ECOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED DOORNHOEK 2 SOLAR PV FACILITY, KLERKSDORP, NORTH WEST PROVINCE

Prepared for:

Doornhoek PV (Pty) Ltd

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Author

Tarryn Martin (Botanical Specialist) (*Pri. Sci. Nat* 008745)

Tarryn has over ten years of experience working as a botanist, nine of which are in the environmental sector. She has worked as a specialist and project manager on projects within South Africa, Mozambique, Lesotho, Zambia, Tanzania, Cameroon, Swaziland and Malawi. The majority of these projects required lender finance and consequently met both in-country and lender requirements.

Tarryn has extensive experience writing botanical impact assessments, critical habitat assessments, biodiversity management plans, biodiversity monitoring plans and Environmental Impact Assessments to International Standards, especially to those of the International Finance Corporation (IFC). Her experience includes working on large mining projects such as the Kenmare Heavy Minerals Mine, where she monitored forest health, undertook botanical impact assessments for their expansion projects and designed biodiversity management and monitoring plans. She has also project managed Environmental Impact Assessments for graphite mines in northern Mozambique and has a good understanding of the Mozambique Environmental legislation and processes.

Tarryn holds a BSc (Botany and Zoology), a BSc (Hons) in African Vertebrate Biodiversity and an MSc with distinction in Botany from Rhodes University. Tarryn's Master's thesis examined the impact of fire on the recovery of C_3 and C_4 Panicoid and non-Panicoid grasses within the context of climate change for which she won the Junior Captain Scott-Medal (Plant Science) for producing the top MSc of 2010 from the South African Academy of Science and Art as well as an Award for Outstanding Academic Achievement in Range and Forage Science from the Grassland Society of Southern Africa.

Tarryn is a professional member of the South African Council for Natural Scientific Professionals (since 2014).

Amber Jackson (Faunal Specialist) (*Cand. Nat. Sci)*

Amber has over ten years' experience in environmental consulting and has managed projects across various sectors including mining, agriculture, forestry, renewable energy, housing, coastal and wetland recreational infrastructure. Most of these projects required lender finance and therefore met both in-country, lender and sector specific requirements.

Amber completed the IFC lead and Swiss funded programme in Environmental and Social Risk Management course in 2018. The purpose of the course was to upskill Sub-Saharan African environmental consultants to increase the uptake of E&S standards by Financial Institutions.

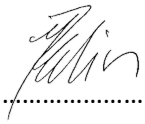
Amber specialises in terrestrial vertebrate faunal assessments. She has conducted large scale faunal impact assessments that are to international lender's standards in Mozambique, Tanzania, Lesotho and Malawi. In South Africa her faunal impact assessments comply with the protocols for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial biodiversity and follows the SANBI Species Environmental Assessment Guideline. Her specialist input goes beyond impact assessments and includes faunal opportunities and constraints assessments, Critical Habitat Assessments, Biodiversity related Management Plans and Biodiversity Monitoring Programmes.

Amber holds a BSc (Zoology and Ecology, Environment & Conservation) and BSc (Hons) in Ecology, Environment & Conservation from WITS University and an MPhil in Environmental Management from University of Cape Town. She was awarded the Denzil and Dorethy Carr Prize for her plant collection in 2006. Amber's honours focused on the landscape effects on Herpetofauna in Kruger National Park and her Master's thesis focused on the management of social and natural aspects of environmental systems with a dissertation in food security that investigated the complex food system of informal and formal distribution markets.

Declaration of Independence

Tarryn Martin (Botanical Specialist)

- I, Tarryn Martin, declare that, in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Amended Environmental Impact Assessment Regulations, 2017;
- 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 report are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



…….. 25 April 2022

SIGNED DATE

Amber Jackson (Faunal Specialist)

- I, Amber Jackson, declare that, in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Amended Environmental Impact Assessment Regulations, 2017;
- 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 report are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

SIGNED

25.04.2022

DATE

Non-Technical Summary

Introduction

The Applicant, Doornhoek (Pty) Ltd, is proposing the construction of a photovoltaic (PV) solar energy facility (known as the Doornhoek 2 PV facility) located on a site approximately 11km north of Klerksdorp in the North West Province. The solar PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 50MW. The development area is situated within the City of Matlosana Local Municipality within the Dr Kenneth Kaunda District Municipality. The site is accessible via an existing district road located adjacent to the east of the development area.

The proposed Doornhoek 2 PV Facility will cover approximately 80ha and will include the following infrastructure:

- PV modules and mounting structures
- Inverters and transformers
- Battery Energy Storage System (BESS)
- Site and internal access roads (up to 8m wide)
- Operation and Maintenance buildings including a gate house and security building, control centre, offices, warehouses and workshops for storage and maintenance.
- Temporary and permanent laydown area
- Grid connection infrastructure, including:
    - 33kV cabling between the project components and the facility substation
    - A 132kV facility substation
    - A 132kV Eskom switching station
    - A Loop-in-Loop out (LILO) overhead 132kV power line between the Eskom switching station and the existing Watershed–Klerksdorp 1 132kV power line.

Methodology

A field survey was undertaken during the early flowering season from the 1-2 November 2021. The purpose of the survey was to assess the site-specific botanical state of the project area by recording the species present (both indigenous and alien invasive species), identifying sensitive ecosystems such as rocky outcrops, riparian areas or areas with species of conservation concern, and identifying the current land use.

The project site was walked and sample plots were analysed by determining the dominant species in each plot, as well as any alien invasive species and potential SCC occurring within the plots. Each sample plot was sampled until no new species were recorded. Vegetation communities were then described according to the dominant species recorded from each type, and these were mapped and assigned a sensitivity score.

A desktop faunal assessment was undertaken and is based on available habitat identified in the botanical and aquatic survey and brief field survey by the faunal specialist.

Results

Flora

Two vegetation types were recorded within the property portion that the project infrastructure will be located within:

- Near-intact Vaal-Vet Sandy Grassland (Endangered)
- Klerksdorp Thornveld (Least Concern)

Fauna

No amphibian or reptile SCC has distribution ranges that include the project area. Four vulnerable and seven near threatened mammal species have a distribution which includes the project area. Of these species, only three (Southern African Hedgehog, Grey Rhebok and Serval) have a high likelihood of occurrence within the Project Area of Influence (PAOI). Since the serval is typically associated with watercourses and the rhebok with ridges, the likelihood that the project will have a direct impact on these species' habitat is low. The hedgehog prefers dense vegetation and rocky outcrops for nesting and foraging and as such the likelihood of it using the project site is low as neither of these habitat requirements are present.

Site Ecological Importance

The field survey assessed the Site Ecological Index (SEI) for the two vegetation types present within the PAOI. The near-intact Vaal-Vet Sandy Grassland (Endangered) was found to have an SEI of high and the Klerksdorp Thornveld (Least Concern) was determined to have an SEI of Medium. Project infrastructure has been designed to avoid impacts to the near-intact Vaal-Vet Sandy Grassland by placing it in previously cultivated land and Klerksdorp Thornveld. This has ensured that there are negligible impacts to the endangered vegetation type.

Project infrastructure will impact 3.6% of the remaining extent of Klerksdorp Thornveld. The field survey determined that this habitat is characterised by a relatively low diversity throughout most of the site.

Although the planning unit in which the project is located is listed as a CBA1, the vegetation within the project footprint shows historical evidence of disturbance from grazing and trampling by livestock (refer to section 3.5). The function of the CBA, which is located in previously disturbed Klerksdorp Thornveld, is to provide an ecological for the movement of species. Project infrastructure will result in the loss of 4.7% of the portion of corridor that occurs within the property boundary. When combined with Doornhoek 1, this increases to 10.8% of the corridor. The objective of the corridor to maintain landscape connectivity within the property can still be maintained within the remaining 90% of the corridor and species movement across the site is unlikely to be severely impacted.

Nine impacts were identified for the project site. Three of these are of high significance, three of moderate significance, two of low significance and one was negligible before mitigation measures are implemented. The significance can be reduced to five moderate, three low and one negligible impact if the recommended mitigation measures are implemented.

It is recommended that the following conditions are included in the Final EMPr as well as the conditions of the Environmental Authorisation (EA), if granted:

- The remaining vegetation within the property should remain intact so that it can continue to function as an ecological corridor for species movement.
- All necessary plant permits must be obtained prior to the commencement of any construction activities.
- No project infrastructure should be located within the near-intact Endangered Vaal-Vet Grassland.
- Where feasible, laydown areas must be placed in previously disturbed sites.
- If any SCC are to be impacted, these must be relocated to nearest appropriate habitat.
- Construction vehicles and machinery must not encroach into identified 'no-go' areas or areas outside the project footprint. This is especially important for the Endangered near-intact Vaal-Vet Sandy Grassland.
- Topsoil (20 cm, where possible) must be collected and stored in an area of low sensitivity and used to rehabilitate impacted areas that are no longer required during the operational phase (e.g. laydown areas).
- Employees must be prohibited from collecting any plants.
- Alien invasive plant clearing should be undertaken in line with an Alien Vegetation Management plan, which should be compiled as part of the EMPr and implemented with immediate effect.
- Only indigenous plant species typical of the local vegetation and approved by a botanist should be used for the rehabilitation of natural habitat.

Project infrastructure has been designed to avoid sensitive features such as the endangered near-intact Vaal-Vet Sandy Grassland and to minimise the impact on the functioning of the area as an ecological corridor. Further to the above, impacts on the terrestrial plant and faunal species and associated habitats can be reduced to acceptable levels through the implementation of mitigation measures. The specialist is therefore of the opinion that the development can proceed provided the recommendations contained in this report are implemented.

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Glossary of Terms

Alien Invasive Species refers to an exotic species that can spread rapidly and displace native species causing damage to the environment

Biodiversity is the term that is used to describe the variety of life on Earth and is defined as "*the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems*" (Secretariat of the Convention on Biological Diversity, 2005).

Habitat Fragmentation occurs when large expanses of habitat are transformed into smaller patches of discontinuous habitat units isolated from each other by transformed habitats such as farmland.

Key Biodiversity Area are globally recognised sites that contain significant concentrations of biodiversity.

Natural Habitat refers to habitats composed of viable assemblages of plant and/or animal species of largely native origin and/or where human activity has not essentially modified an area's primary ecological function and species composition.

Protected Area is a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values**.** *(IUCN Definition 2008)*

Acronyms

CBA	Critical Biodiversity Area
CR	Critically Endangered
ECO	Environmental Control Officer
EN	Endangered
EIA	Environmental Impact Assessment
EOO	Extent of Occupancy
GIS	Geographical Information System
IUCN	International Union for Conservation of Nature
LC	Least Concern
NBSAP	National Biodiversity and Strategy Action Plan
NEMBA	National Environmental Management Biodiversity Act
PNCO	Provincial Nature Conservation Ordinance
SCC	Species of Conservation Concern
QDS	Quarter Degree Square
SA	South Africa
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
TOPS	Threatened and Protected Species
VU	Vulnerable

Specialist Check List

The content of this specialist report complies with the legislated requirements as described in the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity (GN R. 320 of 2020).

SPECIALIST REPORT REQUIREMENTS ACCORDING TO GN R. 320			SECTION OF REPORT
3.1	The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:		
	3.1.1	Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Page 2-3 Appendix 5 and 6
	3.1.2	A signed statement of independence by the specialist;	Page 3
	3.1.3	A statement of the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 2.3
	3.1.4	A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	Chapter 2
	3.1.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Section 1.3
	3.1.6	A location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	Section 6.2
	3.1.7	Additional environmental impacts expected from the proposed development;	Chapter 7
	3.1.8	Any direct, indirect and cumulative impacts of the proposed development;	Chapter 7
	3.1.9	The degree to which the impacts and risks can be mitigated;	Chapter 7
	3.1.10	The degree to which the impacts and risks can be reversed;	
	3.1.11	The degree to which the impacts and risks can cause loss of irreplaceable resources;	
	3.1.12	Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	Section 8.2
	3.1.13	A motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a "low" terrestrial biodiversity sensitivity and that were not considered appropriate;	N/A
	3.1.14	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	Section 8.3
	3.1.15	Any conditions to which this statement is subjected.	Section 8.2
3.2	The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr where relevant.		✓
3.3	A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.		

1. INTRODUCTION

1.1. Introduction

The Applicant, Doornhoek (Pty) Ltd, is proposing the construction of a photovoltaic (PV) solar energy facility (known as the Doornhoek 2 PV facility) located on a site approximately 11km north of Klerksdorp in the North West Province. The solar PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 50MW. The development area is situated within the City of Matlosana Local Municipality within the Dr Kenneth Kaunda District Municipality. The site is accessible via an existing district road located adjacent to the east of the development area.

The proposed Doornhoek 2 PV facility and associated infrastructure will be located on Portion 18 of the Farm Doornhoek No. 372-IP. The project site is located within the Klerksdorp Renewable Energy Development Zones (REDZ), and therefore, a Basic Assessment (BA) process will be undertaken in accordance with GN R114 (as formally gazetted on 16 February 2018).

An additional up to 115MW PV facility (Doornhoek 1 PV Facility) is concurrently being considered on the same property and is being assessed through a separate Basic Assessment (BA) process.

The proposed Doornhoek 2 PV Facility will cover approximately 80ha and will include the following infrastructure:

- PV modules and mounting structures
- Inverters and transformers
- Battery Energy Storage System (BESS)
- Site and internal access roads (up to 8m wide)
- Operation and Maintenance buildings including a gate house and security building, control centre, offices, warehouses and workshops for storage and maintenance.
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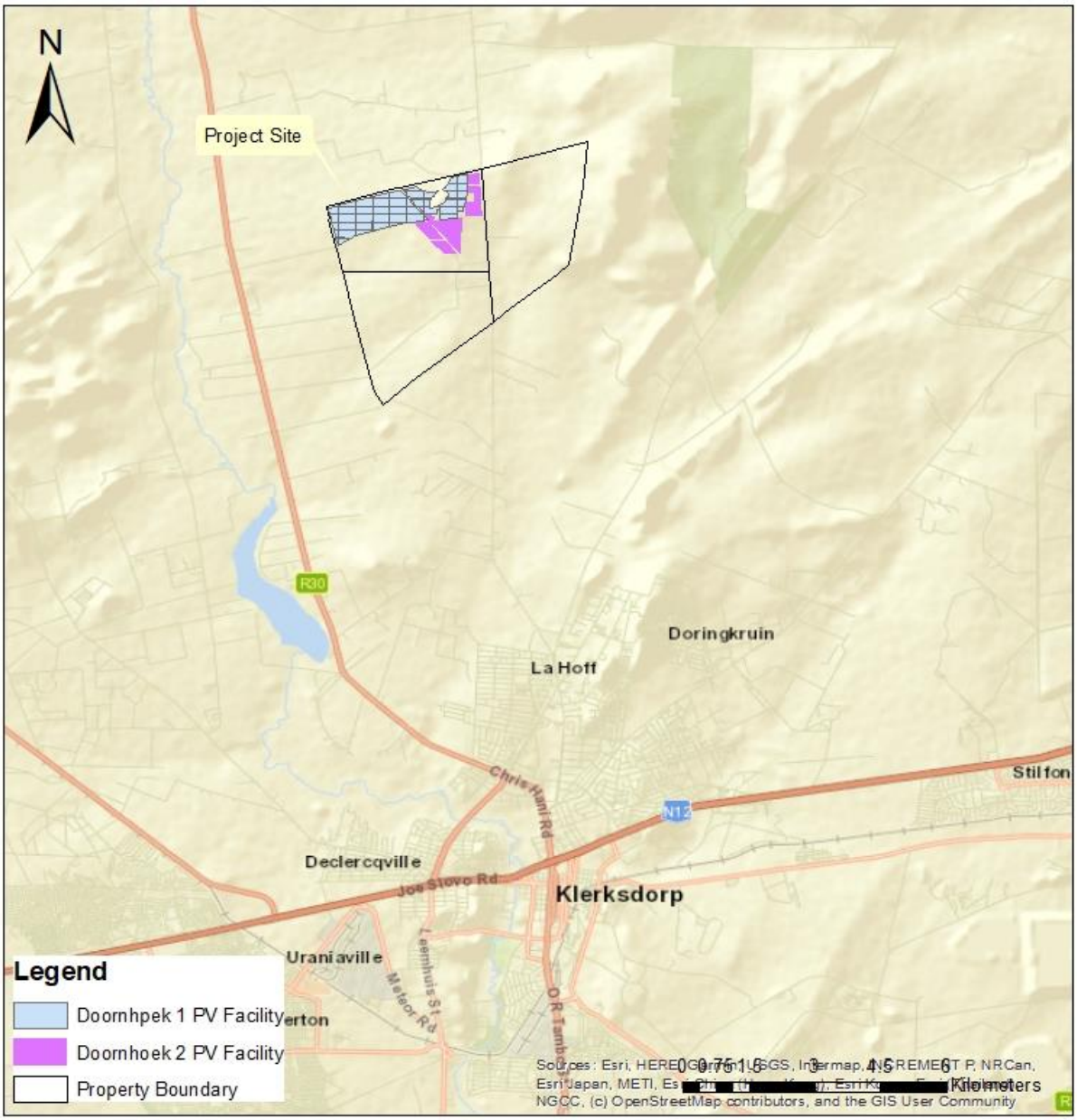

Figure 1.1: Locality map showing the project site (Doornhoek 2) in relation to the town of Klerksdorp and the other PV facility Doornhoek 1

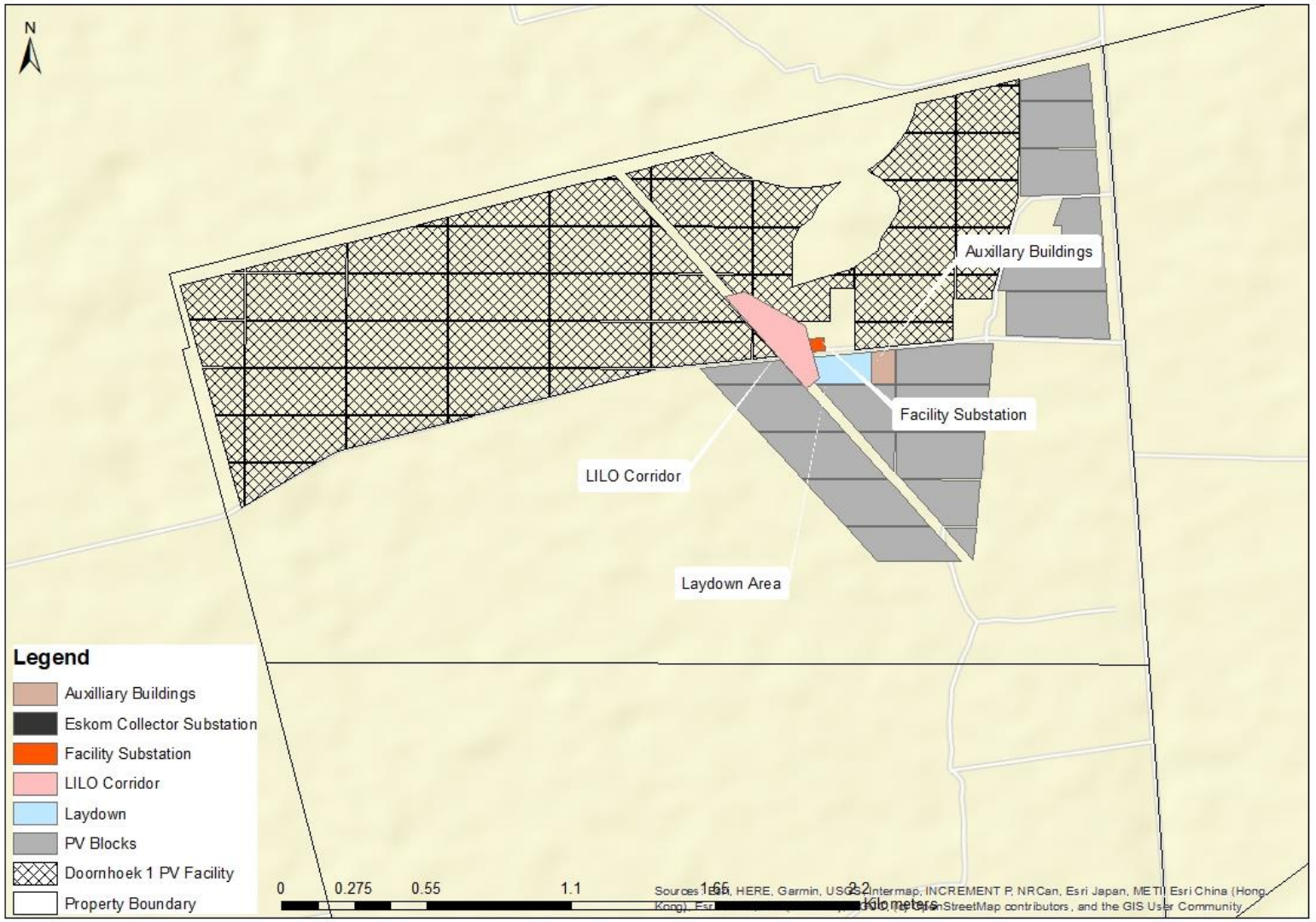

Figure 1.2: Map illustrating the infrastructure layout for the Doornhoek 2 PV Facility. Doornhoek 1 PV facility (cross hatched) has been shown for context.

1.2. Objectives

The objectives of the ecological assessment are as follows:

- Undertake a desktop assessment of the site to determine its sensitivity and species of conservation concern (SCC) that could be present within the site.
- Undertake a field survey, to record the following information:
    - Species present
    - Identification of species that are either protected (TOPS and PNCO) or considered threatened (CR, EN, VU) on the South African Red Data List
    - Assess the level of degradation/ecological status of the site (i.e. intact, near natural, transformed).
- Assess the sensitivity of each site using the sensitivity analysis outlined in the Species Guideline Document (2021).
- For areas of moderate and high sensitivity, assess the impact that the construction of the project infrastructure will have on the vegetation and plant SCC.
- Where necessary, provide mitigation measures to reduce the impact of the infrastructure on the environment.
- Provide a specialist statement/opinion.

1.3. Limitations and Assumptions

This report is based on current available information and, as a result, the following limitations and assumptions are implicit:

- Species of Conservation Concern (SCC) are difficult to find and may be difficult to identify, thus species described in this report do not comprise an exhaustive list. It is almost certain that additional SCCs are present.
- Sampling could only be carried out at one stage in the annual or seasonal cycle. The survey was conducted in late spring when most plants were starting to flower. Some grasses may have gone undetected. However, the time available in the field, and information gathered during the survey was sufficient to provide enough information to determine the status of the affected area.
- This assessment includes plants, mammals (excluding bats), amphibians and reptiles. It does not include birds, bats or invertebrates.
- The faunal assessment is based on a desktop survey and available habitat was confirmed by the botanical and aquatic specialist that conducted a field assessment.

2. METHODOLOGY

2.1. Project Area

The “project area” or “impacted project site” is defined as the area that will be directly impacted by project infrastructure such as the developable areas, pipelines, roads, electrical and fibre lines.

The project area of influence (PAOI) refers to the broader area around the project area that may be indirectly impacted by project activities.

2.2. Desktop Assessment

2.2.1. Flora

A desktop assessment was undertaken prior to the site visit to determine the vegetation types present, identify species of conservation concern that might occur on site and identify the threat and conservation status of the project site. Key resources were consulted including:

- The DFFE screening report for the site.
- The South African Vegetation Map (Mucina and Rutherford, 2018).
- The North West Biodiversity Spatial Plan (2015).
- The Red List of Ecosystems (SANBI, 2021).
- National Biodiversity Management: Biodiversity Act (NEMBA) List of Threatened or Protected Species.
- The National Biodiversity Assessment (SANBI, 2018).
- The Plants of Southern Africa (POSA) database.
- iNaturalist.

A species list was compiled for the site and the likelihood of occurrence assessed for species listed as Critically Endangered, Endangered, Vulnerable and Near Threatened (Section 4.5.1 and Appendix 2).

2.2.2. Fauna

The known diversity of the vertebrate fauna (excluding birds and bats) in the project area was determined by a literature review. Species known from the region, or from adjacent regions whose preferred habitat(s) were known to occur within the study area, were also included. Literature sources included:

- Amphibians –Du Preez & Carruthers (2017), FrogMap (ADU, 2021)
- Reptiles – Branch (1998), ReptileMap (ADU, 2021),
- Mammals – Stuart & Stuart (2014), MammalMap (ADU, 2021).

To establish which of those species identified in the literature review are Species of Conservation Concern (SCC), the following sources were consulted:

- Atlas and Red List of Reptiles of South Africa, Lesotho and Swaziland (Bates *et al*., 2014)
- Atlas and Red List of Frogs of South Africa, Lesotho and Swaziland (Minter *et al*., 2004)
- Red List of Mammals of South Africa, Swaziland and Lesotho.
- CITES Appendix I and II

2.3. Field Survey

A field survey was undertaken during the early flowering season from the 1-2 November 2021. The purpose of the survey was to assess the site-specific botanical state of the project area by recording the species present (both indigenous and alien invasive species), identifying sensitive ecosystems such as rocky outcrops, riparian areas or areas with species of conservation concern, and identifying the current land use.

The project site was walked and sample plots were analysed by determining the dominant species in each plot, as well as any alien invasive species and potential SCC occurring within the plots. Each sample plot was sampled until no new species were recorded. Vegetation communities were then described according to the dominant species recorded from each type, and these were mapped and assigned a sensitivity score. Figure 2.1 illustrates the location of the sample plots.

2.4. Site Sensitivity Assessment

The Species Environmental Assessment guideline (SANBI, 2020) was applied to assess the Site Ecological Importance (SEI) of the project area. The habitats and the species of conservation concern in the project area were assessed based on their conservation importance, functional integrity and receptor resilience (Table 2.1). The combination of these resulted in a rating of SEI and interpretation of mitigation requirements based on the ratings.

The sensitivity map was developed using available spatial planning tools as well as by applying the SEI sensitivity based on the field survey.

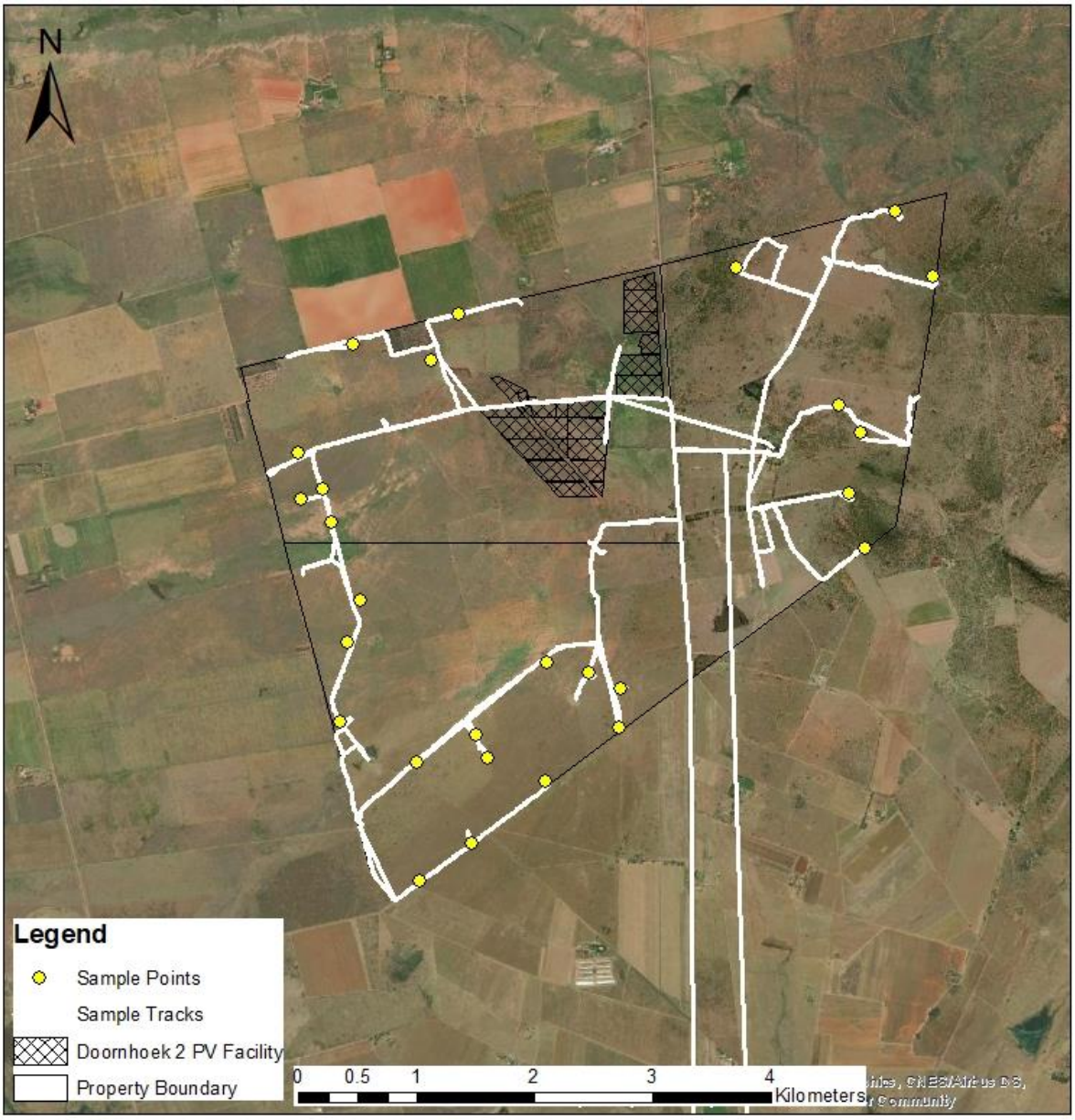

Figure 2.1: Sample site map showing sample sites and tracks

Table 2.1: Criteria for establishing Site Ecological importance and description of criteria

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

2.5. Description of impact analysis methodology used

To ensure a balanced and objective approach to assessing the significance of potential impacts, a rating scale developed by CES has been developed in accordance with the requirements outlined in Appendix 1 of the EIA Regulations (2014 and subsequent 2017 & 2021 amendments).

Impact significance pre-mitigation

This rating scale adopts six key factors to determine the overall significance of the impact prior to mitigation:

1. **Nature of impact:** Defines whether the impact has a negative or positive effect on the receiving environment.
2. **Type of impact:** Defines whether the impact has a direct, indirect or cumulative effect on the environment.
3. **Duration:** Defines the relationship of the impact to temporal scales. The temporal scale defines the significance of the impact at various time scales as an indication of the duration of the impact. This may extend from the short-term (less than 5 years, equivalent to the construction phase) to permanent. Generally, the longer the impact occurs the greater the significance of any given impact.
4. **Extent:** Describes the relationship of the impact to spatial scales i.e. the physical extent of the impact. This may extend from the local area to an impact that crosses international boundaries. The wider the spatial scale the impact extends, the more significant the impact is considered to be.
5. **Probability:** Refers to the likelihood (risk or chance) of the impact occurring. While many impacts generally do occur, there is considerable uncertainty in terms of others. The scale varies from unlikely to definite, with the overall impact significance increasing as the likelihood increases.

6. **Severity or benefits:** The severity/beneficial scale is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on the receiving environment. The severity of an impact can be evaluated prior and post mitigation to demonstrate the seriousness of the impact if it is not mitigated, as well as the effectiveness of the mitigation measures. The word 'mitigation' does not only refer to 'compensation', but also includes concepts of containment and remedy. For beneficial impacts, optimization refers to any measure that can enhance the benefits. Mitigation or optimisation should be practical, technically feasible and economically viable.

For each impact, the duration, extent and probability are ranked and assigned a score. These scores are combined and used to determine the overall impact significance prior to mitigation. They must then be considered against the severity rating to determine the overall significance of an activity. This is because the severity of the impact is far more important than the other three criteria. The overall significance is either negative or positive (Criterion 1) and direct, indirect or cumulative (Criterion 2).

Table 2.2: Evaluation Criteria.

Duration (Temporal Scale)		
Short term	*Less than 5 years*	
Medium term	*Between 5-20 years*	
Long term	*Between 20 and 40 years (a generation) and from a human perspective also permanent*	
Permanent	*Over 40 years and resulting in a permanent and lasting change that will always be there*	
Extent (Spatial Scale)		
Localised	*At localised scale and a few hectares in extent*	
Study Area	*The proposed site and its immediate environs*	
Regional	*District and Provincial level*	
National	*Country*	
International	*Internationally*	
Probability (Likelihood)		
Unlikely	*The likelihood of these impacts occurring is slight*	
May Occur	*The likelihood of these impacts occurring is possible*	
Probable	*The likelihood of these impacts occurring is probable*	
Definite	*The likelihood is that this impact will definitely occur*	
Severity Scale	*Severity*	*Benefit*

Very Severe/ Beneficial	An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated.	A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit.
Severe/ Beneficial	Long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some combination of these.	A long-term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these.
Moderately severe/Beneficial	Medium to long term impacts on the affected system(s) or party (ies), which could be mitigated.	A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way.
Slight	Medium- or short-term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary.	A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.
No effect/don't or can't know	The system(s) or party(ies) is not affected by the proposed development.	In certain cases, it may not be possible to determine the severity of an impact.

** In certain cases, it may not be possible to determine the severity of an impact thus it may be determined: Don't know/Can't know.*

Table 2.3: Description of Overall Significance Rating

Significance Rate		*Description*
Don't Know		*In certain cases, it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information.*
NO SIGNIFICANCE		*There are no primary or secondary effects at all that are important to scientists or the public.*
LOW NEGATIVE	***LOW POSITIVE***	*Impacts of low significance are typically acceptable impacts for which mitigation is desirable but not essential. The impact by itself is insufficient, even in combination with other low impacts, to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural environment or on social systems.*
MODERATE NEGATIVE	**MODERATE POSITIVE**	*Impacts of moderate significance are impacts that require mitigation. The impact is insufficient by itself to prevent the implementation of the project but in conjunction with other impacts may prevent its implementation. These impacts will usually result in a negative medium to long-term effect on the natural environment or on social systems.*
HIGH NEGATIVE	***HIGH POSITIVE***	*Impacts that are rated as being high are serious impacts and may prevent the implementation of the project if no mitigation measures are implemented, or the impact is very difficult to mitigate. These impacts would be considered by society as constituting a major and usually long-term change to the environment or social systems and result in severe effects.*
VERY HIGH NEGATIVE	***VERY HIGH POSITIVE***	*Impacts that are rated as very high are very serious impact which may be sufficient by itself to prevent the implementation of the project. The impact may result in permanent change. Very often these impacts are unmitigable and usually result in very severe effects or very beneficial effects.*

Impact significance post-mitigation

Once mitigation measures are proposed, the following three factors are then considered to determine the overall significance of the impact after mitigation.

1. **Reversibility Scale**: This scale defines the degree to which an environment can be returned to its original/partially original state.
2. **Irreplaceable loss Scale:** This scale defines the degree of loss which an impact may cause.
3. **Mitigation potential Scale:** This scale defines the degree of difficulty of reversing and/or mitigating the various impacts ranges from very difficult to easily achievable. Both the practical feasibility of the

measure, the potential cost and the potential effectiveness is taken into consideration when determining the appropriate degree of difficulty.

Table 2.4: Post-mitigation Evaluation Criteria

Reversibility	
Reversible	*The activity will lead to an impact that can be reversed provided appropriate mitigation measures are implemented.*
Irreversible	*The activity will lead to an impact that is permanent regardless of the implementation of mitigation measures.*
Irreplaceable loss	
Resource will not be lost	*The resource will not be lost/destroyed provided mitigation measures are implemented.*
Resource will be partly lost	*The resource will be partially destroyed even though mitigation measures are implemented.*
Resource will be lost	*The resource will be lost despite the implementation of mitigation measures.*
Mitigation potential	
Easily achievable	*The impact can be easily, effectively and cost effectively mitigated/reversed.*
Achievable	*The impact can be effectively mitigated/reversed without much difficulty or cost.*
Difficult	*The impact could be mitigated/reversed but there will be some difficultly in ensuring effectiveness and/or implementation, and significant costs.*
Very Difficult	*The impact could be mitigated/reversed but it would be very difficult to ensure effectiveness, technically very challenging and financially very costly.*

The following assumptions and limitations are inherent in the rating methodology:

- Value Judgements: Although this scale attempts to provide a balance and rigor to assessing the significance of impacts, the evaluation relies heavily on the values of the person making the judgment.
- Cumulative Impacts: These affect the significance ranking of an impact because it considers the impact in terms of both on-site and off-site sources. This is particularly problematic in terms of impacts beyond the scope of the proposed development. For this reason, it is important to consider impacts in terms of their cumulative nature.
- Seasonality: Certain impacts will vary in significance based on seasonal change. Thus, it is difficult to provide a static assessment. Seasonality will need to be implicit in the temporal scale, with management measures being imposed accordingly (e.g. dust suppression measures being implemented during the dry season).

3. BIOPHYSICAL DESCRIPTION

3.1. Climate

Klerksdorp is characterised by a semi-arid climate that receives an average of 610mm per year (Climate-data.org, 2022). The majority of the rainfall occurs between the months of November and March with the highest rainfall occurring in December.

The average annual temperature for Klerksdorp is 18.1 °C. Temperatures range from maximums of 29^0C in November and December to a minimum of 3^0C in July.

3.2. Topography

The project site is relatively flat with a gentle slope from an east to westerly direction with a change in elevation from 1369 masl to 1403 masl (difference of 34m) (Figure 3.1 and 3.2).

Figure 3.1: Photograph illustrating the general topography at the project site

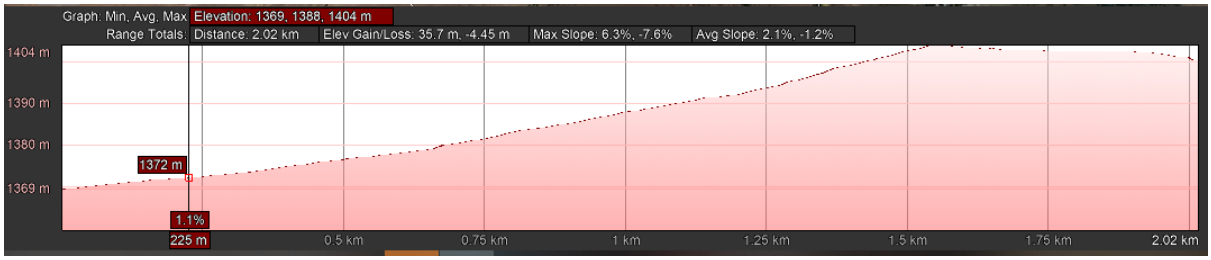

Figure 3.2: Elevation Profile of the site west to east

3.3. Soils and Geology

The Ventersdorp Supergroup underlies the project site and is comprised of the Klipriviersberg Group, Plat-berg Group, and Pniel Group which are of igneous origin. The underlying geology gives rise to eutrophic, red Hutton soils which are typically loose and structureless making them favourable for the cultivation of crops.

3.4. Hydrology

The project site is located east of the Skoonspruit River and north of the Rietgatspruit River (Figure 3.3). The aquatic assessment determined that there were no true wetlands directly within the solar PV sites (Pers. Comm: Amanda Mileson, 2022). There is a valley bottom wetland to the east of the project site and two preferential surface flow paths within 500m of the project site. These two areas form the headwater of the wetlands to the east but lack distinct soil and floral indicators associated with wetlands. They can however be considered moist grassland (Pers. Comm: Amanda Mileson, 2022). It is recommended that the aquatic impact assessment is consulted for the further details on the aquatic environment associated with the project site.

3.5. Current Land Use

The project site is currently used to graze livestock, specifically cattle. Previously, areas were used to grow maize but these have since been left fallow and allowed to return to grassland (Pers Comm, Neil Orford (landowner)). Aerial imagery from 1991 and 2002 indicate the northern boundary of the property, where Doornhoek 1 infrastructure will be located, was previously cultivated and the area where Doornhoek 2 is located show evidence of disturbance (Figure 3.4).

According to the SAPAD spatial planning tool, the project site is also a designated Private Nature Reserve.

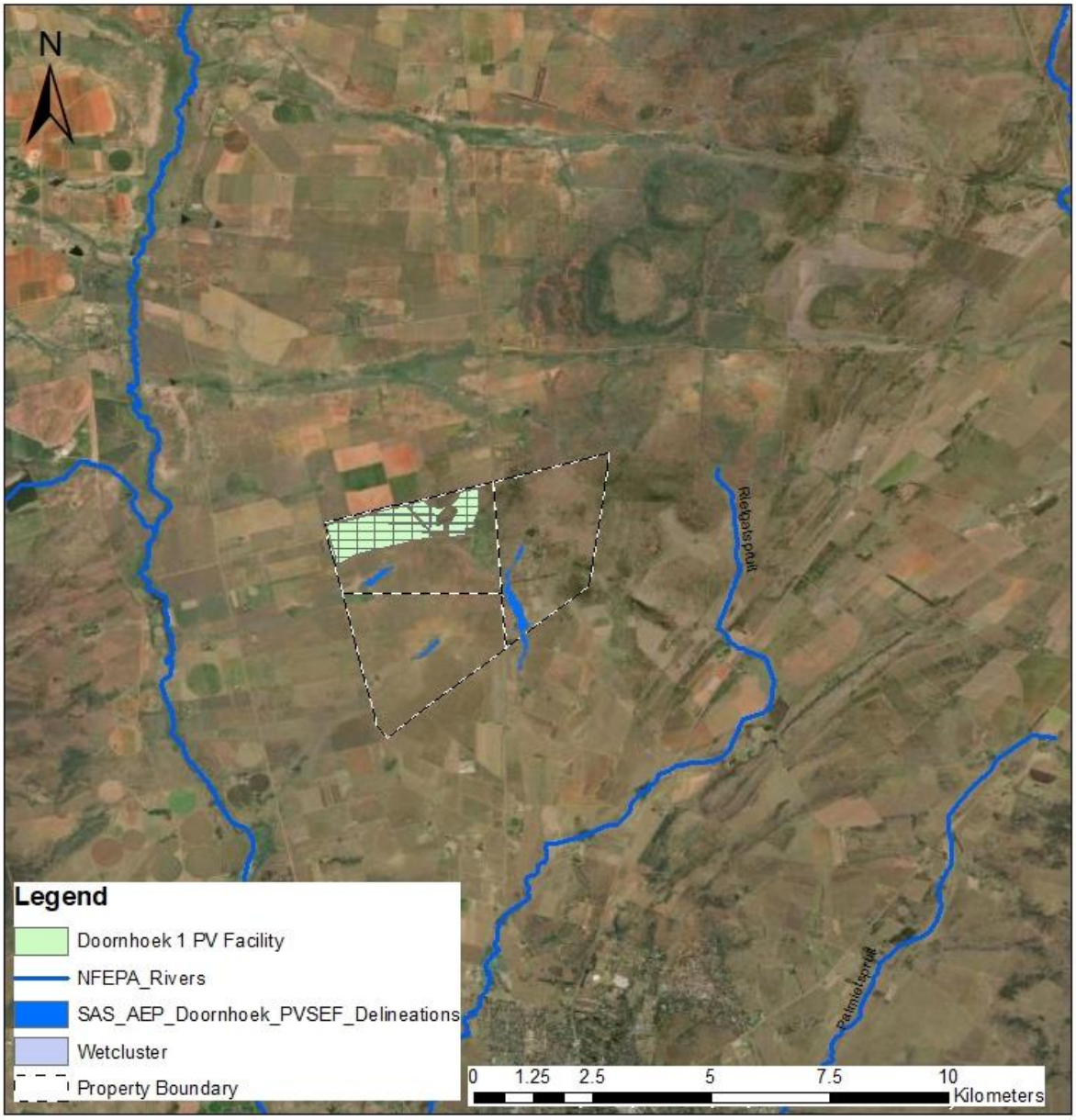

Figure 3.3: Hydrology map of the project site

Figure 3.4: Aerial imagery showing the project site located on land previously used for agriculture.

4. VEGETATION AND FLORISTICS

The project site occurs within the Grassland Biome, which in South Africa, occurs mainly in the high central plateaus (Highveld), inland areas of the eastern seaboard, mountainous areas of Kwa-Zulu Natal and central parts of the Eastern Cape (Mucina *et al.*, 2006). Grasslands are structurally simple and strongly dominated by grass (Poaceae) species although forbs also form an important component. Woody species are usually limited to specific niche habitats.

4.1. Description of the vegetation

Vegetation types and distributions are described based on the National Vegetation Map (Figure 4.1) and data gathered during the field survey (Figure 4.4).

4.1.1. Vaal-Vet Sandy Grassland

This vegetation type occurs in the North West and Free State Provinces from Lichtenberg to Klerksdorp (Mucina *et al.*, 2006). It is typically found on plains and is characterised by low-tussock grasslands dominated by *Themeda triandra.* In areas that are overgrazed, *T. triandra* is typically replaced by *Elionurus muticus, Cymbopogon pospischelli and Aristida congesta* (Figure 4.2).

This vegetation type is listed as Endangered with a conservation target of 24%. This vegetation type is not protected with only 0.3% statutorily conserved and over 63% transformed for cultivation. The remaining areas are under grazing pressure from livestock (RLE, 2021).

This vegetation type occurs along the western boundary of the property portion and is currently used to graze cattle (Figure 4.4). Species diversity is generally low and comprised of grass species such as *Themeda triandra*, *Elionurus muticus* and *Aristida congesta* interspersed with clumps of *Aloe greatheadii* in areas that were previously disturbed.

4.1.2. Klerksdorp Thornveld

Klerksdorp Thornveld occurs in the North West province occurring on plains and undulating plains and is characterised by open to dense *Vachellia karroo* bush clumps in dry grassland (Mucina *et al.*, 2006). Other common trees associated with this vegetation type include *Senegalia caffra, Celtis Africana, Searsia lancea, Ziziphus mucronata* and low shrubs include *Asparagus species, Helichrysum dregeanum, Felicia muricata, Gomphocarpus fruticosa*. Grass species present are similar to that found within the Vaal-vet Sandy Grassland.

This vegetation type is listed as Least Concern and has a conservation target of 24%. Only about 2.5% is statutorily conserved and it is therefore listed as poorly protected (RLE, 2021).

This is the dominant vegetation type occurring in the centre and eastern portion of the proposed project site (Figure 4.4). This vegetation type on site is comprised of scattered clumps of *Vachellia*

karroo with patches of *Searsia lancea* occurring within disturbed sites. There is a well grazed grass understory (*Setaria sphacelata, Eragrostis superba, Aristida sp.* and some *Themeda triandra)* interspersed with species such as *Senecio inaequidens* and patches of *Aloe greatheadii.* The habitat is characterised by a relatively low diversity throughout most of the site.

4.1.3. Previously Cultivated Land

There are areas of previously cultivated land within the site. These areas have been left fallow and returned to grassland that still exhibits evidence of disturbance with a lower species diversity than semi-intact areas.

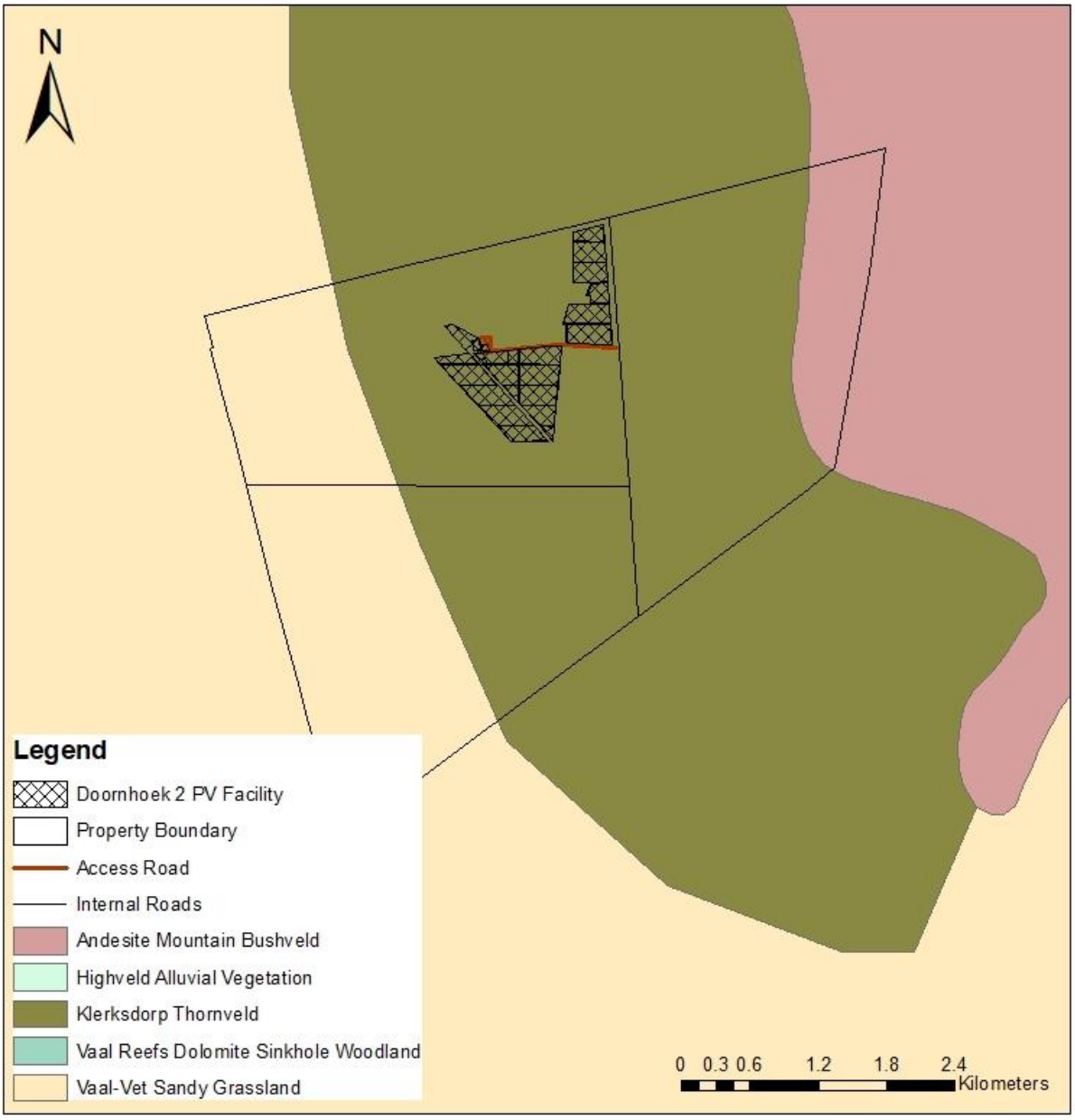

Figure 4.1: National vegetation map for the project site

Figure 4.2: Vaal-vet Grassland found within the project site

Figure 4.3: Klerksdorp Thornveld found within the project site

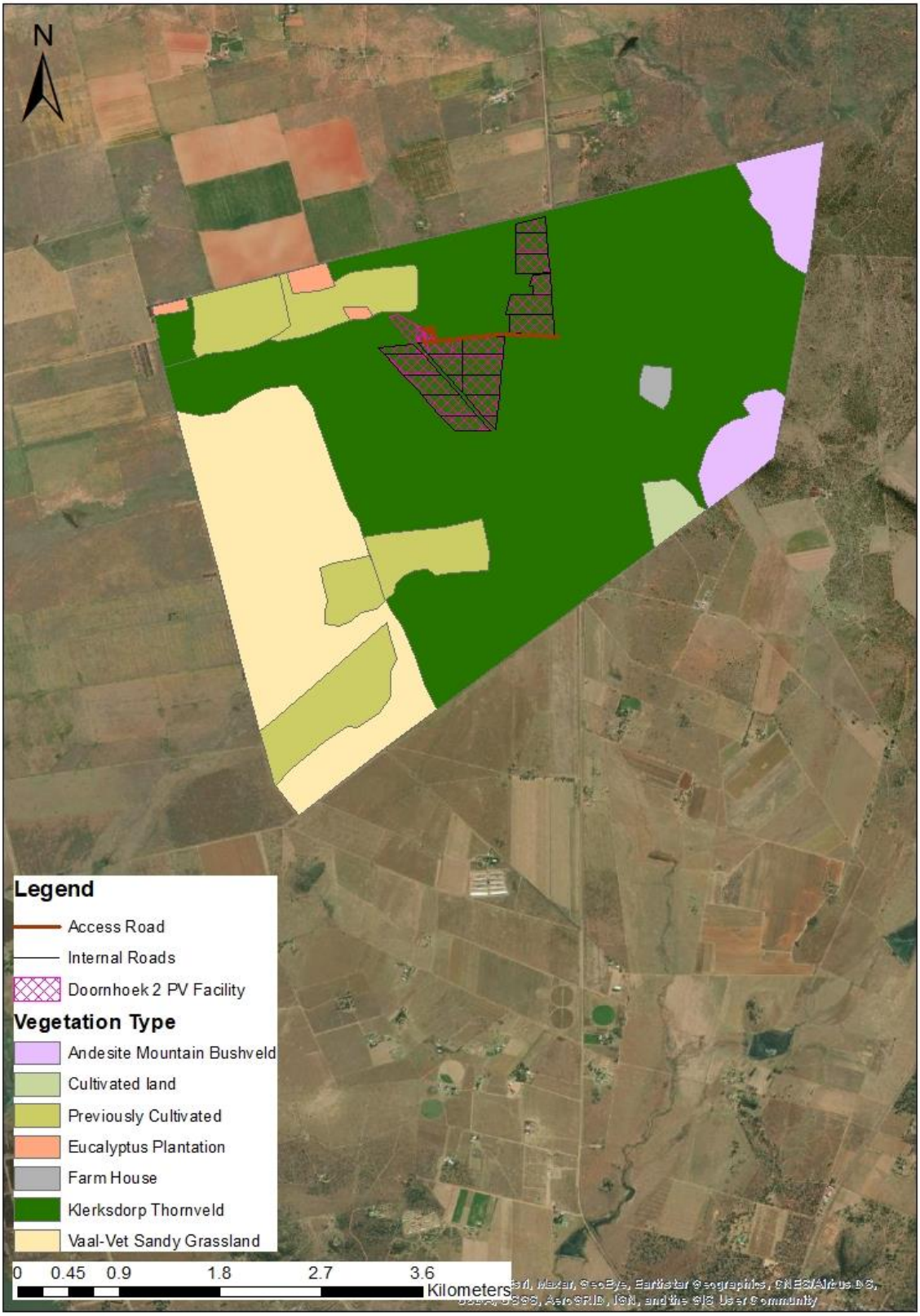

Figure 4.4: Vegetation map for the project site based on data gathered from the field survey

4.2. Floristics

Thirty-five species were recorded within the project site and area of influence (Table 4.1). Of these thirty-five species, one is an alien invasive species, three are listed as a Schedule 4 species and thirty-two are listed as Least Concern on the South African Red Data List .

Table 4.1: Species recorded on site and their conservation status

Family	Scientific name	Red List	TOPS	PNCO
HYACINTHACEAE	*Albuca setosa*	Least Concern	-	-
ASPHODELACEAE	*Aloe greatheadii*	Least Concern	-	Schedule 4
AMARYLLIDACEAE	*Ammocharis coranica*	Least Concern	-	Schedule 4
SCROPHULARIACEAE	*Aptosimum elongatum*	Least Concern	-	-
APOCYNACEAE	*Asclepias stellifera*	Least Concern	-	-
ASPARAGACEAE	*Asparagus sp.*	Least Concern	-	-
AMARYLLIDACEAE	*Boophone disticha*	Least Concern	-	Schedule 4
ASPHODELACEAE	*Bulbine cf narcissifolia*	Least Concern	-	-
ASPHODELACEAE	*Bulbine favosa*	Least Concern	-	-
APOCYNACEAE	*Carissa bispinosa*	Least Concern	-	-
VERBENACEAE	*Chascanum hederaceum*	Least Concern	-	-
BORAGINACEAE	*Ehretia rigida*	Least Concern	-	-
POACEAE	*Eragrostis superba*	Least Concern	-	-
EBENACEAE	*Euclea crispa*	Least Concern	-	-
MALVACEAE	*Grewia flava*	Least Concern	-	-
HYPOXIDACEAE	*Hypoxis hemerocallidea*	Least Concern	-	-
THYMELAEACEAE	*Lasiosiphon capitatus*	Least Concern	-	-
HYACINTHACEAE	*Ledebouria inquinata*	Least Concern	-	-
HYACINTHACEAE	*Ledebouria luteola*	Least Concern	-	-
OLEACEAE	*Olea europaea subsp. Africana*	Least Concern	-	-
CACTACEAE	*Opuntia ficus-indica*	Category 1b invasive	-	-
PLANTAGINACEAE	*Plantago lanceolata*	Least Concern	-	-
ANACARDIACEAE	*Searsia cf leptodictya*	Least Concern	-	-
ANACARDIACEAE	*Searsia lancea*	Least Concern	-	-
ANACARDIACEAE	*Searsia pyroides*	Least Concern	-	-
ASTERACEAE	*Senecio inaequidens*	Least Concern	-	-
FABACEAE	*Senegalia hereroensis*	Least Concern	-	-
POACEAE	*Setaria sphacelata*	Not Evaluated	-	-
ASTERACEAE	*Stoebe plumosum*	Least Concern	-	-
POACEAE	*Themeda triandra*	Least Concern	-	-
FABACEAE	*Vachellia karroo*	Least Concern	-	-
RHAMNACEAE	*Ziziphus zeyheriana*	Least Concern	-	-
POACEAE	*Cynadon dactylon*	Least Concern	-	-
POACEAE	*Aristida sp.*	Least Concern	-	-
POACEAE	*Cymbopogon sp.*	Least Concern	-	-

4.3. Species of Conservation Concern

A list of species of conservation concern that could occur within the project site was compiled during the desktop study. This list draws on records from the POSA database, the DFFE screener and records from iNaturalist. One species of conservation (Sensitive species 1261[1]) concern was listed by the DFFE screening report and one near threatened (NT) species (*Pearsonia bracteata*) was listed on the POSA website as occurring within the area. The likelihood of occurrence for each species was assessed by comparing the habitat preference of each species to the available habitat within the project area. Where there was a high likelihood of occurrence, the distribution of each species was also assessed.

Table 4.2: Likelihood of occurrence of SCC identified during the desktop assessment

Species	Conservation Status	Likelihood of Occurrence	Comment
Pearsonia bracteata	Near Threatened	Moderate	This species is known from 8-14 locations between Wolkberg and Pretoria to Klerksdorp and is associated with plateau grassland (von Staden, 2011). Available habitat on site is degraded and heavily grazed and as such the likelihood of occurrence of this species is moderate.
Sensitive species 1261	Vulnerable	Moderate	This species occurs from Lichtenberg to Wolmaransstad and Sasolburg and is associated with sandy loam soils in thornveld and Themeda grassland. Available habitat on site is degraded and heavily grazed and as such the likelihood of occurrence of this species is moderate.

4.4. Alien Species

Two alien invasive species (*Opuntia ficus-indica and Eucalyptus sp)* classified as Category 1b on the National Environmental Management: Biodiversity Act (2004) Alien Invasive Species Lists, 2020 was recorded within the project area. Project activities must not result in the further spread of these alien invasive species.

[1] To protect the identity of species that are susceptible to collection by poachers, best practice guidelines require that these species are referred to by their species number denoted by SANBI.

5. FAUNA

5.1. Amphibians

The project area is included in the distribution of 18 amphibian species of which 14 have been confirmed within the same QDS as the project area (IUCN 2022, FitzPatrick 2022) (Appendix 2). No amphibians were observed during the field survey.

One SCC has a distribution which includes the project area, namely, the Giant Bull Frog (*Pyxicephalus adspersus*) which was listed as regionally Near-Threatened (Minter, et al., 2004) but has since been downgraded to Least Concern by the IUCN SSC Amphibian Specialist Group (IUCN, 2013). For this reason this species has not been included in the species assessment guidelines (SANBI, 2021).

5.2. Reptiles

The North West Province hosts 57 reptile species of which one is listed as vulnerable and three are endemic (IUCN, 2022). Approximately 53 of these reptile species have a distribution range that includes the project area of which 32 have been observed within the same QDS as the project area (Appendix 3) (IUCN 2022, ReptileMAP 2022). The landowner reported the presence of venomous snakes on the farm including the Cape Cobra (*Naja nivea*) and Puff Adder (*Bitis arietans*).

No reptile SCC have a distribution range which includes the project area.

Reptiles that inhabit the site will likely move out of the immediate area and into the adjacent remaining habitat during construction. Given there will likely be minimal and intermittent operational disturbance reptiles are likely to reinhabit the project are following construction.

5.3. Mammals

The QDS within which the project area occurs has confirmed the historical occurrence of 65 mammal species of which 55 could occur within the project area, namely, nine antelope species, 18 carnivore species, two primate species, four hare species, nine rodent species and the Aardvark, Hyrax, shrew and hedgehog species. (FitzPatrick 2022) (Appendix 4). Mammal species recorded during the field survey include the Warthog (*Phacochoerus africanus*), South African Ground Squirrel (*Xerus inauris*), Yellow Mongoose (*Cynictis penicillate*), Meerkat (*Suricata suricatta*) and Steenbok (*Raphicerus campestris*) (Figure 5.1). The farm hosted antelope including Blesbok (*Damaliscus pygargus phillipsi*), Eland (*Taurotragus oryx*) and Kudu (*Tragelaphus strepsiceros*). The farm owner reported the presence of Genet, Aardwolf (*Proteles cristata*) and Aardvark (*Orycteropus afer*). Small mammals, namely rodents, moles and hares are also expected to use the area.

Four vulnerable and seven near threatened mammal species have a distribution which includes the project area (Table 5.1). Of these species, only three (Southern African Hedgehog, Grey Rhebok and

Serval) have a high likelihood of occurrence within the PAOI. Since the Serval is typically associated with watercourses and the rhebok with ridges, the likelihood that the project will have a direct impact on these species' habitat is low. The hedgehog prefers dense vegetation and rocky outcrops for nesting and foraging and as such the likelihood of it using the project site is low as neither of these habitat requirements are present.

Figure 5.1: Photographs of Ground Squirrels and Steenbok observed during the field survey.

Table 5.1: SCC with a distribution that includes the project area

Species name	Conservation status		Habitat	Likelihood of occurrence
	National (Child et al., 2019)	Global (IUCN)		
Maquassie (Makwassie) Musk Shrew (*Crocidura maquassiensis*)	VU	LC	EOO: 284,735 km^2 AOO: Between 1,790km^2 (32m buffer) to 47,246 km^2 (500 m buffer) according to EWT, however, the SANBI guidelines state an AOO of 0.72km^2. Population: 179,000 individuals Rare species, recorded only from disparate localities. Little is known about the habitats and ecology of this species. However, this near endemic species is known to inhabit wetlands, moist grasslands and grasslands. It may tolerate a wider range of habitats as is has been found in rocky or montane grassland, coastal forest, mixed bracken and grassland alongside a river and a garden. It has not been recorded in the NW Province post-1999 despite the type specimen originating from Maquassie (1928) approximately ±85km SW of Klerksdorp. (Taylor et al., 2016, Cassola, 2016)	Moderate Within the moist areas of the PAOI. Such as the valley bottom wetland to the east, the wetland to the west and the two preferential surface flow paths/ moist grassland identified within 500 m of the sites which form the headwaters of the wetlands to the west. (refer sasenvgroup, 2022)
Leopard (*Panthera pardus*)	VU	VU	Densely wooded and rocky areas are preferred habitat although across its distribution it has a wide habitat tolerance (grassland savannah, coastal scrub, shrubland and semidesert) (Swanepoel, *et al*., 2016; Stein, *et al*., 2020).	Low This species is unlikely to occur onsite permanently and may only use it for passage

				but if it does occur onsite it will likely inhabit the ridge
White-tailed Rat (*Mystromys albicaudatus*)	VU	VU	Population: 6,997-13,648. AOO: 3,719 km^2 0-3719m asl This species shows a preference for grasslands with shallow limestone substrate/calcrete soils living in burrows or crevices. Little is known about this species as it is difficult to sample. (Avenant, et al., 2016; Avenant, et al., 2019)	Moderate Within Grassland vegetation subject to burning.
Black-footed Cat (*Felis nigripes*)	VU	VU	<2,000 m asl These ground-dwellers use dens in hollowed out abandoned termite mounds as well as dens dug by springhares, ground squirrels and Aardvark in grass and dwarf shrub savannah, grassland and desert biomes with a MAR of 100 and 500 mm. This species is a specialist in open dry habitats with some vegetation cover. Prey includes mammals, birds, reptiles, amphibians and invertebrates. Large-eared Mouse (*Malacothrix typica*) forms a large part of their diet in arid areas. Population is estimated at 9,707 individuals and has a EOO of 930,000 km². This species will forage between 8.42±2.09 km from its den and individuals have a range of ±8.6–10 km² for females and ±16.1–20.7 km² for males. (Wilson, Sliwa & Drouilly , 2016; Sliwa, et al., 2016).	Moderate If present this species will likely inhabit the Grassland vegetation.

Grey Rhebok (*Pelea capreolus*)	NT	NT	Inhabit rocky hills, grassy mountain slopes, and plateau grasslands and require good grass cover for shelter (Taylor, Cowell & Drouilly, 2017; Taylor, et al., 2016).	High Recorded in 2013 in QDS 2626DA. If present this species will inhabit the ridge habitat
Serval (*Leptailurus serval*)	NT	LC	This species depends on vegetation boarding water sources such as wetlands, marshland, rank grass and vleis as well as well-watered savannah with long-grass. Servals prey on small mammals, birds, reptiles, fish, and rarely invertebrates. Their main diet consists of Vlei Rats (*Otomys sp.*) and Striped Mice (*Rhabdomys pumilio*). (Thiel, 2019; Ramesh, *et al*., 2016)	High Recorded in 2018 in QDS 2626DC. If present this species will likely inhabit areas along water courses.
Brown Hyena (*Hyaena brunnea*)	NT	NT	It is estimated that there are 800–2,200 individuals in SA with low occupancy of the Free State. Inhabits desert areas (<100 mm MAR), semi-desert, open scrub and open woodland savannah (<700 mm). Avoids developed areas but can survive close to them. (Wiesel, 2015; Yarnell, et al., 2016)	Low Minimal suitable habitat onsite but was recorded in 2014 in QDS (2626DA).
African Clawless Otter (*Aonyx capensis*)	NT	NT	0-3000m asl Provided freshwater (0.5–1.5 m deep) is available this species can occur in a variety of habitats. Permanent habitation is dependent on the availability of prey and shelter and females may exhibit territoriality in these areas. Although this species can tolerate high levels of pollution, eutrophication, and disturbance (traffic, dogs, etc) in developed areas this is only in moderation. (Jacques, Reed-Smith, & Somers, 2021; Okes, et al., 2016).	Moderate Recorded in 2018 in QDS (2626DA & 2626DC). If present in the project area this species will likely inhabit areas close to water sources.

Spotted-necked Otter (*Hydrictis maculicollis*)	NT	NT	0-2500m asl Habitat requirements include streams, rivers, lakes (natural & manmade) and open waters which are unpolluted and are not silted. Shelters along water edges with cover provided by boulders, reeds, long grass, dense bushes and overhanging trees. Feed predominantly on fish and occasionally crabs, frogs, insects (esp. dragonfly larvae) and birds. (Ponsonby, et al., 2016; Reed-Smith, Jacques & Somers, 2021).	Low If present this species will likely inhabit areas close to water sources.
Vlei Rat (*Otymys auratus*)	NT	NT	Inhabits mesic Highveld Grassland and associated with sedges and grasses adapted to densely vegetated wetlands with wet soils (Taylor, Baxter & Child, 2016).	Low If present this species will likely inhabit areas close to water sources.
Southern African Hedgehog (*Atelerix frontalis*)	NT	LC	800– 2000 m asl MAR 200–800 mm Nocturnal Inhabit semi-arid and sub-temperate habitats, including scrub brush, western Karoo, grassland, thornveld and suburban. It prefers dense vegetation and rocky outcrops that provide food, cover and nesting materials (Light, et al., 2016).	High Recorded in 2018 in QDS 2626DC Known to occur within the Vaal-Vet Sandy Grasslands and although Klerkdorp Thornveld was not listed it does occur in other types thornvelds (Kimberley & Queenstown).

6. SENSITIVITY ASSESSMENT

6.1. North West Biodiversity Spatial Plan

The North West Biodiversity Sector Plan (North West Department of Rural, Environment and Agricultural Development (DREAD), 2015) maps biodiversity priority areas, including Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and Other Natural Areas (ONAs) which require safeguarding to ensure the persistence of biodiversity and ecosystems functioning, through a systematic conservation planning process. It is important to note that Biodiversity Sector Plans are developed at relatively course scales using the best available spatial data. These maps therefore need to be verified at project level and the appropriate land use recommendation applied.

- CBA's are defined as "*terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services*." (DREAD, 2015). The provided map distinguishes between CBA 1 areas, which are those that are likely to be in a natural condition, and CBA 2 areas, which are areas that are potentially degraded or represent secondary vegetation. Subsequent to this publication, SANBI published guides for developing Critical Biodiversity Area maps. These guidelines require that degraded or secondary natural areas are classified as ESAs, and not CBAs.

- ESA's are "*terrestrial and aquatic areas that are not essential for meeting biodiversity representation targets (thresholds), but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree or extent of restriction on land use and resource use in these areas may be lower than that recommended for CBAs*." (DREAD, 2015). As with the CBAs, a distinction is made between ESA 1 that are areas in a natural, near natural or moderately degraded condition and ESA 2 which are degraded and need to be restored.

- ONAs are "*areas that still contain natural habitat but that are not required to meet biodiversity targets"* (DREAD, 2015).

According to the North West Biodiversity Sector Plan (2015), the footprint of this facility falls within a CBA 1 area. The CBA layer for the North West Biodiversity Spatial Plan does not include the underlying reason why areas have been selected as CBAs, however, it does provide a broad overview on the categories that triggered the CBA status. This has been used to provide comment on the impact of project infrastructure on the functioning of the CBA (Table 6.1).

Table 6.1: Comment on CBA status of the project site

CBA Category Triggered		Comment
T1	Critical Patches of Endangered Ecosystems	The project infrastructure has been positioned to avoid impacts on near-intact Vaal-Vet Sandy Grassland which is the endangered vegetation type within the CBA planning unit. Infrastructure has instead been located within the Klerksdorp Thornveld which is listed as Least Concern.
T7	Corridor	The CBAs in this region are extensive and appear to cover all remaining natural habitat (Figure 6.2). The infrastructure has been positioned on the edge of the CBA to limit the impact it will have on the functioning of the corridor, which is fairly wide. Project infrastructure will impact 80ha of the 1709ha wide corridor which is equivalent to 4.7% of the corridor that falls within the property boundary (Figure 6.1). If combined with the adjacent development (Doornhoek 1) the loss of corridor will be 10.8%. The objective of the corridor to maintain landscape connectivity can still be maintained within the property and species movement across the site is unlikely to be severely impacted by project infrastructure.
T8	Critical Corridor	

Project infrastructure will not impact the near-intact Vaal-Vet Sandy Grassland (listed as the Endangered vegetation type) as these areas have has been purposefully avoided by the applicant. The vegetation within the project footprint shows historical evidence of disturbance from grazing and trampling by livestock (refer to section 3.5).

By locating project infrastructure in previously disturbed Klerksdorp Thornveld, the functioning of the corridor has not been significantly impacted. Project infrastructure will result in the loss of 4.7% of the portion of corridor that occurs within the project site. The objective of the corridor to maintain landscape connectivity within the property can still be maintained and species movement across the site is unlikely to be severely impacted.

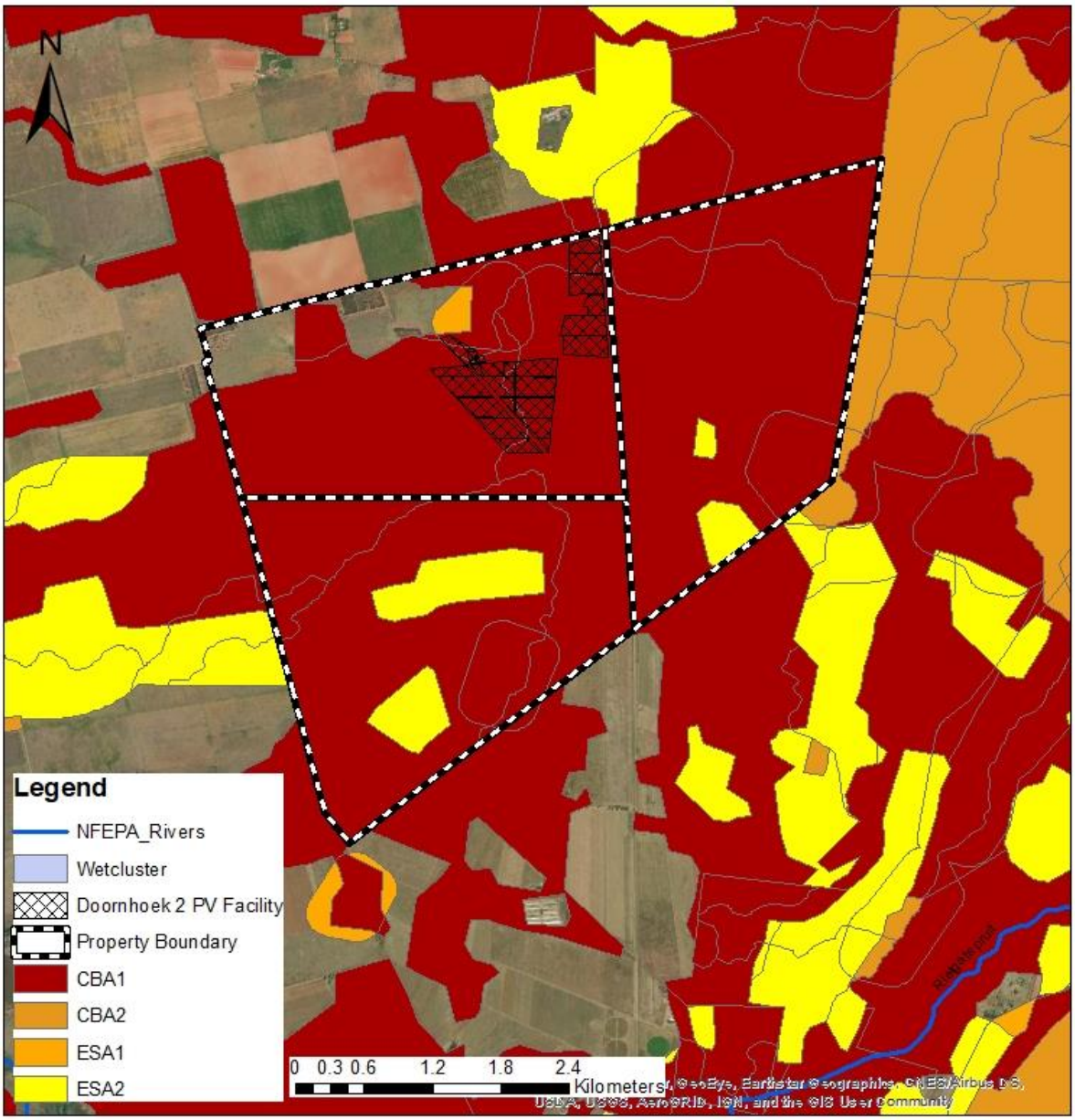

Figure 6.1: Map illustrating the project site in relation to CBAs and ESAs. A portion of the project site falls within a CBA1 area.

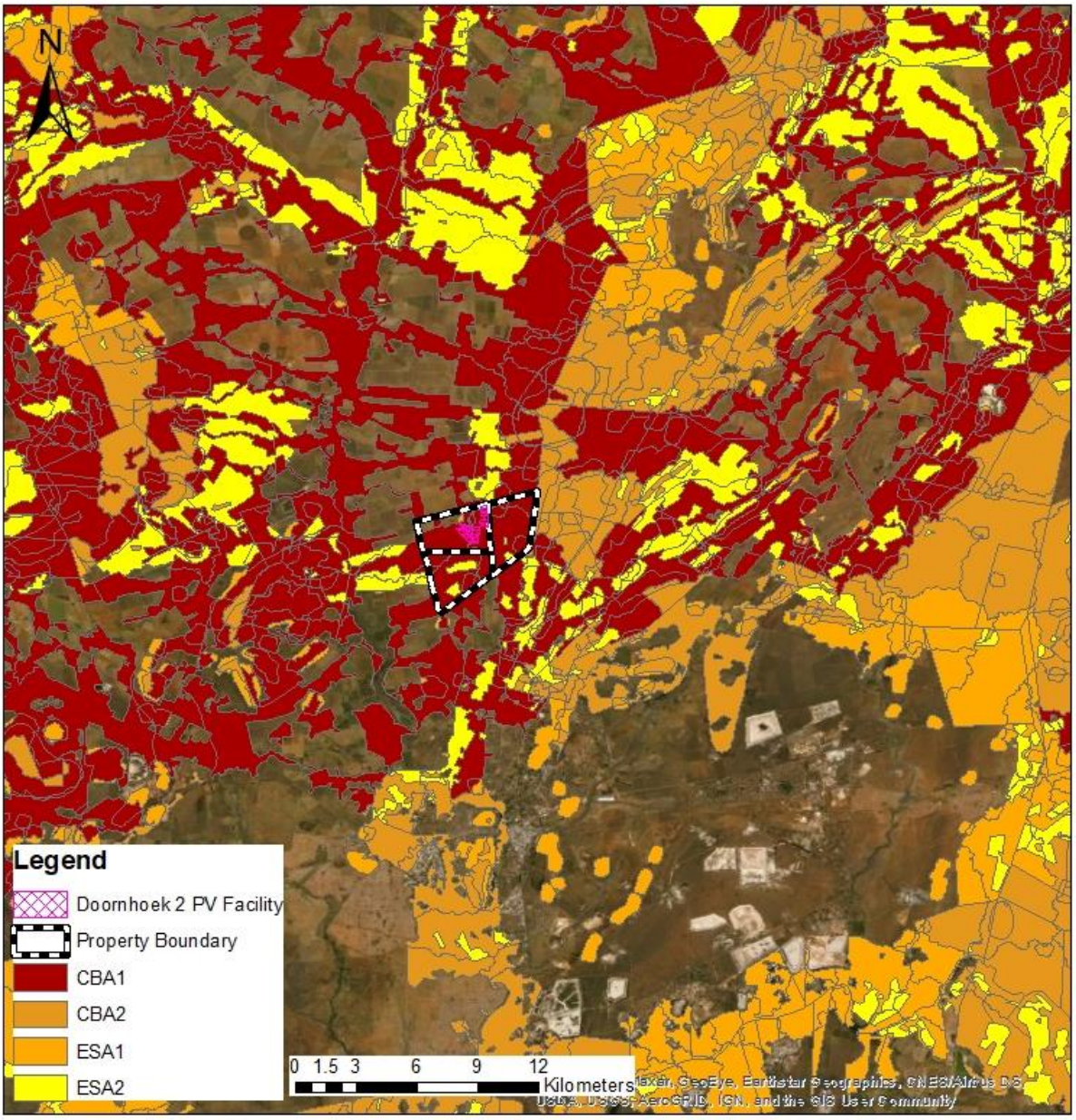

Figure 6.2: Map illustrating the project site (pink polygon) in relation to CBAs and ESAs in the broader region.

6.2. Site sensitivity

The Species Environmental Assessment guideline (SANBI, 2021) was applied to assess the Site Ecological Importance (SEI) of the project area. The habitats and the species of conservation concern in the project area were assessed based on their conservation importance, functional integrity and receptor resilience (Table 6.2). The combination of these resulted in a rating of SEI (Figure 6.3).

Near-intact Vaal-Vet Sandy Grassland was determined to be of high sensitivity as it is listed as Endangered and more than 100ha of semi-intact vegetation is present along the western boundary of the property portions.

Klerksdorp Thornveld was found to be of medium sensitivity due to a combination of the likelihood that Sensitive Species 1261 occurring within the project site and this vegetation type likely to have a high resilience to disturbance.

Andesite Mountain Bushveld was found to have a high sensitivity due to it being intact and likely to support SCC combined with its medium resilience to disturbance.

Previously cultivated and cultivated land was found to have a low SEI as the vegetation present showed signs of previous disturbance and it has a high receptor resilience.

Table 6.2: Sensitivity assessment for each vegetation type within the project site

Habitat / Species	Conservation Importance (CI)	Functional Integrity (FI)	BI	Receptor Resilience	SEI
Near-intact Vaal-Vet Sandy Grassland	High	Very High	. Very High	High	**High**
	Vaal-Vet Sandy Grassland is listed as Endangered. The portion within the project area comprises 0.02% of ecosystem extent.	>100ha of intact and semi-intact endangered ecosystem occurs within the project site Good habitat connectivity		This vegetation type was predominantly grasses and had a low diversity within the project site probably as a result of historical ploughing and ongoing grazing. Although these species are predominantly perennials, a significant amount of reproduction also takes place from seeds allowing them to persist in the seedbank provided the topsoil is not lost and there is sufficient rain (SANBI, 2013).	
Previously Cultivated Land	Medium	Medium	Medium	High	**Low**
	These areas were previously used for agriculture and have	There is evidence of previous disturbances		This vegetation type was predominantly grasses and had a low diversity within the project site probably as a result of historical ploughing and ongoing grazing. Although these species are predominantly perennials, a significant	

Habitat / Species	Conservation Importance (CI)	Functional Integrity (FI)	BI	Receptor Resilience	SEI
	been left fallow and are therefore degraded.	within these sites.		amount of reproduction also takes place from seeds allowing them to persist in the seedbank provided the topsoil is not lost and there is sufficient rain (SANBI, 2013).	
Klerksdorp Thornveld	High	High	High	High	**Medium**
	Species 1261 is listed as Vulnerable and has a high likelihood of occurrence within the project site as it is associated with thornveld and *Themeda triandra* grasslands	Large area of semi-intact and intact vegetation with good habitat connectivity and functional ecological corridors.		This vegetation type on site comprised predominantly of *Vachellia karroo* and a well grazed grass understory of grasses that are characterised by a relatively low diversity throughout most of the site. It is likely that this vegetation type will recover within 10 years to represent 70% of its original species composition if the seedbank is not lost (Grassland Ecosystem Guidelines, 2013).	
Andesite Mountain Bushveld	Medium	High	Medium	Medium	**High**
	>50% of the receptor contains natural habitat with the potential to support SCC	Good habitat connectivity with functional ecological corridors and minor negative ecological impacts.		This vegetation type was very diverse with a large number of trees and shrubs. Recovery back to its original state after a disturbance is likely to take >10 years.	

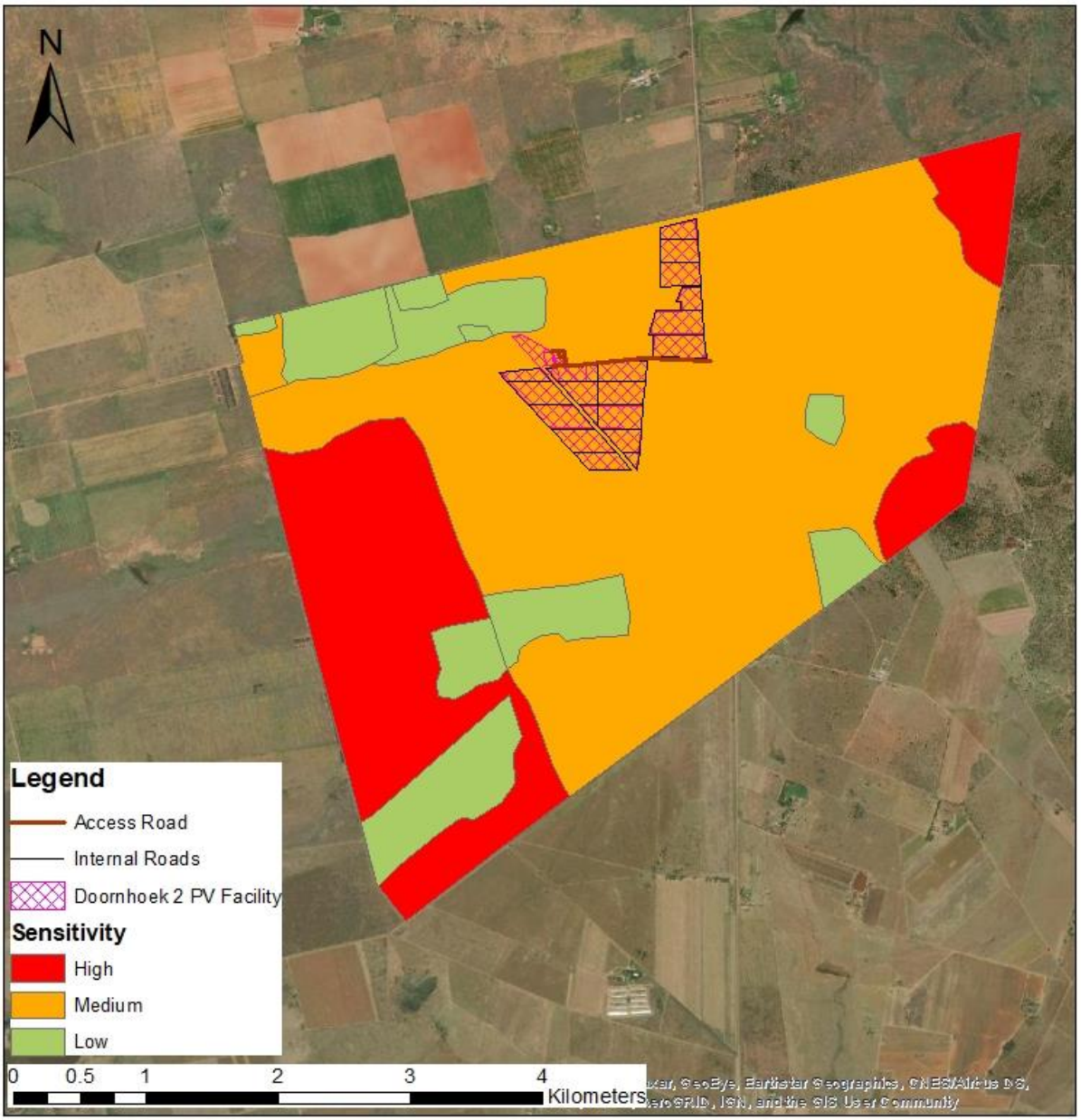

Figure: 6.3: Sensitivity map of the proposed project site showing areas of high, moderate and low sensitivity.

7. IMPACT ASSESSMENT

7.1. Construction and Operational Phase Impacts

The clearing of vegetation for the construction of the solar PV facility, access roads and associated infrastructure could result in the following impacts:

- The direct loss of vegetation types and associated plant species, including species of conservation concern
- The direct loss of faunal habitats
- Clearing of vegetation also creates breaks in habitat leading to habitat fragmentation and edge effects
- The clearing of vegetation and subsequent disturbance to the soil, and therefore seed bank, can lead to the infestation of alien invasive plant species and other ruderal species
- Heavy machinery associated with clearing of vegetation and construction of the solar PV facility and access roads will increase ambient noise levels and dust emissions resulting in some species vacating the area
- The movement of construction machinery within the site, may cause unintentional mortalities of faunal species

The spatial extent, temporal scale and impact significance will vary for each impact and these have thus been individually assessed in Table 7.1 below.

Table 7.1: Assessment of impacts associated with the construction, operation and decommissioning of the solar PV facility

POTENTIAL ISSUES	ALTERNATIVES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION
CONSTRUCTION PHASE														
Loss of Klerksdorp Thornveld	Preferred Alternative	The clearing of vegetation for the construction of the solar PV facility and associated infrastructure will result in the permanent loss of approximately 3ha of Klerksdorp Thornveld where the substations and the building are located and the long term loss of 80 ha of Klerksdorp Thornveld (Trees and large shrubs under the solar panels will be removed and the remaining grass, herbs and short shrubs brushcut). The extent of vegetation that will be impacted equates to 3.6% of the remaining extent of this vegetation unit. The loss of this vegetation type, which is listed as Least Concern and is degraded, will have an overall impact of moderate significance. This impact is difficult to mitigate as the loss of vegetation is definite and permanent and as such the impact will remain of moderate significance even after mitigation measures have been implemented.	Negative	Direct	Moderate	Study Area	Permanent	Definite	Irreversible	Resource could be partially lost	Difficult	MODERATE-	• Construction vehicles and machinery must not encroach into identified 'no-go' areas or areas outside the project footprint. • Topsoil (20 cm, where possible) must be collected and stored in an area of low (preferable) and medium sensitivity and used to rehabilitate impacted areas that are no longer required during the operational phase (e.g. laydown areas). • Only indigenous species must be used for rehabilitation. • Where possible, lay down areas must be located within previously disturbed sites. • Employees must be prohibited from making open fires during the construction phase. • Employees must be prohibited from collecting plants. It is recommended that spot checks of pockets and bags are done on a regular basis to ensure that no unlawful harvesting of plant species is occurring. • An alien invasive management plan for the site must be created. • An in-situ search and rescue plan must be developed and implemented for succulents and geophytes that will be impacted by the construction of the project site. • Plant translocation to adjacent suitable habitat may only be done for species that are not range restricted and for populations that have not been quantified as regionally significant. • In such cases that this is not feasible, any requirement for translocation must be discussed with the relative authorities prior to translocation taking place. • The vegetation under the solar panels will be brushcut during the construction and operational phases. The vegetation should be allowed to return to its natural state once the infrastructure has been decommissioned.	MODERATE-
	Cumulative	The cumulative impact associated with both solar PV facilities will result in the combined loss of 185 ha of Klerksdorp Thornveld which is 8.7 of the remaining extent of this vegetation type. The overall significance of the impact will be Moderate.	Negative	Direct	Moderate	Study Area	Permanent	Definite	Irreversible	Resource could be partially lost	Difficult	MODERATE-		MODERATE-
	No-Go Impact	If the project did not proceed, the property would continue to be grazed by cattle resulting in the continued degradation of the site. The no-go alternative would be low.	Negative	Direct	Low	Localised	Long Term	Probable	Reversible	Resource could be partially lost	Difficult	LOW-	N/A	N/A
Loss of near-intact Vaal-Vet Sandy Grassland	Preferred Alternative	Project infrastructure has been designed to avoid impacts on the Endangered near-intact Vaal-Vet Sandy Grassland Vegetation Unit. Impacts will therefore be negligible.	Negligible									Negligible	N/A	N/A

POTENTIAL ISSUES	ALTERNATIVES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION
	Cumulative		Negligible									Negligible	N/A	N/A
	No-Go Impact	If the project did not proceed, the property would continue to be grazed by cattle resulting in the continued degradation of the site. The no-go alternative would be low.	Negative	Direct	Low	Localised	Long Term	Probable	Reversible	Resource could be partially lost	Difficult	LOW-	N/A	N/A
Loss of Plant Species of Conservation Concern	Preferred Alternative	No restricted range species or CR, EN or VU species were recorded within the site during the field survey. However, two SCC were identified during the desktop assessment, both of which have been determined to have a moderate likelihood of occurrence. If the species are present, the impact will be of high significance. However, if the recommended mitigation measures are implemented, the impact can be reduced to moderate significance.	Negative	Direct	Moderate	Localised	Long Term	May Occur	Reversible	Resource could be partially lost	Achievable	HIGH-	All mitigation measures listed under impact one must be implemented.	MODERATE-
	Cumulative	The cumulative impact associated with both solar PV facilities will result in the combined loss of 280 ha of vegetation, slightly increasing the probability that these species will be impacted.	Negative	Direct	Severe	Study Area	Long Term	May Occur	Reversible	Resource could be partially lost	Achievable	HIGH		MODERATE-
	No-Go Impact	If the project did not proceed, the property would continue to be grazed by cattle resulting in the continued degradation of the site. The no-go alternative would be low.	Positive	Direct	Moderate	Local	May Occur	Definite	Reversible	Resource will not be impacted	Achievable	LOW+	• N/A	N/A
Loss of Faunal Habitat	Preferred Alternative	The clearing of vegetation for the project infrastructure will result in the loss of 80 ha of faunal habitat (natural and previously cultivated). Trees and shrubs will be removed, burrows will be impacted by heavy machinery and fallen trees that provide microhabitats for species will be removed.	Negative	Direct	Moderate	Localised	Permanent	Definite	Reversible	Resource could be partially lost	Difficult	HIGH-	• Rehabilitation efforts must provide habitat for faunal species by placing logs and rocks at strategic sites to provide shelter for small mammals and reptiles. • Construction vehicles and machinery must not encroach into identified 'no-go' areas or areas outside the project footprint. • Employees must be prohibited from making open fires during the construction phase to prevent uncontrolled run-away fires.	MODERATE-
	Cumulative	The cumulative impact associated with both solar PV facilities will result in the combined loss of 280 ha of faunal habitat, adding to this loss.	Negative	Direct	Moderate	Study Area	Permanent	Definite	Reversible	Resource could be partially lost	Difficult	HIGH		MODERATE-
	No-Go Impact	If the project did not go ahead, the faunal habitat would remain intact and the no-go alternative would be negligible.	Negligible									N/A		

POTENTIAL ISSUES	ALTERNATIVES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION
Disruption of Ecosystem Function and Process	Preferred Alternative	Fragmentation is one of the most important impacts on vegetation as it creates breaks in previously continuous vegetation, causing a reduction in the gene pool and a decrease in species richness and diversity. This impact occurs when more and more areas are cleared, resulting in the isolation of functional ecosystems, which results in reduced biodiversity and reduced movement due to the absence of ecological corridors. The solar PV facility has been positioned on the edge of natural habitat, adjacent to existing agricultural land to the north. Although the addition of this infrastructure will increase habitat fragmentation, this has been managed by the placement of infrastructure on the edge of natural habitat rather that in the middle of natural habitat. The functioning of existing corridors to the west, east and north can still continue uninterrupted.	Negative	Direct	Moderate	Localised	Permanent	Probable	Irreversible	Resource could be partially lost	Difficult	MODERATE-	In addition to the mitigation measures listed under impact 1, the following should be implemented: • Rehabilitate laydown areas • Use existing access roads and upgrade these where necessary • The property to the south of the project infrastructure should remain intact to ensure the continued functioning of the ecological corridor that facilitates the movement of plant and animal species.	MODERATE-
	Cumulative	The cumulative impact associated with the combined solar PV facilities will result in the combined loss of 185 ha of natural habitat which will slightly exacerbate the impact.	Negative	Direct	Moderate	Study Area	Permanent	Probable	Irreversible	Resource could be partially lost	Difficult	MODERATE-		MODERATE-
	No-Go Impact	If the project does not go ahead, the vegetation would remain intact and there will be limited impacts to ecosystem function and process. The impact associated with this will be of low significance.	Negative	Direct	Moderate	Local	May Occur	Definite	Reversible	Resource will not be impacted	Achievable	LOW-	• N/A	N/A

POTENTIAL ISSUES	ALTERNATIVES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION
Disturbance to faunal species and potential reduction in abundance and mortality of faunal species	Preferred Alternative	Faunal species will be disturbed during construction due to increased noise levels and vibrations from construction machinery as well as increased dust levels from clearing vegetation. Faunal Species that vacate the immediate area, may return following completion of construction or new individuals or species may inhabit the area. Increased traffic and the movement of construction machinery within the site, may cause unintentional mortalities of faunal species.	Negative	Direct	Moderate	Localised	Short Term	Definite	Reversible	Resource could be partially lost	Difficult	LOW	• All night lighting must be minimised and if required, only down lighting must be used and placed as low as practical and low light emitting bulbs (LED's). • Vehicles and machinery must meet best practice standards this will minimise noise and vibrations. • Staff and contractors' vehicles must comply with speed limits of maximum of 40km/hr • Project must start and be completed within the minimum timeframe. i.e. may not be started and left incomplete. • ECO (or relevant person) to walk ahead of clearing construction machinery and move slow moving species, e.g. tortoises, out of harms way and into suitable neighbouring habitat. • Any faunal species that may die as a result of construction must be recorded (photographed, gps co-ord) and if somewhat intact preserved and donated to SANBI or nearest university or museum. • Any faunal species observed onsite must be recorded (photographed, gps co-ord) and loaded onto iNaturalist. • Staff and contractors are not permitted to capture, collect or eat any faunal species onsite. • No animals may be killed by any staff and/or contractors related to the project, including snakes. An individual/s must be trained in snake handling to relocate snakes.	LOW
	Cumulative	The combined impact from both solar facilities will slightly exacerbate this impact.	Negative	Direct	Moderate	Study Area	Short Term	Definite	Reversible	Resource could be partially lost	Difficult	LOW		LOW
	No-Go Impact	If the project does not go ahead, faunal species are unlikely to be impacted and as such the no-go alternative is negligible.	Negligible									N/A		
Operational Phase														
Infestation of Alien Plant Species	Preferred Alternative	If laydown areas and roads are not rehabilitated, these disturbed areas can become places for alien invasive species to become established and if left unmitigated these species can spread and establish themselves in intact vegetation, resulting in the displacement of indigenous species and possible local extinctions of SCC.	Negative	Direct	Severe	Study Area	Permanent	Definite	Reversible	Resource could be partially lost	Achievable	HIGH-	• The site must be checked regularly for the presence of alien invasive species. When alien invasive species are found, immediate action must be taken to remove them. • The prickly pears currently noted on site must be removed and disposed of. • An alien invasive management plan must be incorporated into the EMPr. • The ECO must create a list with accompanying photographs of possible alien invasive species that could occur on site prior to construction. This photo guide must be used to determine if any alien invasive species are present.	LOW-
	Cumulative	The combined impact from both solar facilities will slightly exacerbate this impact.	Negative	Direct	Severe	Regional	Permanent	Probable	Reversible	Resource could be partially lost	Achievable	HIGH-		LOW-

POTENTIAL ISSUES	ALTERNATIVES	SOURCE OF ISSUE	NATURE	TYPE	CONSEQUENCE OF IMPACT	EXTENT OF IMPACT	DURATION OF IMPACT	PROBABILITY OF IMPACT	REVERSIBILITY	IRREPLACEABLE LOSS	MITIGATION POTENTIAL	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION MEASURES	SIGNIFICANCE OF IMPACT WITH MITIGATION
	No-Go Impact	If the project does not go ahead, the vegetation would remain intact and there will be limited impacts to ecosystem function and process. The impact associated with this will be of low significance.	Positive	Direct	Moderate	Local	May Occur	Definite	Reversible	Resource will not be impacted	Achievable	LOW-	• N/A	N/A
Decommissioning Phase														
Loss of Indigenous Vegetation	Preferred Alternative	The decommissioning of the solar PV facility will require laydown areas and will disrupt vegetation that has re-established around the areas that were disturbed during the construction phase. The loss of vegetation will be similar to the construction phase impacts.	Negative	Direct	Moderate	Study Area	Permanent	Definite	Reversible	Resource could be partially lost	Difficult	MODERATE	• Construction vehicles and machinery must not encroach into identified 'no-go' areas or areas outside the project footprint. • Topsoil (20 cm, where possible) must be collected and stored in an area of low sensitivity and used to rehabilitate impacted areas that are no longer required during the operational phase (e.g. laydown areas). • Only indigenous species must be used for rehabilitation. • Lay down areas must not be located within any sensitive features such as watercourses, drainage lines or on rocky outcrops. • Employees must be prohibited from making open fires during the construction phase. • Employees must be prohibited from collecting any plants. • An alien invasive management plan for the site must be created.	MODERATE
Disturbance to faunal species and potential reduction in abundance and mortality of faunal species	Preferred Alternative	As with the construction phase, the decommissioning phase will also require heavy machinery and the disruption of faunal habitat. Impacts will therefore be similar to that of the construction phase.	Negative	Direct	Severe	Localised	Short Term	Definite	Reversible	Resource could be partially lost	Difficult	LOW	• All mitigation measures listed under the construction phase must be implemented.	LOW

8. CONCLUSIONS AND RECOMMENDATIONS

8.1. Conclusions

The field survey assessed the Site Ecological Index (SEI) for the two vegetation types present within the PAOI. The near-intact Vaal-Vet Sandy Grassland (Endangered) was found to have an SEI of high and the Klerksdorp Thornveld (Least Concern) was determined to have an SEI of Medium. Project infrastructure has been designed to avoid impacts to the near-intact Vaal-Vet Sandy Grassland by placing it in previously cultivated land and Klerksdorp Thornveld. This has ensured that there are negligible impacts to the endangered vegetation type.

No amphibian or reptile SCC has distribution ranges that include the project area. Four vulnerable and seven near threatened mammal species have a distribution which includes the project area. Of these species, only three (Southern African Hedgehog, Grey Rhebok and Serval) have a high likelihood of occurrence within the PAOI. Since the serval is typically associated with watercourses and the rhebok with ridges, the likelihood that the project will have a direct impact on these species' habitat is low. The hedgehog prefers dense vegetation and rocky outcrops for nesting and foraging and as such the likelihood of it using the project site is low as neither of these habitat requirements are present.

Project infrastructure will impact 3.6% of the remaining extent of Klerksdorp Thornveld. The field survey determined that this habitat is characterised by a relatively low diversity throughout most of the site.

Although the planning unit in which the project is located is listed as a CBA1, the vegetation within the project footprint shows historical evidence of disturbance from grazing and trampling by livestock (refer to section 3.5). The function of the CBA, which is located in previously disturbed Klerksdorp Thornveld, is to provide an ecological for the movement of species. Project infrastructure will result in the loss of 4.7% of the portion of corridor that occurs within the property boundary. When combined with Doornhoek 1, this increases to 10.8% of the corridor. The objective of the corridor to maintain landscape connectivity within the property can still be maintained within the remaining 90% of the corridor and species movement across the site is unlikely to be severely impacted.

Nine impacts were identified for the project site. Three of these are of high significance, three of moderate significance, two of low significance and one was negligible before mitigation measures are implemented. The significance can be reduced to five moderate, three low and one negligible impact if the recommended mitigation measures are implemented.

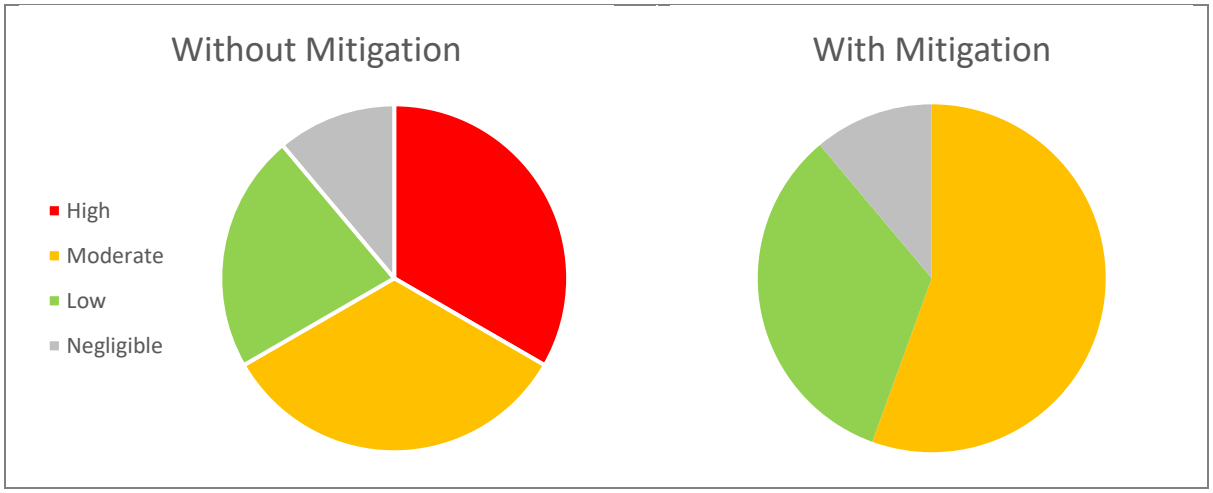

Figure 8.1: Pie graph illustrating the impacts with and without mitigation.

8.2. Recommendations

It is recommended that the following conditions are included in the Final EMPr as well as the conditions of the Environmental Authorisation (EA), if granted:

- The remaining vegetation outside of the PV facility footprint and within the property should remain intact so that it can continue to function as an ecological corridor for species movement.
- All necessary plant permits must be obtained prior to the commencement of any construction activities.
- Project infrastructure must not be located within the Endangered near-intact Vaal-Vet Sandy Grassland.
- Where feasible, laydown areas must be placed in previously disturbed sites.
- If any SCC are to be impacted, those that are easy to transplant must be relocated to nearest appropriate habitat.
- Construction vehicles and machinery must not encroach into identified 'no-go' areas or areas outside the project footprint. This is especially important for the Endangered Vaal-Vet Sandy Grassland.
- Topsoil (20 cm, where possible) must be collected and stored in an area of low (preferable) or medium sensitivity and used to rehabilitate impacted areas that are no longer required during the operational phase (e.g. laydown areas).
- Employees must be prohibited from collecting any plants.
- Alien invasive plant clearing should be undertaken in line with an Alien Vegetation Management plan, which should be compiled as part of the EMPr and implemented with immediate effect.
- Only indigenous plant species typical of the local vegetation and approved by a botanist should be used for the rehabilitation of natural habitat.

8.3. Ecological Statement and Opinion of the Specialist

Project infrastructure has been designed to avoid sensitive features such as the endangered near-intact Vaal-Vet Sandy Grassland and to minimise the impact on the functioning of the area as an ecological corridor. Further to the above, impacts on the terrestrial plant and faunal species and associated habitats can be reduced to acceptable levels through the implementation of mitigation measures. The specialist is therefore of the opinion that the development can proceed provided the recommendations contained in this report are implemented.

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APPENDIX 1: PLANTS

Table A1: Plant Species with collection records within the vicinity of the project area (POSA, 2022)

Family	Scientific Name	IUCN	Ecology
Euphorbiaceae	*Acalypha segetalis*	LC	Indigenous
Euphorbiaceae	*Acalypha angustata*	LC	Indigenous
Euphorbiaceae	*Acalypha depressinervia*	LC	Indigenous
Asteraceae	*Acanthospermum glabratum*		Not indigenous; Naturalised
Asteraceae	*Acanthospermum hispidum*		Not indigenous; Naturalised
Lamiaceae	*Acrotome hispida*	LC	Indigenous
Lamiaceae	*Acrotome inflata*	LC	Indigenous
Crassulaceae	*Adromischus sp.*		
Amaranthaceae	*Aerva leucura*	LC	Indigenous
Rubiaceae	*Afrocanthium mundianum*	LC	Indigenous
Lythraceae	*Ammannia baccifera*		Indigenous
Anacampserotaceae	*Anacampseros sp.*		
Boraginaceae	*Anchusa azurea*		Not indigenous; Naturalised
Poaceae	*Andropogon schirensis*	LC	Indigenous
Rubiaceae	*Anthospermum spathulatum*	LC	Indigenous; Endemic
Rubiaceae	*Anthospermum rigidum*	LC	Indigenous
Apiaceae	*Apium graveolens*		Not indigenous; Naturalised; Invasive
Scrophulariaceae	*Aptosimum elongatum*	LC	Indigenous
Scrophulariaceae	*Aptosimum indivisum*	LC	Indigenous
Scrophulariaceae	*Aptosimum procumbens*	LC	Indigenous
Asteraceae	*Arctotis arctotoides*	LC	Indigenous
Poaceae	*Aristida canescens*	LC	Indigenous
Poaceae	*Aristida bipartita*	LC	Indigenous
Poaceae	*Aristida diffusa*	LC	Indigenous
Poaceae	*Aristida stipitata*	LC	Indigenous
Apocynaceae	*Asclepias meyeriana*	LC	Indigenous
Apocynaceae	*Asclepias fulva*	LC	Indigenous
Apocynaceae	*Asclepias eminens*	LC	Indigenous
Apocynaceae	*Asclepias gibba*	LC	Indigenous
Apocynaceae	*Asclepias aurea*	LC	Indigenous
Apocynaceae	*Asclepias gibba*	LC	Indigenous
Apocynaceae	*Aspidoglossum biflorum*	LC	Indigenous
Aspleniaceae	*Asplenium cordatum*	LC	Indigenous
Acanthaceae	*Barleria macrostegia*	LC	Indigenous
Acanthaceae	*Barleria obtusa*	LC	Indigenous
Elatinaceae	*Bergia decumbens*	LC	Indigenous
Asteraceae	*Berkheya radula*	LC	Indigenous

Asteraceae	*Berkheya carlinoides*	LC	Indigenous; Endemic
Apiaceae	*Berula repanda*	LC	Indigenous
Acanthaceae	*Blepharis angusta*	LC	Indigenous; Endemic
Apocynaceae	*Brachystelma sp.*		
Poaceae	*Bromus sp.*		
Bryaceae	*Bryum argenteum*		Indigenous
Orobanchaceae	*Buchnera reducta*	LC	Indigenous
Asphodelaceae	*Bulbine narcissifolia*	LC	Indigenous
Asphodelaceae	*Bulbine abyssinica*	LC	Indigenous
Cyperaceae	*Bulbostylis burchellii*	LC	Indigenous
Colchicaceae	*Camptorrhiza strumosa*	LC	Indigenous
Brassicaceae	*Capsella bursa-pastoris*		Not indigenous; Naturalised
Apocynaceae	*Carissa bispinosa*	LC	Indigenous
Amaranthaceae	*Celosia argentea*		Not indigenous; Naturalised
Cannabaceae	*Celtis africana*	LC	Indigenous
Asteraceae	*Centaurea melitensis*		Not indigenous; Naturalised
Apocynaceae	*Ceropegia ramosissima*		Indigenous; Endemic
Apocynaceae	*Ceropegia barberae*		Indigenous
Apocynaceae	*Ceropegia circinata*		Indigenous
Apocynaceae	*Ceropegia rehmannii*		Indigenous
Scrophulariaceae	*Chaenostoma sp.*		
Verbenaceae	*Chascanum hederaceum*	LC	Indigenous
Verbenaceae	*Chascanum hederaceum*	LC	Indigenous
Pteridaceae	*Cheilanthes hirta*	LC	Indigenous
Pteridaceae	*Cheilanthes involuta*	LC	Indigenous
Amaranthaceae	*Chenopodium sp.*		
Agavaceae	*Chlorophytum fasciculatum*	LC	Indigenous
Apiaceae	*Choritaenia capensis*	LC	Indigenous; Endemic
Asteraceae	*Cineraria erodioides*		Indigenous
Asteraceae	*Cirsium vulgare*		Not indigenous; Naturalised; Invasive
Vitaceae	*Cissus sp.*		
Ranunculaceae	*Clematis brachiata*	LC	Indigenous
Cleomaceae	*Cleome rubella*	LC	Indigenous
Cleomaceae	*Cleome monophylla*	LC	Indigenous
Cucurbitaceae	*Coccinia sessilifolia*	LC	Indigenous
Commelinaceae	*Commelina africana*	LC	Indigenous
Commelinaceae	*Commelina africana*	LC	Indigenous
Commelinaceae	*Commelina livingstonii*	LC	Indigenous
Nyctaginaceae	*Commicarpus pentandrus*	LC	Indigenous
Apiaceae	*Conium chaerophylloides*	LC	Indigenous
Convolvulaceae	*Convolvulus sagittatus*	LC	Indigenous
Malvaceae	*Corchorus aspleniifolius*	LC	Indigenous
Apocynaceae	*Cordylogyne globosa*	LC	Indigenous

Rubiaceae	*Cordylostigma virgatum*		Indigenous
Asteraceae	*Cotula sp.*		
Asteraceae	*Cotula anthemoides*	LC	Indigenous
Acanthaceae	*Crabbea angustifolia*	LC	Indigenous; Endemic
Crassulaceae	*Crassula lanceolata*	LC	Indigenous
Amaryllidaceae	*Crinum bulbispermum*	LC	Indigenous
Fabaceae	*Crotalaria sp.*		
Fabaceae	*Crotalaria distans*	LC	Indigenous
Fabaceae	*Crotalaria magaliesbergensis*	LC	Indigenous; Endemic
Fabaceae	*Crotalaria burkeana*	LC	Indigenous
Cucurbitaceae	*Cucumis zeyheri*	LC	Indigenous
Convolvulaceae	*Cuscuta campestris*		Not indigenous; Naturalised; Invasive
Poaceae	*Cynodon hirsutus*	LC	Indigenous
Boraginaceae	*Cynoglossum hispidum*	LC	Indigenous
Cyperaceae	*Cyperus fastigiatus*	LC	Indigenous
Cyperaceae	*Cyperus difformis*	LC	Indigenous
Cyperaceae	*Cyperus sphaerospermus*	LC	Indigenous
Cyperaceae	*Cyperus capensis*	LC	Indigenous; Endemic
Lobeliaceae	*Cyphia persicifolia*	LC	Indigenous; Endemic
Vitaceae	*Cyphostemma hereroense*	LC	Indigenous
Solanaceae	*Datura ferox*		Not indigenous; Naturalised; Invasive
Hyacinthaceae	*Daubenya comata*	LC	Indigenous; Endemic
Aizoaceae	*Delosperma sp.*		
Asteraceae	*Denekia capensis*	LC	Indigenous
Fabaceae	*Desmodium repandum*	LC	Indigenous
Apiaceae	*Deverra burchellii*	LC	Indigenous
Acanthaceae	*Dicliptera leistneri*	LC	Indigenous; Endemic
Asteraceae	*Dicoma sp.*		
Asteraceae	*Dicoma anomala*	LC	Indigenous
Poaceae	*Digitaria sp.*		
Poaceae	*Digitaria eriantha*	LC	Indigenous
Ebenaceae	*Diospyros lycioides*	LC	Indigenous
Ebenaceae	*Diospyros austroafricana*	LC	Indigenous
Malvaceae	*Dombeya rotundifolia*		Indigenous
Malvaceae	*Dombeya rotundifolia*	LC	Indigenous
Acanthaceae	*Dyschoriste burchellii*	LC	Indigenous
Amaranthaceae	*Dysphania schraderiana*		Indigenous
Amaranthaceae	*Dysphania multifida*		Not indigenous; Naturalised; Invasive
Cyperaceae	*Eleocharis dregeana*	LC	Indigenous
Poaceae	*Eleusine coracana*	LC	Indigenous
Poaceae	*Eragrostis plana*	LC	Indigenous

Poaceae	*Eragrostis curvula*	LC	Indigenous
Poaceae	*Eragrostis obtusa*	LC	Indigenous
Poaceae	*Eragrostis superba*	LC	Indigenous
Poaceae	*Eragrostis gummiflua*	LC	Indigenous
Asteraceae	*Erigeron bonariensis*		Not indigenous; Naturalised; Invasive
Ruscaceae	*Eriospermum sp.*		
Fabaceae	*Erythrina zeyheri*	LC	Indigenous
Ebenaceae	*Euclea undulata*	LC	Indigenous
Euphorbiaceae	*Euphorbia inaequilatera*	LC	Indigenous
Euphorbiaceae	*Euphorbia indica*	NE	Not indigenous; Naturalised
Euphorbiaceae	*Euphorbia serpens*	NE	Not indigenous; Naturalised
Asteraceae	*Felicia muricata*	LC	Indigenous
Asteraceae	*Foveolina dichotoma*	LC	Indigenous
Asteraceae	*Galinsoga parviflora*		Not indigenous; Naturalised; Invasive
Asteraceae	*Geigeria aspera*	LC	Indigenous
Amaryllidaceae	*Gethyllis transkarooica*	LC	Indigenous
Gisekiaceae	*Gisekia pharnaceoides*	LC	Indigenous
Iridaceae	*Gladiolus crassifolius*	LC	Indigenous
Iridaceae	*Gladiolus permeabilis*	LC	Indigenous
Asteraceae	*Gnaphalium filagopsis*	LC	Indigenous
Scrophulariaceae	*Gomphostigma virgatum*	LC	Indigenous
Malvaceae	*Grewia occidentalis*	LC	Indigenous
Malvaceae	*Grewia flava*	LC	Indigenous
Amaranthaceae	*Guilleminea densa*		Not indigenous; Naturalised; Invasive
Celastraceae	*Gymnosporia buxifolia*	LC	Indigenous
Asteraceae	*Haplocarpha scaposa*	LC	Indigenous
Asteraceae	*Helichrysum rugulosum*	LC	Indigenous
Asteraceae	*Helichrysum nudifolium*	LC	Indigenous
Asteraceae	*Helichrysum paronychioides*	LC	Indigenous
Asteraceae	*Helichrysum setosum*	LC	Indigenous
Asteraceae	*Helichrysum zeyheri*	LC	Indigenous
Asteraceae	*Helichrysum argyrosphaerum*	LC	Indigenous
Malvaceae	*Hermannia depressa*	LC	Indigenous
Malvaceae	*Hermannia grandistipula*	LC	Indigenous
Malvaceae	*Hermannia stellulata*	LC	Indigenous
Malvaceae	*Hibiscus trionum*		Not indigenous; Naturalised
Malvaceae	*Hibiscus calyphyllus*	LC	Indigenous
Asteraceae	*Hilliardiella elaeagnoides*		Indigenous
Hypoxidaceae	*Hypoxis hemerocallidea*	LC	Indigenous
Hypoxidaceae	*Hypoxis rigidula*	LC	Indigenous
Hypoxidaceae	*Hypoxis filiformis*	LC	Indigenous

Fabaceae	*Indigofera heterotricha*	LC	Indigenous
Fabaceae	*Indigofera vicioides*	LC	Indigenous
Fabaceae	*Indigofera cryptantha*	LC	Indigenous
Fabaceae	*Indigofera oxalidea*	LC	Indigenous
Fabaceae	*Indigofera dimidiata*	LC	Indigenous
Convolvulaceae	*Ipomoea bathycolpos*	LC	Indigenous; Endemic
Convolvulaceae	*Ipomoea oenotheroides*	LC	Indigenous
Convolvulaceae	*Ipomoea crassipes*	LC	Indigenous
Scrophulariaceae	*Jamesbrittenia sp.*		
Scrophulariaceae	*Jamesbrittenia aurantiaca*	LC	Indigenous
Scrophulariaceae	*Jamesbrittenia montana*	LC	Indigenous
Scrophulariaceae	*Jamesbrittenia burkeana*	LC	Indigenous
Juncaceae	*Juncus exsertus*	LC	Indigenous
Crassulaceae	*Kalanchoe thyrsiflora*	LC	Indigenous
Crassulaceae	*Kalanchoe rotundifolia*	LC	Indigenous
Asphodelaceae	*Kniphofia ensifolia*	LC	Indigenous
Rubiaceae	*Kohautia caespitosa*	LC	Indigenous
Cyperaceae	*Kyllinga pulchella*	LC	Indigenous
Asteraceae	*Lactuca serriola*		Not indigenous; Naturalised
Hydrocharitaceae	*Lagarosiphon muscoides*	LC	Indigenous
Thymelaeaceae	*Lasiosiphon kraussianus*		Indigenous
Thymelaeaceae	*Lasiosiphon capitatus*	LC	Indigenous
Thymelaeaceae	*Lasiosiphon anthylloides*	LC	Indigenous; Endemic
Hyacinthaceae	*Ledebouria luteola*	LC	Indigenous
Hyacinthaceae	*Ledebouria burkei*	LC	Indigenous
Hyacinthaceae	*Ledebouria marginata*	LC	Indigenous
Araceae	*Lemna gibba*	LC	Indigenous
Brassicaceae	*Lepidium didymum*		Not indigenous; Naturalised; Invasive
Fabaceae	*Lessertia phillipsiana*	DD	Indigenous; Endemic
Scrophulariaceae	*Limosella africana*	LC	Indigenous
Verbenaceae	*Lippia scaberrima*	LC	Indigenous
Fabaceae	*Listia heterophylla*	LC	Indigenous
Boraginaceae	*Lithospermum cinereum*	LC	Indigenous
Asteraceae	*Litogyne gariepina*	LC	Indigenous
Lobeliaceae	*Lobelia sonderiana*	LC	Indigenous
Lobeliaceae	*Lobelia erinus*	LC	Indigenous
Lobeliaceae	*Lobelia thermalis*	LC	Indigenous
Solanaceae	*Lycium arenicola*	LC	Indigenous
Solanaceae	*Lycium pilifolium*	LC	Indigenous
Malvaceae	*Mahernia sp.*		
Aytoniaceae	*Mannia capensis*		Indigenous
Marsileaceae	*Marsilea farinosa*	LC	Indigenous
Marsileaceae	*Marsilea macrocarpa*	LC	Indigenous

Fabaceae	*Medicago laciniata*	NE	Not indigenous; Naturalised
Melianthaceae	*Melianthus comosus*	LC	Indigenous
Oleaceae	*Menodora heterophylla*	LC	Indigenous
Oleaceae	*Menodora africana*	LC	Indigenous
Fabaceae	*Mimosa pigra*		Not indigenous; Naturalised; Invasive
Phrymaceae	*Mimulus gracilis*	LC	Indigenous
Nyctaginaceae	*Mirabilis jalapa*		Not indigenous; Naturalised; Invasive
Poaceae	*Monocymbium ceresiiforme*	LC	Indigenous
Geraniaceae	*Monsonia emarginata*	LC	Indigenous; Endemic
Geraniaceae	*Monsonia angustifolia*	LC	Indigenous
Fabaceae	*Mundulea sericea*	LC	Indigenous
Amaryllidaceae	*Nerine krigei*	LC	Indigenous; Endemic
Amaryllidaceae	*Nerine frithii*	LC	Indigenous; Endemic
Asteraceae	*Nidorella sp.*		
Asteraceae	*Nidorella resedifolia*	LC	Indigenous
Asteraceae	*Nolletia annetjieae*	LC	Indigenous
Lamiaceae	*Ocimum angustifolium*	LC	Indigenous
Onagraceae	*Oenothera rosea*		Not indigenous; Naturalised; Invasive
Onagraceae	*Oenothera tetraptera*		Not indigenous; Naturalised; Invasive
Resedaceae	*Oligomeris dregeana*	LC	Indigenous
Apocynaceae	*Orbea lutea*	LC	Indigenous
Asteraceae	*Osteospermum muricatum*	LC	Indigenous
Asteraceae	*Osteospermum scariosum*	NE	Indigenous
Oxalidaceae	*Oxalis corniculata*		Not indigenous; Naturalised; Invasive
Oxalidaceae	*Oxalis depressa*	LC	Indigenous
Apocynaceae	*Pachycarpus schinzianus*	LC	Indigenous
Poaceae	*Panicum coloratum*	LC	Indigenous
Poaceae	*Panicum novemnerve*	LC	Indigenous
Apocynaceae	*Parapodium costatum*	LC	Indigenous
Fabaceae	*Pearsonia bracteata*	NT	Indigenous; Endemic
Geraniaceae	*Pelargonium malacoides*		Indigenous
Geraniaceae	*Pelargonium auritum*	LC	Indigenous
Geraniaceae	*Pelargonium sidoides*	LC	Indigenous
Geraniaceae	*Pelargonium nelsonii*	LC	Indigenous; Endemic
Pteridaceae	*Pellaea calomelanos*	LC	Indigenous
Apocynaceae	*Pentarrhinum insipidum*	LC	Indigenous
Asteraceae	*Pentzia globosa*	LC	Indigenous
Polygonaceae	*Persicaria nepalensis*		Not indigenous; Naturalised
Polygonaceae	*Persicaria lapathifolia*		Not indigenous; Naturalised; Invasive

Polygonaceae	*Persicaria amphibia*	LC	Not indigenous; Naturalised
Polygonaceae	*Persicaria hystricula*	LC	Indigenous
Phyllanthaceae	*Phyllanthus incurvus*	LC	Indigenous
Phyllanthaceae	*Phyllanthus parvulus*	LC	Indigenous
Solanaceae	*Physalis viscosa*		Not indigenous; Naturalised; Invasive
Solanaceae	*Physalis angulata*		Not indigenous; Naturalised; Invasive
Asteraceae	*Platycarphella parvifolia*	LC	Indigenous; Endemic
Plumbaginaceae	*Plumbago auriculata*	LC	Indigenous
Poaceae	*Pogonarthria squarrosa*	LC	Indigenous
Caryophyllaceae	*Pollichia campestris*	LC	Indigenous
Asteraceae	*Polydora angustifolia*	LC	Indigenous
Polygalaceae	*Polygala sp.*		
Polygalaceae	*Polygala hottentotta*	LC	Indigenous
Polygonaceae	*Polygonum aviculare*		Not indigenous; Naturalised
Polygonaceae	*Polygonum plebeium*	LC	Indigenous
Potamogetonaceae	*Potamogeton schweinfurthii*	LC	Indigenous
Potamogetonaceae	*Potamogeton pectinatus*	LC	Indigenous
Asteraceae	*Pseudognaphalium oligandrum*	LC	Indigenous
Asteraceae	*Pseudognaphalium luteoalbum*	LC	Cryptogenic
Pedaliaceae	*Pterodiscus speciosus*	LC	Indigenous
Ranunculaceae	*Ranunculus multifidus*	LC	Indigenous
Apocynaceae	*Raphionacme hirsuta*	LC	Indigenous
Apocynaceae	*Raphionacme velutina*	LC	Indigenous
Asteraceae	*Rhaponticum repens*		Not indigenous; Naturalised
Fabaceae	*Rhynchosia sp.*		
Fabaceae	*Rhynchosia minima*	NE	Indigenous
Ricciaceae	*Riccia okahandjana*		Indigenous
Apocynaceae	*Riocreuxia polyantha*	LC	Indigenous
Brassicaceae	*Rorippa fluviatilis*	LC	Indigenous
Polygonaceae	*Rumex conglomeratus*	LC	Indigenous
Polygonaceae	*Rumex lanceolatus*	LC	Indigenous
Lamiaceae	*Salvia runcinata*	LC	Indigenous
Dipsacaceae	*Scabiosa columbaria*	LC	Indigenous
Poaceae	*Schizachyrium sanguineum*	LC	Indigenous
Asteraceae	*Schkuhria pinnata*		Not indigenous; Naturalised
Cyperaceae	*Schoenoplectus triqueter*		Not indigenous; Naturalised
Cyperaceae	*Schoenoplectus muricinux*	LC	Indigenous
Anacardiaceae	*Searsia ciliata*	LC	Indigenous
Anacardiaceae	*Searsia rigida*	LC	Indigenous; Endemic
Anacardiaceae	*Searsia lancea*	LC	Indigenous
Anacardiaceae	*Searsia pyroides*	LC	Indigenous

Anacardiaceae	*Searsia rigida*	LC	Indigenous; Endemic
Anacardiaceae	*Searsia leptodictya*	NE	Indigenous
Gentianaceae	*Sebaea filiformis*	LC	Indigenous
Scrophulariaceae	*Selago tenuifolia*	LC	Indigenous; Endemic
Scrophulariaceae	*Selago mixta*	LC	Indigenous; Endemic
Asteraceae	*Senecio harveianus*	LC	Indigenous
Asteraceae	*Senecio coronatus*	LC	Indigenous
Asteraceae	*Senecio consanguineus*	LC	Indigenous
Asteraceae	*Senecio erubescens*	NE	Indigenous; Endemic
Fabaceae	*Senegalia hereroensis*	LC	Indigenous
Fabaceae	*Senna italica*	LC	Indigenous
Asteraceae	*Seriphium plumosum*		Indigenous
Fabaceae	*Sesbania bispinosa*	NE	Not indigenous; Naturalised
Poaceae	*Setaria nigrirostris*	LC	Indigenous
Poaceae	*Setaria incrassata*	LC	Indigenous
Solanaceae	*Solanum tomentosum*		Indigenous
Solanaceae	*Solanum campylacanthum*		Indigenous
Solanaceae	*Solanum lichtensteinii*	LC	Indigenous
Asteraceae	*Sonchus oleraceus*		Not indigenous; Naturalised; Invasive
Asteraceae	*Sonchus asper*		Not indigenous; Naturalised
Poaceae	*Sporobolus stapfianus*	LC	Indigenous
Poaceae	*Sporobolus albicans*	LC	Indigenous
Lamiaceae	*Stachys spathulata*	LC	Indigenous
Caryophyllaceae	*Stellaria apetala*		Not indigenous; Naturalised; Invasive
Poaceae	*Stipagrostis uniplumis*	LC	Indigenous
Orobanchaceae	*Striga elegans*	LC	Indigenous
Asteraceae	*Symphyotrichum squamatum*		Not indigenous; Naturalised
Asteraceae	*Tagetes minuta*		Not indigenous; Naturalised; Invasive
Asteraceae	*Tarchonanthus camphoratus*	LC	Indigenous
Fabaceae	*Tephrosia capensis*	LC	Indigenous
Fabaceae	*Tephrosia semiglabra*	LC	Indigenous
Fabaceae	*Tephrosia lupinifolia*	LC	Indigenous
Zygophyllaceae	*Tetraena simplex*		Indigenous
Ranunculaceae	*Thalictrum minus*	LC	Indigenous
Santalaceae	*Thesium transvaalense*	LC	Indigenous; Endemic
Asteraceae	*Tolpis capensis*	LC	Indigenous
Asphodelaceae	*Trachyandra erythrorrhiza*	LC	Indigenous; Endemic
Asphodelaceae	*Trachyandra saltii*	LC	Indigenous
Asteraceae	*Tragopogon porrifolius*		Not indigenous; Naturalised
Poaceae	*Tragus berteronianus*	LC	Indigenous
Zygophyllaceae	*Tribulus terrestris*	LC	Indigenous

Boraginaceae	*Trichodesma angustifolium*	LC	Indigenous
Poaceae	*Trichoneura grandiglumis*	LC	Indigenous
Fabaceae	*Trifolium africanum*	NE	Indigenous
Poaceae	*Triraphis andropogonoides*	LC	Indigenous
Cucurbitaceae	*Trochomeria debilis*	LC	Indigenous
Lentibulariaceae	*Utricularia stellaris*	LC	Indigenous
Fabaceae	*Vachellia karroo*	LC	Indigenous
Rubiaceae	*Vangueria pygmaea*	LC	Indigenous
Verbenaceae	*Verbena brasiliensis*		Not indigenous; Naturalised; Invasive
Plantaginaceae	*Veronica anagallis-aquatica*	LC	Indigenous
Plantaginaceae	*Veronica agrestis*	NE	Not indigenous; Naturalised
Fabaceae	*Vicia sativa*	NE	Not indigenous; Naturalised; Invasive
Santalaceae	*Viscum verrucosum*	LC	Indigenous
Campanulaceae	*Wahlenbergia denticulata*	LC	Indigenous; Endemic
Campanulaceae	*Wahlenbergia undulata*	LC	Indigenous
Campanulaceae	*Wahlenbergia krebsii*	LC	Indigenous
Solanaceae	*Withania somnifera*	LC	Indigenous
Asteraceae	*Xanthium spinosum*		Not indigenous; Naturalised; Invasive
Convolvulaceae	*Xenostegia tridentata*	LC	Indigenous
Rutaceae	*Zanthoxylum capense*	LC	Indigenous
Asteraceae	*Zinnia peruviana*		Not indigenous; Naturalised; Invasive
Rhamnaceae	*Ziziphus mucronata*		Indigenous
Rhamnaceae	*Ziziphus zeyheriana*	LC	Indigenous
Fabaceae	*Zornia glochidiata*	LC	Indigenous

APPENDIX 2: AMPHIBIANS

Table A2: Amphibian Species with a distribution that includes the project area (Fitzpatrick, 2022; IUCN, 2022)

Family	Scientific name	Common name	Red list	QDS (2626DA, 2626DC) (FrogMAP, 2022)		
			category	# of QDSs	# of records	Last recorded
Bufonidae	*Schismaderma carens*	Red Toad	Least Concern	2	2	2019/12/11
Bufonidae	*Sclerophrys capensis*	Raucous Toad	Least Concern	1	1	2017/02/01
Bufonidae	*Sclerophrys garmani*	Olive Toad	Least Concern (IUCN, 2016)	1	6	2021/10/31
Bufonidae	*Sclerophrys gutturalis*	Guttural Toad	Least Concern (IUCN, 2016)	2	14	2021/01/15
Bufonidae	*Sclerophrys poweri*	Power's Toad	Least Concern	2	12	2019/01/13
Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	Least Concern	2	9	2022/01/15
Microhylidae	*Phrynomantis bifasciatus*	Banded Rubber Frog	Least Concern	1	2	2021/12/13
Phrynobatrachidae	*Phrynobatrachus natalensis*	Snoring Puddle Frog	Least Concern (IUCN, 2013)	2	4	2021/05/12
Pipidae	*Xenopus laevis*	Common Platanna	Least Concern	2	6	2020/02/18
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	Least Concern (2017)	2	11	2021/05/19
Pyxicephalidae	*Amietia fuscigula*	Cape River Frog	Least Concern (2017)	1	1	1981/02/23
Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	Least Concern (2013)	2	28	2022/01/15
Pyxicephalidae	*Pyxicephalus adspersus*	Giant Bull Frog	Near Threatened	2	6	2019/08/17
Pyxicephalidae	*Strongylopus fasciatus*	Striped Stream Frog	Least Concern	2	5	2021/05/04
				26	**109**	**2021-01-15***
						2018-10-15**

APPENDIX 3: REPTILES

Table A2: Reptile Species with a distribution that includes the project area (Fitzpatrick, 2022; IUCN, 2022)

Family	Scientific name	Common name	Red list category (SARCA 2014)	QDS (2626DA, 2626DC) (ReptileMAP, 2022)		
				# of QDSs	# of records	Last recorded
Lizards						
Agamidae	*Agama aculeata distanti*	Distant's Ground Agama	Least Concern	2	2	1900/06/15
Agamidae	*Agama atra*	Southern Rock Agama	Least Concern	2	5	2020/10/13
Chamaeleonidae	*Chamaeleo dilepis*	Common Flap-neck Chameleon	Least Concern	2	6	2016/01/20
Gekkonidae	*Hemidactylus mabouia*	Common Tropical House Gecko	Least Concern	1	8	2021/11/12
Gekkonidae	*Lygodactylus capensis*	Common Dwarf Gecko	Least Concern	2	13	2021/01/17
Gekkonidae	*Pachydactylus capensis*	Cape Gecko	Least Concern	2	5	2013/11/01
Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	Least Concern	1	2	1981/02/23
Lacertidae	*Nucras holubi*	Holub's Sandveld Lizard	Least Concern	1	2	1981/02/24
Scincidae	*Panaspis wahlbergii*	Wahlberg's Snake-eyed Skink	Least Concern	2	3	2018/10/01
Scincidae	*Trachylepis capensis*	Cape Skink	Least Concern	1	2	1981/02/24
Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	Least Concern	1	14	2020/07/19
Scincidae	*Trachylepis varia sensu lato*	Common Variable Skink Complex	Least Concern	2	4	1981/02/24
Varanidae	*Varanus albigularis albigularis*	Rock Monitor	Least Concern	2	2	2019/01/20
Varanidae	*Varanus niloticus*	Water Monitor	Least Concern	1	6	2020/03/07
Snakes						
Colubridae	*Crotaphopeltis hotamboeia*	Red-lipped Snake	Least Concern	2	9	2021/12/01
Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	Least Concern	1	2	2009/06/02
Cordylidae	*Cordylus vittifer*	Common Girdled Lizard	Least Concern	1	2	1900/06/15
Elapidae	*Hemachatus haemachatus*	Rinkhals	Least Concern	2	10	2013/11/19

Elapidae	*Naja nivea*	Cape Cobra	Least Concern	2	4	2021/03/24
Lamprophiidae	*Boaedon capensis*	Brown House Snake	Least Concern	2	10	2020/11/23
Lamprophiidae	*Lamprophis aurora*	Aurora House Snake	Least Concern	2	4	2014/10/01
Lamprophiidae	*Lycophidion capense capense*	Cape Wolf Snake	Least Concern	1	2	1900/06/15
Lamprophiidae	*Psammophis brevirostris*	Short-snouted Grass Snake	Least Concern	1	2	2020/09/27
Lamprophiidae	*Psammophylax tritaeniatus*	Striped Grass Snake	Least Concern	2	4	2013/03/21
Lamprophiidae	*Pseudaspis cana*	Mole Snake	Least Concern	2	2	2019/12/11
Typhlopidae	*Afrotyphlops bibronii*	Bibron's Blind Snake	Least Concern	1	1	2017/09/12
Typhlopidae	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	Least Concern	1	1	1900/06/15
Viperidae	*Bitis arietans arietans*	Puff Adder	Least Concern	2	16	2021/12/01
Viperidae	*Causus rhombeatus*	Rhombic Night Adder	Least Concern	1	2	1900/06/15
Tortoises and Terrapins						
Pelomedusidae	*Pelomedusa galeata*	South African Marsh Terrapin	Not evaluated	2	3	2021/11/28
Testudinidae	*Kinixys lobatsiana*	Lobatse Hinged Tortoise	Least Concern	1	2	2020/11/29
Testudinidae	*Stigmochelys pardalis*	Leopard Tortoise	Least Concern	2	5	2018/03/11
Total				**51**	**156**	**2017-09-12***
						2012-04-15**

APPENDIX 4: MAMMALS

Table A3: Mammal Species with a distribution that includes the project area (Fitzpatrick, 2022; IUCN, 2022)

Family	Scientific name	Common name	Red list category	QDS (2626DA, 2626DC) (MammalMAP, 2022)			Confirmed onsite
			(Child, et al., 2016)	# of QDSs	# of records	Last recorded	
Artiodactyla							
Bovidae	*Damaliscus pygargus phillipsi*	Blesbok	Least Concern	2	31	2021/05/30	1
Bovidae	*Pelea capreolus*	Vaal Rhebok	Near Threatened	1	2	2013/04/30	
Bovidae	*Raphicerus campestris*	Steenbok	Least Concern	2	16	2021/07/18	
Bovidae	*Redunca arundinum*	Southern Reedbuck	Least Concern	2	3	2013/04/30	
Bovidae	*Redunca fulvorufula*	Mountain Reedbuck	Least Concern	2	9	2013/06/15	
Bovidae	*Sylvicapra grimmia*	Bush Duiker	Least Concern	2	14	2021/07/25	
Bovidae	*Taurotragus oryx*	Common Eland	Least Concern	2	37	2021/11/28	1
Bovidae	*Tragelaphus scriptus*	Bushbuck	Least Concern	2	3	2019/07/20	
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu	Least Concern	2	43	2021/11/28	1
Suidae	*Phacochoerus africanus*	Common Warthog	Least Concern	2	20	2021/04/14	1
Carnivores							
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern	2	61	2021/12/26	
Canidae	*Vulpes chama*	Cape Fox	Least Concern	1	2	2013/05/29	
Felidae	*Caracal caracal*	Caracal	Least Concern	1	1	2019/11/30	
Felidae	*Leptailurus serval*	Serval	Near Threatened	1	2	2018/07/14	
Felidae	*Pantherus pardus*	Leopard	Vulnerable				
Felidae	*Felis nigripes*	Black-footed Cat	Vulnerable				

Herpestidae	*Atilax paludinosus*	Marsh Mongoose	Least Concern	1	39	2013/06/05	
Herpestidae	*Cynictis penicillata*	Yellow Mongoose	Least Concern	2	40	2021/08/28	1
Herpestidae	*Herpestes sanguineus*	Slender Mongoose	Least Concern	2	35	2020/03/16	
Herpestidae	*Ichneumia albicauda*	White-tailed Mongoose	Least Concern	1	2	2013/11/21	
Herpestidae	*Suricata suricatta*	Meerkat	Least Concern	2	6	2018/05/09	1
Hyaenidae	*Hyaena brunnea*	Brown Hyena	Near Threatened	1	6	2013/07/09	
Hyaenidae	*Proteles cristata*	Aardwolf	Least Concern	1	5	2013/07/12	1
Mustelidae	*Aonyx capensis*	African Clawless Otter	Near Threatened	2	6	2018/07/29	
Mustelidae	*Hydructus maculicollis*	Spotted-necked Otter	Near Threatened				
Viveridae	*Genetta maculata*	Common Large-spotted Genet	Least Concern	1	1	2016/12/26	
Viverridae	*Genetta genetta*	Common Genet	Least Concern	1	4	2020/11/07	
Viverridae	*Genetta tigrina*	Cape Genet (Cape Large-spotted Genet)	Least Concern	1	5	2013/07/09	
Primates							
Cercopithecidae	*Chlorocebus pygerythrus*	Vervet Monkey	Least Concern	2	20	2021/06/05	
Cercopithecidae	*Chlorocebus pygerythrus pygerythrus*	Vervet Monkey (subspecies pygerythrus)	Least Concern	2	15	2016/10/29	
Cercopithecidae	*Papio ursinus*	Chacma Baboon	Least Concern	1	3	2013/07/05	
Lagomorph							
Leporidae	*Lepus capensis*	Cape Hare	Least Concern	2	28	2018/07/29	
Leporidae	*Lepus saxatilis*	Scrub Hare	Least Concern	2	11	2019/11/02	
Leporidae	*Pronolagus randensis*	Jameson's Red Rock Hare	Least Concern	1	2	2013/05/31	
Pedetidae	*Pedetes capensis*	South African Spring Hare	Least Concern	2	41	2019/01/31	
Rodents							
Bathyergidae	*Cryptomys hottentotus*	Southern African Mole-rat	Least Concern	1	1	1970/08/08	
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern	1	12	2016/08/13	
Muridae	*Aethomys namaquensis*	Namaqua Rock Mouse	Least Concern	1	3	2013/05/30	
Muridae	*Rhabdomys pumilio*	Xeric Four-striped Grass Rat	Least Concern	2	2	2013/06/28	

Sciuridae	*Paraxerus cepapi*	Smith's Bush Squirrel	Least Concern	1	1	2018/10/07	
Sciuridae	*Xerus inauris*	South African Ground Squirrel	Least Concern	2	61	2022/01/05	1
Thryonomyidae	*Thryonomys swinderianus*	Greater Cane Rat	Least Concern	1	1	2014/01/01	
Muridae	*Otymys auratus*	Vlei Rat	Near Threatened				
Nesomyidae	*Mystromys albicaudatus*	White-tailed Rat	Vulnerable				
Tubulidentata							
Orycteropodidae	*Orycteropus afer*	Aardvark	Least Concern	1	4	2013/06/02	
Hyracoidea							
Procaviidae	*Procavia capensis*	Cape Rock Hyrax	Least Concern	2	2	2013/08/08	
Eulipotyphla							
Erinaceidae	*Atelerix frontalis*	Southern African Hedgehog	Near Threatened	1	1	2018/01/08	
Soricidae	*Myosorex varius*	Forest Shrew	Least Concern	1	1	2011/07/01	
				107	**1030**	**2017-04-06*** **2013-06-03****	**8**

APPENDIX 5: PROOF OF SACNASP REGISTRATION AND HIGHEST QUALIFICATION

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Tarryn Barbara Lee Martin

Registration Number: 008745

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Environmental Science (Professional Natural Scientist)
Botanical Science (Professional Natural Scientist)

Effective **29 January 2014** Expires **31 March 2023**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

RHODES UNIVERSITY

THIS IS TO CERTIFY THAT

TARRYN BARBARA LEE MARTIN

WAS THIS DAY AT A CONGREGATION OF THE UNIVERSITY
ADMITTED TO THE DEGREE OF

MASTER OF SCIENCE

IN

BOTANY

WITH DISTINCTION

VICE CHANCELLOR

DEAN OF THE FACULTY OF SCIENCE

REGISTRAR

GRAHAMSTOWN
10 APRIL 2010

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Amber Leah Jackson

Registration number: 100125/12

is registered as a

Candidate Natural Scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule I of the Act)

Environmental Science **15 August 2012**

15 August 2012
Pretoria

President

Executive Director

University of Cape Town • iYunivesithi yaseKapa • Universiteit van Kaapstad

we certify that

Amber Leah Jackson

was admitted to the degree of

Master of Philosophy

in Environmental Management

on 9 June 2011

Vice-Chancellor

Registrar

APPENDIX 6: CV

CONTACT DETAILS

Name	**Tarryn Martin**
Name of Company	**Biodiversity Africa**
Designation	Director
Profession	Botanical Specialist and Environmental Manager
E-mail	tarryn@biodiversityafrica.com
Office number	+27 (0)71 332 3994
Education	2010: Master of Science with distinction (Botany) 2004: Bachelor of Science (Hons) in African Terrestrial Vertebrate Biodiversity 2003: Bachelor of Science
Nationality	**South African**
Professional Body	**SACNASP**: South African Council for Natural Scientific Profession: Professional Natural Scientist (400018/14) **SAAB**: Member of the South African Association of Botanists **IAIASa**: Member of the International Association for Impact Assessments South Africa Member of Golden Key International Honour Society
Key areas of expertise	• Biodiversity Surveys and Impact Assessments • Environmental Impact Assessments • Critical Habitat Assessments • Biodiversity Management and Monitoring Plans

PROFILE

Tarryn has over ten years of experience working as a botanist, nine of which are in the environmental sector. She has worked as a specialist and project manager on projects within South Africa, Mozambique, Lesotho, Zambia, Tanzania, Cameroon and Malawi.

She has extensive experience writing botanical impact assessments, critical habitat assessments, biodiversity management plans, biodiversity monitoring plans and Environmental Impact Assessments to International Standards, especially to those of the International Finance Corporation (IFC). Her experience includes working on large mining projects such as the Kenmare Heavy Minerals Mine, where she monitored forest health, undertook botanical impact assessments for their expansion projects and designed biodiversity management and monitoring plans. She has also project managed Environmental Impact Assessments for graphite mines in northern Mozambique and has a good understanding of the Mozambique Environmental legislation and

processes.

Tarryn holds a BSc (Botany and Zoology), a BSc (Hons) in African Vertebrate Biodiversity and an MSc with distinction in Botany from Rhodes University. Tarryn's Master's thesis examined the impact of fire on the recovery of C_3 and C_4 Panicoid and non-Panicoid grasses within the context of climate change for which she won the Junior Captain Scott-Medal (Plant Science) for producing the top MSc of 2010 from the South African Academy of Science and Art as well as an Award for Outstanding Academic Achievement in Range and Forage Science from the Grassland Society of Southern Africa. Tarryn is a professional member of the South African Council for Natural Scientific Professionals (since 2014).

EMPLOYMENT EXPERIENCE

Director and Botanical Specialist, Biodiversity Africa

July 2021 - present

- Botanical and ecological assessments for local and international EIAs in Southern Africa
- Identifying and mapping vegetation communities and sensitive areas
- Designing and implementing biodiversity management and monitoring plans
- Designing rehabilitation plans
- Designing alien management plans
- Critical Habitat Assessments
- Large ESIA studies
- Managing budgets

Principal Environmental Consultant, Branch Manager and Botanical Specialist, Coastal and Environmental Services

May 2012-June 2021

- Botanical and ecological assessments for local and international EIAs in Southern Africa
- Identifying and mapping vegetation communities and sensitive areas
- Designing and implementing biodiversity management and monitoring plans
- Designing rehabilitation and biodiversity offset plans
- Designing alien management plans
- Critical Habitat Assessments
- Large ESIA studies
- Managing budgets
- Cape Town branch manager
- Coordinating specialists and site visits

Accounts Manager, Green Route DMC

October 2011- January 2012

- Project and staff co-ordination
- Managing large budgets for incentive and conference groups travelling to southern Africa

- Creating tailor-made programs for clients
- Negotiating rates with vendors and assisting with the ground management of inbound groups to ensure client satisfaction.

Camp Administrator and Project Co-ordinator, Windsor Mountain International Summer Camp, USA

April 2011 - September 2012

- Co-ordinated staff and camper travel arrangements, main camp events and assisted with marketing the camp to prospective families.

Freelance Project Manager, Green Route DMC

November 2010 - April 2011

- Project and staff co-ordination
- Managing large budgets for incentive and conference groups travelling to southern Africa
- Creating tailor-made programs for clients
- Negotiating rates with vendors and assisting with the ground management of inbound groups to ensure client satisfaction.

Camp Counselor, Windsor Mountain Summer Camp, USA

June 2010 - October 2010

NERC Research Assistant, Botany Department, Rhodes University, Grahamstown in collaboration with Sheffield University, Sheffield, England

April 2009 - May 2010

- Set up and maintained experiments within a common garden plot experiment
- collected, collated and entered data
- Assisted with the analysis of the data and writing of journal articles

Head Demonstrator, Botany Department, Rhodes University

March 2007 - October 2008

Operations Assistant, Green Route DMC

September 2005 - February 2007

- Project and staff co-ordination
- Managing large budgets for incentive and conference groups travelling to southern Africa
- Creating tailor-made programs for clients
- Negotiating rates with vendors and assisting with the ground management of inbound groups to ensure client satisfaction

PUBLICATIONS

- Ripley, B.; Visser, V.; Christin, PA.; Archibald, S.; Martin, T and Osborne, C. Fire ecology of C_3 and C_4 grasses depends on evolutionary history and frequency of burning but not photosynthetic type. *Ecology.* 96 (10): 2679-2691. 2015
- Taylor, S.; Ripley, B.S.; Martin, T.; De Wet, L-A.; Woodward, F.I.; Osborne, C.P. Physiological advantages of C_4 grasses in the field: a comparative experiment demonstrating the importance of drought. *Global Change Biology*. 20 (6): 1992-2003. 2014
- Ripley, B; Donald, G; Osborne, C; Abraham, T and Martin, T. Experimental investigation of fire ecology in the C3 and C4 subspecies of *Alloteropsis semialata. Journal of Ecology.* 98 (5): 1196 - 1203. 2010
- South African Association of Botanists (SAAB) conference, Grahamstown. Title: Responses of C3 and C4 Panicoid and non-Panicoid grasses to fire. January 2010
- South African Association of Botanists (SAAB) conference, Drakensberg. Title: Photosynthetic and Evolutionary determinants of the response of selected C3 and C4 (NADP-ME) grasses to fire. January 2008

COURSES

- Rhodes University and CES, Grahamstown
- EIA Short Course 2012
- Fynbos identification course, Kirstenbosch, 2015.
- Photography Short Course, Cape Town School of Photography, 2015.
- Using Organized Reasoning to Improve Environmental Impact Assessment, 2018, International IAIA conference, Durban

CONSULTING EXPERIENCE

International Projects

- 2020 – 2021: Project manager for the 2Africa subsea cable ESIA in Mozambique.
- 2020 – 2021: Project manager for the Category B EIA for the Wihinana Graphite Mine, Cabo delgado, Mozambique
- 2020 – 2021: Project manager for the category B exploration ESIA for Sofala Heavy Minerals Mine, Inhambane, Mozambique
- 2020: Critical Habitat Assessment for a graphite mine in Cabo Delgado, Mozambique. This assessment was to IFC standards.
- 2020: Analysed the botanical dataset for Lurio Green Resources and provided comment on the findings and gaps.
- 2020: Biodiversity Management Plan and Monitoring Plan for mine at Pilivilli in Nampula Province, Mozambique. This assessment was to IFC standards.
- 2019: Botanical Assessment for a cocoa plantation, Tanzania. This assessment was to IFC standards.
- 2019: Critical Habitat Assessment, Biodiversity Management Plan and Ecosystem Services Assessment for JCM Solar Farm in Cameroon. This assessment was to IFC standards.
- 2019: Undertook the Kenmare Road and Infrastructure Botanical Baseline Survey and Impact Assessment for an infrastructure corridor that will link the existing mine at Moma to the new proposed mine at Pillivilli in Nampula Province, Mozambique. This assessment was to IFC standards.

- 2012 – Present: Kenmare Terrestrial Monitoring Program Project Manager and Specialist Survey, Nampula Province, Mozambique.
- 2018: Conducted a field survey and wrote a botanical report to IFC standards for the proposed Balama Graphite Mine Environmental and Social Impact Assessment (ESIA) in Cabo Delgado Province, Mozambique.
- 2018: Co-authored the critical habitat assessment chapter for the proposed Kenmare Pilivilli Heavy Minerals Mine.
- 2018: Authored the Conservation Efforts chapter for the Kenmare Pilivilli Heavy Minerals Mine.
- 2017-2018: Co-authored and analysed data for the Kenmare Bioregional Survey of *Icuria dunensis* (species trigger for critical habitat) in Nampula Province, Mozambique. This was for a mining project that needed to be IFC compliant.
- 2017: Conducted a field survey and wrote a botanical report to IFC standards for the proposed Ancuabe Graphite Mine Environmental and Social Impact Assessment (ESIA) in Cabo Delgado Province, Mozambique.
- 2017-2018: Managed the Suni Resources Montepuez Graphite Mine Environmental Impact Assessment. This included the management of ten specialists, the co-ordination of their field surveys, regular client liaison and the writing of the Environmental Impact Assessment Report which summarised the specialists findings, assessed the impacts of the proposed mine on the environment and provided mitigation measures to reduce the impact.
  I was also the lead botanist for this baseline survey and impact assessment and undertook the required field work and analysed the data and wrote the report.

- 2017: Undertook the botanical baseline survey and impact assessment for the proposed Kenmare Pilivili Heavy Mineral Mine in Nampula Province, Mozambique. This was to IFC Standards.
- 2017: Ecological Survey for the Megaruma Mining Limitada Ruby Mine Exploration License, Cabo Delgado, Mozambique.
- 2016: Undertook the botanical baseline survey and impact assessment, wrote an alien invasive management plan and co-authored the biodeiveristy monitoring plan for this farm. The project was located in Zambezia Province, Mozambique.
- 2015-2016: Conducted the Triton Minerals Nicanda Hills Graphite Mine Botanical Survey and Impact Assessment. Was also the project manager and specialist co-ordinator for this project. The project was located in Cabo Delgado Province, Mozambique.
- 2015: Was part of the team that undertook a Critical Habitat Assessment for the Nhangonzo Coastal Stream site at Inhassora in Mozambique that Sasol intend to establish drill pads at. This project needed to meet the IFC standards.
- 2014: Lurio Green Resources Wood Chip Mill and Medium Density Fibre-board Plant, Project Manager and Ecological Specialist, Nampula Province, Mozambique. 2014-2015.
- 2013-2014: LHDA Botanical Survey, Baseline and Impact assessment, Lesotho.
- 2014: Biotherm Solar Voltaic Ecological Assessment, Zambia.
- 2013-2014: Lurio Green Resources Plantation Botanical Assessment, Vegetation and Sensitivity Mapping, Specialist Co-ordination, Nampula Province, Mozambique.
- 2013: Syrah Resources Botanical Baseline Survey and Ecological Assessment., Cabo Delgado Mozambique.
- 2013-2014: Baobab Mining Ecological Baseline Survey and Impact Assessment, Tete, Mozambique.

South African Projects

- 2021 - Present: Project Manager for the Sturdee Energy Solar PV facility, Western Cape
- 2021: Ecological Assessment for the Sturdee Energy Solar PV facility, Western Cape
- 2021: Rehabilitation plan for a housing development (Hope Village)
- 2020: Ecological Assessment for the Eskom Juno-Gromis Powerline deviation, Western Cape
- 2020: Project Manager for the Basic Assessment for SANSA development at Matjiesfontein (Western Cape). Project received authorization in 2021.
- 2020: Ecological Assessment for construction of satellite antennae, Matjiesfontein, Western Cape
- 2019: Ecological Assessment for a wind farm EIA, Kleinzee, Northern Cape
- 2019: Ecological Assessment for two housing developments in Zeerust, North West Province
- 2019: Botanical Assessment in Retreat, Cape Town for the DRDLR land claim.
- 2019: Cape Agulhas Municipality Botanical Assessment for the expansion of industrial zone, Western Cape, South Africa, 2019.
- 2018: Ecological Assessment for the construction of a farm dam in Greyton, Western Cape.
- 2018: Conducted the Ecological Survey for a housing development in Noordhoek, Cape Town
- 2018: Conducted the field survey and developed an alien invasive management plan for the Swartland Municipality, Western Cape.
- 2017: Undertook the field survey and co-authored a coastal dune study that assesses the impacts associated with the proposed rezoning and subdivision of Farm Bookram No. 30 to develop a resort.
- 2017: Project managed and co-authored a risk assessment for the use of Marram Grass to stabilise dunes in the City of Cape Town.
- 2015-2016: iGas Saldanha to Ankerlig Biodiversity Assessment Project Manager, Saldanha.
- 2015: Innowind Ukomoleza Wind Energy Facility Alien Invasive Management Plan, Eastern Cape Province, South Africa.
- 2015: Savannah Nxuba Wind Energy Facility Powerline Ecological Assessment, ground truthing and permit applications, Eastern Cape South Africa.
- 2014: Cob Bay botanical groundtruthing assessment, Eastern Cape, South Africa.
- 2013-2016: Dassiesridge Wind Energy Facility Project Manager, Eastern Cape, South Africa.
- 2013: Harvestvale botanical groundtruthing assessment, Eastern Cape, South Africa.
- 2012: Tsitsikamma Wind Energy Facility Community Power Line Ecological Assessment, Eastern Cape, South Africa.
- 2012: Golden Valley Wind Energy Facility Power Line Ecological Assessment, Eastern Cape, South Africa.
- 2012: Middleton Wind Energy Facility Ecological Assessment and Project Management, Eastern Cape, South Africa.
- 2012: Mossel Bay Power Line Ecological Assessment, Western Cape, South Africa.
- 2012: Groundtruthing the turbine sites for the Waainek Wind Energy Facility, Eastern Cape, South Africa.
- 2012: Toliara Mineral Sands Rehabilitation and Offset Strategy Report, Madagascar.

CONTACT DETAILS

Name	**Amber Jackson**
Name of Company	**Biodiversity Africa**
Designation	Director
Profession	Faunal Specialist and Environmental Manager
E-mail	amber@biodiversityafrica.com
Office number	+27 (0)78 340 6295
Education	2011 M. Phil Environmental Management (University of Cape Town) 2008 BSc (Hons) Ecology, Environment and Conservation (University of the Witwatersrand) 2007 BSc 'Ecology, Environment and Conservation' and Zoology (WITS)
Nationality	**South African**
Professional Body	**SACNASP**: South African Council for Natural Scientific Profession (100125/12) **ZSSA**: Zoological Society of Southern Africa **HAA**: Herpetological Association of Southern Africa **IAIASa**: Member of the International Association for Impact Assessments South Africa
Key areas of expertise	• Biodiversity Surveys and Impact Assessments • Environmental Impact Assessments • Critical Habitat Assessments • Biodiversity Management and Monitoring Plans

PROFILE

Amber has over ten years' experience in environmental consulting and has managed projects across various sectors including mining, agriculture, forestry, renewable energy, housing, coastal and wetland recreational infrastructure. Most of these projects required lender finance and therefore met both in-country, lender and sector specific requirements.

Amber completed the IFC lead and Swiss funded programme in Environmental and Social Risk Management course in 2018. The purpose of the course was to upskill Sub-Saharan African environmental consultants to increase the uptake of E&S standards by Financial Institutions.

Amber specialises in terrestrial vertebrate faunal assessments. She has conducted large scale faunal impact assessments that are to international lender's standards in Mozambique, Tanzania, Lesotho and Malawi. In South Africa her faunal impact assessments comply with the protocols for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial biodiversity and follows the SANBI Species Environmental Assessment Guideline. Her specialist input goes beyond impact assessments and includes faunal opportunities and constraints assessments, Critical Habitat Assessments, Biodiversity related Management Plans and Biodiversity Monitoring Programmes.

Amber holds a BSc (Zoology and Ecology, Environment & Conservation) and BSc (Hons) in Ecology, Environment & Conservation from WITS University and an MPhil in Environmental Management from University of Cape Town. Amber's honours focused on the landscape effects on Herpetofauna in Kruger National Park and her Master's thesis focused on the management of social and natural aspects of environmental systems with a dissertation in food security that investigated the complex food system of informal and formal distribution markets

EMPLOYMENT EXPERIENCE

Director and Faunal Specialist, Biodiversity Africa

July 2021 - present

- Faunal assessments for local and international EIAs in Southern Africa
- Identifying and mapping habitats and sensitive areas
- Designing and implementing biodiversity management and monitoring plans
- Critical Habitat Assessments
- Large ESIA studies
- Managing budgets

Principal Environmental Consultant and Faunal,

Coastal and Environmental Services

September 2011-June 2021

- Faunal and ecological assessments for local and international EIAs in Southern Africa
- Identifying and mapping habitat and sensitive areas
- Designing and implementing biodiversity management and monitoring plans
- Critical Habitat Assessments
- Large ESIA studies
- Coordinating specialists and site visits
- Faunal Impact Assessment
- Project Management, including budgets, deliverables and timelines.
- Environmental Impact Assessments and Basic Assessments project
- Environmental Control Officer
- Public/client/authority liaison
- Mentoring and training of junior staff

COURSES

- **Herpetological Association of Southern Africa Conference- Cape St Frances** September 2019
- **International Finance Corporation Environmental and Social Risk Management (ESRM) Program** January – November 2018
- **IAIA WC EMP Implementation Workshop** 27 February 2018
- **IAIAsa National Annual Conference** August 2017
  Goudini Spa, Rawsonville.
- **Biodiversity & Business Indaba, NBBN** April 2017
  Theme: Moving Forward Together (Partnerships & Collaborations)
- **Snake Awareness, Identification and Handling course, Cape Reptile Institute (CRI)** November 2016
- **Coaching Skills programme, Kim Coach** November 2016
- **Western Cape Biodiversity Information Event, IAIAsa** May 2016
  Theme: Biodiversity offsets & the launch of a Biodiversity Information Tool
- **Photography Short Course** 2015.
  Cape Town School of Photography,
- **Mainstreaming Biodiversity into Business: WHAT, WHY, WHEN and HOW** June 2014 Hosted by Dr Marie Parramon Gurney on behalf of the NBBN at the Rhodes Business School
- **IAIAsa National Annual Conference** September 2013
  Thaba'Nchu Sun, Bloemfontein
- **St Johns Life first aid course** July 2012

CONSULTING EXPERIENCE

International Projects

- 2018-Crooks Brothers Post EIA Work- Environmental and Social EMPr, Policies, E&S Management Plans and Monitoring Programmes
- 2018-Triton Ancuabe Graphite Mine (ESHIA), Mozambique. IFC Standards.
- 2016-Bankable Feasibility Study of Simandou Infrastructure Project – Port and Railway Summary of critical habitat, biodiversity offset plan and monitoring and evaluation plan.
- 2016-Lurio Green Resources Forestry Projects ESIA project upgrade to Lender standards including IFC, EIB, FSC and AfDB.
- 2014-Green Resources Woodchip and MDF plant (EPDA).
- 2014-Niassa Green Resources Forestry Projects ESIA to Lender standards including IFC, EIB, FSC and AfDB.
- 2020-Kenmare Faunal Biodiversity Management Plan, Mozambique.
- 2020-Kenmare Faunal Monitoring Pogramme (year 1)- Baseline, Mozambique.
- 2019-Kenmare addendum ESIA Faunal Impact Assessment, Mozambique.
- 2019-Kenmare infrastructure corridor ESIA Faunal Impact Assessment, Mozambique.
- 2019/20-Olam Cocoa Plantation Faunal Impact Assessment, Tanzania.
- 2019-JCM Solar Voltaic project Faunal desktop critical habitat assessment, Cameroon.
- 2018-Suni Resources Balama Graphite Mine Project Faunal Impact Assessment, Mozambique.
- 2017/18-Battery Minerals Montepuez Graphite Mine Project Faunal Impact Assessment, Mozambique.
- 2017-Triton Minerals Nicanda Hills Graphite Mine Project Faunal Impact Assessment, Mozambique.
- 2017-Sasol Biodiversity Assessment, Mozambique.
- 2014-Lesotho Highlands Water Project Faunal Impact Assessment, Lesotho.
- 2012-Malawi Monazite mine Projects (ESIA) EMP ecological management contribution
- Liberia Palm bay & Butow (ESIA)
- PGS Seismic Project (ESIA), Mozambique.

South African Projects

- 2018-Port St Johns Second Beach Coastal Infrastructure Project - E&S Risk Assessment
- 2015-Blouberg Development Initiative- E&S Risk Assessment
- 2019-Boulders Powerline BA Faunal desktop impact assessment, WC, SA.
- 2019-Ramotshere housing development BA Faunal desktop impact assessment, NW, SA.
- 2019-Cape Agulhas Municipality Industrial development faunal impact assessment, WC, SA.
- 2019-SANSA Solar PV BA Faunal desktop impact assessment, WC, SA.
- 2019-Wisson Coal to Urea Faunal desktop assessment, Mpumalanga.
- 2019-Assessment Boschendal Estate Faunal Opportunities and Constraints, WC, SA.
- 2019-Ganspan-Pan Wetland Reserve Recreational and Tourist Development Avifaunal Impact Assessment, NC, SA.
- 2018-City of Johannesburg Municipal Reserve Proclamation for Linksfield Ridge and Northcliff Hill Faunal Assessment, South Africa.
- 2017-Augrabies falls hydro-electric project Hydro-SA Faunal Impact Assessment.
- Port St Johns Second Beach Coastal Infrastructure Project (EIA), South Africa.
- Woodbridge Island Revetment checklist.
- Belmont Valley Golf Course and Makana Residential Estate (EIA)
- Belton Farm Eco Estate (BA).

- Ramotshere housing development (BA).
- G7 Brandvalley Wind Energy Project (EIA)
- G7 Rietkloof Wind Energy Project (EIA)
- G7 Brandvalley Powerlines (BA)
- G7 Rietkloof Powerlines (BA)
- Boschendal wine estate Hydro-electric schemes (BA, 24G and WULA)
- Mossel Bay Wind Energy Project (EIA)
- Mossel Bay Powerline (BA) 132kV interconnection
- Inyanda Farm Wind Energy (EIA)
- Middleton Wind Energy (EIA)
- Peddie Wind Energy (EIA)
- Cookhouse Wind Energy Project (EIA)
- Haverfontein Wind Energy Project (EIA)
- Plan 8 Wind Energy Project (EIA)
- Brakkefontein Wind Energy Project (EIA)
- Grassridge Wind Energy Project (EIA) (Coega)
- St Lucia Wind Energy Project (EIA)
- ACSA ECO CT (Lead ECO)
- Enel Paleisheuwel Solar farm (Lead ECO)
- NRA Caledon road upgrade ECO
- Solar Capital DeAar Solar farm annual audits
- Eskom Pinotage substation WUL offset compliance