Northern Cape Province (Figure 1-2). The scoping assessment comprises terrestrial and freshwater ecosystems and agricultural potential. The proposed development is traversed by the N10 and covers approximately 7.65 ha. The proposed development will comprise the following:

- Solar PV array, comprising PV modules and mounting structures;
- Inverters and transformers;
- Cabling between the project components;
- A 120MV on-site facility substation to facilitate the connection between the Solar PV Energy Facility and mine electrical distribution system;
- Offices, control room/s and a storage facility;
- A 132kV overhead power line for the distribution of the generated power, which will be connected to the existing metallurgical complex and shaft substations;
- Temporary laydown areas; and
- An access road (paved/gravel), internal gravel roads and fencing around the development area.

The approach was informed by 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 320 (20 March 2020) in terms of NEMA, dated 20 March and 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).

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.

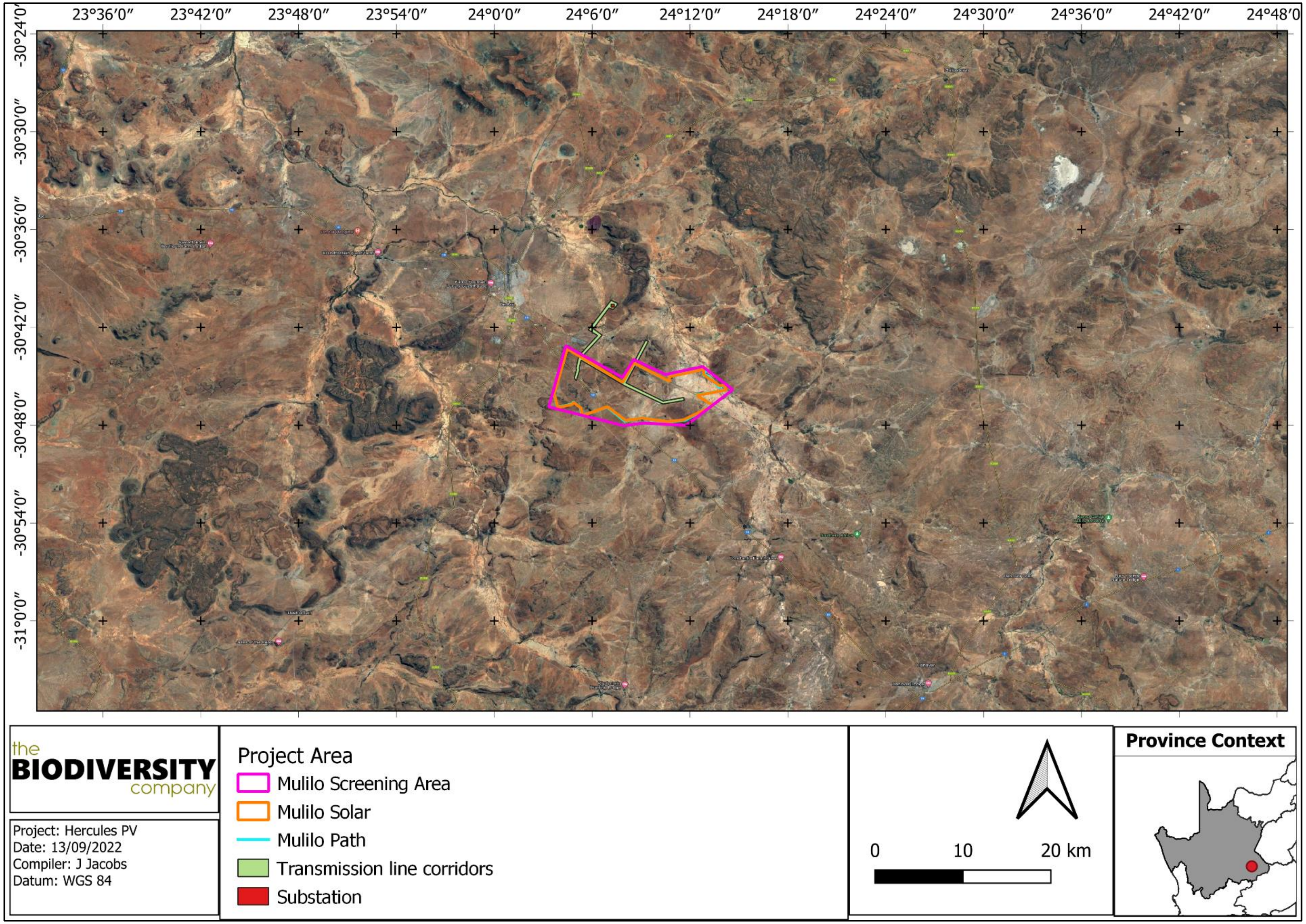


Figure 1-1 ***Proposed location of the project area in relation to the nearby towns***

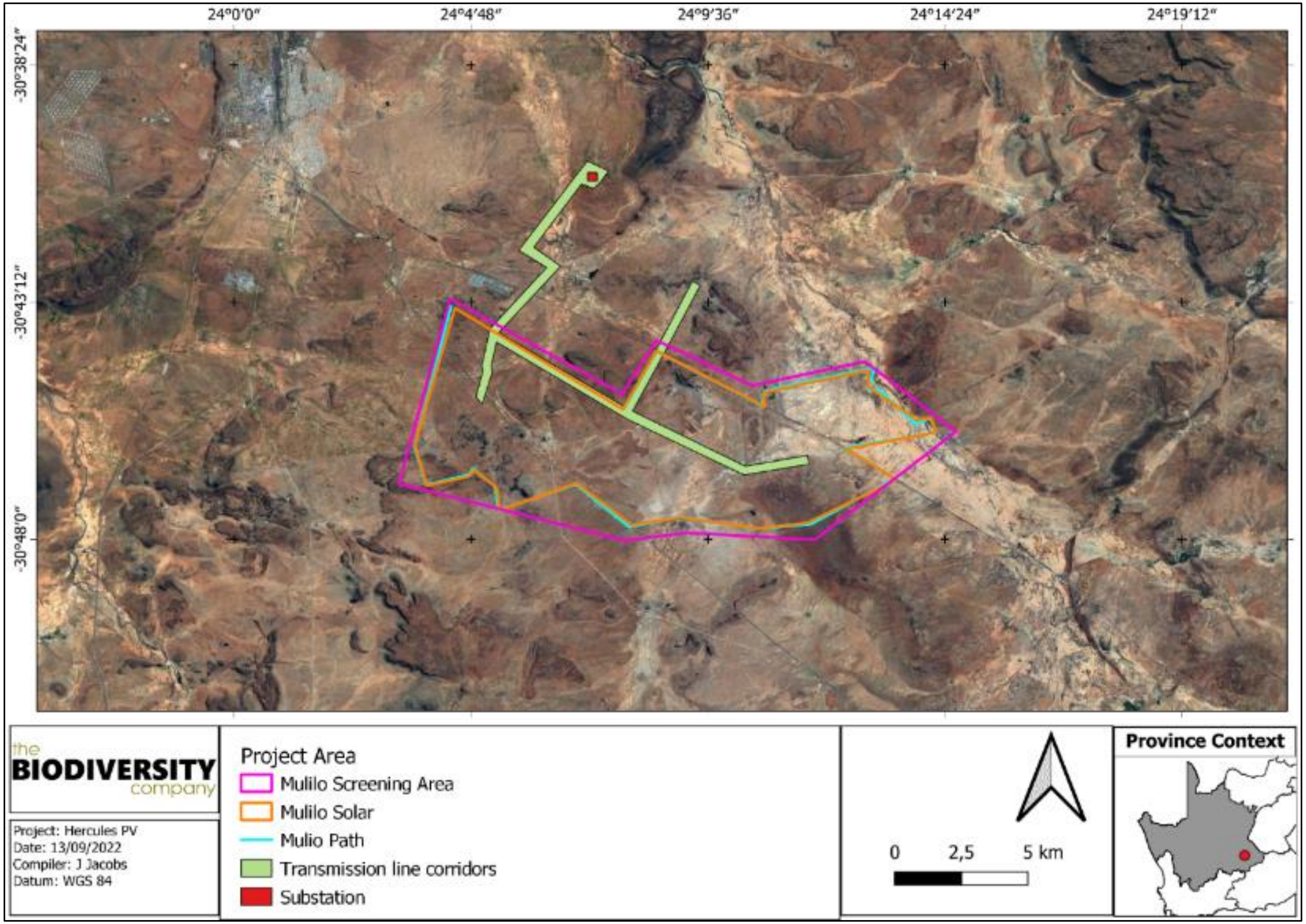


Figure 1-2 The project area

1.2 Specialist Details

Report Name	**Scoping Assessment for the proposed Hercules Photovoltaic (PV) Self Generation Project**
Reference	**Hercules PV**
Submitted to	SES Sharples Environmental Services Est 1998
Report Writer	**Jan Jacobs**
	Jan Jacobs completed his BSc Honours degree in Biodiversity and Conservation Biology at the University of the Western Cape in 2016 and completed his Master of Applied Science degree in Nature Conservation at the Tshwane University of Technology in 2022. He will officially graduate on 26 October 2022.
Reviewer	**Carami Burger**
	Carami Burger has completed her Bachelor of Science Honours degree in Ecological Interactions and Ecosystem Resilience. Carami is an ecologist and has completed various studies as part of Basic Assessments and Environmental Impact Assessments.
Reviewer	**Andrew Husted**
	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 13 experience in the environmental consulting field.
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, 2017. 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.

1.3 Scope of Work

The principle aim of the scoping assessment was to identify any constraints for the development of the area. This was achieved through the following:

- Desktop assessment to identify the relevant ecologically important geographical features within the project area;
- Desktop assessment to compile an expected species list and identify possible threatened flora and fauna species that occur within the project area;
- Desktop assessment to identify the relevant ecologically important hydrological features within the project area;
- Desktop assessment to identify the relevant land capability, land types and soil types within the project area;
- Completion of a high level impact assessment; and
- The prescription of mitigation measures and recommendations for identified risks.

2 Key Legislative Requirements

The legislation, policies and guidelines listed below in Table 2-1 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 2-1 A list of key legislative requirements relevant to biodiversity and conservation in the Northern Cape Province

Region	Legislation / Guideline
National	Constitution of the Republic of South Africa (Act No. 108 of 1996)
	The National Environmental Management Act (NEMA) (Act No. 107 of 1998)
	The National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
	The National Environmental Management: Biodiversity Act (Act No. 10 of 2004), Threatened or Protected Species Regulations
	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)
	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)
	The National Environmental Management: Waste Act, 2008 (Act 59 of 2008);
	The Environment Conservation Act (Act No. 73 of 1989)
	Natural Scientific Professions Act (Act No. 27 of 2003)
	National Biodiversity Framework (NBF, 2009)
	National Forest Act (Act No. 84 of 1998)
	National Veld and Forest Fire Act (101 of 1998)
	National Water Act (NWA) (Act No. 36 of 1998)
	World Heritage Convention Act (Act No. 49 of 1999)
	Municipal Systems Act (Act No. 32 of 2000)
	Alien and Invasive Species Regulations and, Alien and Invasive Species List 20142020, published under NEMBA
	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA)
Provincial	Northern Cape Biodiversity Sector Plan (2016)

	Northern Cape Planning and Development Act (Act No. 73 of 1998)
	Northern Cape Nature Conservation Act (Act. No. 9 of 2009)

3 Desktop Assessment

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.

3.1 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 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.
    - *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 Protected Areas Database (SAPAD) (DEA, 2021) – The SAPAD Database contains spatial data pertinent to the conservation of South African biodiversity. 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) (SANBI, 2016) – The NPAES provides spatial information on areas that are suitable for terrestrial ecosystem protection. These focus areas are large, intact and unfragmented and therefore, of high importance for biodiversity, climate resilience and freshwater protection.
- Conservation/Biodiversity Sector Plan:

The **Namakwa District Biodiversity Sector Plan** was completed in 2010 for the Northern Cape Department of Environment and Nature Conservation (NCDENC) (NCDENC, 2010). The purpose of the biodiversity sector plan was to develop the spatial component of a bioregional plan (i.e., map of Critical Biodiversity Areas and associated land-use guidelines). A Northern Cape Critical Biodiversity Area map was produced as part of this plan and sites were assigned to the following

CBA categories based on their biodiversity characteristics, spatial configuration, and requirement for meeting targets for both biodiversity pattern and ecological processes:

- Critical Biodiversity Area 1 (CBA1);
- Critical Biodiversity Area 2 (CBA2);
- Ecological Support Area (ESA);
- Other Natural Area (ONA); and
- Protected Area (PA)

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (Desmet *et al.,* 2013).

Ecological Support Areas (ESA's) are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of Critical Biodiversity Areas and/or in delivering ecosystem services (SANBI, 2017). Critical Biodiversity Areas and Ecological Support Areas may be terrestrial or aquatic.

Other Natural Areas (ONAs) consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs. A biodiversity sector plan or bioregional plan must not specify the desired state/management objectives for ONAs or provide land-use guidelines for ONAs (Driver *et al.,* 2017).

- Important Bird and Biodiversity Areas (IBAs) (BirdLife South Africa, 2017) – IBAs constitute a global network of over 13 500 sites, of which 112 sites are found in South Africa. IBAs are sites of global significance for bird conservation, identified through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria;

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

- The land capability sensitivity (DAFF, 2017) expected for the area, also presenting the extent of crop field boundaries.

3.2 Desktop Flora Assessment

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 3-1). 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.

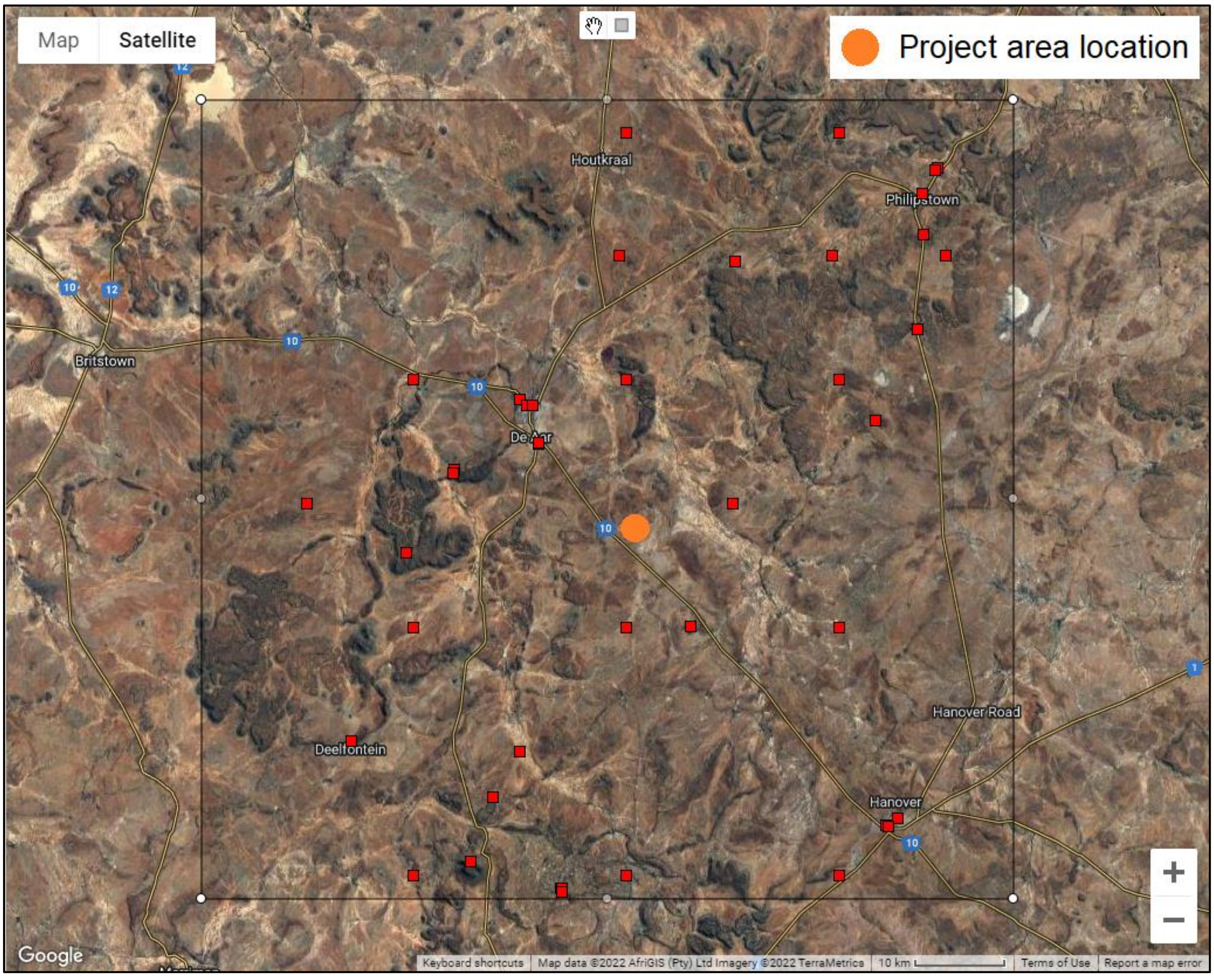


Figure 3-1 Map illustrating extent of area used to obtain the expected flora species list from the Plants of South Africa (POSA) database. Orange dot indicates approximate location of the project area. The red squares are cluster markers of botanical records as per POSA data.

3.3 Desktop Faunal Assessment

The faunal desktop assessment comprised of the following, compiling an expected:

- Amphibian list, generated from the IUCN spatial dataset (2017) and FrogMap database (Fitzpatrick Institute of African Ornithology, 2021a), using the 3024 quarter degree square;
- Reptile list, generated from the IUCN spatial dataset (2017) and ReptileMap database (Fitzpatrick Institute of African Ornithology, 2021b), using the 3024 quarter degree square;
- Avifauna list, generated from the SABAP2 dataset by looking at pentads 3035_2355; 3035_2400; 3035_2405; 3040_2355; 3040_2400; 3040_2405; 3045_2355; 3045_2400 and 3045_2405); and
- Mammal list from the IUCN spatial dataset (2017).

3.4 Assumptions and Limitations

The following assumptions and limitations are applicable for this assessment:

- The assessment area was based on the area provided by the client and any alterations to the footprint and/or missing GIS information pertaining to the assessment area would have affected the area surveyed;

- The scoping assessment has been completed at a desktop level only. All datasets and species lists have been considered for the local area and surrounds; and
- The species likelihood of occurrence is based on desktop information and might be changed after the assessment.

4 Results & Discussion

4.1 Ecologically Important Landscape Features

The GIS analysis pertaining to the relevance of the proposed project to ecologically important landscape features is summarised in Table 4-1.

Table 4-1 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.	4.1.1
Ecosystem Protection Level	Relevant – Overlaps with a Not Protected Ecosystem and a Poorly Protected Ecosystem.	4.1.2
Critical Biodiversity Area	Relevant – The project area overlaps with an ESA, a CBA2 and CBA1s.	4.1.3
Protected Areas	Irrelevant – The project area is located 11 km from the nearest protected area.	4.1.4
National Protected Areas Expansion Strategy	Irrelevant – The project area does not overlap with any NPAES areas.	4.1.5
Important Bird and Biodiversity Areas	Relevant – Overlaps with the Platberg-Karoo Conservancy IBA.	4.1.6
REDZ	Irrelevant – Does not overlap with any Renewable Energy Development Zones	-
Powerline Corridor	Relevant – Overlaps with the Central Corridor.	-
South African Inventory of Inland Aquatic Ecosystems	Relevant – The project area overlaps with any two unevaluated NBA wetlands, two EN rivers and one LT river.	4.1.7
National Freshwater Priority Area	Relevant – The project area overlaps with several NFEPA wetlands and an NFEPA river.	4.1.8
Strategic Water Source Areas	Irrelevant- The project area does not overlap with any SWSAs.	-

4.1.1 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), 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. According to the spatial dataset the proposed project overlaps with a LC ecosystem – the Northern Upper Karroo, and part of the Besemkaree Koppies Shrubland (Figure 4-1).

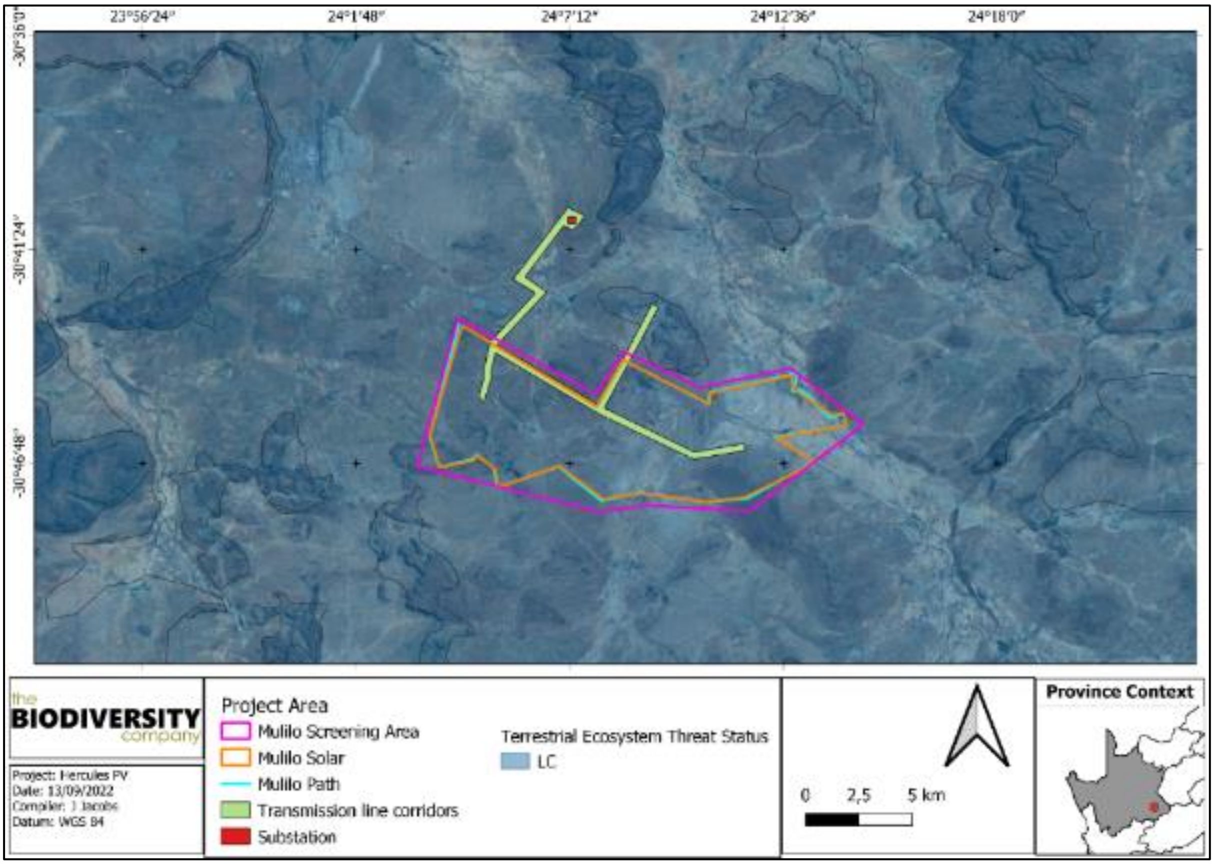


Figure 4-1 Map illustrating the ecosystem threat status associated with the project area

4.1.2 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 proposed project overlaps mainly with a NP ecosystem (Northern Upper Karroo), and partially the corridor with a PP ecosystem (Besemkaree Koppies Shrubland) (Figure 4-2).

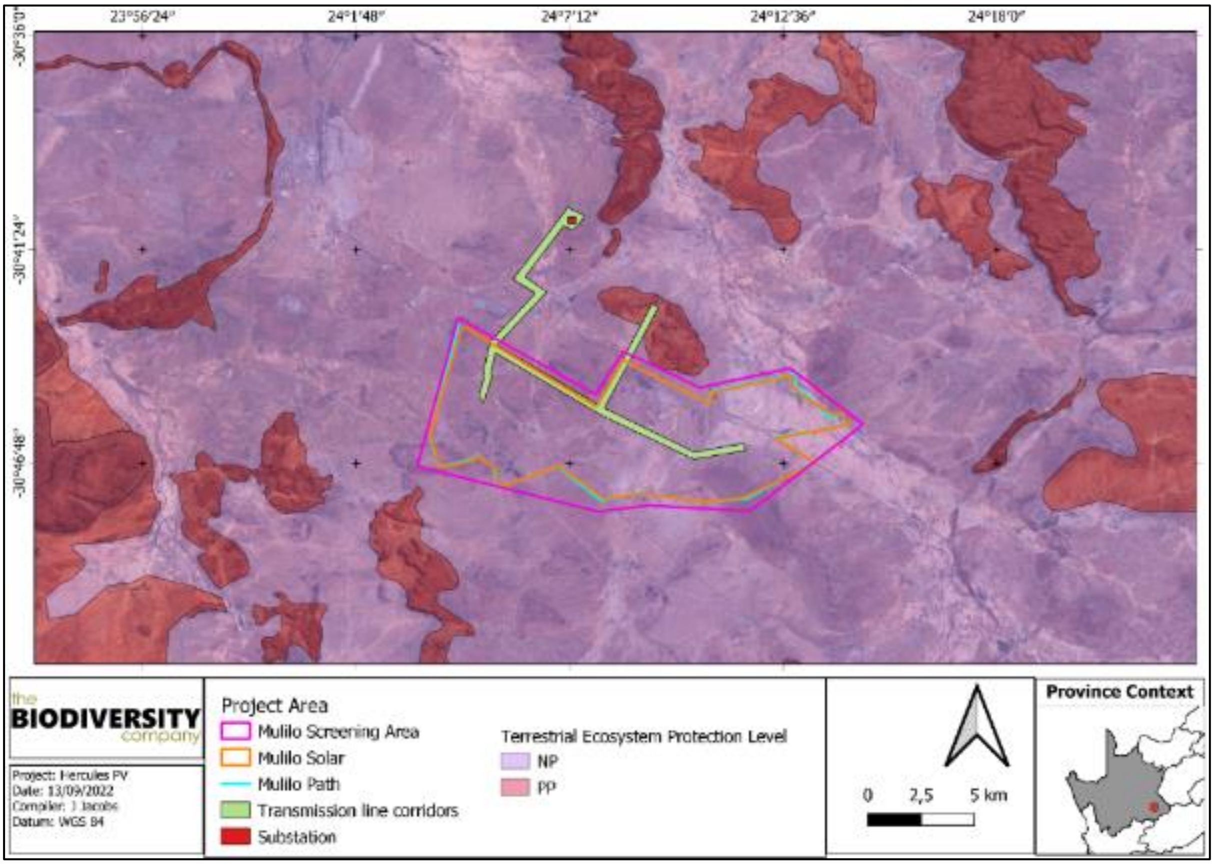


Figure 4-2 Map illustrating the ecosystem protection level associated with the project area

4.1.3 Critical Biodiversity Areas and Ecological Support Areas

The conservation of CBAs is crucial, in that if these areas are not maintained in a natural or near-natural state, biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI-BGIS, 2017).

The purpose of the Northern Cape BSP (2016) is to inform land-use planning and development on a provincial scale and to aid in natural resource management. One of the outputs is a map of Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). These are classified into different categories, namely CBA1 areas, CBA2 areas, ESA areas and Other Natural Areas (ONAs) based on biodiversity characteristics, spatial configuration, and requirements for meeting targets for both biodiversity patterns and ecological processes.

Figure 4-3 shows the project area superimposed on the Terrestrial CBA maps. The project area overlaps with an ESA, a CBA2, and 10 CBA1s (Figure 4-3).

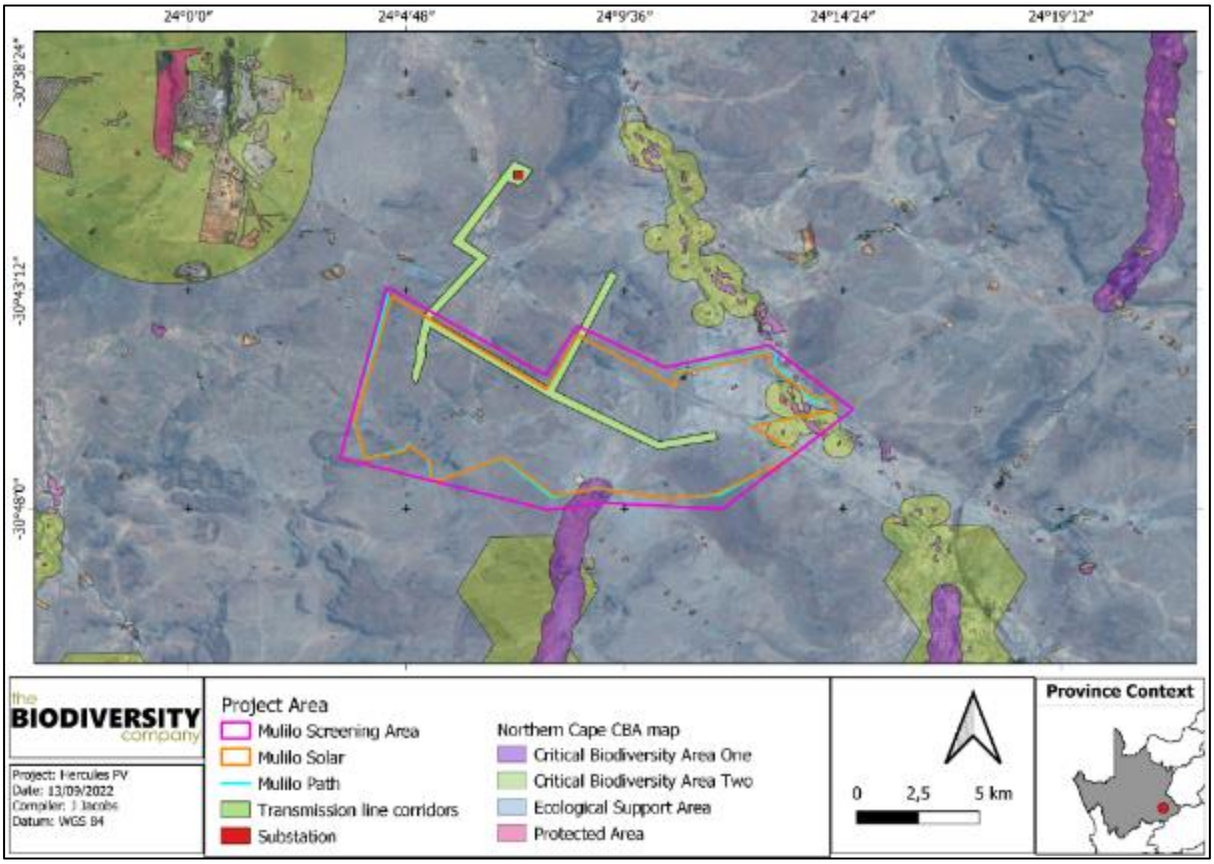


Figure 4-3 Map illustrating the locations of CBAs in the project area

4.1.4 Protected areas

According to the protected area spatial datasets from SAPAD (2022) and SACAD (2022), the project area does not overlap with any protected areas or conservation areas. The nearest protected area, De Aar Nature Reserve, is located 10 km North-West from the project area (Figure 4-4). Thus, the project area is located outside of the 5 km Protected Area Buffer Zone of the nearest protected area.

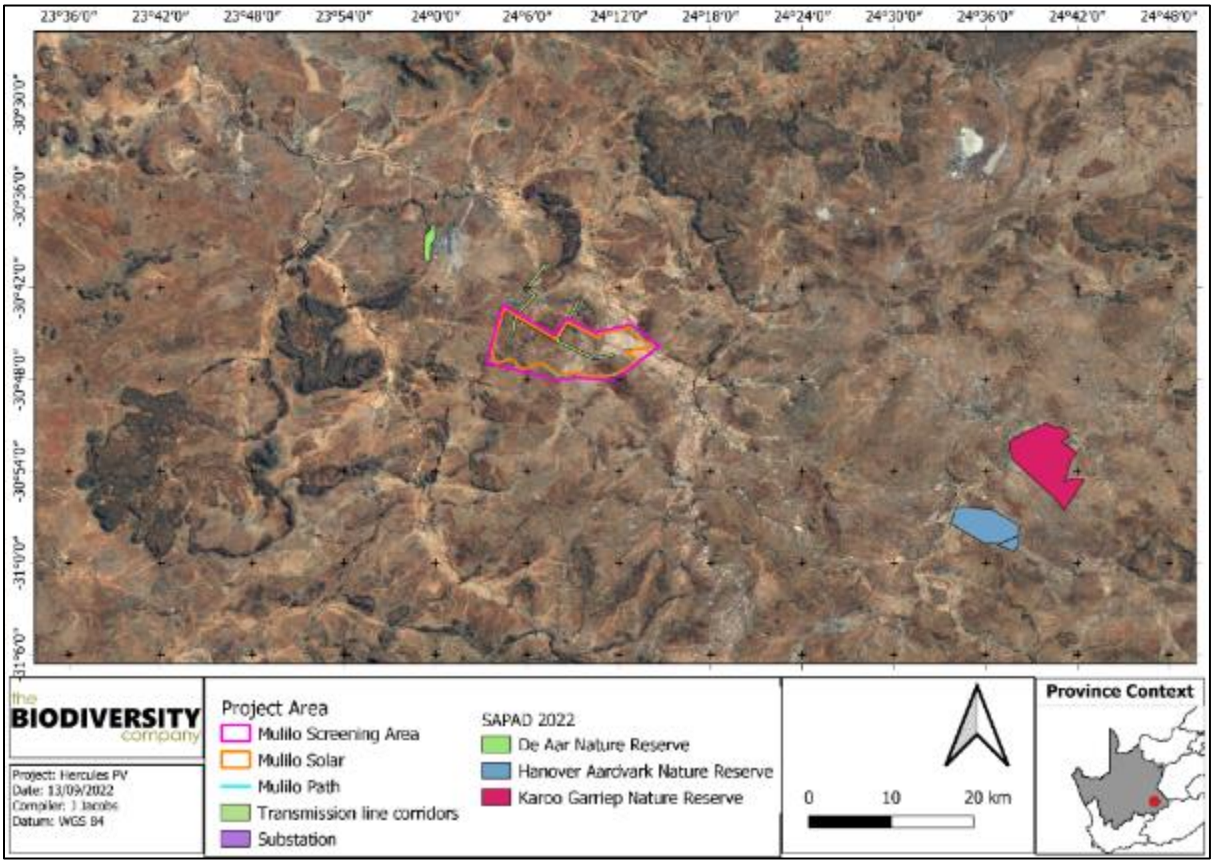


Figure 4-4 The project area in relation to the protected areas

4.1.5 National Protected Area Expansion Strategy

National Protected Area Expansion Strategy 2016 (NPAES) areas were identified through a systematic biodiversity planning process. They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with a strong emphasis on climate change resilience and requirements for protecting freshwater ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for fine scale planning which may identify a range of different priority sites based on local requirements, constraints and opportunities (NPAES, 2016). The project area does not overlap with any NPAES areas (Figure 4-5).

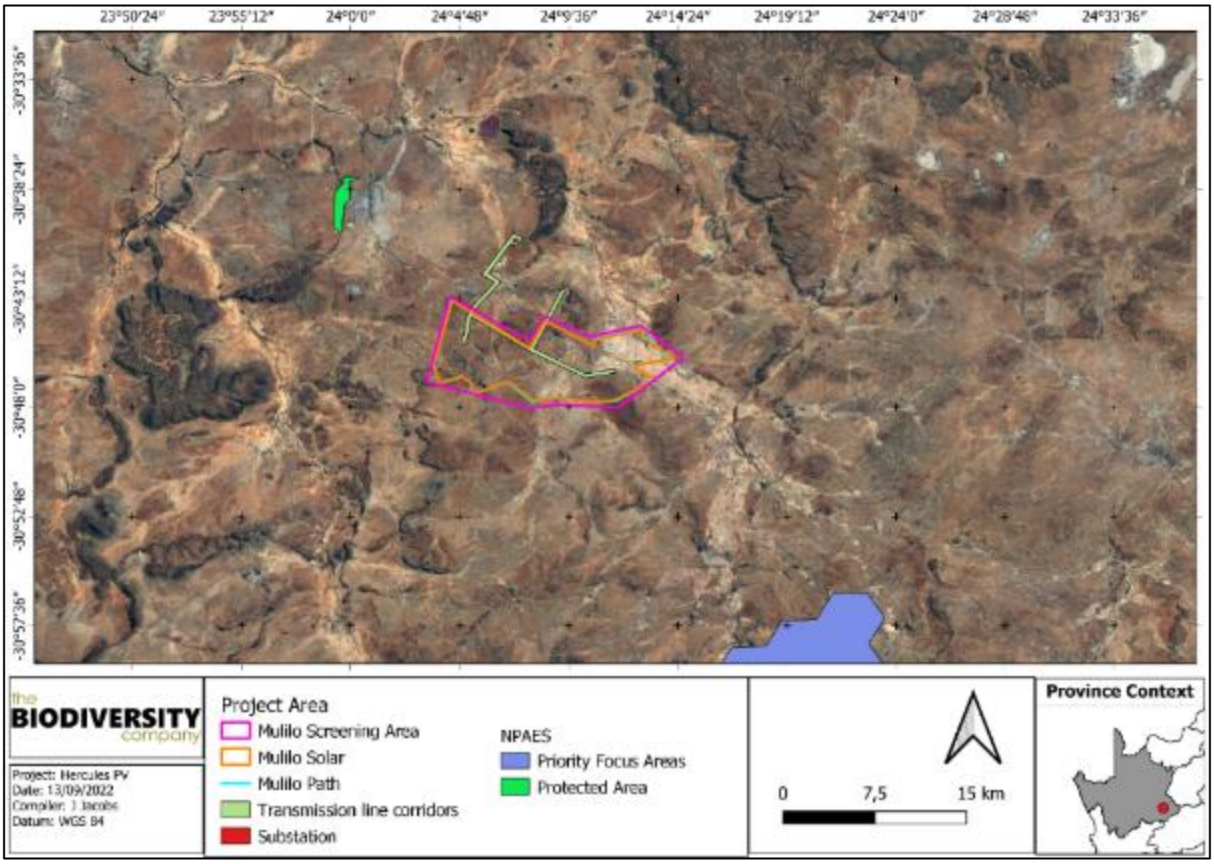


Figure 4-5 The project area in relation to the National Protected Area Expansion Strategy

4.1.6 Important Bird and Biodiversity Area

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 South Africa, 2017).

According to Birdlife South Africa (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 4-6 shows that the project area overlaps with the Platberg-Karoo Conservancy IBA.

The Platberg-Karoo Conservancy is landscape that covers the districts of De Aar, Philipstown and Hanover, and consists of extensive flat to gently undulating plains that are broken by dolerite hills and flat-topped inselbergs. This IBA also includes several ephemeral rivers, including the Brak, Hondeblaf, Seekoei, Elandsfontein and Ongers rivers (Birdlife South Africa, 2015).

This IBA is important because it contributes significantly to the conservation of large terrestrial birds and raptors, such as 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*), Verreaux's Eagle (*Aquila verreauxii*) and Tawny Eagle (*A. rapax*). In total, 289 bird species have been recorded in the Platberg-Karoo Conservancy (Birdlife South Africa, 2015).

Globally threatened trigger species include Blue Crane, Ludwig's Bustard, Kori Bustard, Secretarybird, Martial Eagle, Blue Korhaan, Black Harrier (*Circus maurus*) and Denham's Bustard (*Neotis denhami*). Regionally threatened species are Black Stork, Lanner Falcon (*Falco biarmicus*), Tawny Eagle, Karoo Korhaan (*Eupodotis vigorsii*) and Verreaux's Eagle. Biome-restricted species 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*). Congregatory species include Lesser Kestrel (*Falco naumanni*) and Amur Falcon (*Falco amurensis*) (Birdlife South Africa, 2015).

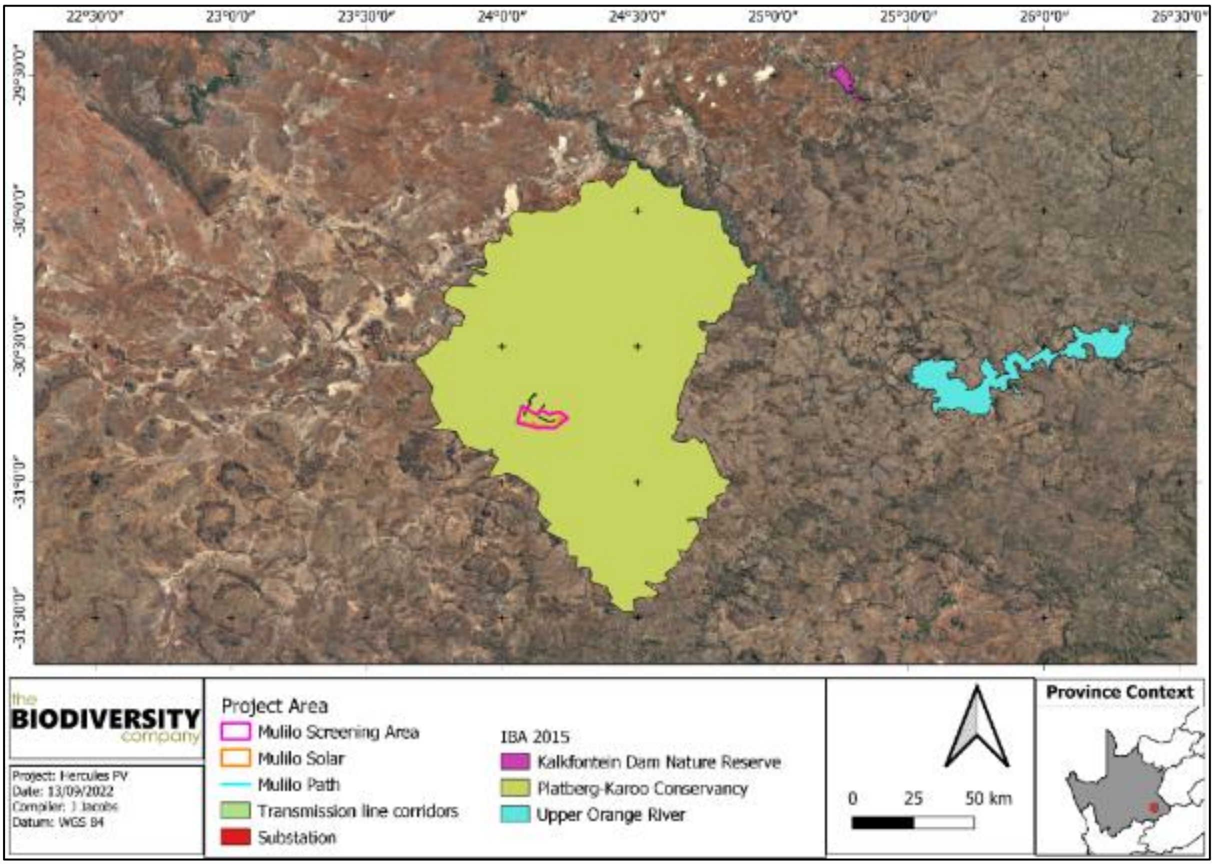


Figure 4-6 The project area in relation to the nearest IBAs

4.1.7 Hydrological Setting

The South African Inventory of Inland Aquatic Ecosystems (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 project area overlaps with two EN rivers and one LT river (Figure 4-7).

The project area is located in the Brak River D62D quaternary catchment, within the Orange Water Management Area (WMA 6) (NWA, 2016), and Nama Karoo Ecoregion (Figure 4-8, Kleynhans *et al*., 2005). The main watercourse that drains the project area is the upper reaches of the Brak River [Sub-Quaternary Reaches (SQRs D62D-5391 and D62D-5332)], a non-perennial river system with an associated low-density network of non-perennial and ephemeral tributaries falling adjacent to and within the project area footprint. The Brak River then flows in a north westerly direction joining the Orange River approximately 174 km (as the crow flies) downstream of the project area.

The land uses surrounding the project area predominantly includes farming (grazing) activities between natural (open – predominantly mountainous areas) land situated between the aforementioned watercourses. Land use within a catchment influences the ecological integrity of the associated watercourses. Due to the limited land and water use modification within the project related catchment areas, the SQRs were considered largely natural to moderately modified at a desktop level (DWS, 2014). Ephemeral watercourses of the arid regions such as the Karoo are typically dependent on groundwater discharge and are particularly vulnerable to changes in hydrology and are known to be slow to recover from any impacts.

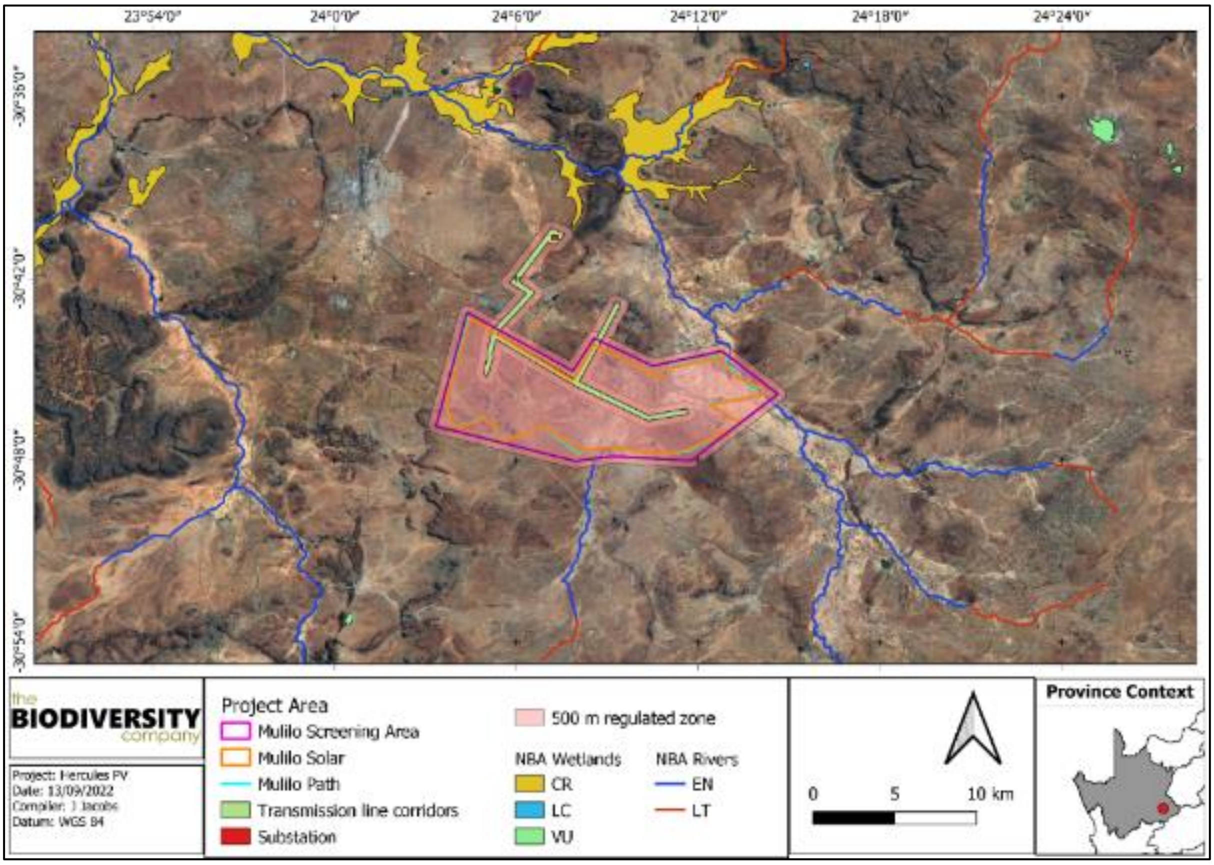


Figure 4-7 Map illustrating the ecosystem threat status of rivers and wetland ecosystems in the project area

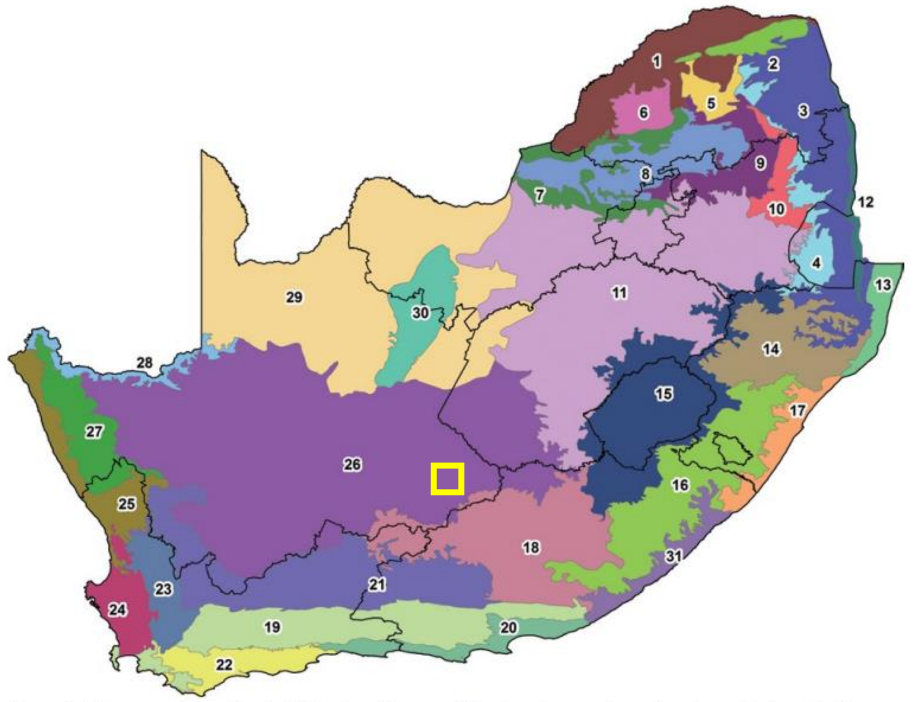


Figure 1.—The ecoregions of South Africa. 1 = Limpopo Plain, 2 = Soutpansberg, 3 = Lowveld, 4 = Northeastern Highlands, 5 = Northern Plateau, 6 = Waterberg, 7 = Western Bankenveld, 8 = Bushveld Basin, 9 = Eastern Bankenveld, 10 = Northern Escarpment Mountains, 11 = Highveld, 12 = Lebombo Uplands, 13 = KwaZulu-Natal Coastal Plain, 14 = Northeastern Uplands, 15 = Eastern Escarpment Mountains, 16 = Southeastern Uplands, 17 = Northeastern Coastal Belt, 18 = Drought Corridor, 19 = Southern Folded Mountains, 20 = Southeastern Coastal Belt, 21 = Great Karoo, 22 = Southern Coastal Belt, 23 = Western Folded Mountains, 24 = Southwestern Coastal Belt, 25 = Western Coastal Belt, 26 = Nama-Karoo, 27 = Namaqua Highlands, 28 = Orange River Gorge, 29 = Southern Kalahari, 30 = Ghaap Plateau, 31 = Eastern Coastal Belt. Black lines represent provincial boundaries.

Figure 4-8 Ecoregions for the project area (yellow square) according to Kleynhans et al. (2005)

4.1.8 Resource Water Quality Objectives

The NWA sets out to ensure that water resources are used, managed and controlled in such a way that they benefit all users. In order to achieve this, the Act has prescribed a series of measures such as Resource Water Quality Objectives (RWQOs) to ensure comprehensive protection of water resources so that they can be used sustainably (DWA, 2011).

The Brak River does not have RWQOs specific to this system therefore, the RWQOs for the nearest downstream watercourses serves as the allocated RWQOs to be monitored against. The Brak River drains into the Orange River in close proximity to site OS08 on the Orange River at Prieska (Orange River Quaternary Catchment D72A) (DWAF, 2009). The RWQOs for the watercourses downstream of the project area are presented in Table 4-2 and results from the aquatic assessment were compared to these RWQOs. The Present Ecological Status (PES) of OS08 is moderately modified (class C), while the Recommended Ecological Category (REC) to be maintained is a largely natural (class B). The Ecological Importance and Sensitivity Category for this catchment is rated as Moderate.

Table 4-2 Summary of resources assigned RQOs for the relevant Orange River region (DWAF, 2009)

RWQO site code	Study Unit	Quaternary Catchment	Hydro ID	Electrical Conductivity	Present Ecological State	Management Class	Recommended Ecological Category
Orange River (OS08)	Prieska	D72A	D7H002	550 µS/cm	C	A	B

The project area activities should be aligned with the RWQOs for the Orange WMA in order to limit impacts to local watercourses and their ecological drivers (water quality, flow dynamics and habitat) while maintaining biodiversity goals for the directly associated Brak River catchment and those watercourses downstream of the project area. The stipulated RWQOs should be considered for the Environmental Management Plan (EMP) and monitoring protocols should environmental authorisation be granted for this project.

4.1.9 Desktop Present Ecological Status of Sub-Quaternary Reach

This section provides desktop information regarding the local project related SQR(s) with regards to the PES including the Ecological Importance, Ecological Sensitivity and anthropogenic impacts within the SQR. The desktop PES information was obtained from DWS (2014) for the two SQRs associated with the project area and the relevant information is presented in Table 4-3.

The desktop PES of the Brak SQR D62D-5486 is moderately modified (class C), and that of the Brak tributary SQR D62D-5332 is largely natural (class B). The ecological importance and sensitivity of the two river reaches are rated as moderate and low, respectively. The factors influencing the current desktop PES status for the Brak SQR D62D-5391 includes: Livestock, roads network and crossings infrastructure, and instream weirs. The factors influencing the current PES status for the Brak tributary SQR D62D-5332 includes: Livestock, roads network and crossings infrastructure, cultivation and instream weirs.

The two major aspects determining the status of the SQRs are water quality and habitat conditions. The physico-chemical (water quality) modifications within the three SQRs have been rated as small with low volumes of return water (effluent) input expected from the agricultural and urban activities (altered land use) present in the catchment areas. Modifications to instream/riparian/wetland habitat continuity, and flow modification were rated to range from small to large within the three SQRs. Additionally, the habitat diversity classes of the SQRs were rated as very low with a low diversity of fish (*Enteromius oraniensis* - Orange River Chubbyhead Barb and *Labeo umbratus* – Moggel) and macroinvertebrate species expected within these systems. Despite this these taxa maintain a moderate sensitivity to altered flows and water quality, highlighting the need for the project to limit impacts to these aspects.

Table 4-3 The desktop information pertaining to the associated Sub Quaternary Reaches

Component/Catchment	Brak (D62D-5486)	Brak tributary (D62D-5332)
Freshwater Ecoregion	Nama Karoo (29)	Nama Karoo (29)
Dominant slope class	Lower foothills (class E)	-
River flow type/ Seasonality	Non-perennial	Non-perennial
Present Ecological Status	**Moderately Modified (class C)**	**Largely Natural (class B)**
Ecological Importance Class	Moderate	Low
Ecological Sensitivity	Low	Low
RWQOs - Recommended Ecological Category	**Largely Natural (class B)**	

The current gradient of the considered river reaches in proximity to the project area are found to be a class E geoclass, which places the reaches as lower foothills river reaches (Rountree *et al.,* 2000). Typically, lower foothill reaches are associated with a moderately gentle gradient comprising pools and runs with limited riffles/rapids within a narrow to wide channel. A floodplain is a common associated feature. The instream habitat composition includes mixed alluvial substrates dominated by gravel and sand while some systems are dominated by bedrock. Stones and mud may be present between sand bars due to the flow characteristics associated with the aforementioned gradient.

4.1.10 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 4-9 shows that the project area's 500 m regulated zone overlaps with several classified NFEPA wetlands as well as several unclassified NFEPA wetlands. The project area also overlaps with an NFEPA river.

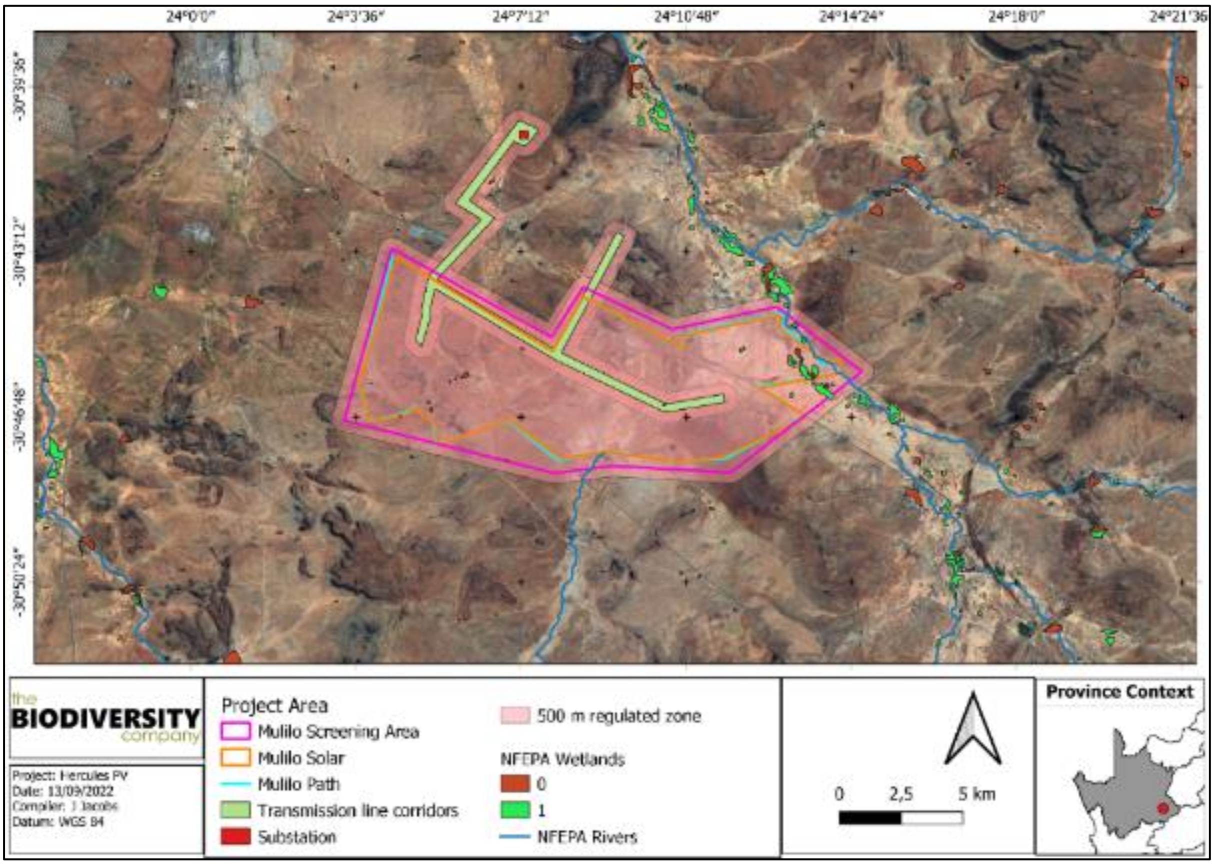


Figure 4-9 The project area in relation to the National Freshwater Ecosystem Priority Areas

4.1.11 Land Capability

As part of the desktop assessment, soil information was obtained using published South African Land Type Data. Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 - 2006). The land type data is presented at a scale of 1:250 000 and comprises of the division of land into land types.

4.1.12 Climate

The NKu 3 vegetation type is characterised by a summer rainfall with a Mean Annual Precipitation (MAP) that ranges between 190 mm and 400 mm (see Figure 4-10). Rainfall is low and unreliable, and droughts are also unpredictable and sometimes prolonged. Frost occurs during winter, Dust devils and small whirlwinds occur frequently in summer but dust storms are uncommon (Mucina & Rutherford, 2006).

The Gh 4 vegetation type is characterised by a summer rainfall with a MAP that ranges between 280 mm and 580 mm (see Figure 4-11). The summer rainfall can be strong, and droughts occur in winter. Frost occurs commonly, with aridity exacerbating the coldest periods. Lightning-induced fires are a high likelihood due to the high lightning flash densities (Mucina & Rutherford, 2006).

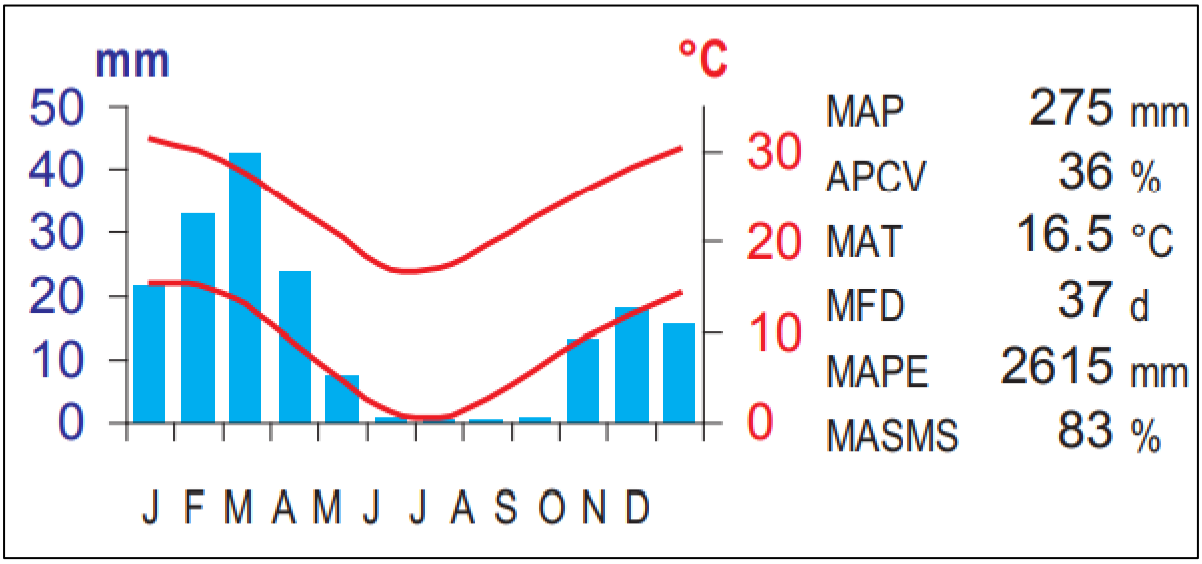


Figure 4-10 Climate for the Northern Upper Karoo (Mucina & Rutherford, 2006)

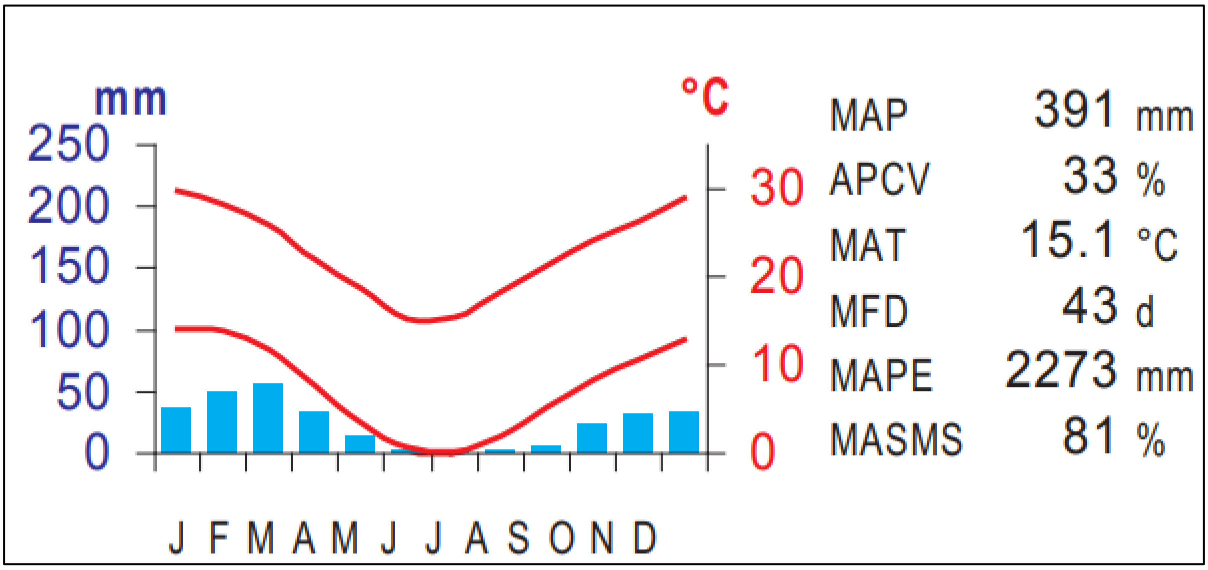


Figure 4-11 Climate for the Besemkaree Koppies Shrubland (Mucina & Rutherford, 2006)

4.1.13 Geology and Soil

According to the land type database (Land Type Survey Staff, 1972 - 2006) the development falls within the following land types: Ae137, Ae138, Ae139, Ae140 and Fb73.

The Ae land types consists of one or more of the following soils: Shorrocks, Skilderkrans, Mispah, Vaalbank and Williamson. By contrast, the Fb 73 land type mostly consists of Mispah, other soils such as Williamson, Shorrocks, Skilderkrans, Broekspruit and Arniston. The terrain units for each land type and expected soils for each land type are illustrated in Figure 8 2 and Table 8 1 respectively.

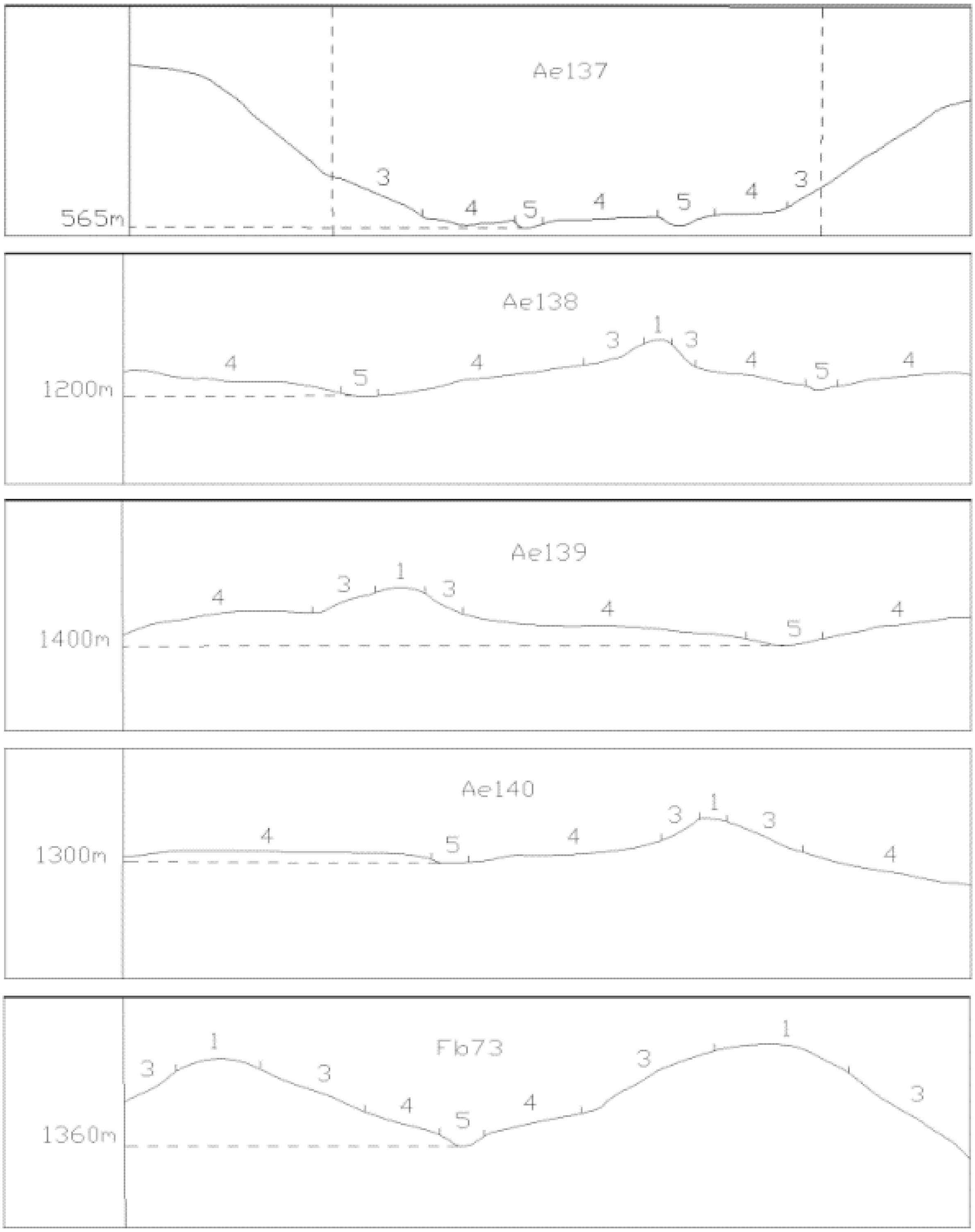


Figure 4-12 ***Illustrations of the land type terrain units (Land Type Survey Staff, 1972 – 2006)***

Table 4-4 ***Soils expected at the respective terrain units within each of the land types (Land Type Survey Staff, 1972 - 2006)***

Ae 137 Terrain units							
1 (30%)		3 (55%)		4 (10%)		5 (5%)	
Shorrocks, Mangano	72%	Shorrocks, Mangano	75%	Shorrocks, Mangano	63%	Mutale, Makulek	35%

Mispah, Muden	15%	Mispah, Muden	13%	Skilderkrans, Broekspruit	15%	Lindley, Craven	30%
Skilderkrans, Broekspruit	10%	Skilderkrans, Broekspruit	10%	Mispah, Muden	10%	Limpopo, Letaba	18%
Bare Rock	3%	Vaalbank	2%	Lindley, Craven	5%	Shorrocks, Mangano	5%
				Mutale, Makulek	3%	Skilderkrans, Broekspruit	5%
				Vaalbank	2%	Vaalbank	5%
				Limpopo. Letaba	2%	Stream Beds	2%
Ae 138 Terrain units							
1 (3%)		**3 (20%)**		**4 (75%)**		**5 (2%)**	
Bare Rock	40%	Mangano	70%	Shorrocks, Mangano	67%	Mutale, Makulek	20%
Mangano	30%	Mispah, Kalkbank	15%	Mangano	15%	Limpopo, Letaba	20%
Mispah, Kalkbank	30%	Bare Rock	5%	Mispah, Kalkbank	10%	Lindley, Arniston	20%
		Reveille, Uitsicht	5%	Reveille, Uitsicht	3%	Reveille, Uitsicht	15%
		Skilderkrans, Broekspruit	5%	Shigalo	3%	Shorrocks, Mangano	10%
				Skilderkrans, Broekspruit	2%	Skilderkrans, Broekspruit	10%
						Stream Beds	5%
Ae 139 Terrain units							
1 (2%)		**3 (8%)**		**4 (50%)**		**5 (40%)**	
Bare Rock	60%	Mispah, Kalkbank	30%	Shorrocks, Makatini, Shigalo	60%	Makulek, Mutale	30%
Williamson	20%	Shorrocks, Makatini, Shigalo	25%	Skilderkrans, Broekspruit	25%	Craven, Lindley	25%
Mispah, Kalkbank	10%	Skilderkrans, Broekspruit	20%	Craven, Lindley	5%	Shorrocks, Makatini, Shigalo	20%
Shorrocks, Makatini, Shigalo	5%	Williamson	20%	Mispah, Kalkbank	5%	Letaba, Limpopo	15%
Skilderkrans, Broekspruit	5%	Bare Rock	5%	Williamson	5%	Stream Beds	10%
Ae 140 Terrain units							
1 (2%)		**3 (8%)**		**4 (85%)**		**5 (5%)**	
Bare Rock	75%	Mispah	30%	Shorrocks, Shigalo, Mangano, Makatini	55%	Williamson, Kanonkop	35%
Williamson, Kanonkop	10%	Bare Rock	20%	Skilderkrans, Uitsicht, Broekspruit	25%	Makulek, Mutale	25%
Shorrocks, Shigalo, Mangano, Makatini	5%	Shorrocks, Shigalo, Mangano, Makatini	20%	Williamson, Kanonkop	5%	Letaba, Limpopo	20%
Skilderkrans, Uitsicht, Broekspruit	5%	Williamson, Kanonkop	20%	Mispah	5%	Shorrocks, Shigalo, Mangano, Makatini	5%
Mispah	5%	Skilderkrans, Uitsicht, Broekspruit	10%	Swartland, Nyoka	5%	Skilderkrans, Uitsicht, Broekspruit	5%
				Craven, Lindley	5%	Swartland, Nyoka	5%
						Stream Beds	5%
FB 73 Terrain units							

1 (25%)		3 (65%)		4 (5%)		5 (5%)	
Mispah	50%	Mispah	30%	Mispah	45%	Mispah	30%
Bare Rock	20%	Williamson	20%	Skilderkrans, Broekspruit	25%	Waterval, Arniston	30%
Williamson	15%	Shorrocks	20%	Shorrocks	15%	Leeufontein, Highflats	25%
Shorrocks	10%	Bare Rock	15%	Bare Rock	5%	Williamson	10%
Skilderkrans, Broekspruit	5%	Skilderkrans, Broekspruit	15%	Williamson	5%	Skilderkrans, Broekspruit	3%
				Waterval, Arniston	3%	Stream Beds	2%
				Leeufontein, Highflats	2%		

4.1.14 Flora Assessment

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

4.1.14.1 Vegetation Type

The project area is situated in the Nama-Karoo and Grassland biomes.

The Nama-Karoo is a large, landlocked region located on the central plateau of the western half of South Africa and extends into southeastern Namibia. This biome has an arid continental climate which experiences very limited effects from the oceans. Summer rainfall is low and unreliable while droughts are unpredictable and sometimes prolonged. Summers are hot (mean January maximum more than 30°C) with frequent dust devils and whirlwinds but uncommon dust storms, while winters are cold (mean July minimum is close to zero in the Upper Karoo vegetation types) with frost occurring in nearly all areas (Mucina & Rutherford, 2006).

Nama-Karoo vegetation are characterised by a complex of extensive plains dominated by low (dwarf) shrubs (generally less than 1 m tall), intermixed with grasses, succulents, geophytes and annual forbs. Small trees can only be found along drainage lines or on rocky outcrops (Mucina & Rutherford, 2006).

The grasslands of the Highveld in South Africa are temperate and have cold and dry conditions, with rainfall during the summer (which can sometimes be a strong summer rainfall) and winter drought. Frost is common and there is a high risk of lightning-induced fires. In terms of vegetation structural composition, grasslands are characteristically dominated by grasses of the Poaceae Family (Mucina & Rutherford, 2006).

On a fine-scale vegetation type, the project area overlaps with the Northern Upper Karoo and Besemkaree Koppies Shrubland vegetation types (Figure 4-13).

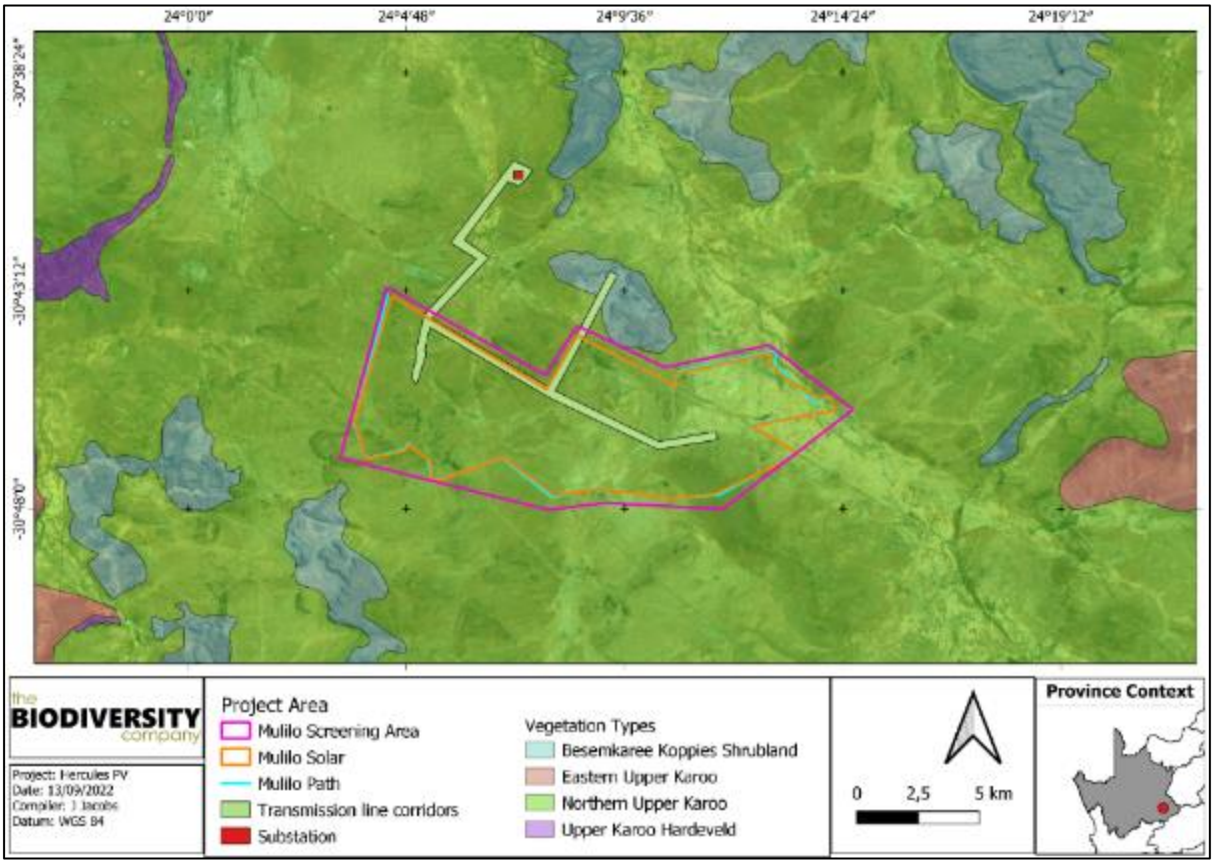


Figure 4-13 Map illustrating the vegetation types associated with the project area

4.1.14.1.1 Northern Upper Karoo

Northern Upper Karoo is distributed in the Northern Cape and Free State Provinces within the northern regions of the Upper Karoo Plateau from Prieska, Vosburg and Carnarvon in the West to Philipstown, Petrusville and Petrusburg in the East. A few patches of this vegetation type also occur in Griqualand West. The altitude ranges between 1 000 and 1 500 meters above sea level (m.a.s.l.). Its landscape features consist of a flat to gently sloping landscape with isolated hills of Upper Karoo Hardeveld in the south and Vaalbos Rocky Shrubland in the northeast and with many interspersed pans. In terms of vegetation structure, it consists of shrubland dominated by dwarf karoo shrubs, grasses and *Senegalia mellifera* subsp. *detinens* and other low trees, especially on sandy soils in the northern parts and vicinity of the Orange River (Mucina & Rutherford, 2006).

Conservation Status

According to Mucina and Rutherford (2006) Northern Upper Karoo is classified as Least Threatened. Although the target for conservation is 21%, no portion of this vegetation type is currently under statutory conservation. About 4% has already been cleared for cultivation or transformed by dam construction. Erosion varies between very low (46.2%), low (32%) and moderate (20%) (Mucina & Rutherford, 2006).

4.1.14.2 Besemkaree Koppies Shrubland

Besemkaree Koppies Shrubland is distributed in the Northern Cape, Free State and Eastern Cape Provinces on plains of Eastern Upper Karoo in the South and within dry grasslands of the southern and central parts of the Free State. Additionally, dolerite-dominated landscapes along the Orange River also belong to this vegetation type. The altitude ranges from 1 120 to 1 680 m.a.s.l. In terms of vegetation, it consists of slopes of koppies, butts and tafelbergs covered by two-layered karroid shrubland. The lower (closed-canopy) layer is dominated by dwarf small-leaved shrubs and, especially in precipitationrich years, also by abundant grasses. The upper (loose canopy) layer is dominated by tall shrubs, including *Searsia* species (Mucina & Rutherford, 2006).

Conservation Status

According to Mucina and Rutherford (2006) Besemkaree Koppies Shrubland is classified as Least Threatened, with the target for conservation being 28%. Only 5% of this vegetation type is currently under statutory conservation in the Rolfontein, Tussen Die Riviere, Oviston, Gariep Dam, Caledon and Kalkfontein Dam Nature Reserves. Additionally, a small patch is also conserved in the privately owned Vulture Conservation Area. About 3% of this vegetation type has been transformed by dam construction. Erosion varies between moderate (68%), high (20%) and low (10%) (Mucina & Rutherford, 2006).

4.1.14.3 Expected Flora Species

The POSA database indicates that 332 species of indigenous plants are expected to occur within the project area (The full list of species will be provided in the final report). Two SCCs based on their conservation status could be expected to occur within the project area and are provided in Table 4-5 below.

Table 4-5 Threatened flora species that may occur within the project area

Family	Taxon	Author	IUCN	Ecology
Iridaceae	*Syringodea pulchella*	Hook.f.	VU	Indigenous; Endemic
Euphorbiaceae	*Euphorbia flanaganii*	N.E.Br.	VU	Indigenous; Endemic

4.1.15 Faunal Assessment

4.1.15.1 Amphibians

Based on the IUCN Red List Spatial Data and FrogMap, 13 amphibian species are expected to occur within the area (The full list will be provided in the final assessment). No amphibian SCCs are expected to occur within the area.

4.1.15.2 Reptiles

Based on the IUCN Red List Spatial Data and the ReptileMAP database, 32 reptile species are expected to occur within the area (The full list will be provided in the final assessment). One species is regarded as threatened (Table 4-6).

Table 4-6 Threatened reptile species that are expected to occur within the project area

Species	Common Name	Conservation Status		Likelihood of Occurrence
		Regional (SANBI, 2016)	IUCN (2021)	
Psammobates tentorius	Tent Tortoise	NT	LC	High

Psammobates tentorius (Tent Tortoise) is listed as NT on a regional and global basis. It occurs in the arid regions of South Africa and Namibia (IUCN, 2017). Known threats include road mortality, veld fires, electrocution by livestock/game fences, and overgrazing from domestic livestock (IUCN, 2017). The presence of arid habitat within the project area contributes to a high likelihood of occurrence for this species.

4.1.15.3 Mammals

The IUCN Red List Spatial Data lists 56 mammal species that could be expected to occur within the area (The full list will be provided in the final assessment). This list excludes large mammal species that are normally restricted to protected areas. Six of these expected species are regarded as threatened (Table 4-7). Of these six SCCs, two have a low likelihood of occurrence based on the lack of suitable habitat in the project area.

Table 4-7 Threatened mammal species that are expected to occur within the project area

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2021)	
Aonyx capensis	Cape Clawless Otter	NT	NT	High
Felis nigripes	Black-footed Cat	VU	VU	Moderate
Leptailurus serval	Serval	NT	LC	Low
Panthera pardus	Leopard	VU	VU	Moderate
Parahyaena brunnea	Brown Hyaena	NT	NT	Moderate
Poecilogale albinucha	African Striped Weasel	NT	LC	Low

Aonyx capensis (Cape Clawless Otter) is the most widely distributed otter species in Africa (IUCN, 2017). This species is predominantly aquatic, and it is seldom found far from water (IUCN, 2017). It is mostly threatened by riverine habitat destruction due to bush clearing, deforestation, overgrazing, siltation, draining of wetlands or water extraction or denudation of riparian vegetation (IUCN, 2017). This species has a high likelihood of occurrence based on the presence of rivers in the project area.

Felis nigripes (Black-footed cat) is endemic to the arid regions of southern Africa (IUCN, 2017). This species is naturally rare, has cryptic colouring, is small in size and is nocturnal. These factors have contributed to a lack of information on this species (IUCN, 2017). The highest densities of this species have been recorded in the more arid Karoo region of South Africa (IUCN, 2017). The arid habitat in the project area can be considered to be somewhat suitable for the species and the likelihood of occurrence is therefore rated as moderate.

Leptailurus serval (Serval) occurs widely through sub-Saharan Africa, except for tropical rainforest and the Saharan desert (IUCN, 2017). Servals occupy dense, well-watered grassland and reedbeds and are always near water (Apps, 2012). Outside of protected areas in southern Africa, their habitats are destroyed by agriculture and forestry developments (Apps, 2012). The lack of grassland and reedbed habitat in the project area contributed to a low likelihood of occurrence for this species.

Panthera pardus (Leopard) has a wide habitat tolerance and are quite adaptable to human encroachment and crop-farming areas (Apps, 2012). It is mostly nocturnal, although it can be seen during the day, especially in protected areas (Apps, 2012). The Leopard's ability to adapt to anthropogenic activities and the presence of mountainous areas around the project area contributed to a moderate likelihood of occurrence in the project area for this species.

Parahyaena brunnea (Brown Hyaena) is endemic to southern Africa (IUCN, 2017). This species occurs in dry areas, generally with annual rainfall less than 100 mm, particularly along the coast, semi-desert, open scrub and open woodland savanna (IUCN, 2017). Given its known ability to persist outside of formally protected areas the likelihood of occurrence of this species in the project area is moderate.

Poecilogale albinucha (African Striped Weasel) occurs from southwestern Uganda and Kenya to the Western Cape in South Africa (IUCN, 2017). It lives in moist grassland or open woodland with soils suitable for digging burrows (Apps, 2012). In southern Africa, this species is generally rare and the main threat is habitat destruction, due to tree plantations, crops and overgrazing (Apps, 2012). African Striped Weasels are also being heavily exploited so that their body parts can be used in traditional charms and magic (Apps, 2012). The lack of open woodland or moist grassland habitat in the project area contributed to a low likelihood of occurrence for this species.

4.1.15.4 Avifauna

The SABAP2 Data lists 176 avifauna species that could be expected to occur within the area (The full list will be provided in the final assessment). Fourteen of these expected species are regarded as threatened (Table 4-8). Three of these SCCs species have a low likelihood of occurrence due to a lack of suitable habitat and food sources in the project area.

Table 4-8 Threatened avifauna species that are expected to occur within the project area

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2021)	
Anthus crenatus	African Rock Pipit	NT	NT	High
Aquila rapax	Tawny Eagle	VU	LC	High
Aquila verreauxii	Verreaux's Eagle	VU	LC	Moderate
Calidris ferruginea	Curlew Sandpiper	LC	NT	Moderate
Ciconia nigra	Black Stork	VU	LC	Moderate
Eupodotis caerulescens	Blue Korhaan	LC	NT	High
Falco biarmicus	Lanner Falcon	VU	LC	High
Grus paradisea	Blue Crane	NT	VU	Low
Gyps coprotheres	Cape Vulture	EN	EN	Low
Heterotetrax vigorsii	Karoo Korhaan	NT	LC	High
Neotis ludwigii	Ludwig's Bustard	EN	EN	High
Phoenicopterus roseus	Greater Flamingo	NT	LC	Low
Polemaetus bellicosus	Martial Eagle	EN	EN	High
Sagittarius serpentarius	Secretarybird	VU	EN	High

Anthus crenatus (African Rock Pipit) is endemic to southern Africa, occurring in South Africa, Lesotho and possibly eSwatini (IUCN, 2017. The African Rock Pipit is mostly found near steep rocky habitats with scattered shrubs and grassy areas, and in Lesotho it prefers foothills (IUCN, 2017). Possible threats include afforestation and climate change (IUCN, 2017). The presence of suitable habitat (mountainous areas) near the project area has contributed to a high likelihood of occurrence for this species.

Aquila rapax (Tawny Eagle) has a widespread distribution in sub-Saharan Africa, with additional scattered populations occurring in North Africa, the Middle East and South Asia (IUCN, 2017). It lives in dry open habitats, woodlands and savannas (IUCN, 2017). Population declines in southern Africa occur on farmlands, most likely due to the consumption of poisonous carcasses and accidental drowning in water reservoirs (IUCN, 2017). Tawny Eagles are also killed by accidental poisoning and collisions with powerlines (IUCN, 2017). The presence of suitably dry open habitat in the project area contributed to a high likelihood of occurrence for this species.

Aquila verreauxii (Verreaux's Eagle) has a wide global distribution, occurring in several countries in Africa and the Middle East (IUCN, 2017). This species lives in remote, mountainous, rocky areas, savannas and semi-desert (IUCN, 2017). Any area where Rock Hyraxes occur in substantial numbers will be occupied by Verreaux's Eagles (IUCN, 2017). Threats in southern Africa include persecution as well as a decline in Rock Hyrax numbers due to hunting for food and skins (IUCN, 2017). The presence of suitable habitat within the project area contributed to a moderate likelihood of occurrence for this species.

Calidris ferruginea (Curlew Sandpiper) is a resident of Africa which migrates to the Russian Federation during the breeding season (IUCN, 2017). During the winter, the Curlew Sandpiper prefers a wide variety of coastal habitats such as brackish lagoons, tidal mudflats and sandflats, estuaries, saltmarshes and rocky shores. Inland habitats include the muddy edges of marshes, large rivers and lakes (both saline and freshwater), irrigated land, flooded areas, dams and saltpans (IUCN, 2017). In southern

Africa, it is threatened by habitat degradation and disturbance by tourists (IUCN, 2017). The presence of wetlands in the project area contributed to a moderate likelihood of occurrence for this species.

Ciconia nigra (Black Stork) has a very wide global distribution across Africa, Europe and Asia (IUCN, 2017). It inhabits old, undisturbed open forests and forages in shallow streams, pools, marshes, swampy areas, damp meadows, flood-plains, pools in dry riverbeds and grasslands (IUCN, 2017). In South Africa, Black Storks usually avoid large water bodies and dense forest, but non-breeding individuals will sometimes frequent the estuaries of tidal rivers (IUCN, 2017). The main threat of this species is habitat degradation, and other threats include fatal collisions with powerlines and overhead cables (IUCN, 2017). The presence of suitable foraging habitat (wetlands) in the project area contributed to a moderate likelihood of occurrence for this species.

Eupodotis caerulescens (Blue Korhaan) is near-endemic to South Africa, with its distribution extending only marginally into western Lesotho (IUCN, 2017). It prefers to live in open, fairly short grassland and a mixture of grassland and karoo dwarf-shrubland within 1 km of water, with termite mounds and few to no trees (IUCN, 2017). It forages in agricultural areas such as old and fallow cropland, pastures and winter cultivation (IUCN, 2017). The main threat to Blue Korhaans is habitat loss, mainly driven by agricultural development (IUCN, 2017). The presence of suitable habitat in the project area contributed to a high likelihood of occurrence for this species.

Falco biarmicus (Lanner Falcon) is native to South Africa and inhabits a wide variety of habitats, from lowland deserts to forested mountains (IUCN, 2017). Their diet is mainly composed of small birds such as pigeons and francolins (IUCN, 2017). The likelihood of occurrence for this species in the project area is rated as high due to the suitable habitat and the expected presence of many bird species on which Lanner Falcons may predate.

Grus paradisea (Blue Crane) is near-endemic to South Africa, with populations also found in Namibia and Lesotho (IUCN, 2017). During the breeding season, it is found in habitats dominated by grasses or sedges, near natural and man-made water sources, as well as lowland agricultural areas (IUCN, 2017). During the non-breeding season, it is seen in short, dry, natural grasslands, and the Karoo and Fynbos biomes (IUCN, 2017). Threats include accidental poisoning in agricultural areas, habitat loss through afforestation and potentially habitat degradation caused by climate change (IUCN, 2017). The lack of suitable grassland habitat in the project area contributed to a low likelihood of occurrence for this species.

Gyps coprotheres (Cape Vulture) is found in southern Africa, where it prefers protected areas and woody vegetation for foraging and steep cliffs for roosting (IUCN, 2017). Various threats are leading to a decline in this species' population numbers, including poisoning (deliberate and accidental), collision with cables, wind farm developments, habitat loss and unsustainable harvesting for traditional uses (IUCN, 2017). The lack of protected areas within 5 km of the project area as well as the lack of woody vegetation in and around the project area contributed to a low likelihood of occurrence for this species.

Heterotetrax vigorsii (Karoo Korhaan) is classified as NT on a regional level and is endemic to southern Africa, occurring in South Africa, Namibia and Lesotho (IUCN, 2017). It mainly occurs in shrubland, but is also found in some modified habitats (IUCN, 2017). Possible threats to this species are climate change and severe weather (IUCN, 2017). The presence of shrubland habitat in the project area contributed to a high likelihood of occurrence for this species.

Neotis ludwigii (Ludwig's Bustard) occurs in the Karoo and Nama-Karoo biomes of southern Africa, occurring in the south-west of Angola, western Namibia and in large parts of South Africa (IUCN, 2017). It lives in open lowland and upland plains with grass and light thornbush, sandy open shrub veld and semi-desert in the arid and semi-arid Nama-Karoo and Karoo biomes (IUCN, 2017). The main threat of Ludwig's Bustard is collision with overhead powerlines, and other threats include deliberate hunting, accidental capture in snares set for mammals, poisoning and human disturbance (IUCN, 2017). The presence of suitable Nama-Karoo habitat in the project area contributed to a high likelihood of occurrence for this species.

Phoenicopterus roseus (Greater Flamingo) is distributed from West Africa eastward throughout the Mediterranean to South West and South Asia, and throughout sub-Saharan Africa (IUCN, 2017). It prefers shallow eutrophic water bodies such as saline lagoons, saltpans and large saline or alkaline lakes (IUCN, 2017). However, it is also found frequenting sewage treatment pans, inland dams, estuaries and coastal waters (IUCN, 2017). The lack of suitable habitat within the project area contributed to a low likelihood of occurrence for this species.

Polemaetus bellicosus (Martial Eagle) is listed as EN on a regional scale and on a global scale (IUCN, 2017). This species has an extensive range across much of sub-Saharan Africa, but populations are declining due to deliberate and incidental poisoning, habitat loss, reduction in available prey, pollution and collisions with power lines (IUCN, 2017). It inhabits open woodland, wooded savanna, bushy grassland, thorn-bush and, in southern Africa, more open country and even sub-desert (IUCN, 2017). The presence of suitable habitat in the project area contributed to a high likelihood of occurrence for this species.

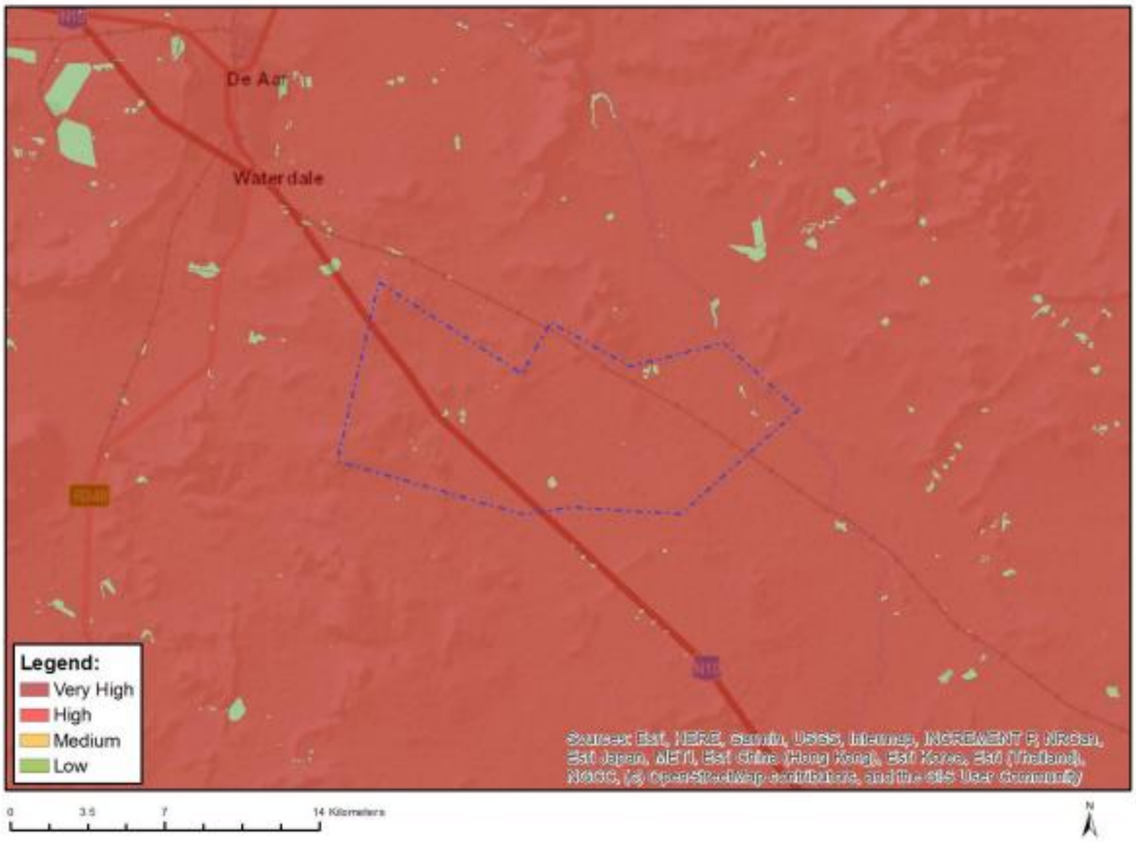
Sagittarius serpentarius (Secretarybird) occurs in sub-Saharan Africa and inhabits grasslands, open plains, and lightly wooded savanna (IUCN, 2017). It is also found in agricultural areas and sub-desert (IUCN, 2017). It mainly eats insects (86% of diet) but will also prey on rodents and other mammals, lizards, snakes, eggs, young birds and amphibians (IUCN, 2017). The likelihood of occurrence for this species is rated as high due to the open areas present in the project area as well as the expected presence of several prey species.

4.1.16 DEA 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 gathered from the National Web-based Environmental Screening Tool (Figure 4-14 to Figure 4-19):

- Terrestrial Biodiversity Theme sensitivity is Very High for the project area, with the possibility of a CBA1, CBA2, ESA and NFEPA Sub-catchments being present;
- Plant Species Theme sensitivity is Low for the project area;
- Animal Species Theme sensitivity is High for the project area, with the possibility of *Neotis ludwigii* (EN), *Aquila rapax* (VU) and *Bunolagus monticularis* (CR) being present;
- Avian Theme sensitivity is Low for the project area;
- Aquatic Biodiversity Theme sensitivity is High for the project area, with the possibility of rivers, a SWSA, wetlands, estuaries and NFEPA quinary catchments being present; and
- Agricultural Theme sensitivity is predominantly Low to Medium for the project area, with the possibility of annual crop cultivation and planted pastures rotation being present.

MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY



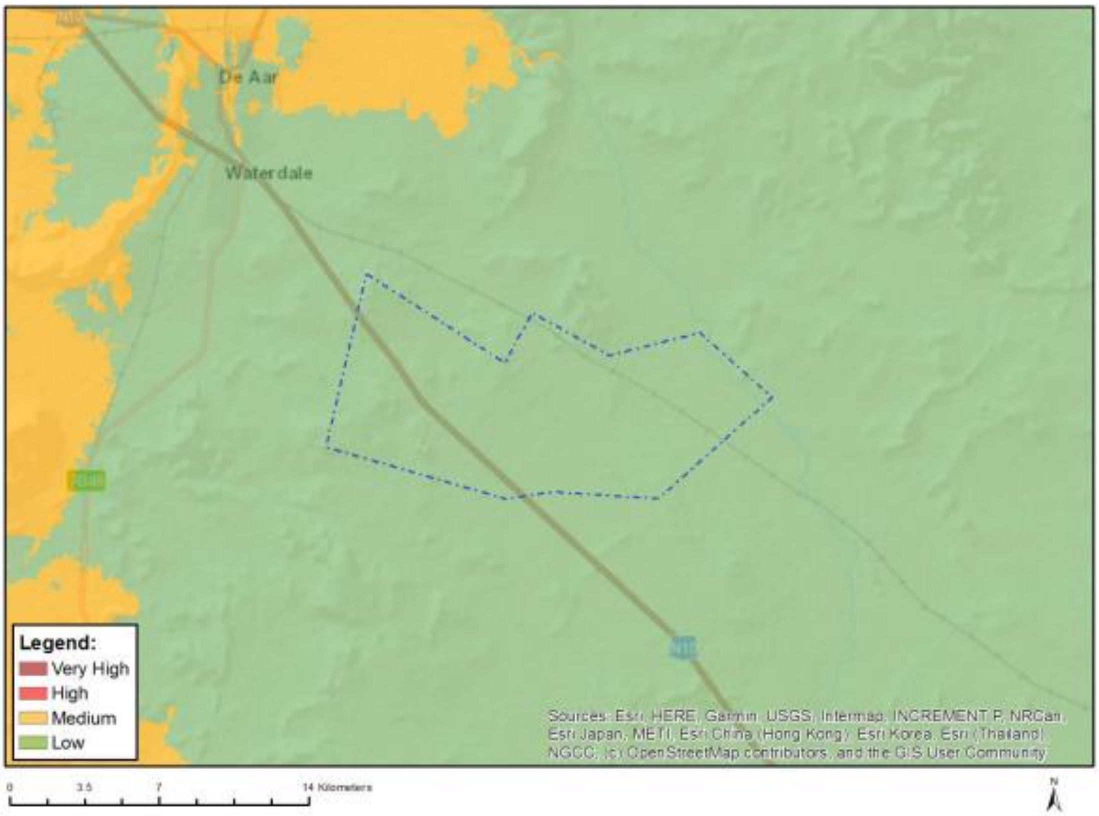
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Very High	Critical biodiveristy area 1
Very High	Critical biodiveristy area 2
Very High	Ecological support area
Very High	FEPA Subcatchments

Figure 4-14 Relative terrestrial biodiversity theme sensitivity for the project area

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.

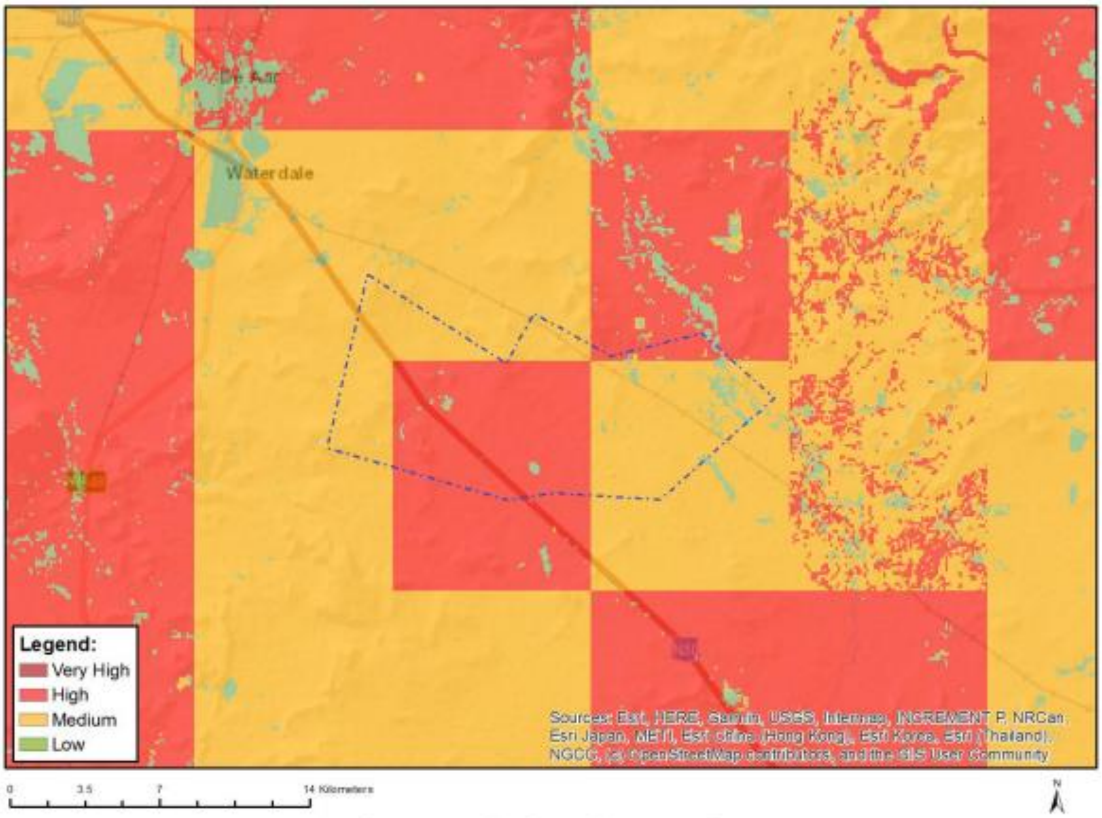
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity

Figure 4-15 Relative plant species theme sensitivity for the project area

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-Neotis ludwigii
Medium	Aves-Aquila rapax
Medium	Mammalia-Bunolagus monticularis

Figure 4-16 Relative animal species theme sensitivity for the project area

MAP OF RELATIVE AVIAN THEME SENSITIVITY

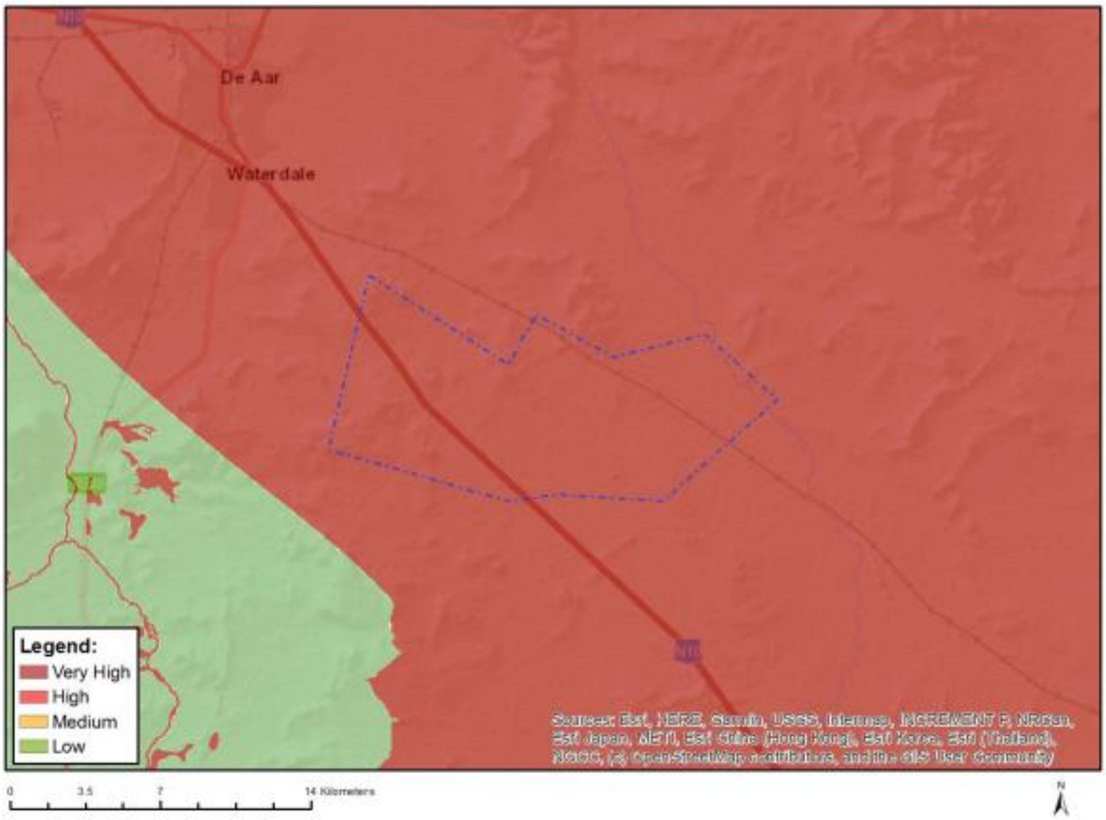
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity

Figure 4-17 Relative avian theme sensitivity for the project area

MAP OF RELATIVE AQUATIC BIODIVERSITY THEME SENSITIVITY



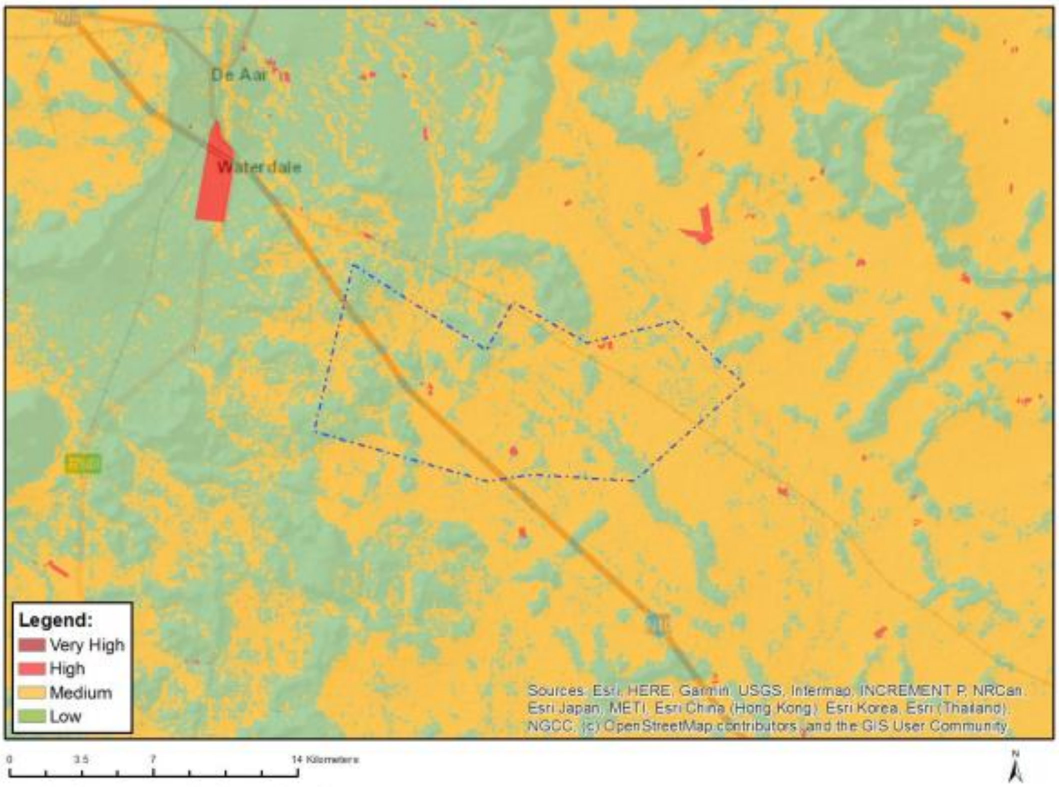
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	Rivers
Very High	Strategic water source area
Very High	Wetlands and Estuaries
Very High	Freshwater ecosystem priority area quinary catchments

Figure 4-18 Relative aquatic biodiversity theme sensitivity for the project area

MAP OF RELATIVE AGRICULTURE THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Annual Crop Cultivation / Planted Pastures Rotation;Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low
High	Annual Crop Cultivation / Planted Pastures Rotation;Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
Low	Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low
Medium	Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate

Figure 4-19 Relative agriculture theme sensitivity for the project area

5 Impact Screening

5.1 Terrestrial Impact Assessment

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 terrestrial habitat expected in the project area consists of Northern Upper Karoo (Least Threatened), which based on the desktop scoping assessment is expected to host two flora SCCs, namely *Syringodea pulchella* and *Euphorbia flanaganii*. Portions of the project area are classified as ESA, CBA1 and CBA2. The 500 m buffer zone around the project area also overlaps with several classified as well as unclassified NFEPA wetlands, NFEPA rivers, two unclassified NBA wetlands, two EN rivers and one LT river. A total of 10 fauna SCCs were given a high likelihood of occurrence, while a further six were given a moderate likelihood of occurrence. Based on the desktop assessment information it can be said that the sensitivity rating of the project area will be high. However, the actual state of the project area must be confirmed by a field assessment.

Table 5-1 Scoping evaluation table summarising the impacts identified to terrestrial biodiversity

Impact **Biodiversity loss/disturbance**			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Destruction, fragmentation and degradation of habitats and ecosystems	Direct impacts: » Disturbance / degradation / loss to vegetation and habitats » Ecological corridors are disrupted » Habitat fragmentation Indirect impacts: » Erosion risk increases » Fire risk increases » Increase in invasive alien species	Local	None identified at this stage
Spread and/or establishment of alien and/or invasive species	Direct impacts: » Loss of vegetation and habitat due to increase in alien species Indirect impacts: » Creation of infrastructure suitable for breeding activities of alien and/or invasive species » Spreading of potentially dangerous diseases due to invasive and pest species	Local	None identified at this stage
Direct mortality of fauna	Direct impacts: » Loss of SCC species » Loss of fauna diversity Indirect impacts: » Loss of diversity and species composition in the area. » Possible impact on the food chain	Local	None identified at this stage
Reduced dispersal/migration of fauna	Direct impacts: » Loss of genetic diversity » Isolation of species and groups leading to inbreeding Indirect impacts: » Reduced seed dispersal » Loss of ecosystem services	National/ Local	None identified at this stage
Environmental pollution due to water runoff, spills from vehicles and erosion	Direct impacts: » Pollution in waterbodies and the surrounding environment » Faunal mortality (direct and indirectly) Indirect impacts: » Ground water pollution » Loss of ecosystem services	Regional/ Local	None identified at this stage
Disruption/alteration of ecological life cycles (breeding,	Direct impacts:	Local	None identified at this stage

migration, feeding) due to noise, dust, heat radiation and light pollution.	» Disruption/alteration of ecological life cycles due to noise » Reduced pollination and growth of vegetation due to dust » Faunal mortality due to light pollution (nocturnal species becoming more visible to predators) » Heat radiation could lead to the displacement of species Indirect impacts: » Loss of ecosystem services		
Staff and others interacting directly with fauna (potentially dangerous) or poaching of animals	Direct impacts: » Loss of SCCs or TOPS species Indirect impacts: » Loss of ecosystem service » Loss of genetic diversity	Local	None identified at this stage
Description of expected significance of impact			
The development of the area could result in the loss or degradation of the habitat and vegetation and is expected to support a number of fauna species. The construction of the solar facility could also lead to the displacement/mortalities of the fauna and more specifically SCC fauna species. The operation of the facility could result in the disruption of ecological life cycles. This could be as a result of a number of things, but mainly due to dust, noise, light pollution and heat radiation. The disturbance of the soil/vegetation layer will allow for the establishment of flora alien invasive species. In turn, the new infrastructure could provide refuge for invasive/feral fauna species. Erosion is another possible impact that could result from the disturbance of the top soil and vegetation cover. A number of machines, vehicles and equipment will be required, aided by chemicals and concrete mixes for the project. Leaks, spillages or breakages from any of these could result in contamination of the receiving water resources. Contaminated water resources are likely to have an effect on the associated biota. The significance of these impacts will be determined after a field assessment has been conducted.			
Gaps in knowledge & recommendations for further study			
» This is completed at a desktop level only. » Identification and descriptions of habitats. » Identification of the Site Ecological Importance. » Location and identification of SCCs as well as in the case of fauna their location of the nests/dens. » Determine a suitable buffer width for the identified features.			
Recommendations with regards to general field surveys			
» Field surveys to prioritise the development areas, but also consider the 500 m PAOI. » Fieldwork to be undertaken during the wet season period. » Avifauna assessment field work to be conducted over two seasons to ensure migratory species are considered.			

5.2 Freshwater Impact Assessment

A key consideration for the scoping level impact assessment is the presence of the water resources delineated in proximity beyond the project area. The available data also suggests the presence of drainage features and wetlands within proximity to the project area. A Zone of Regulation (ZoR) of 500 m is applicable for any wetland system that is present beyond the project boundary.

Table 5-2 Scoping evaluation table summarising the impacts identified to wetlands

Impact Wetland disturbance / loss			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Disturbance / degradation / loss to wetland soils or vegetation due to the construction of the facility and associated infrastructure, such as crossings	Direct impacts: » Disturbance / degradation / loss to wetland soils or vegetation Indirect impacts: » Loss of ecosystem services	Local	None identified at this stage

Increased erosion and sedimentation & contamination of resources	Direct impacts: » Erosion and structural changes to the systems Indirect impacts: » Sedimentation & contamination of downstream reaches	Local	None identified at this stage
Description of expected significance of impact The development of the area could result in the encroachment into water resources and result in the loss or degradation of these systems. Water resources are also likely to be traversed by linear infrastructure, but these systems can be avoided by spanning infrastructure. These disturbances could also result in the infestation and establishment of alien vegetation would affect the functioning of the systems. Earthworks will expose and mobilise earth materials which could result in sedimentation of the receiving systems. A number of machines, vehicles and equipment will be required, aided by chemicals and concrete mixes for the project. Leaks, spillages or breakages from any of these could result in contamination of the receiving water resources. Contaminated water resources are likely to influence the associated biota. It is anticipated to increase stormwater runoff due to the hardened surfaces and the crossings will result in an increase in run-off volume and velocities, resulting in altered flow regimes. The changes could result in physical changes to the receiving systems caused by erosion, run-off and also sedimentation, and the functional changes could result in changes to the vegetative structure of the systems. The reporting of surface run-off to the systems could also result in the contamination of the systems, transporting (in addition to sediment) diesel, hydrocarbons and soil from the operational areas.			
Gaps in knowledge & recommendations for further study » This is completed at a desktop level only. » Identification, delineation and characterisation of water resources. » Undertake a functional assessment of systems where applicable. » Determine a suitable buffer width for the resources. Recommendations with regards to general field surveys » Field surveys to prioritise the development areas, but also consider the 500 m regulation area. » Beneficial to undertake fieldwork during the wet season period.			

5.3 Soil Impact Assessment

Considering the occurrence of various soil forms that are commonly associated with high land capabilities, it is unlikely that areas with high land capability sensitivity do occur within the project area. Further to this, due to the climatic capability, the ultimate land potential is more likely to be low.

Table 5-3 Scoping evaluation table summarising the impacts identified to soils

Impact **Loss of land capability**			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Compaction/soil stripping/transformation of land use which leads to loss of land capability	Direct impacts: » Loss of soil / land capability Indirect impacts: » Loss of land capability	Local	None identified at this stage
Erosion	Direct impacts: » Loss of topsoil Indirect impacts: » Loss of land capability	Site/Local	None identified at this stage
Description of expected significance of impact According to the DEA Screening Tool (Figure 4-19), the relative agriculture theme sensitivity of the project area is predominantly Low to Medium. The development of the area could result in the encroachment into areas characterised by high land potential properties, which can ultimately result in the loss of land capability. These disturbances could also result in the infestation and establishment of alien vegetation, which in turn can have a detrimental impact on soil resources. Earthworks will expose and mobilise earth materials which could result in compaction and/or erosion. A number of machines, vehicles and equipment will be required, aided by chemicals and concrete mixes for the project. Leaks, spillages or breakages from any of these could result in contamination of soil resources, which could affect the salinity or pH of the soil, which can render the fertility of the soil unable to provide nutrition to plants. During the operational			

phase, the impacts associated with the substation, transmission lines and the solar PV array will be easily managed by best "housekeeping" practices. The significance of these impacts will be determined after a field assessment has been conducted.

Gaps in knowledge & recommendations for further study

- This is completed at a desktop level only.
- Identification and delineation of soil forms.
- Determine of soil sensitivity.

Recommendations with regards to general field surveys

- Field surveys to prioritise the development areas.

6 Conclusion

6.1 Terrestrial Ecology

Based on the desktop assessment it can be said that the project area is sensitive with a moderate to high likelihood of species of conservation concern occurring. This assumption is based on the ESA, CBA1s, CBA2, IBA, and NFEPA wetlands and NFEPA rivers in and around the project area.

The expected post-mitigation risk significance for the project in isolation is expected to be medium, but in consideration of other projects in the area, it is considered to be high. The expectant anthropogenic activities are likely to drive habitat destruction causing displacement of fauna and flora and possibly event 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.

6.2 Freshwater Ecology

A key consideration for the impact assessment is the presence of the identified water resources in relation to the project area. The available data also suggests the presence of features in proximity to the project area, with wetland systems expected within the 500 m regulation zone.

Construction could result in the encroachment into water resources and result in the loss or degradation of these system, most of which are functional and provide ecological services. These disturbances could also result in the infestation and establishment of alien vegetation would affect the functioning of the systems. Leaks and/or spillages could result in contamination of the receiving water resources. Contaminated water resources are likely to have an effect on the associated biota. An increase in stormwater runoff could result in physical changes to the receiving systems caused by erosion, run-off and also sedimentation, and the functional changes could result in changes to the vegetative structure of the systems.

6.3 Land Capability

Various soil forms are expected throughout the project area, of which some are commonly associated with higher land capabilities. Even though the soil depth, texture and permeability of these soils ensure higher land capability, the climatic capability of the area often reduces the land potential considerably. Areas characterised by "High" land potential are expected for selected areas.

The proposed development can result in the loss of land capability. The disturbances could further also result in the infestation and establishment of alien vegetation, which in turn can have a detrimental impact on soil resources. The development of the area could also result in compaction and/or erosion. Further to this, these activities could also cause leaks and/or spillages resulting in contamination of soil resources, which could affect the salinity or pH of the soil, which can render the fertility of the soil unable to provide nutrition to plants.

7 Terms of Methodology

7.1 Flora Survey

The fieldwork and sample sites will be placed within targeted areas (i.e., target sites) perceived as ecologically sensitive based on the preliminary interpretation of satellite imagery (Google Corporation) and GIS analysis (which will included the latest applicable biodiversity datasets) available prior to the fieldwork. The focus of the fieldwork will therefore be to maximise coverage and navigate to each target site in the field, to perform a rapid vegetation and ecological assessment at each sample site. Emphasis will be placed on sensitive habitats, especially those overlapping with the proposed project area.

Homogenous vegetation units will be subjectively identified using satellite imagery and existing land cover maps. The floristic diversity and search for flora SCC will be conducted through timed meanders within representative habitat units delineated during the fieldwork. Emphasis will be placed mostly on sensitive habitats overlapping with the proposed project areas.

The timed random meander method is highly efficient for conducting floristic analysis, specifically in detecting flora SCC and maximising floristic coverage. 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. The timed meander search will be performed based on the original technique described by Goff *et al.* (1982). Suitable habitat for SCC will be identified according to Raimondo *et al.* (2009) and targeted as part of the timed meanders.

At each sample site notes will be made regarding current impacts (e.g., livestock grazing, erosion etc.), subjective recording of dominant vegetation species, and any sensitive features (e.g., wetlands, outcrops etc.). In addition, opportunistic observations will be made while navigating through the project area.

7.2 Fauna Survey

The faunal assessment within this report pertains to herpetofauna (amphibians and reptiles), avifauna and mammals. The faunal field survey will be comprised of the following techniques:

- Visual and auditory searches - This typically comprises of meandering and using binoculars to view species from a distance without them being disturbed; and listening to species calls;
- Active hand-searches - Used for species that shelter in or under particular micro-habitats (typically rocks, exfoliating rock outcrops, fallen trees, leaf litter, bark etc.);
- Point counts for the avifauna; and
- Utilization of local knowledge.

Relevant field guides and texts that will be 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);
- Smithers' Mammals of Southern Africa (Apps, 2000);
- A Field Guide to the Tracks and Signs of Southern and East African Wildlife (Stuart and Stuart, 2000);
- Book of birds of South Africa, Lesotho and Swaziland (Taylor *et al.,* 2015); and
- Roberts – Birds of Southern Africa (Hockey *et al.,* 2005).

7.3 Terrestrial Site Ecological Importance

The different habitat types within the project area will be delineated and identified based on observations during the field assessment, and available satellite imagery. These habitat types will be assigned Ecological Importance (EI) categories based on their ecological integrity, conservation value, the presence of species of conservation concern and their ecosystem processes.

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) as follows.

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 7-1 and Table 7-2, respectively.

Table 7-1 Summary of Conservation Importance (CI) criteria

Conservation Importance	Fulfilling Criteria
Very High	Confirmed or highly likely occurrence of Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Extremely Rare or CR 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 Near Threatened (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 7-2 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. 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 7-3.

Table 7-3 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 7-4.

Table 7-4 Summary of Receptor 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: (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.
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: (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	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.
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: (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.
Very Low	Habitat that is unable to recover from major impacts, or species that are unlikely to: (i) remain at a site even when a disturbance or impact is occurring, or (ii) 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 7-5.

Table 7-5 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 project is provided in Table 7-6.

Table 7-6 Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities

Site Ecological Importance	Interpretation in relation to proposed development activities
Very High	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit 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.

7.4 Freshwater Assessment

7.4.1 Water Quality

Water quality was measured in situ using a handheld calibrated multi-parameter water quality meter. The constituents considered that were measured included: pH, electrical conductivity (µS/cm), temperature (°C) and Dissolved Oxygen (DO) in mg/l.

7.4.2 Habitat Assessment

Habitat availability and diversity are major attributes for the biota found in a specific ecosystem, and thus knowledge of the quality of habitats is important in an overall assessment of ecosystem health. Habitat assessment can be defined as the evaluation of the structure of the surrounding physical habitat that influences the quality of the water resource and the condition of the resident aquatic community (Barbour *et al*. 1996). Both the quality and quantity of available habitat affect the structure and composition of resident biological communities (USEPA, 1998). Habitat quality and availability plays a critical role in the occurrence of aquatic biota. For this reason, habitat evaluation is conducted simultaneously with biological evaluations to facilitate the interpretation of results.

7.4.2.1 Habitat Integrity and Riparian Delineation

The Intermediate Habitat Integrity Assessment (IHIA) model was used to assess the integrity of the watercourse habitats from a riparian and instream perspective as described in Kleynhans (1996). The habitat integrity of a river refers to the maintenance of a balanced composition of physico-chemical and habitat characteristics on a temporal and spatial scale which are comparable to the characteristics of natural habitats of the region (Kleynhans, 1996).

This model compares current conditions with reference conditions that are expected to have been present. Specification of the reference condition follows an impact-based approach where the intensity and extent of anthropogenic changes within the catchment surrounding a watercourse are used to interpret the impact on the habitat integrity of the downslope freshwater ecosystem (receiving environment). To accomplish this, information on abiotic changes that can potentially influence river habitat integrity are obtained from surveys (in-field observations) in combination with available data sources such as the latest Google Earth satellite imagery. These changes are all related and interpreted in terms of modification of the drivers of the system, namely hydrology, geomorphology and physico-chemical conditions and how these changes would impact on the natural riverine habitats.

The criteria and ratings utilised in the assessment of habitat integrity are presented in Table 7-7 and

Table 7-8 respectively. The spatial framework for each IHIA was 5 km up and downstream of the respective sampling points, from the highest elevation to the lowest elevation within the watercourse.

Table 7-7 Criteria used in the assessment of habitat integrity (Kleynhans, 1996)

Criterion	Relevance
Water abstraction	Direct impact on habitat type, abundance and size. Also implicated in flow, bed, channel and water quality characteristics. Riparian vegetation may be influenced by a decrease in the supply of water.
Flow modification	Consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow can have an impact on habitat attributes such as an increase in duration of high flow season, resulting in low availability of certain habitat types or water at the start of the breeding, flowering or growing season.
Bed modification	Regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment (Gordon *et al*., 1993 in: DWS, 1999). Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation (Hilden & Rapport, 1993 in: DWS, 1999) is also included.
Channel modification	May be the result of a change in flow, which may alter channel characteristics causing a change in marginal instream and riparian habitat. Purposeful channel modification to improve drainage is also included.
Water quality modification	Originates from point and diffuse point sources. Measured directly or agricultural activities, human settlements and industrial activities may indicate the likelihood of modification. Aggravated by a decrease in the volume of water during low or no flow conditions.
Inundation	Destruction of riffle, rapid and riparian zone habitat. Obstruction to the movement of aquatic fauna and influences water quality and the movement of sediments (Gordon *et al*., 1992 in DWS, 1999)).
Exotic macrophytes	Alteration of habitat by obstruction of flow and may influence water quality. Dependent upon the species involved and scale of infestation.
Exotic aquatic fauna	The disturbance of the stream bottom during feeding may influence the water quality and increase turbidity. Dependent upon the species involved and their abundance.
Solid waste disposal	A direct anthropogenic impact which may alter habitat structurally. Also, a general indication of the misuse and mismanagement of the river.
Indigenous vegetation removal	Impairment of the buffer the vegetation forms to the movement of sediment and other catchment runoff products into the river (Gordon *et al*., 1992). Refers to physical removal for farming, firewood and overgrazing.
Exotic vegetation encroachment	Excludes natural vegetation due to vigorous growth, causing bank instability and decreasing the buffering function of the riparian zone. Allochtonous organic matter input will also be changed. Riparian zone habitat diversity is also reduced.
Bank erosion	Decrease in bank stability will cause sedimentation and possible collapse of the river bank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or exotic vegetation encroachment.

Table 7-8 Descriptions used for the ratings of the various habitat criteria (Kleynhans, 1996)

Impact Category	Description	Score
None	No discernible impact, or the modification is located in such a way that it has no impact on habitat quality, diversity, size and variability.	0
Small	The modification is limited to very few localities and the impact on habitat quality, diversity, size and variability are also very small.	1 - 5
Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability are also limited.	6 - 10
Large	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size and variability. Large areas are, however, not influenced.	11 - 15
Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area are affected. Only small areas are not influenced.	16 - 20
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.	21 - 25

The habitat integrity assessment considers the riparian zone and the instream channel of the river. Assessments are made separately for both aspects, but data for the riparian zone are primarily interpreted in terms of the potential impact on the instream component (Table 7-9). The relative weighting (importance value) of criteria remains the same as for the assessment of habitat integrity (DWS, 1999).

Table 7-9 Criteria and weights used for the assessment of instream habitat integrity and riparian habitat integrity (from Kleynhans, 1996)

Instream Criteria	Weight	Riparian Zone Criteria	Weight
Water abstraction	14	Indigenous vegetation removal	13
Flow modification	13	Exotic vegetation encroachment	12
Bed modification	13	Bank erosion	14
Channel modification	13	Channel modification	12
Water quality	14	Water abstraction	13
Inundation	10	Inundation	11
Exotic macrophytes	9	Flow modification	12
Exotic fauna	8	Water quality	13
Solid waste disposal	6		
Total	**100**	**Total**	**100**

The negative weights are added for the instream and riparian facets respectively and the total additional negative weight subtracted from the provisionally determined intermediate integrity to arrive at a final intermediate habitat integrity estimate. The eventual total scores for the instream and riparian zone components are then used to place the habitat integrity in a specific intermediate habitat integrity category (DWS, 1999). These categories are indicated in Table 7-10.

Table 7-10 Intermediate habitat integrity categories (From Kleynhans, 1996)

Category	Description	Score (% of Total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79

D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0

The riparian delineation was completed according to DWAF (2005). Typical riparian cross sections and structures are provided in Figure 7-1. Indicators such as topography and vegetation were the primary indicators used to define the riparian zone. Elevation data was obtained from topography spatial data was also utilised to support the infield assessment.

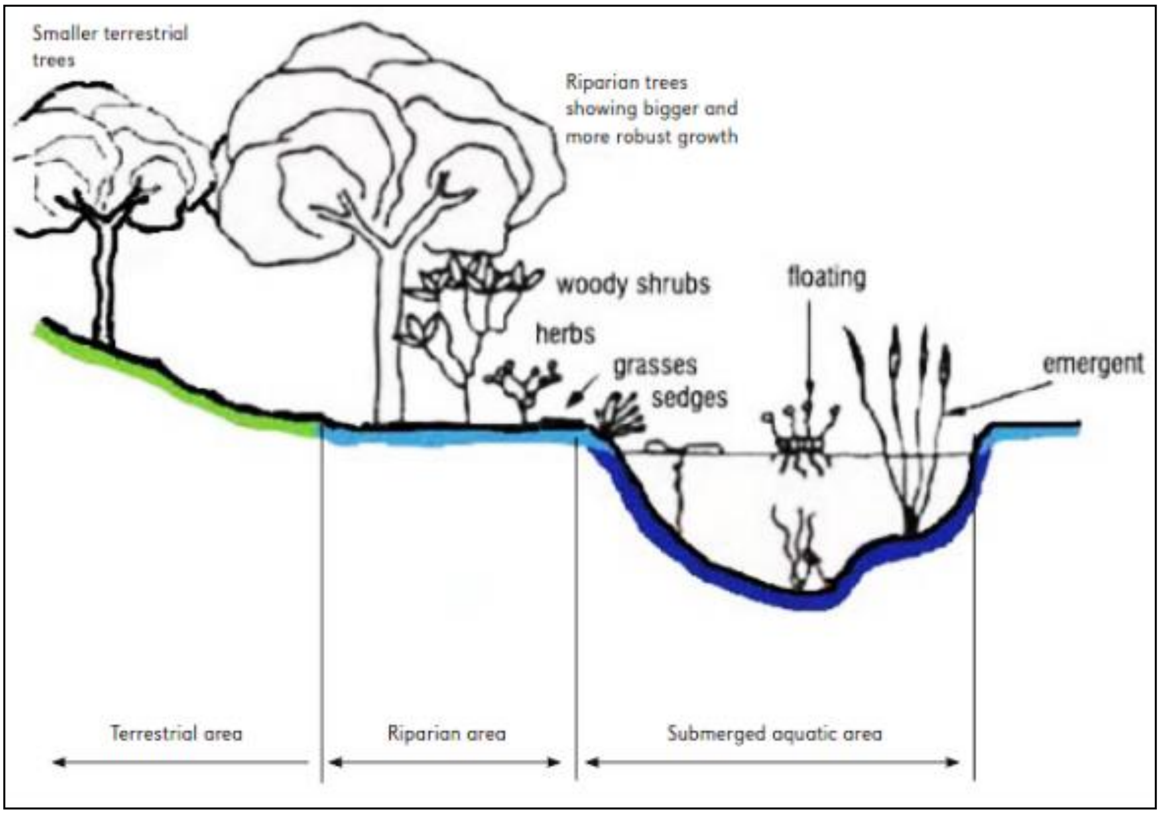


Figure 7-1 Riparian Habitat Delineations (DWAF, 2005)

7.5 Land Capability

Land capability and agricultural potential will be determined by a combination of soil, terrain and climate features. Land capability is defined by the most intensive long-term sustainable use of land under rain-fed conditions. At the same time an indication is given about the permanent limitations associated with the different land use classes.

Land capability is divided into eight classes and these may be divided into three capability groups. Table 7-11 shows how the land classes and groups are arranged in order of decreasing capability and ranges of use. The risk of use and sensitivity increases from class I to class VIII (Smith, 2006).

Table 7-11 Land capability class and intensity of use (Smith, 2006)

Land Capability Class	Increased Intensity of Use									Land Capability Groups
I	W	F	LG	MG	IG	LC	MC	IC	VIC	Arable Land

II	W	F	LG	MG	IG	LC	MC	IC		
III	W	F	LG	MG	IG	LC	MC			
IV	W	F	LG	MG	IG	LC				
V	W	F	LG	MG						
VI	W	F	LG	MG						Grazing Land
VII	W	F	LG							
VIII	W									Wildlife
W - Wildlife		**MG - Moderate Grazing**			**MC - Moderate Cultivation**					
F- Forestry		**IG - Intensive Grazing**			**IC - Intensive Cultivation**					
LG - Light Grazing		**LC - Light Cultivation**			**VIC - Very Intensive Cultivation**					

Land capability has been classified into 15 different categories by the DAFF (2017) which indicates the national land capability category and associated sensitivity related to soil resources.

The land potential classes are determined by combining the land capability results and the climate capability of a region as shown in Table 7-12. The final land potential results are then described in Table 7-13. These land potential classes are regarded as the final delineations subject to sensitivity, given the comprehensive addition of climatic conditions as those relevant to the DAFF (2017) land capabilities. The main contributors to the climatic conditions as per Smith (2006) is that of MAP, Mean Annual Potential Evaporation (MAPE), mean September temperatures, mean June temperatures and mean annual temperatures. These parameters will be derived from Mucina and Rutherford (2006) for each vegetation type located within a relevant project area. This will give the specialist the opportunity to consider micro-climate, aspect, topography etc.

Table 7-12 The combination table for land potential classification

Land capability class	Climate capability class							
	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
I	L1	L1	L2	L2	L3	L3	L4	L4
II	L1	L2	L2	L3	L3	L4	L4	L5
III	L2	L2	L3	L3	L4	L4	L5	L6
IV	L2	L3	L3	L4	L4	L5	L5	L6
V	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei
VI	L4	L4	L5	L5	L5	L6	L6	L7
VII	L5	L5	L6	L6	L7	L7	L7	L8
VIII	L6	L6	L7	L7	L8	L8	L8	L8

Table 7-13 The Land Potential Classes

Land potential	Description of land potential class
L1	Very high potential: No limitations. Appropriate contour protection must be implemented and inspected.
L2	High potential: Very infrequent and/or minor limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected.
L3	Good potential: Infrequent and/or moderate limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected.

L4	Moderate potential: Moderately regular and/or severe to moderate limitations due to soil, slope, temperatures or rainfall. Appropriate permission is required before ploughing virgin land.
L5	Restricted potential: Regular and/or severe to moderate limitations due to soil, slope, temperatures or rainfall.
L6	Very restricted potential: Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable
L7	Low potential: Severe limitations due to soil, slope, temperatures or rainfall. Non-arable
L8	Very low potential: Very severe limitations due to soil, slope, temperatures or rainfall. Non-arable

7.5.1 Climate Capability

According to Smith (2006), climatic capability is determined by taking into consideration various steps pertaining to the temperature, rainfall and Class A-pan of a region. The first step in this methodology is to determine the MAP to Class A-pan ratio.

Table 7-14 Climatic capability (step 1) (Smith, 2006)

Climatic Capability Class	Limitation Rating	Description	MAP: Class A pan Class
C1	None to Slight	Local climate is favourable for good yields for a wide range of adapted crops throughout the year.	0.75-1.00
C2	Slight	Local climate is favourable for a wide range of adapted crops and a year-round growing season. Moisture stress and lower temperature increase risk and decrease yields relative to C1.	0.50-0.75
C3	Slight to Moderate	Slightly restricted growing season due to the occurrence of low temperatures and frost. Good yield potential for a moderate range of adapted crops.	0.47-0.50
C4	Moderate	Moderately restricted growing season due to the occurrence of low temperatures and severe frost. Good yield potential for a moderate range of adapted crops but planting date options more limited than C3.	0.44-0.47
C5	Moderate to Severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Suitable crops at risk of some yield loss.	0.41-0.44
C6	Severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Limited suitable crops that frequently experience yield loss.	0.38-0.41
C7	Severe to Very Severe	Severely restricted choice of crops due to heat and moisture stress.	0.34-0.38
C8	Very Severe	Very severely restricted choice of crops due to heat and moisture stress. Suitable crops at high risk of yield loss.	0.30-0.34

In the event that the MAP: Class A-pan ratio is calculated to fall within the C7 or C8 class, no further steps are required, and the climatic capability can therefore be determined to be C7 or C8. In cases where the above-mentioned ratio falls within C1-C6, steps 2 to 3 will be required to further refine the climatic capability.

Step 2

Mean September temperatures;

- <10℃ = C6
- 10 - 11℃ = C5
- 11 - 12℃ = C4
- 12 - 13℃ = C3
- >13℃ = C1

Step 3

Mean June temperatures;

- <9 ℃ = C5
- 9 - 10 ℃ = C4
- 10 - 11 ℃ = C3
- 11 - 12 ℃ = C2

7.5.2 Current Land Use

A generalised land-use will be derived for the larger project area considering agricultural productivity.

- Mining;
- Bare areas;
- Agriculture crops;
- Natural veld;
- Grazing lands;
- Forest;
- Plantation;
- Urban;
- Built-up;
- Waterbodies; and
- Wetlands.

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9 Appendix Items

9.1 Appendix A – Specialist Declaration of Independence

I, Jan Jacobs, 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.

Jan Jacobs

Terrestrial Ecologist

The Biodiversity Company

September 2022