APPENDIX D

SPECIALIST REPORTS

APPENDIX D1: Aquatic Biodiversity Compliance Statement

Freshwater Assessment for the proposed 600MW Grootvlei Solar PV Plant, North West Province, South Africa

29 MAY 2023

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Reviewed by	**Qualification**	**Date**	**Signature**	**Version No.**
Elzet Human	M-Tech Nature Conservation (TUT) (Pri. Sci. Nat. Conservation Science 147031)	29 May 2023		2.0
Antoinette Bootsma	M.Sc. Environmental Science (UNISA) (Pri. Sci. Nat. Ecology & Botany 400222-09)	31 May 2023		3.0
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Executive Summary

Nitai Consulting (Pty) Ltd. was appointed by Nemai Green (Pty) Ltd. to undertake a Freshwater Impact Assessment for the proposed 600MW Grootvlei Solar Photovoltaic (PV) Plant and associated infrastructure, North West Province, South Africa.

The terms of reference for this study are as follows:

- Identify and delineate of all associated wetlands within the proposed study area;
- Classify each watercourse according to the National Wetland Classification Systems;
- Compile a baseline description of all the potentially impacted aquatic environments according to Government Notice (GN) No. 320, March 2020;
- Assess the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of all identified wetlands; and
- Comply with Appendix 6 of the EIA Regulations by undertaking a risk assessment and identifying suitable mitigation measures.

According to the National Web Based Environmental Screening Tool of the Department of Forestry, Fisheries and the Environment, the proposed site has a very high sensitivity due to Strategic Water Source Areas and Aquatic Critical Biodiversity Area’s. No watercourses are found within the proposed 600MW Grootvlei Solar PV Plant, however, with site visits (22 March 2023 & 24 April 2023) to the footprint, one Depression was identified within the southern portion of the Alternative 1 layout (see Figure 1 below).

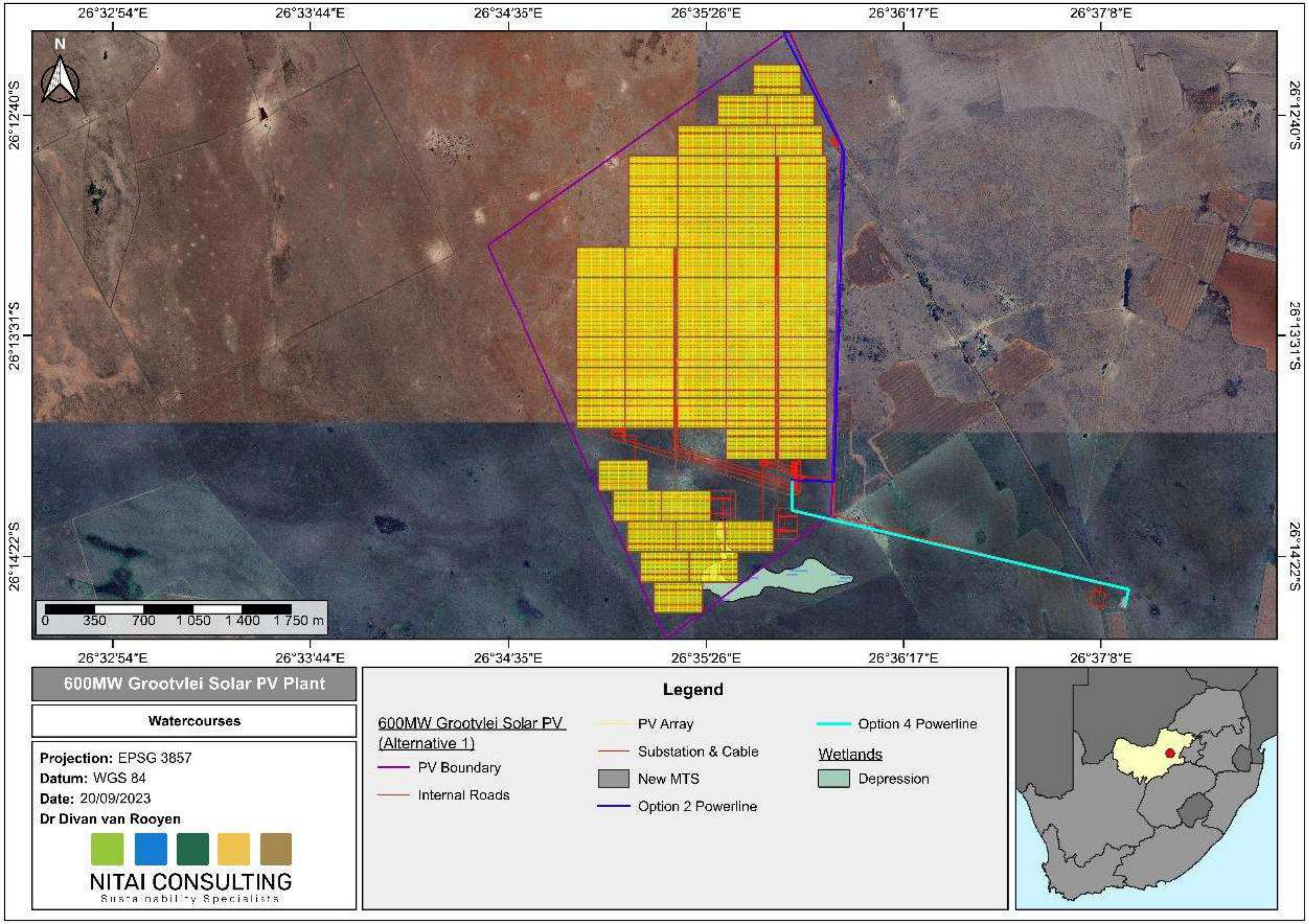

Figure 1: All watercourses associated with the Alternative 1 layout for the 600MW Grootvlei Solar PV Plant (Not all project components are showed due to scale).

Majority of the proposed 600MW Grootvlei Solar PV Plant is comprised of terrestrial vegetation and well-drained Hutton soils. Several vegetation species indicating wetlands were found near the southern portion of the PV footprint. In addition, augered soil samples around these areas did indicate signs of wetness in the form of red-yellow mottling.

Due to the identified wetland, the Alternative 1 layout has been revised to accommodate the sensitive features (see Figure 2 below). The new revised layout (Alternative 2) is situated outside of the wetland and its associated buffer zones.

The Present Ecological State of the wetland within the study area was calculated as C (Moderately modified), while the Ecological Importance and Sensitivity was determined as Moderate (C). This wetland does not hold high ecosystem service importance and is only of moderate value for food for livestock.

Site sensitivity with the use of Alternative 1 is classified as **Very High** due to the footprint encroaching into the wetland. However, since the layout of the 600MW Grootvlei Solar PV Plant has been revised and is situated outside of the wetland (**High** sensitivity) and its associated buffer zones (**Medium** sensitivity), the entire Alternative 2 layout is classified as Low sensitivity and can therefore continue with the use of Alternative 2 as layout. The use of Alternative 2 as layout would have limited to low impacts to the identified watercourse.

As a result of the very high sensitivity according to the Department of Forestry, Fisheries and the Environment Screening Tool, a Risk-based Impact Assessment was conducted in order to minimise and mitigate possible hydrological function changes, sediment impacts, introduction and spread of alien and invasive species as well as pollution. Significance ratings surrounding the Alternative 1 layout is higher than that of the Alternative 2 layout. **Therefore, the Alternative 2 layout is the recommended and preferred layout for the 600MW Grootvlei Solar PV Plant.**

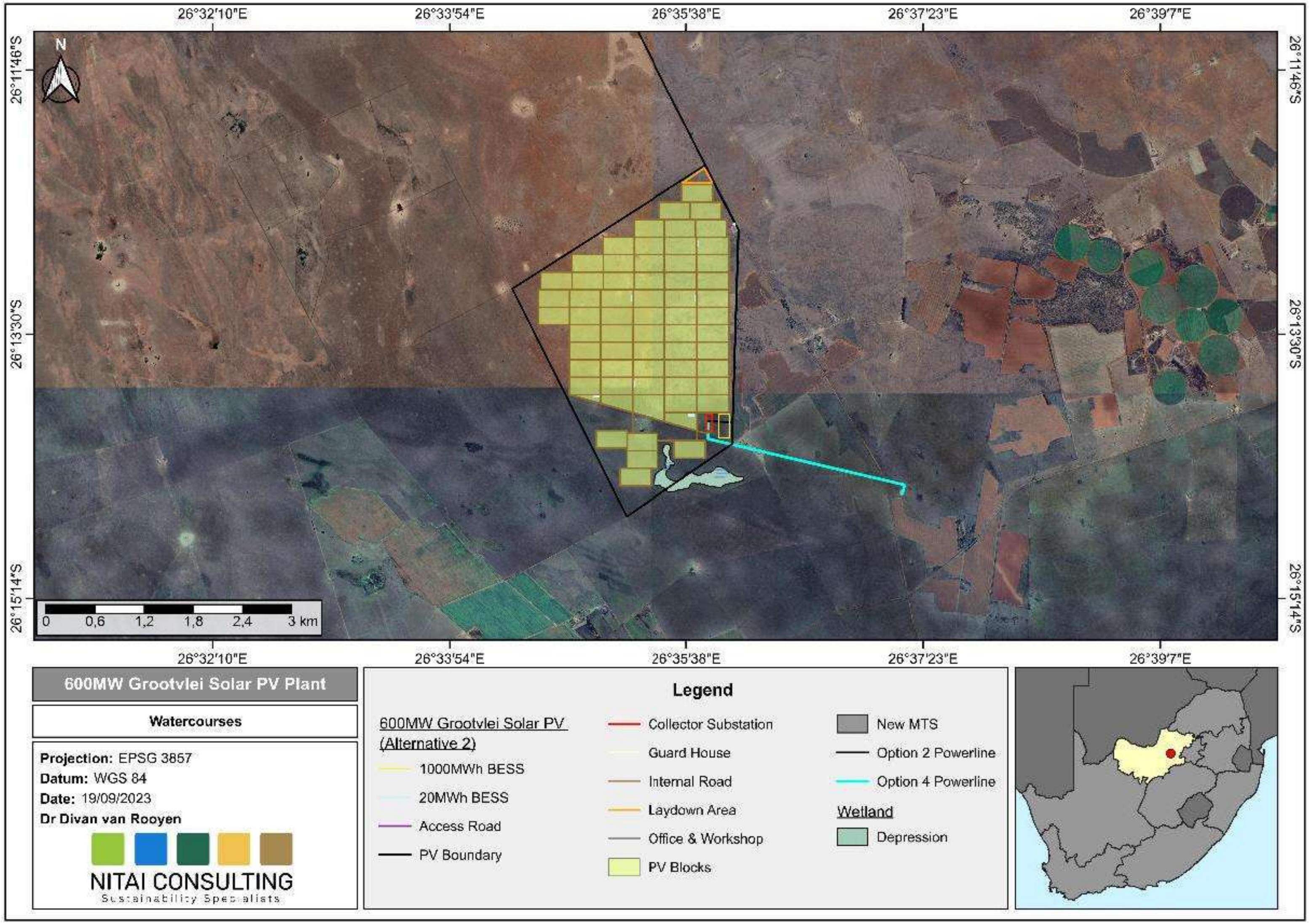

Figure 2: All watercourses associated with the Alternative 2 and Preferred layout for the 600MW Grootvlei Solar PV Plant (Not all project components are showed due to scale).

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List of Abbreviations

BA	Basic Assessment
CBA	Critical Biodiversity Area
CR	Critical
CVB	Channel Valley-Bottom
Dep	Depression
DFFE	Department of Forestry, Fisheries & the Environment
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
F	Floodplain
FL	Flat
GIS	Geographic Information System
GN	Government Notice
ha	Hectares
HGM	Hydrogeomorphic
km	Kilometer (1 000m)
kV	Kilovolt
LC	Least Concern
LILO	Loop In-Loop out
MAP	Mean Annual Precipitation
MTS	Main Transmission Substation
m	Meters
MW	Mega Watt
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act (No. 107 of 1998)
NFEPA	National Freshwater Priority Areas
NWA	National Water Act
NWCS	National Wetland Classification System
NWM	National Wetland Map
PES	Present Ecological State

REMP	River Ecostatus Monitoring Program
S	Seep
SAIIEA	South Africa Inventory of Inland Aquatic Ecosystems
SANBI	South African National Biodiversity Institute
SWA	Strategic Water Areas
UCVB	Unchanneled Valley-Bottom
VU	Vulnerable
WMA	Water Management Area
WRC	Water Research Commission
WUL	Water Use License
WULA	Water Use License Application
WSS	Water Supply Scheme

1 INTRODUCTION

1.1 Background

LTM Green Energies (Pty) Ltd. (hereafter referred to as the proponent) proposes the development of the 600 Mega Watt (MW) Grootvlei Solar PV Plant and associated infrastructure (hereafter referred to as the study area) near Ventersdorp, North West Province, South Africa (Figure 3). South Africa has committed itself to contribute to the global effort to address the challenge of climate change through the Paris Agreement. Therefore, with South Africa's heavy reliance on coal to produce electricity, this has increased the carbon footprint and electricity generation sources need to be diversified to ensure security of supply and reduction of its carbon footprint. As such, with the ever-increasing demand of electricity in Southern Africa, alternative measures to generate electricity needs to be employed to meet these demands. One of these alternative measures South Africa is exploring is Solar energy (Naicker, 2023). Nitai Consulting was appointed to conduct a Freshwater Impact Assessment as part of the Environmental Impact Assessment (EIA) of the proposed 600MW Grootvlei Solar PV Plant.

The presence of possible wetlands within the development area triggers the need for wetland delineation and risk assessment. Moreover, this assessment was done in accordance with the Environmental Impact Regulations (EIA) that were published under GN No. 982 in Gazette No. 38282 of 4 December 2014 and amended by GN 326 of 7 April 2017 published in Gazette No. 40772 (hereafter referred to as "the EIA Regulations") promulgated in terms of the National Environmental Management Act (Act No. 107 of 1998) (NEMA). Furthermore, the findings of this report are in accordance with the requirements of Appendix 6 of the EIA Regulations or to the Procedures for the. Assessment and Minimum Criteria for Reporting on Identified Environmental Themes (GN No. 320 in Government Gazette No. 43110 of 20 March 2020) (see Table 1 for the minimum requirements and criteria for Appendix 6 and Aquatic Biodiversity Themes).

The National Water Act (Act No. 36 of 1998) (NWA) ensures that South Africa's water resources are "protected, used, developed, conserved, managed and controlled." As such, any activity taking place within the regulated area of a watercourse, as defined in GN 509 published in the Government Gazette 40229 of 26 August 2016, would require authorisation in terms of NWA.

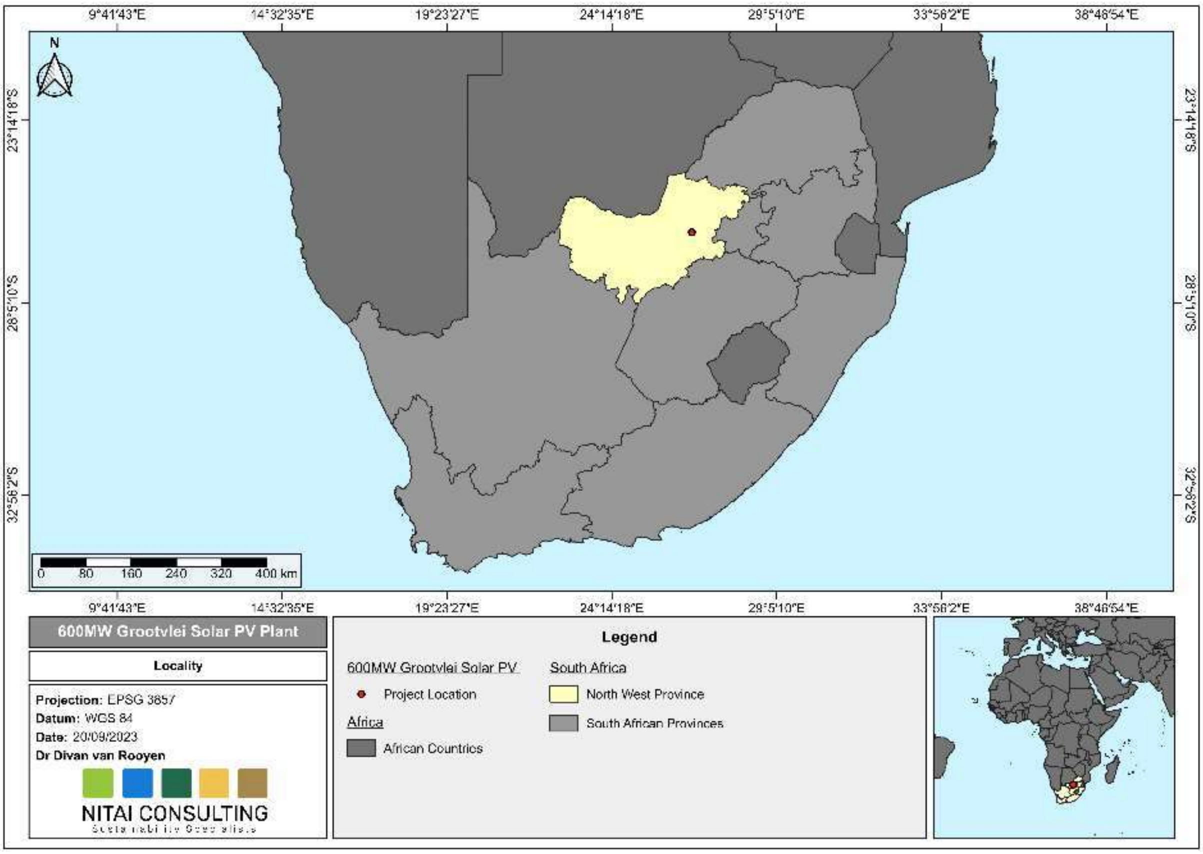

Figure 3: Study area locality in relation to South Africa

1.2 Importance of wetlands

A wetland is defined as per the NWA as "land that is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soil" (NWA, 1998).

The term "Wetlands" describes a variety of aquatic ecosystems, ranging from rivers, springs, seeps and mires in the upper catchment, to midlands marshes, pans and floodplains, to coastal lakes, mangrove swamps and estuaries at the bottom of the catchment (DWAF, 2005).

For an ecosystem to be identified as a wetland, it should comprise the following attributes:

- Hydromorphic soils that display characteristics resulting from prolonged saturation;
- Presence, at least occasionally, of water loving plants (hydrophytes); and,
- A high-water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil.

Wetlands play valuable functions in the landscape and more importantly, they also provide a wide range of ecosystem goods and services such as (DWAF, 2008) such as:

- Flood attenuation;
- Sediment trapping and stabilisation;

- Biodiversity support; and,
- Water quality improvement.

The primary task of wetlands is to regulate runoff and process water. They act as sponges where they hold water during floods and releases it during the dry periods. Therefore, during flooding, wetlands regulate water flows to reduce flood damage and aids in preventing soil erosion. Wetlands recharge groundwater resources and also removes pollutants from water. They are natural filters and aid in purifying water through trapping many pollutants, including sediment, heavy metals and disease-causing organisms (DWAF, 2005).

1.3 Terms of Reference

The aim of the study was to provide a baseline wetland delineation and risk assessment of all associated wetlands within the study area. This was achieved through the following:

- Identify and delineate of all associated wetlands within the proposed study area;
- Classify each watercourse according to the National Wetland Classification Systems;
- Compile a baseline description of all the potentially impacted aquatic environments according to GN No. 320, March 2020 (Table 1);
- Assessing the PES and EIS for all identified wetlands; and
- Comply with Appendix 6 of the EIA Regulations by undertaking a risk assessment and identifying suitable mitigation measures.

1.4 Structure of the report

The report has been structured as follows:

- Introduction;
- Legislation;
- Project Description;
- Methodology;
- Status Quo Analysis;
- Findings of the Assessment; and
- Conclusion.

Table 1: Compliance with Appendix 6 and criteria and minimum requirements for the various environmental themes as published in GN 320, March 2020

Nr.	Content	Reference
a	A specialist report prepared in terms of these Regulations must contain— details of— i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix 1
2.7	SACNASP Qualification and field of practice	Appendix 1
b	A declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix 1
2	The assessment must be undertaken on the preferred site and within the proposed development footprint	Section 3.2
2,3	Threat status of the ecosystem and species as identified by the DEA screening tool	Section 6.4.1
c	An indication of the scope of, and the purpose for which, the report was prepared;	Section 1
cA	An indication of the quality and age of base data used for the specialist report;	Section 2 and Section 4.1.2
cB	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 7
d	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 6.3
e	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 4
2.3	Description of the aquatic biodiversity and ecosystems on the site including: • aquatic ecosystem types • Presence of aquatic species, and compositions of aquatic species communities their habitat, distribution and movement patterns	Section 6.3
2,3,4	A description of the ecological importance and sensitivity of the aquatic ecosystem including: • a) The description (spatially if possible) of the ecosystem process that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of	Section 6.3.7

	surface water and subsurface water, recharge, discharge, sediment transport etc.); • b) The historic ecological condition (reference) as well as present ecological state of rivers (in-stream, riparian and floodplain habitat), wetlands and or estuaries in terms of possible changes to channel and flow regime (surface and groundwater)	
f	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 6 and Section 7
g	An identification of any areas to be avoided, including buffers;	Section 6.4.2 and 6.4.3
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 6.4.3
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4.1.9
j	A description of the findings and potential implications of such findings on the impact of the proposed activity (including identified alternatives on the environment) or activities;	Executive Summary, Section 6
	The following questions should be answered: • Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal? • Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present?	Section 6
	How will the development impact on fixed and dynamic ecological processes that operate within or across the site: • a. Impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); and • b) Change in the sediment regime (e.g. sand movement, meandering river mouth /estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub -catchment; • c) The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary, seasonal, permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.).	Section 7.1.1

	• d) to what extent will the risk associated with water uses and related activities change?	
2,5	How will the proposed development impact on the functioning of the aquatic feature? This must include: • a) Base flows (e.g. too little/too much water in terms of characteristics and requirements of system) • b) Quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over - abstraction or instream or off -stream impoundment of a wetland or river) • c) Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchannelled valley -bottom wetland to a channelled valley -bottom wetland). • d) Quality of water (e.g. due to increased sediment load, contamination by chemical and /or organic effluent, and /or eutrophication) • e) Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal). • f) The loss or degradation of all or part of any unique or important features (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.) associated with or within the aquatic ecosystem.	Section 7.1.1
2,5	How will the development impact on key ecosystem regulating and supporting services especially: • a) Flood attenuation • b) Stream flow regulation • c) Sediment trapping • d) Phosphate assimilation • e) Nitrate assimilation • f) Toxicant assimilation • g) Erosion Control • h) Carbon Storage?	Section 7.1.1
2,5	How will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator - prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	Refer to Terrestrial Biodiversity Report
k	Any mitigation measures for inclusion in the EMPr;	Section 7.1.1
l	Any conditions for inclusion in the environmental authorisation;	Section 7.1.1
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 7.1.1
n	A reasoned opinion—	Executive Summary

	i. [as to] whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	and Section 8
o	A description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
p	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q	Any other information requested by the competent authority.	None

2 LEGISLATION

2.1 South African Legislation

In South Africa, there are a wealth of policies and legislation dealing directly or indirectly with environmental protection and management. Aquatic ecosystems, and in particular wetlands, have been protected and management over the years through various policies and legislation. These include:

- Constitution of the Republic of South Africa (Act 108 of 1996);
- NEMA;
- EIA Regulations
- NWA;
- General Authorisations (GA's);
- National Environmental Management: Biodiversity Act (Act 10 of 2004); and
- National Environmental Management: Protected Areas Act (Act 57 of 2003).

2.1.1 Constitution of the Republic of South Africa (Act 108 of 1996)

The Constitution of the Republic of South Africa (Act 108 of 1996) aims to provide an environment that is protected, for the benefit of the present and future generations, through reasonable legislative and other measures that –

- Prevent pollution and ecological degradation;
- Promote conservation; and,
- Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

2.2 National Environmental Management Act (NEMA, Act 107 of 1998)

The aims of the NEMA are “to provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote cooperative governance and procedures for co-ordinating environment functions exercised by organs of state; to provide for certain aspects of the administration and enforcement of other environmental management laws; and to provide for matters connected therewith”.

NEMA and the EIA Regulations, states that prior to any development, an Environmental Authorisation (EA) application process should be followed. For an EA application, either a Basic Assessment (BA) process or an EIA process can be followed depending on the scale of the Environmental Impact. On 20 March 2020, new regulations were gazetted (GN No. 43110) that has replaced the requirements of Appendix 6 of the EIA Regulations and therefore provides criteria and minimum requirements for the various environmental themes in terms of Section 24(5)(a) and (h) and Section 44 of the NEMA when applying for an EA (refer back to Table 1).

2.3 Legislation Governing Watercourses

2.3.1 National Water Act (NWA, Act 36 of 1998)

The NWA aims to achieve a balance between the use and protection of the country’s water resources, where the entire aquatic ecosystem – not merely the water it provides – is recognised as “the water resource”. Moreover, the NWA has redefined the concept of water resource use and protection so that it not only includes water but the full range of goods and services that aquatic ecosystems provide (DWAF, 2008).

A watercourse is defined as:

- River or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and,
- Any collection of water which the Minister may, by notice in the *Gazette*, declare to be a watercourse.

According to the Water Use Registration Regulations published under GN R1352 in Government Gazette 20606 of 12 November 1999, any person who uses water as contemplated under Section 21 of the NWA must, register the relevant water use. The registration of a water use must be done by notifying the DWS and complete the registration process. According to the Act and Section 21, water uses include:

(a) Taking water from a water resource;
(b) Storage of water;
(c) Impeding or diverting the flow of water in a watercourse;

(d) Engaging in a stream flow reduction activity contemplated in Section 36;
(e) Engaging in a controlled activity identified as such in Section 37(1) or declared under Section 38(1);
(f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
(g) Disposing of waste in a manner which may detrimentally impact on a water resource;
(h) Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
(i) Altering the bed, banks, course or characteristic of a watercourse;
(j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and,
(k) Using water for recreational purposes.

The regulated area of a watercourse for Section 21(c) and (i) water uses is defined as follows in Government Gazette No. 40229 of 26 August 2016:

- The outer edge of the 1 in 100 year flood line and /or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
- In the absence of a determined 1 in 100 year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to Section 144 of the NWA); or
- A 500 m radius from the delineated boundary (extent) of any wetland or pan.

2.3.2 National Environmental Management: Biodiversity Act (NEM:BA, Act 10 of 2004)

The main aim of NEM:BA is to protect species and ecosystems while promoting the sustainable use of indigenous biological resources. Moreover, the act addresses the need for protecting threatened ecosystems. Furthermore, the act aims to provide the South African National Biodiversity Institute (SANBI) the tools to assist in achieving the objectives of this act.

2.3.3 National Environmental Management: Protected Areas Act (NEM:PA, Act 57 of 2003)

The aim of NEM:PA is to provide the declaration and management of protected areas (within the framework of national legislation, including NEMA). In addition, the act aims to effect a national system of protected areas in South Africa as part of a strategy to manage and conserve its biodiversity. Also, NEM:PA wants to promote sustainable utilisation of protected areas in such a way that it would preserve the ecological character of protected areas.

3 PROJECT DESCRIPTION

3.1 Study location

The proposed 600MW Grootvlei Solar Plant and associated infrastructure is situated approximately 20 kilometres (km) north west of Ventersdorp, North West Province, South Africa (see Figure 4 below). Moreover, the proposed study area is located within the Dr Kenneth Kaunda District Municipality and the JB Marks Local Municipality. The study area (approximately 655 hectares (ha)) can be accessed via the N14 (main access road) and the R53 (gravel road).

3.2 Project Description

The proponent proposes the development of two Alternative layouts of the 600MW Grootvlei Solar PV Plant and associated infrastructure located on various farm portions of the following farms; Grootvlei No. 161, Houtkop No. 152, Vogelstruispan No. 151, Lucky Find No. 158, Beta No. 159, and Boschkop near Ventersdorp, in the North West Province (Figure 5 and Figure 6).

The proposed Solar PV Facility will be comprised of the following:

- 600MW PV solar panels or modules (arranged in arrays);
- Mounting structures to support the PV panels;
- DC-AC current inverters stations, transformers, and internal electrical reticulation (underground cabling);
- Grid Connection:
    - Option 1: Consists of 2 x 132 kilovolt (kV) powerlines, approximately 14 km in length, from the new facility 33 kV substation to new 400/132 kV Main Transmission Station (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275 kV power line; or,
    - Option 2: Comprises of 2.8 km 132 kV line from the new facility 33 kV substation facility to the Makokskraal Substation.
- New 400/132 kV MTS;
- On site switching station/substation;
- Administration Buildings (Offices);
- Workshop areas for maintenance and storage;
- Temporary laydown area;
- Internal roads and perimeter fencing of the footprint area;
- Lithium-ion Battery Energy Storage System (BESS);
- Security Infrastructure; and finally,
- Site Access from unnamed gravel road via the N14 and/or R53.

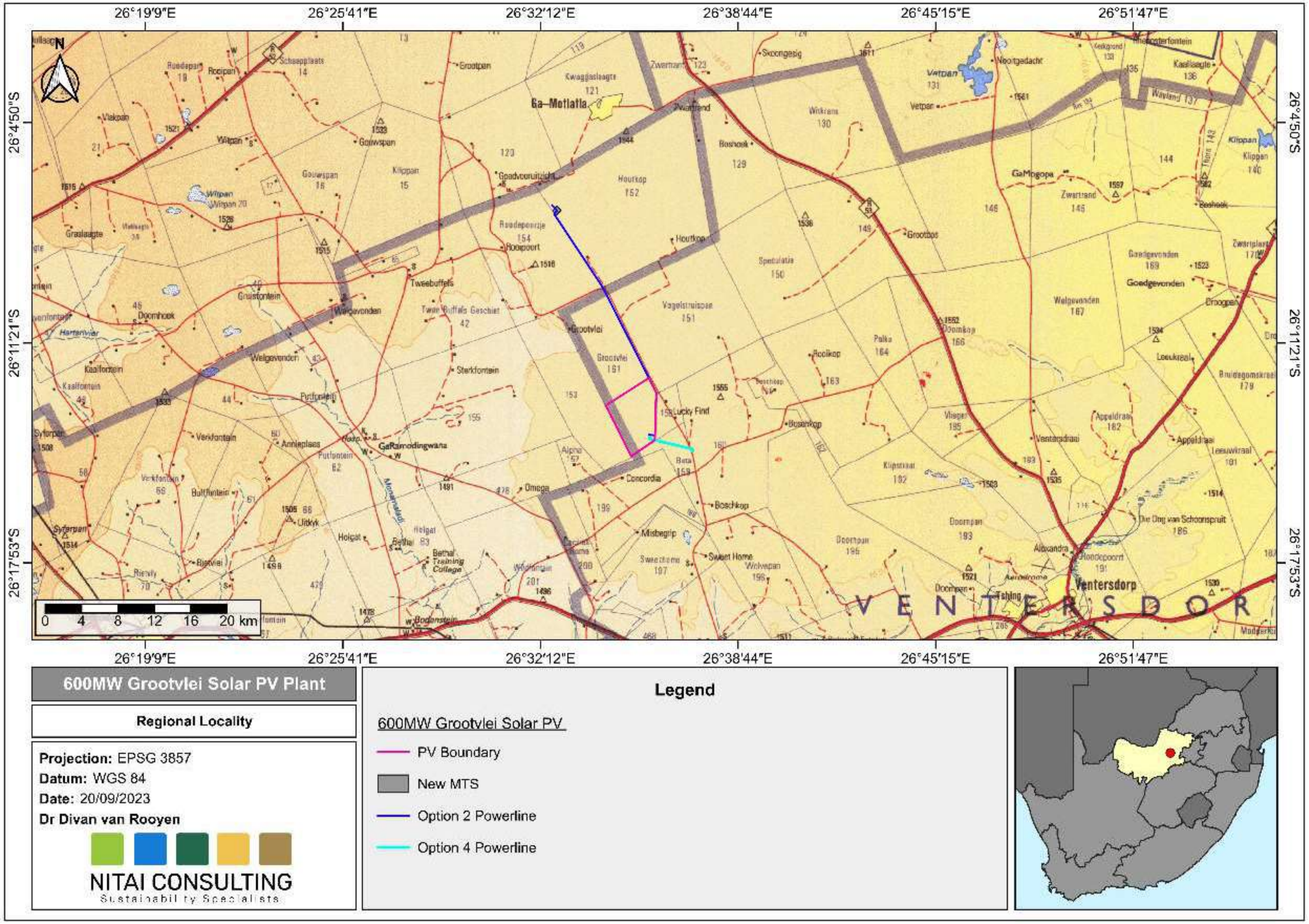

Figure 4: Regional Locality of the proposed study area

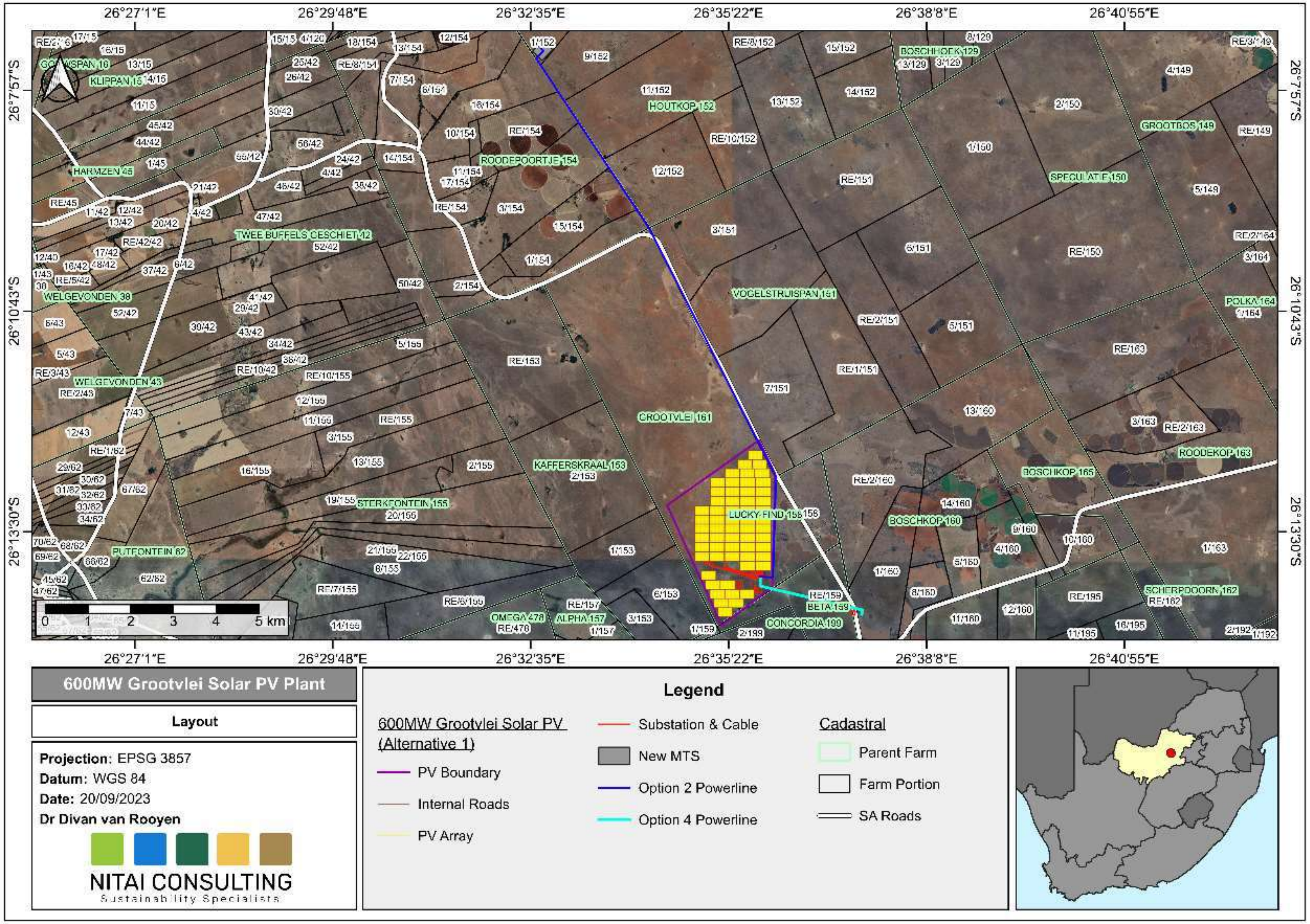

Figure 5: Proposed Alternative 1 layout of the 600 MW Grootvlei Solar PV Facility

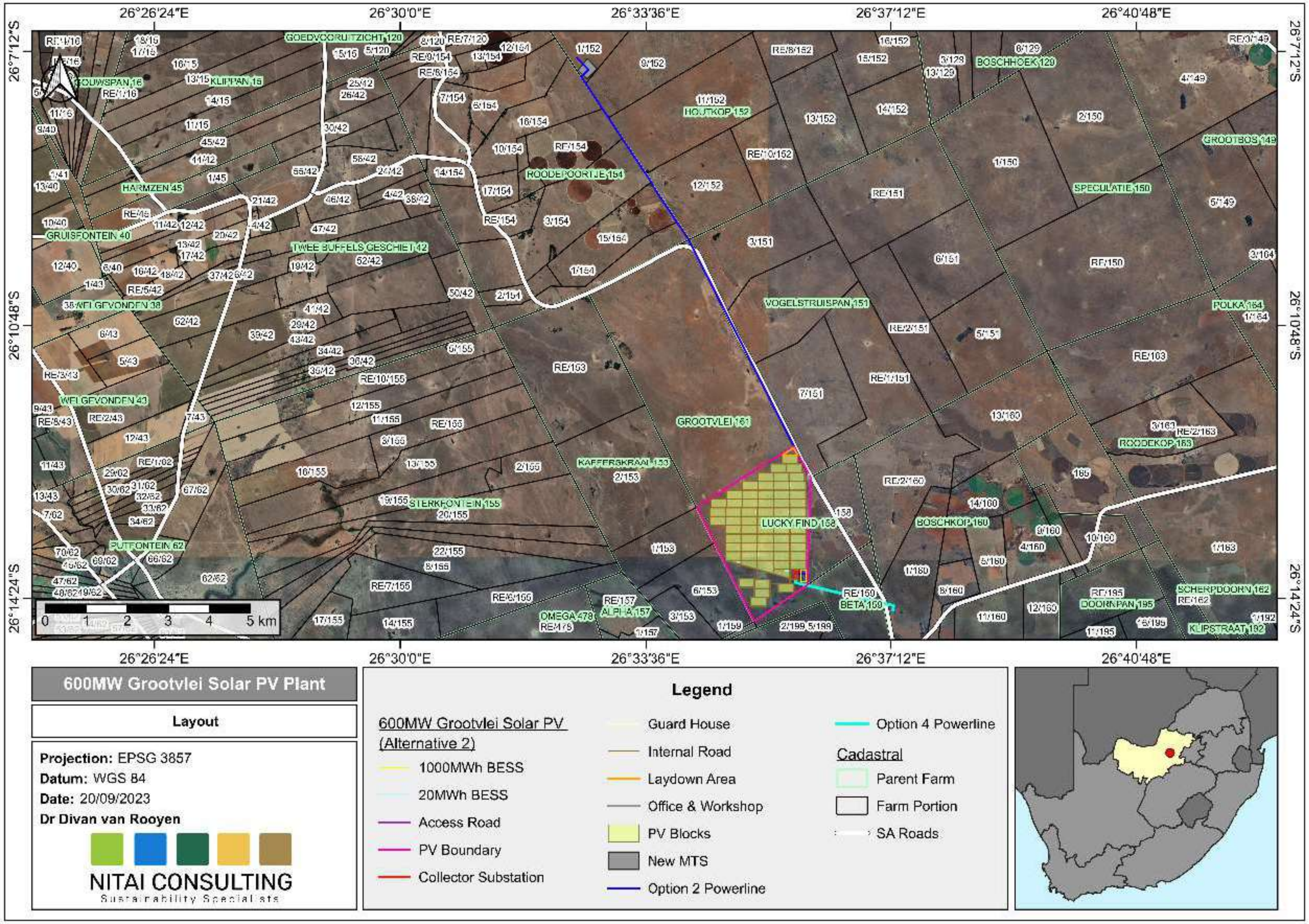

Figure 6: Proposed Alternative 2 layout of the 600 MW Grootvlei Solar PV Facility

4 METHODOLOGY

The following sections provide an overview of the methodology used for this assessment.

4.1 Approach

4.1.1 Desktop Study

The preliminary mapping and classification of rivers and wetlands within the proposed footprint of 600MW Grootvlei Solar PV Plant was undertaken using the latest and historic aerial imagery (Google Earth Pro).

4.1.2 Spatial Data Consulted

The spatial data used over the course of the assessment include the following:

- Aerial imagery (Google Earth Pro);
- National Freshwater Ecosystem Priority Areas (NFEPA) (rivers and wetlands) (Nel *et al*., 2011);
- South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (van Deventer *et al*., 2018);
- South African Inventory of Inland Aquatic Ecosystems (van Deventer *et al*., 2019);
- 5m Contours;
- Geology;
- South African Vegetation Map (Mucina & Rutherford 2018);
- North West Critical Biodiversity Areas (CBA's) and Ecological Support Areas (ESA's) (Showno & Desmet, 2008);
- Strategic Water Source Areas (SWA's) (Nel *et al*., 2013);
- Protected Areas and Protected Areas Expansion Strategy; and,
- DWA Eco-Regions (Kleynhans *et al*., 2005).

4.1.3 Identification and mapping of wetlands

The South African National Biodiversity Institute developed the National Wetland Classification Systems (NWCS) that was considered for this assessment. This is a system that is comprised of a hierarchical classification process that defines a wetland based on the principles of the hydrogeomorphic (HGM) approach.

Wetlands are delineated based on the guidelines set out by DWAF (2005) in their Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas. As stated earlier, wetlands are a land that is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface (see Figure 7 on a cross-section through a wetland). The outer edge of a wetland is delineated by means of considering the following four wetland indicators:

- The Terrain Unit Indicator: Helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator: Identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation;
- The Soil Wetness Indicator: Identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation;
- The Vegetation Indicator: Identifies hydrophilic vegetation associated with frequently saturated soils.

According to the NWA, vegetation is the primary indicator, which must be present under normal circumstances. However, in practice the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

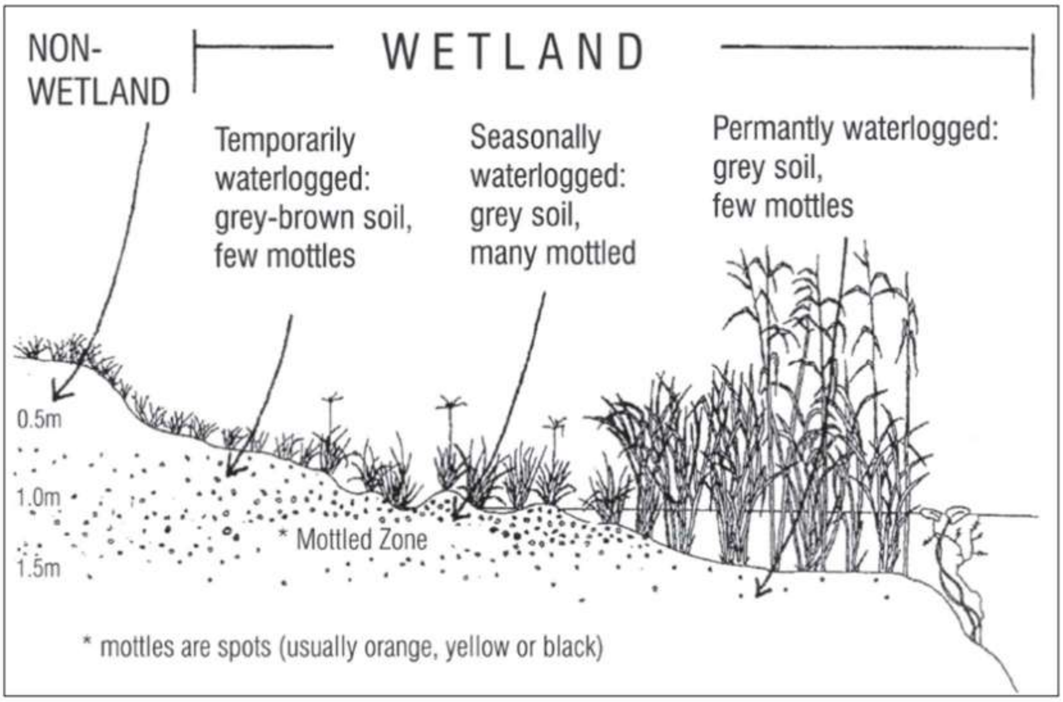

Figure 7: Cross-section through a wetland, indicating how soil wetness and vegetation indicators changes as one moves along a gradient (Extracted from DWAF 2005).

4.1.4 Present Ecological State (PES) of associated watercourses

The approach is to quantify the impacts of human activity or clearly visible impacts on wetland health and then convert it to impact scores to a PES score (Table 2). The PES scores provide an overall indication of the health or integrity of biophysical attributes which is determined through a comparison of the current condition to the natural (or close to natural), so-called "reference" condition (DWAF, 2007). The PES scores are calculated based on four key inter-related drivers namely; hydrology, geomorphology, water quality and vegetation. Moreover, the PES is assessed through evaluating the extent to which anthropogenic activities have altered wetland characteristics across the four inter-related components of wetland health (Macfarlane *et al*., 2020).

Table 2: Present Ecological State categories and Impact Scores (adapted from Macfarlane et al., 2009)

PES	Description	Impact Score Range	Impact Category
A	Unmodified, natural.	0 to 0.9	None
B	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1.0 to 1.9	Small
C	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2.0 to 3.9	Moderate
D	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4.0 to 5.9	Large
E	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6.0 to 7.9	Serious
F	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8.0 to 10.0	Critical

4.1.5 Ecological Importance and Sensitivity (EIS) of associated watercourses

To determine the EIS, the method of Rountree *et al*. (2013): Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0) was used. This is specifically important to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. The determination of the EIS category takes into account the PES scores calculated for WET-Health together with the function and service provision that enables the assessor to determine the EIS category for the wetland or group being assessed. The method uses a scale from 0 to 4 to determine the EIS category where 0 to <=1 is low/marginal importance; >1 to <=2 is moderate; >2 and <=3 is high and >3 to <=4 is very high ().

Table 3: Ecological Importance and Sensitivity Categories (Adapted from Rountree et al., 2013)

Recommended Ecological Management Class	Range of Mean	EIS Category
A	3.0 to 4.0	Very High
B	2.0 to 3.0	High
C	1.0 to 2.0	Moderate
D	0 to 1.0	Low/marginal

4.1.6 The National Wetland Classification System (NWCS)

The SANBI together with the Water Research Commission (WRC) developed the NWCS will be used for this assessment. The basis of this Classification System uses a hierarchical system of defining a wetland based on the HGM units. The wetland HGM units considered are as follows (Ollis *et al*., 2013):

- Unchanneled valley bottom wetland (UCVB);
- Channelled valley bottom wetland (CVB);
- Seep (S);
- Floodplain (F);
- Depression (D); and
- Flat (FL).

4.1.7 Determination of Buffer Zones

The appropriate buffer zones for the proposed 600MW Grootvlei Solar PV Plant were determined using the "Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands, and Estuaries" by Macfarlane and Bredin (2017).

4.1.8 Risk Assessment of associated watercourses

The Risk-Based Assessment was conducted in accordance with the DWS water use authorisation risk assessment matrix guidelines. The significance ratings were calculated according to Table 4:

Table 4: Significance ratings, classes and management description of the DWS water use authorisation risk assessment matrix

Rating	Class	Management Description
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated.
56 – 169	(M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input.
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. License required.

4.1.9 Assumptions and limitations

The following assumptions and limitations accompany this assessment:

- This report is based on the information and layout received from the proponent;
- The findings, observations, conclusions and recommendations are based on the author's best professional and scientific knowledge;
- Wetland just outside the study area has been delineated based on visual observation of wetland vegetation indicators as well as latest Google Earth Satellite Imagery. Therefore, the portions of the wetland outside the PV site should be delineated for the purposes of the WUL application; and,
- **The assessment of wetlands presented in this report is limited to the proposed project footprint and does not include the extended 500m radius regulated area of the 600MW Grootvlei Solar PV Plant. This report is therefore not sufficient for use in a WUL application.**

5 STATUS QUO ANALYSIS

The following sections provide context of the aquatic environment in relation to the proposed 600MW Grootvlei Solar PV Plant.

5.1 Regional context

5.1.1 Climate

The study area is characterised with warm-temperate, summer-rainfall region with an overall Mean Annual Precipitation (MAP) ranging between 593 mm. Summer temperatures are high with severe frequent frost occurring in the winters (Mucina & Rutherford, 2018).

5.1.2 Ecoregion

South Africa is a geologically, geomorphologically, climatically and ecologically complex country that has a diverse range of ecosystems, including freshwater wetlands and rivers (Kleynhans *et al*., 2005). It is important to understand the biophysical drivers that affect the characteristics of water resources in the region when analysing the ecology of any area. River ecoregional classification or “typing” will allow the grouping of rivers according to similarities based on a top-down nested hierarchy. This aids in simplifying and contextualising assessments and statements on ecological water requirements. One of the big advantages of this systems is the extrapolation of information from data rich rivers to data poor rivers within the same hierarchical typing context (Kleynhans *et al*., 2005).

Ecological regions are regions within which there is relative similarity in the mosaic of ecosystems and ecosystem components (biotic and abiotic, aquatic and terrestrial) (Kleynhans *et al*., 2005). The proposed study is located within the **Highveld** ecoregion. A summary of this ecoregion is provided in Table 5 with the location and extent shown in Figure 8.

Table 5: Description of the Ecoregion classified for the study area

Ecoregion (Level I)	Ecoregion (Level II)	Description
11	11.01	**Highveld:** Plains with a moderate to low relief, as well as various grassland vegetation types (with moist types present towards the east and drier types towards the west and south), define this high lying region.

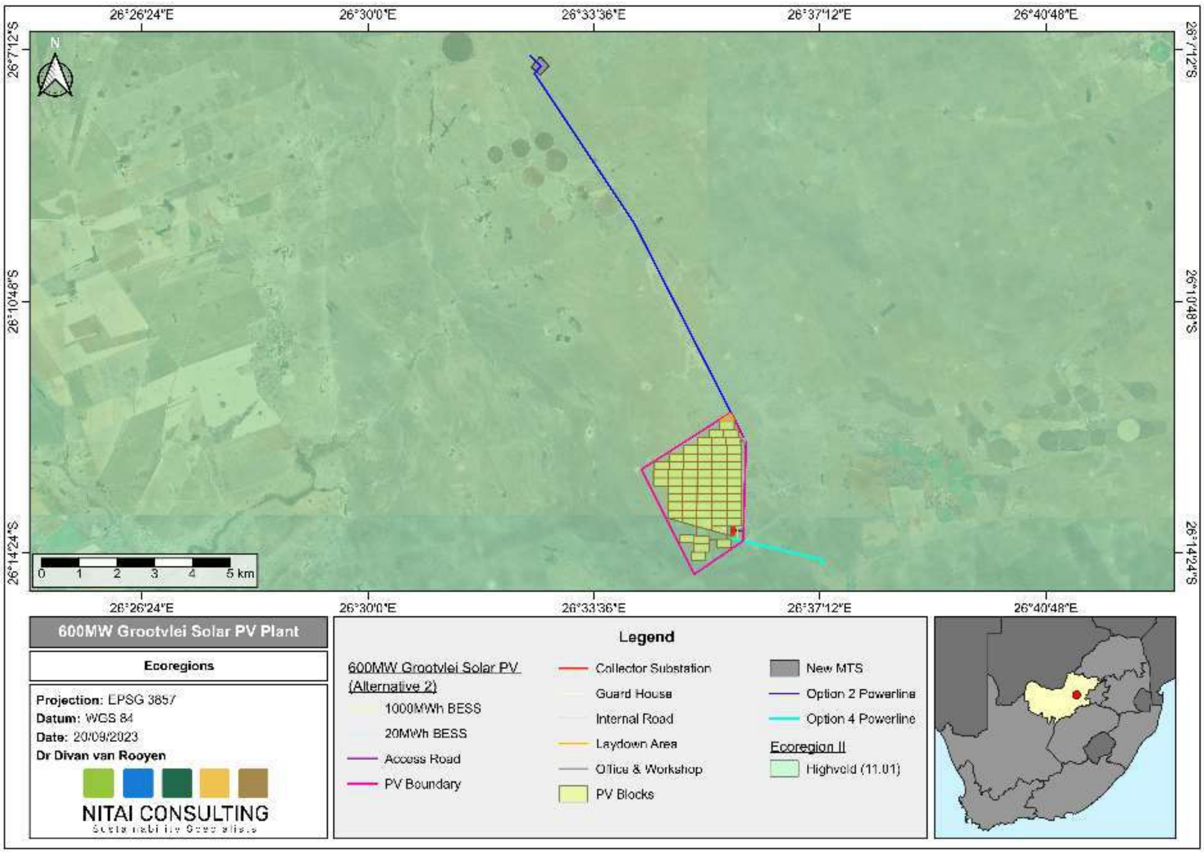

Figure 8: Map indicating the location of the Ecoregion relevant to the study area (Alternative 2 and Preferred Layout)

5.1.3 Geology and Soils

The geology of the study area is comprised of Dolomite and Chert geological types. Furthermore, these two geology types form part of the Malmani Subgroup (Figure 9 and Figure 10) (Transvaal Supergroup). As a result of the geology, the main soil types dominating the landscape is Mispah and Glenrosa soils (Figure 11) and is typical of the Fa land type (Lime rare or absent in the entire landscape) (Mucina & Rutherford, 2006; van der Waals *et al*., 2019). In addition, deeper red to yellow apedal soils in the form of Hutton and Clovelly occurs sporadically and represents the Ab (Red, dystrophic and/or mesotrophic) land type (Mucina & Rutherford, 2006; van der Waals *et al*., 2019).

The soil moisture in both these two land types are either from recharge of lower fractured rock layers, free drainage or leaching from the profiles (van der Waals *et al*., 2019). Within the Fa land type, redox morphology signs are generally lacking due to the rapid percolation through the fractured rock material. However, redox morphology signs are in some cases visible where the climate and flow regime conspire to yield prolonged wetness and saturation. In these cases, the redox morphology can be seen at family level in the Glenrosa form (van der Waals *et al*., 2019). In addition, these rocky and shallow soils can contribute to the expression of wetness and wetlands due to the water capturing function of these soils. In the Ab land type, the soils tend to not exhibit any mottling or redox morphology characteristics and wetlands do occur in these landscapes, however, they are limited to the immediate footprint of watercourses areas (van der Waals *et al*., 2019).

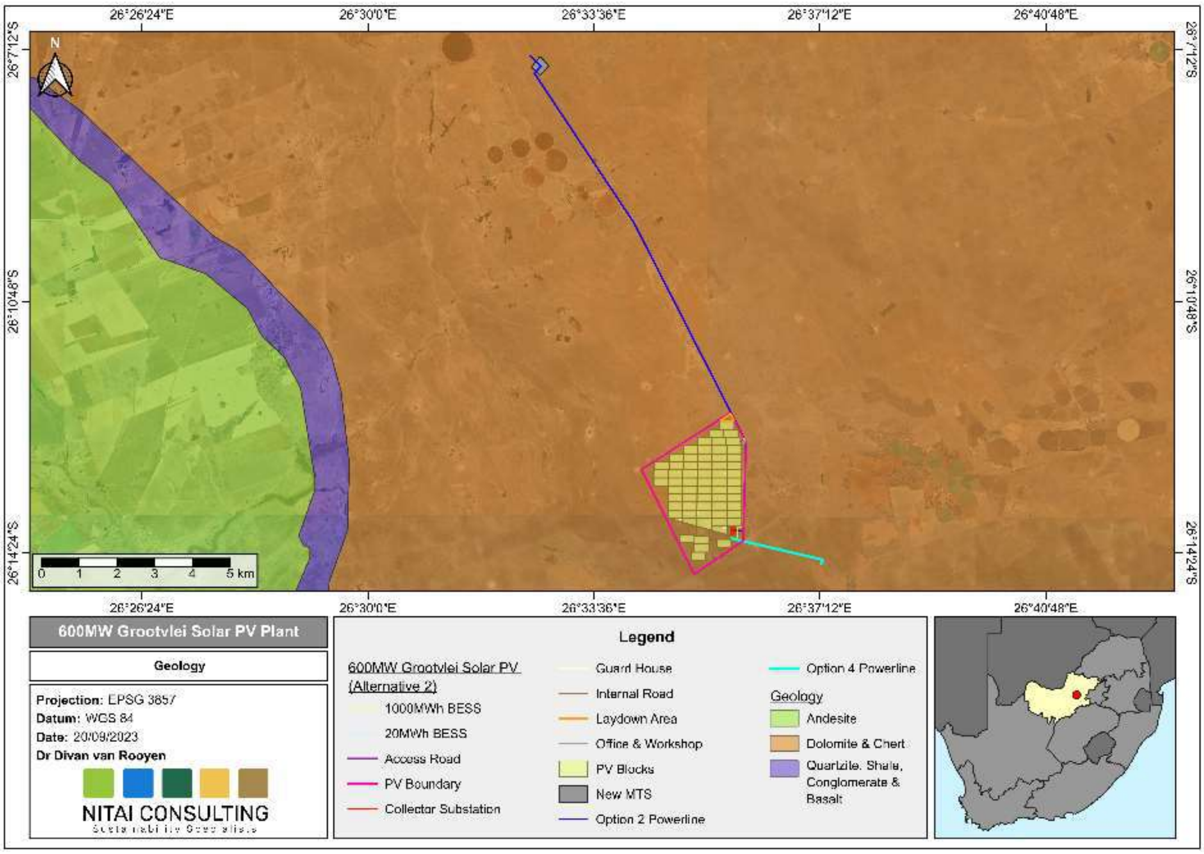

Figure 9: Map indicating the various Geology types associated with the study area (Alternative 2 and Preferred Layout)

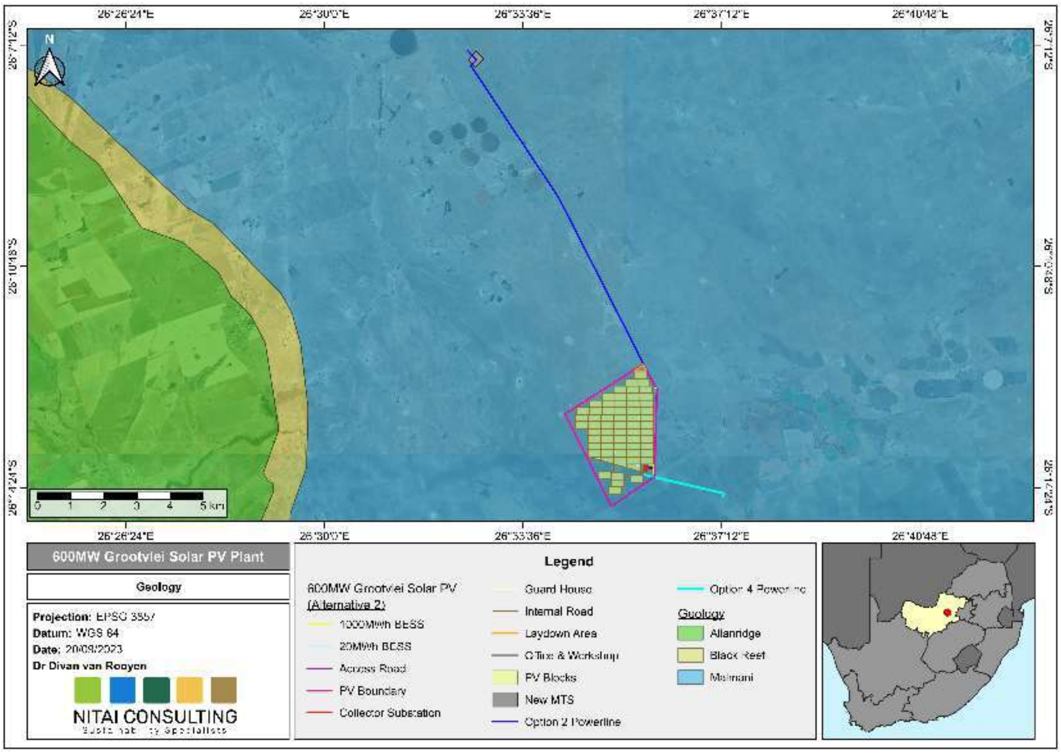

Figure 10: Map indicating the extent of the various different Geology groups associated with the study area (Alternative 2 and Preferred Layout)

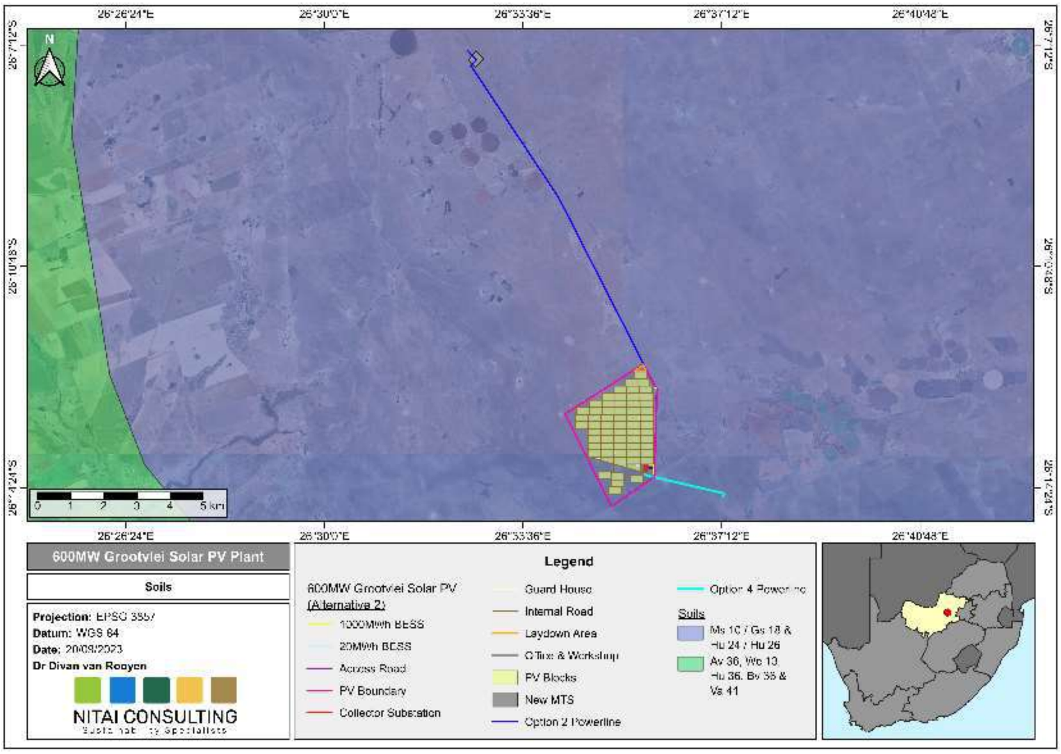

Figure 11: Soil map indicating the Glenrosa, Mispah and Hutton soil forms associated with the study area (Alternative 2 and Preferred Layout)

5.1.4 Vegetation characteristics

The study area falls within the Dry Highveld Grassland Bioregion (Gh 15) and is characterized as the Carletonville Dolomite Grassland (Figure 12). This vegetation type is mainly within the North West Province followed by Gauteng and then marginally within the Free State Province. Characterised as slightly undulating plains dissected by prominent rocky chert ridges. Additionally, species-rich grasslands forming a complex mosaic pattern dominated by many species (Mucina & Rutherford, 2006).

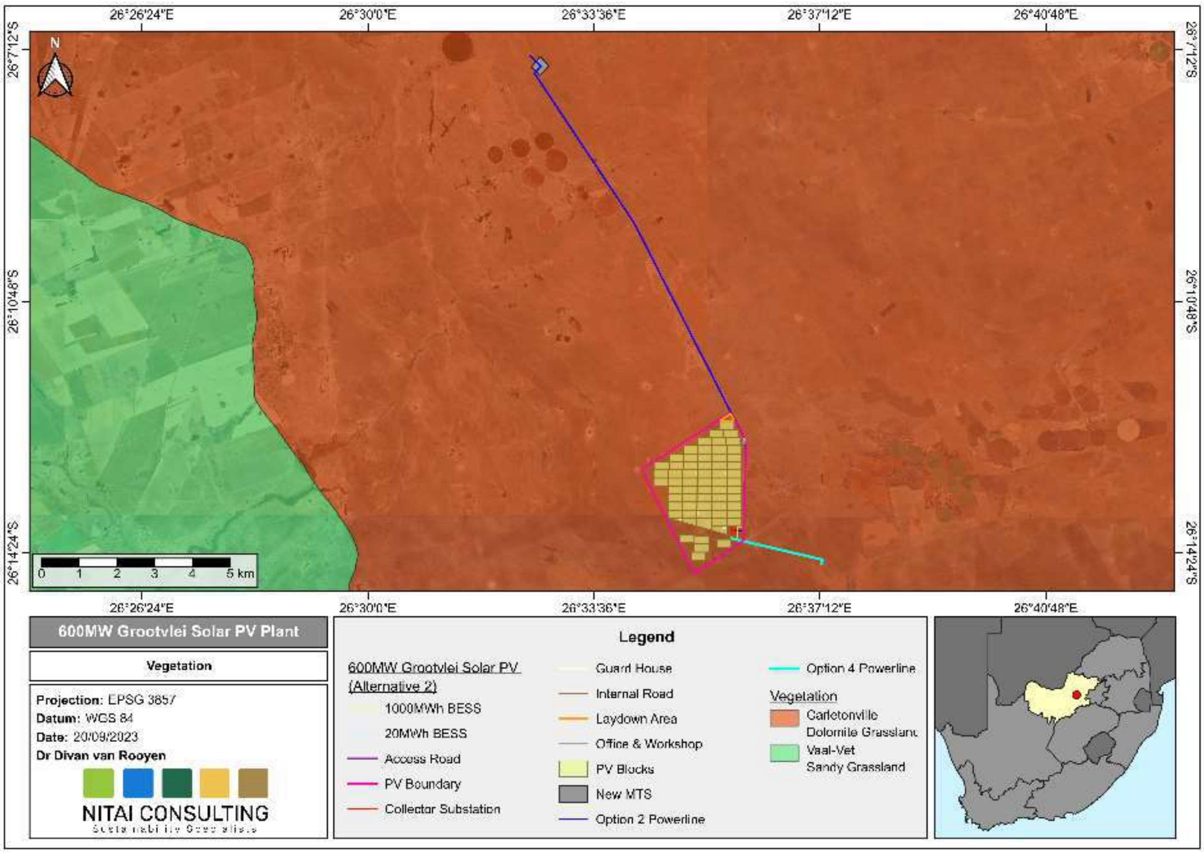

Figure 12: Vegetation type associated with the study area (Alternative 2 and Preferred Layout)

5.1.5 Water Management Areas and Quaternary Catchment

Previously, the Vaal Water Management Area (WMA) was divided into three categories, namely the Lower Vaal, Middle Vaal and the Upper Vaal WMA's (DWAF, 2004a). However, under the most recent GN 1056 No. 40279 of 16 September 2016, the WMA's has been refined into Limpopo, Olifants, Inkomati-Usuthu, Pongola-Mtamvuna, Vaal, Orange, Mzimvubu-Tsitsikamma, Breede-Gouritz and Berg-Olifants. The study area is located within one WMA. The proposed study area is situated within the middle region of the Vaal WMA (Figure 13). The middle region is part of a large water supply system which includes adjacent WMA's. It is situated downstream of the confluence of the Vaal and Rietspruit rivers and upstream of Bloemhof Dam. The region extends to the headwaters of the Schoonspruit River in the north and the Vet River in the south (DWAF, 2002). The land use within the middle region is characterized by agriculture (irrigation crops – wheat, groundnuts, sorghum and sunflowers). In addition, extensive gold mining activities are located within the Middle Vaal region (DWAF, 2004b).

The major rivers within this region are the Schoonspruit, Rhenoster, Vals, Vet and Vaal rivers and the Middle Vaal comprises of C24, C25, C41, C43, C60 and C70 quaternary catchments (DWAF, 2004b). The Middle Vaal is very much dependent on the water releases from the Upper Vaal region to meet its bulk water requirements for urban, mining, and industrial sectors. In addition, local resources are mainly being used for irrigation and smaller towns (DWAF, 2004b). Within the Vaal WMA, mining activities (gold mines) threatens water quality while large volumes of water are returned via treated effluent to the river systems from the urban areas and mine dewatering which further places stress on the water quality of this sub-catchment (DWAF, 2004b).

Majority of the study area is located within the C24F Quaternary Catchment while a small section of the Option 2 Powerline is within C24E Quaternary Catchment (see Figure 14 below). The DWS has determined PES and EIS scores for each Quaternary Catchment area in Southern Africa back in 2014 (DWS, 2014). As such, for the Quaternary Catchments C24F, DWS has determined a PES as C (Moderately modified). In addition, the EIS was determined as C (Moderate Importance and Sensitivity) (DWS, 2014). Furthermore, the PES and EIS scores was determined for the C24E as D (Largely Modified) and C (Moderate Importance and Sensitivity) (DWS, 2014).

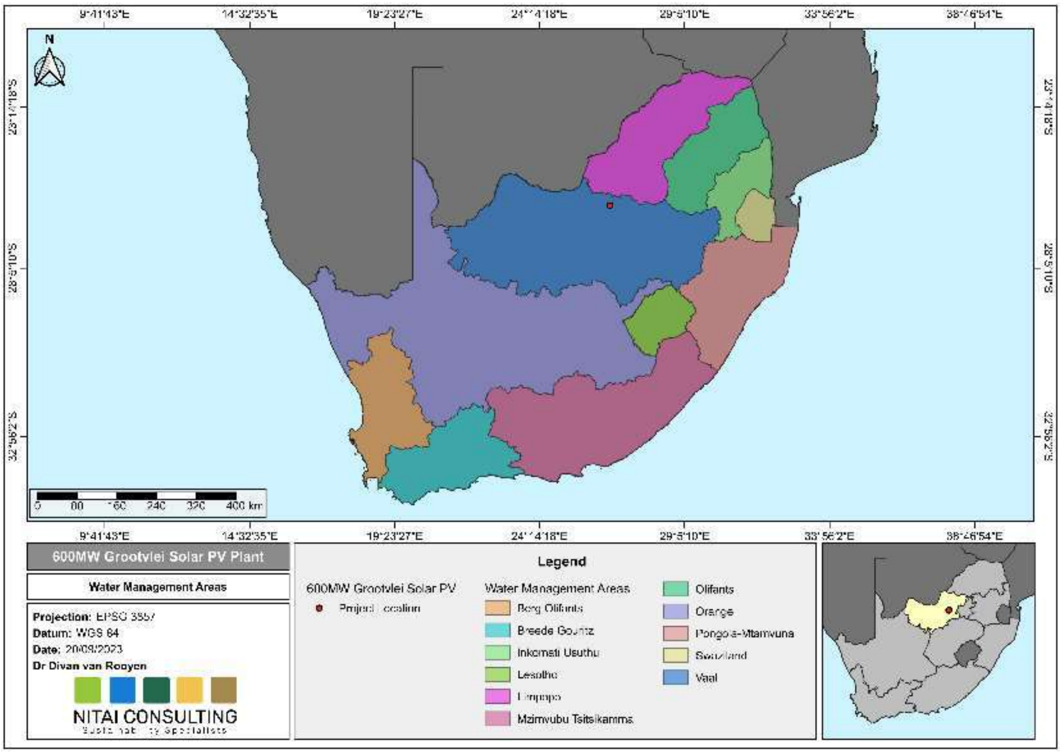

Figure 13: Water Management Area associated with the study area

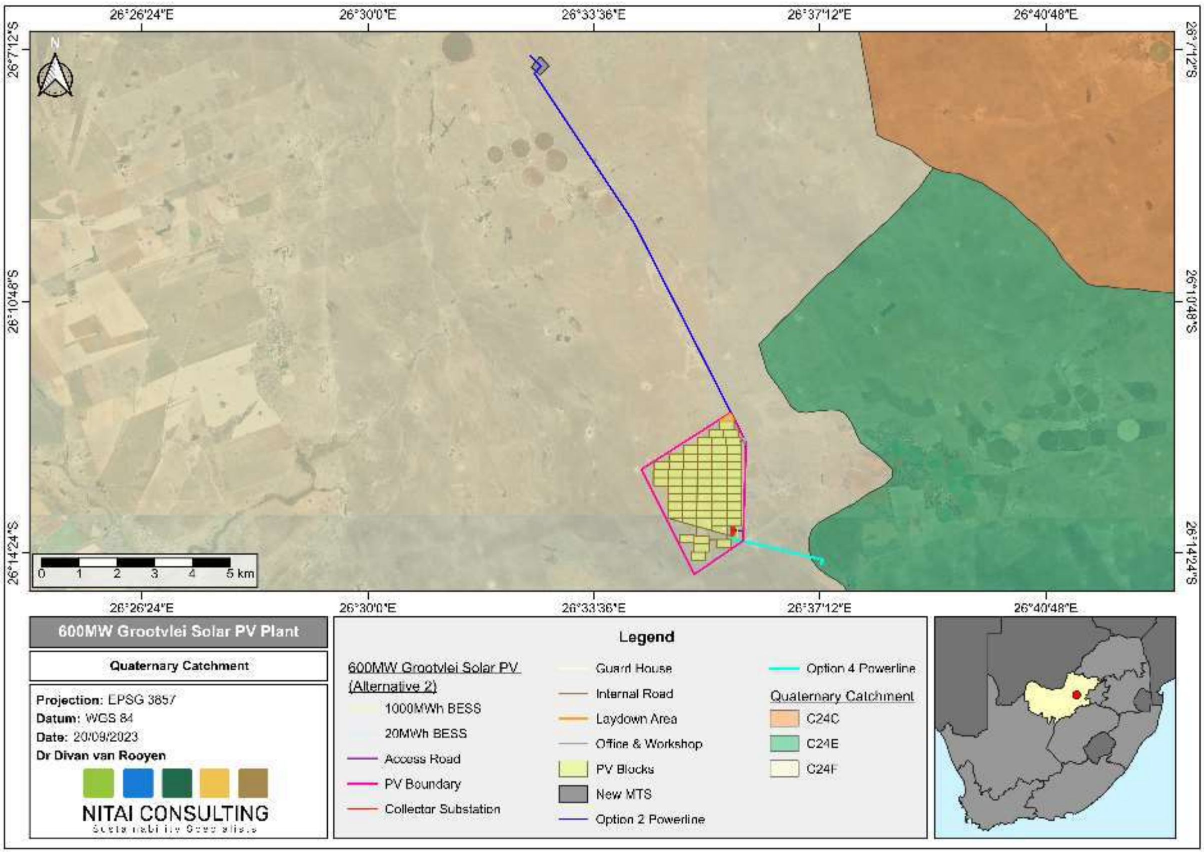

Figure 14: Quaternary Catchments associated with the study area (Alternative 2 and Preferred Layout)

5.2 Conservation context

5.2.1 National Conservation Priorities

5.2.1.1 National Threatened Ecosystems

A list of threatened ecosystems that are currently under threat of being transformed by other land uses has been identified in a national process. A few different versions of the list of threatened ecosystems have been released since the first release back in December 2011 (NEM:BA: National list of ecosystems that are threatened and in need of protection, G34809, GN 1002, December 2011). The main aim of identifying the threatened ecosystems is to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems (SANBI, 2011). The NEMA has divided ecosystems into four groups namely; Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or protected.

Figure 15 shows the remaining extent of Threatened Ecosystems in the region surrounding the study area. Majority of the seismic survey area is situated within **Least Concern (LC)** land while some portions of the Option 1 and 2 Powerlines is within **unclassified land**.

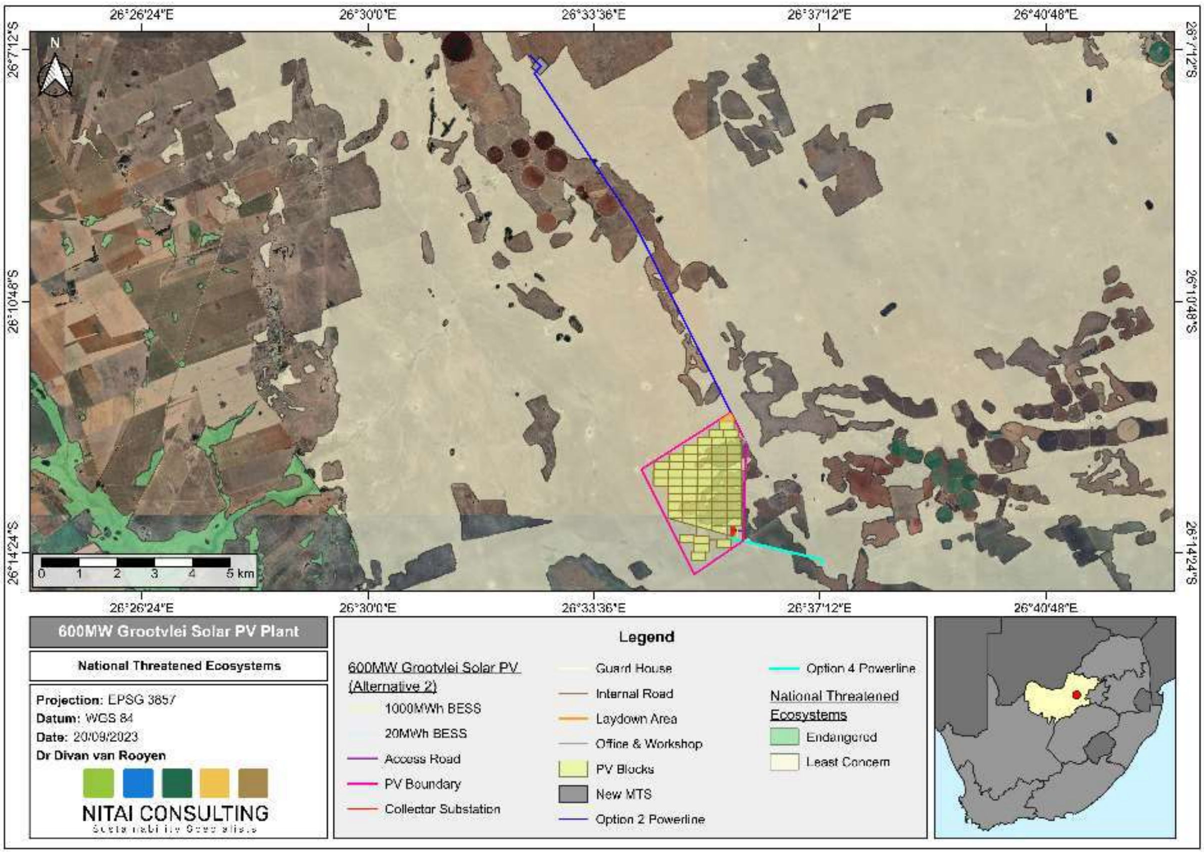

Figure 15: Map showing the location of the study area (Alternative 2 and Preferred Layout) in relation of the estimated remaining extent of the identified Threatened Ecosystems (SANBI, 2021)

5.2.1.2 National Protected Area Expansion Strategy (NPAES)

The location and extent of the existing National Protected Area Expansion Strategy (NPAES) is shown in Figure 16. Majority of the study area is situated within areas that are unclassified while the northern portion of the PV site is within a **Priority Focus Area**.

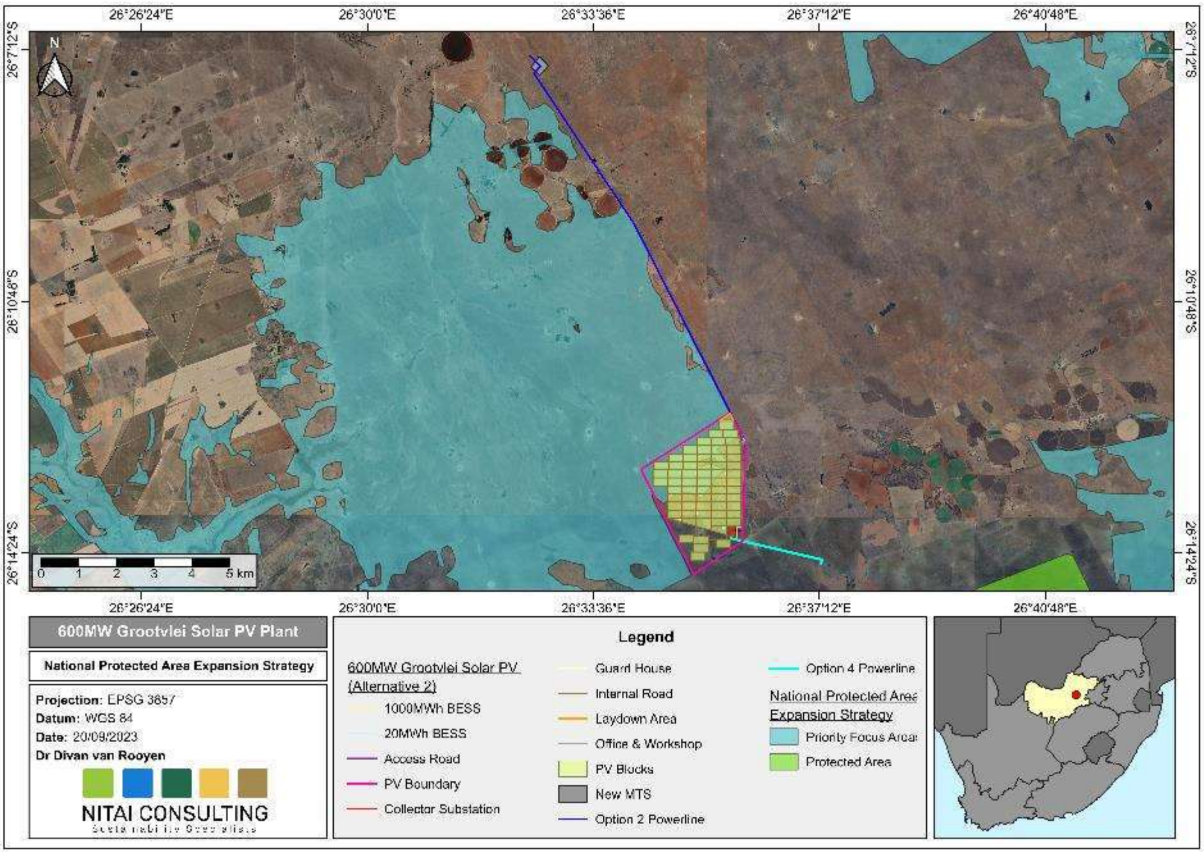

Figure 16: Map showing the study area (Alternative 2 and Preferred Layout) in relation to the National Protected Areas Expansion Strategy

5.2.1.3 Watercourses

National Freshwater Ecosystem Priority Areas (NFEPA) rivers

The watercourses map in Figure 17 highlights the NFEPA rivers, non-perennial rivers and dams associated with the study area. No perennial or non-perennial river is located within the study area as well as within the 500 m regulated area. Also, no agricultural dams are found within the footprint and the surrounding environment.

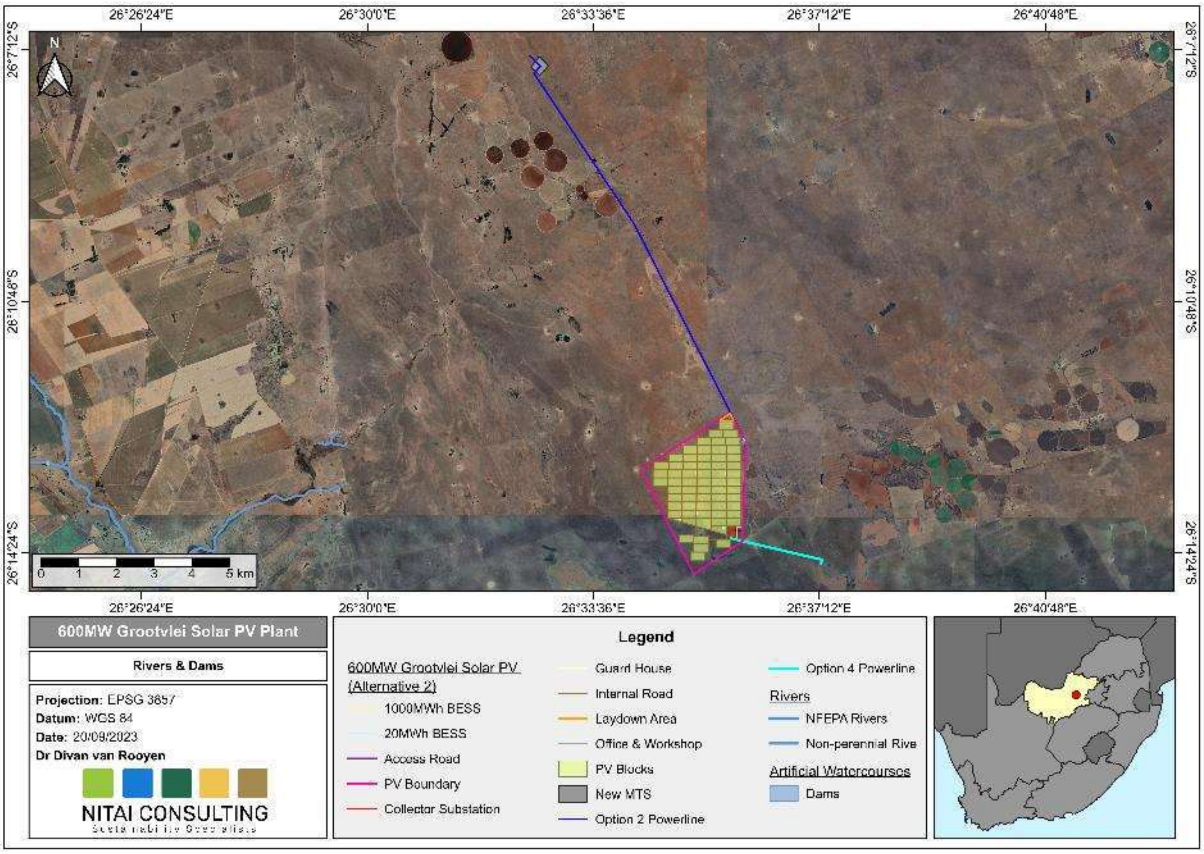

Figure 17: Map showing watercourses (NFEPA rivers, non-perennial rivers and Dams) associated with the study area (Alternative 2 and Preferred Layout)

National Biodiversity Assessment (NBA) 2018 National Wetland Map (NWM) 5

A South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was established in 2018 during the National Biodiversity Assessment (Van Deventer *et al*., 2018). This inventory highlights a collection of data layers pertaining to ecosystem types and pressures for rivers and inland wetland types. This includes the different wetland HGM units (CVB, UCVB, S, Dep, F and FL) as well its protection level (Well protected, Moderately protected, Poorly protected and Not protected) and threat status (Critical, Endangered, Vulnerable and Least Concern).

Within the footprint of the study area, there are no HGM units according to the NBA 2018 NWM 5 spatial data, however, within the 500 m regulated area, there is one HGM unit (Dep) located just south of the PV site (Figure 18). In South Africa, rivers and inland wetlands have the highest percentage of being critically endangered; 42% & 61% respectively (Skowno *et al*., 2019). From the NWM 5 spatial data, all wetlands near the study area are classified as **Least Concern** (Figure 19). Skowno *et al*. (2019) has further indicated that inland wetlands have the lowest overall protection in South Africa compared to other ecosystem realms. A total of 60% is classified as not protected while as less as 10% is classified as well protected and moderately protected (Figure 20). This has been attributed to their poor ecological condition (Skowno *et al*., 2019).

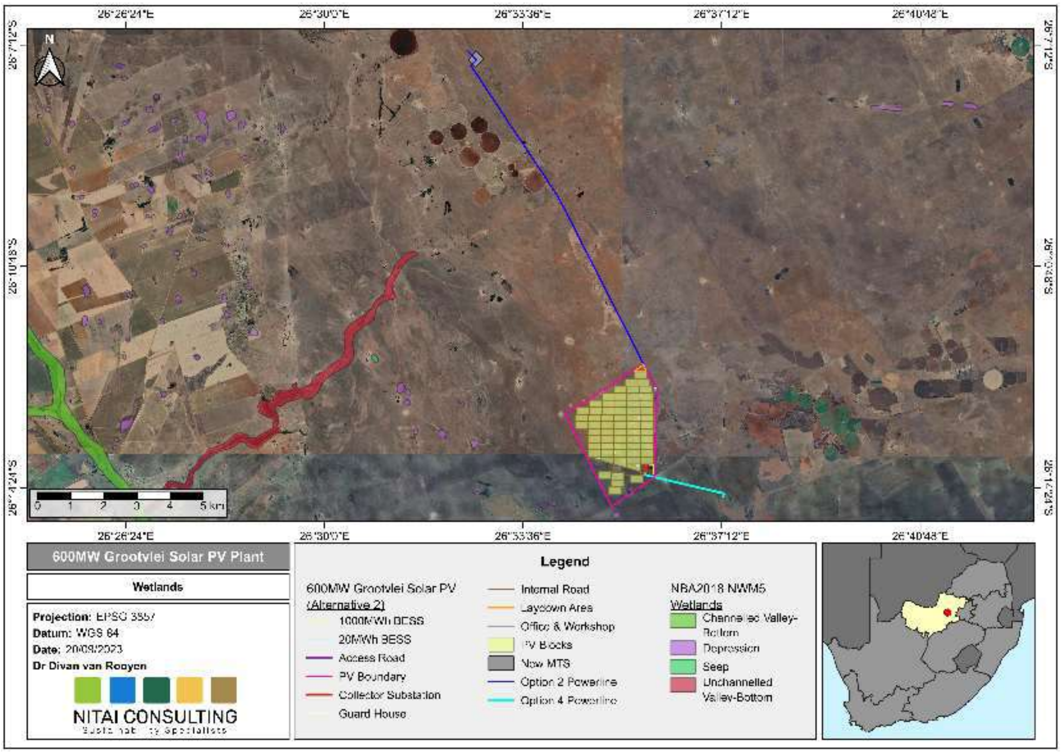

Figure 18: Map indicating the wetland hydrogeomorphic units associated with the study area (Alternative 2 and Preferred Layout)

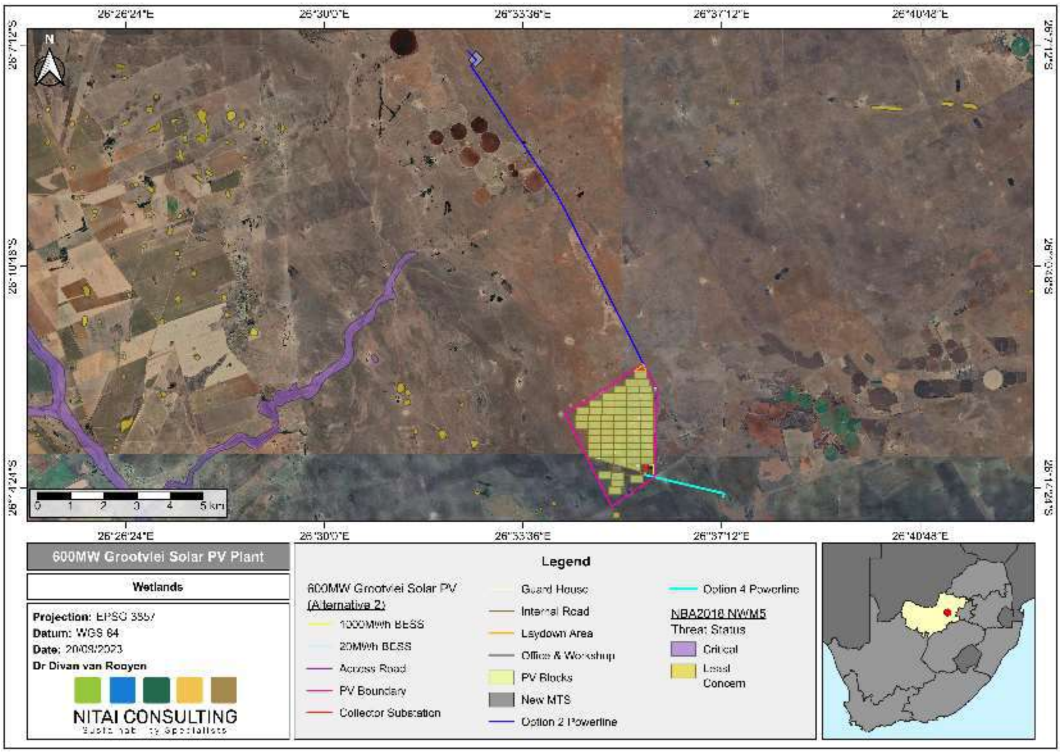

Figure 19: Map indicating the threat status of all the wetlands surrounding the study area (Alternative 2 and Preferred Layout)

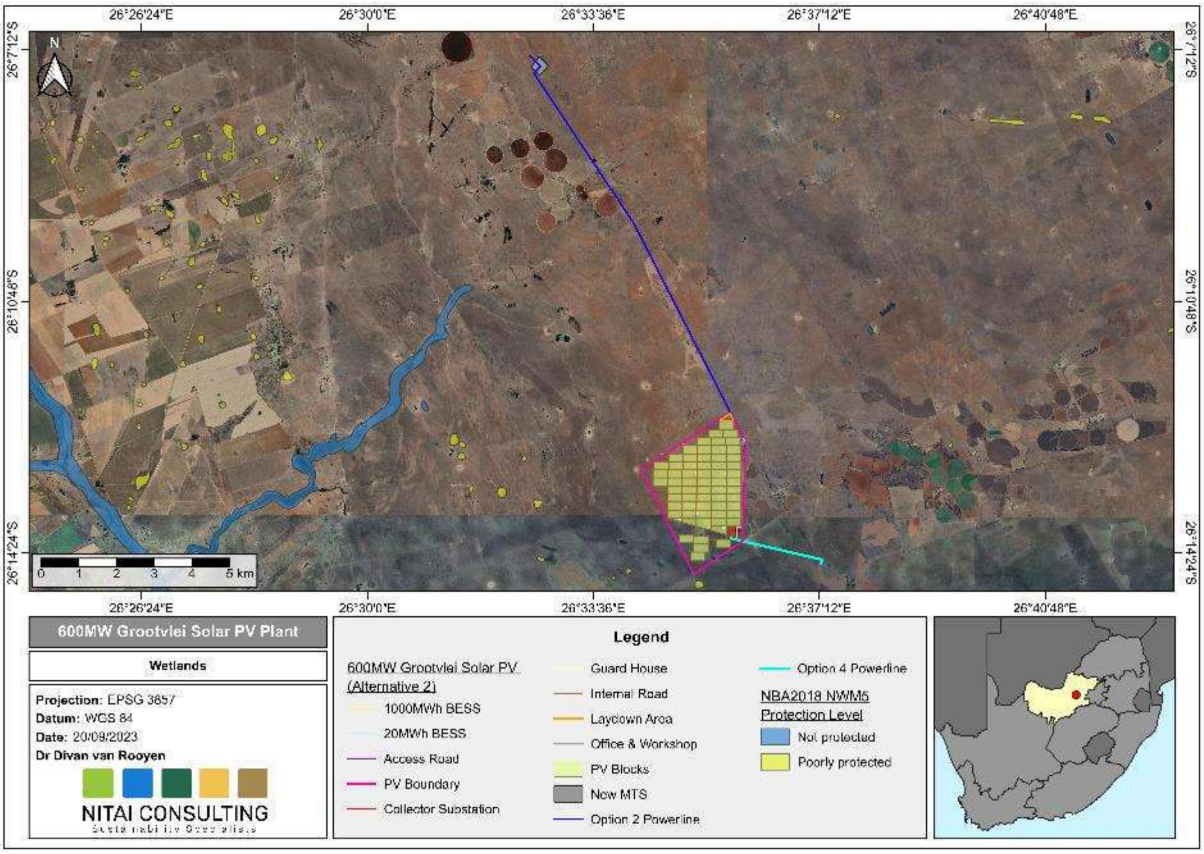

Figure 20: Map indicating the protection level of all the wetlands surrounding the study area (Alternative 2 and Preferred Layout)

5.2.1.4 Strategic Water Source Areas (SWSA's)

Strategic Water Source Areas (SWSA) are either (a) areas that supply an uneven (large quantity) amount of mean annual surface water runoff in relation to their size and are therefore considered to be nationally important or (b) have high groundwater recharge and where the groundwater forms nationally important resource or (c) areas that meat both criteria (a) and (b) (Nel *et al*., 2013; Le Maitre *et al*., 2018). Areas that supply these disproportionate amounts of water can be because of climatic conditions such as high rainfall, or physical properties (ability of the soils and underlying weathered material and rocks to store water as groundwater) (Le Maitre *et al*., 2018). In South Africa, 22 SWSA surface water and 37 SWSA groundwater areas has been identified to be strategically important at national level for water and economic security (Le Maitre *et al*., 2018). The study is situated within the groundwater SWSA of South Africa (Figure 21).

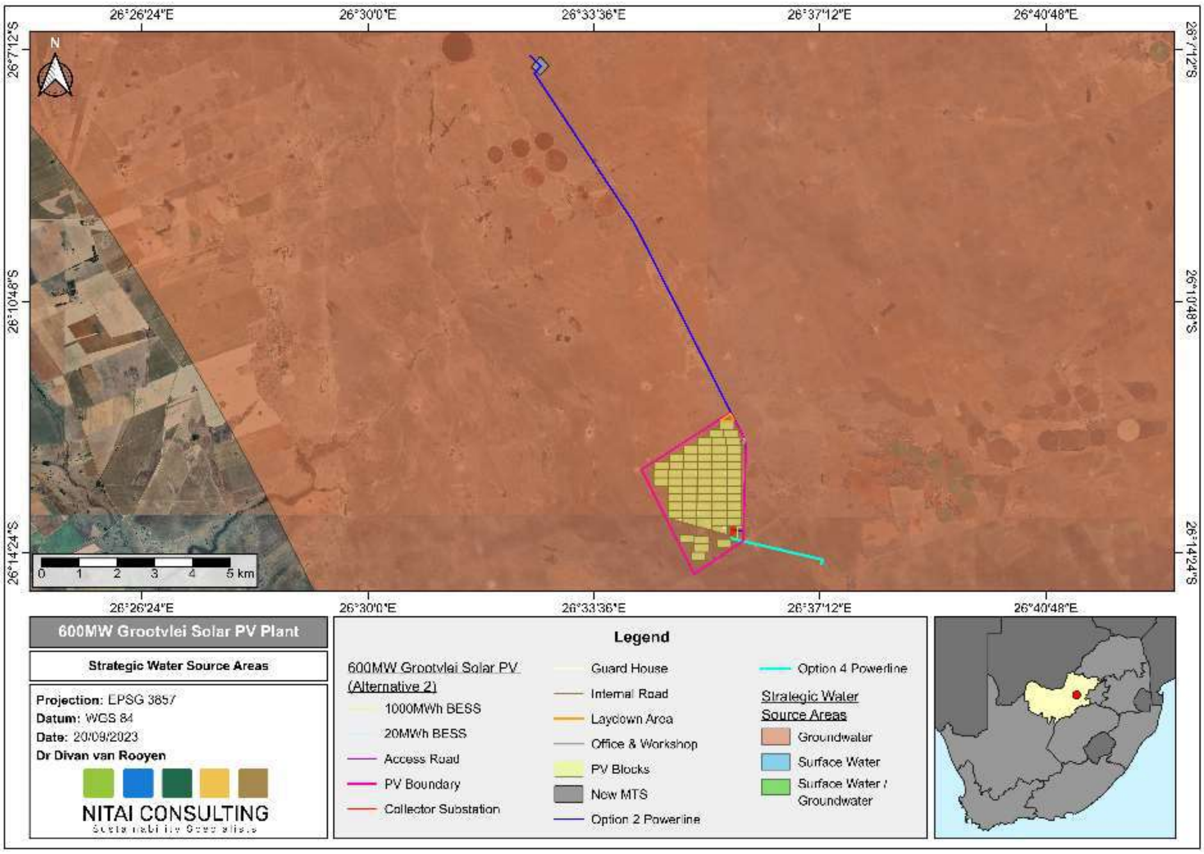

Figure 21: Map indicating the Strategic Water Source Areas in relation to the study area (Alternative 2 and Preferred Layout)

5.2.2 Regional context

5.2.2.1 Critical Biodiversity Areas (CBA's)

On a regional scale, terrestrial and aquatic biodiversity conservation priorities are highlighted in the North West (NW) Biodiversity Sector Plan (Schaller *et al*., 2015). The sector plan identifies Critical Biodiversity Areas (CBA's) which refers to terrestrial and aquatic sites that are required to meet each ecosystem's biodiversity target while being maintained in an appropriate ecological condition for their category, referred to as the land management objective (Schaller *et al*., 2015).

Critical Biodiversity Areas within the NW are areas of the landscape that needs to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services (Schaller *et al*., 2015). The NW Biodiversity Sector Plan distinguishes between the terrestrial CBA's and aquatic CBA's. The aquatic CBA's are classified under two level:

- Aquatic CBA level 1: This includes FEPA Rivers (fish sanctuaries and free-flowing rivers) buffered by 100 m identified in NFEPA and modified by DWS National River Ecostatus Monitoring Program (REMP) and experts and Important Habitats such as Peat Wetlands and Dolomitic Eyes.

- Aquatic CBA level 2: This include Modelled Wetlands such as pans, instream wetlands and riparian areas.

The spatial dataset from Desmet & Schaller (2015) highlights that the study area does not fall within either CBA 1 or CBA 2 (Figure 22).

5.2.2.2 Ecological Support Areas (ESA's)

Ecological Support Areas (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 (Schaller *et al*., 2015). Furthermore, the degree or extent of restriction on any land use and resource within the ESA's may be lower than the CBA's restrictions (Schaller *et al*., 2015).

According to the NW Biodiversity Sector Plan, ESA's are categorised into two groups namely: Ecological Support Area Level 1 and 2. Both ESA levels are areas such as FEPA Fish Catchments, Wetland Clusters, Peat Wetland Buffers and Dolomite Recharge Areas (Schaller *et al*., 2015).

From the NW Biodiversity spatial data, the northern and parts of the eastern and southern and portions of the study areas is situated within either ESA 1 and/or ESA 2 (Figure 22). The other remaining footprint of the study is in unclassified land.

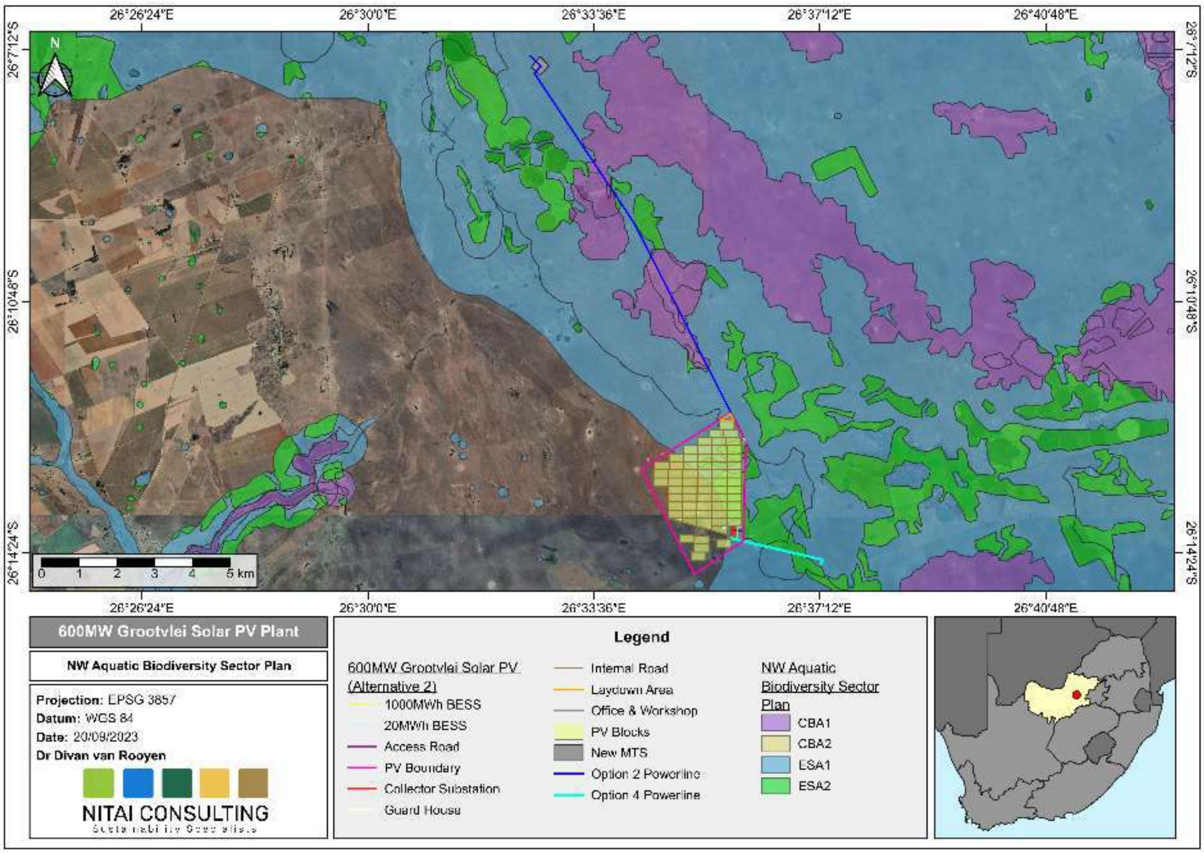

Figure 22: Map indicating the Aquatic Critical Biodiversity Areas Levels 1 and 2 in relation to the study area (Alternative 2 and Preferred Layout)

6 Findings of the Assessment

6.1 Desktop mapping and identifying resources

All areas of interest or potential of wetlands were identified, and pin drops were placed around the perimeter of the area of interest. This was done using the latest satellite aerial imagery from Google Earth. All pin drops "flagged" on Google Earth were visually inspected during the site visit (Figure 23).

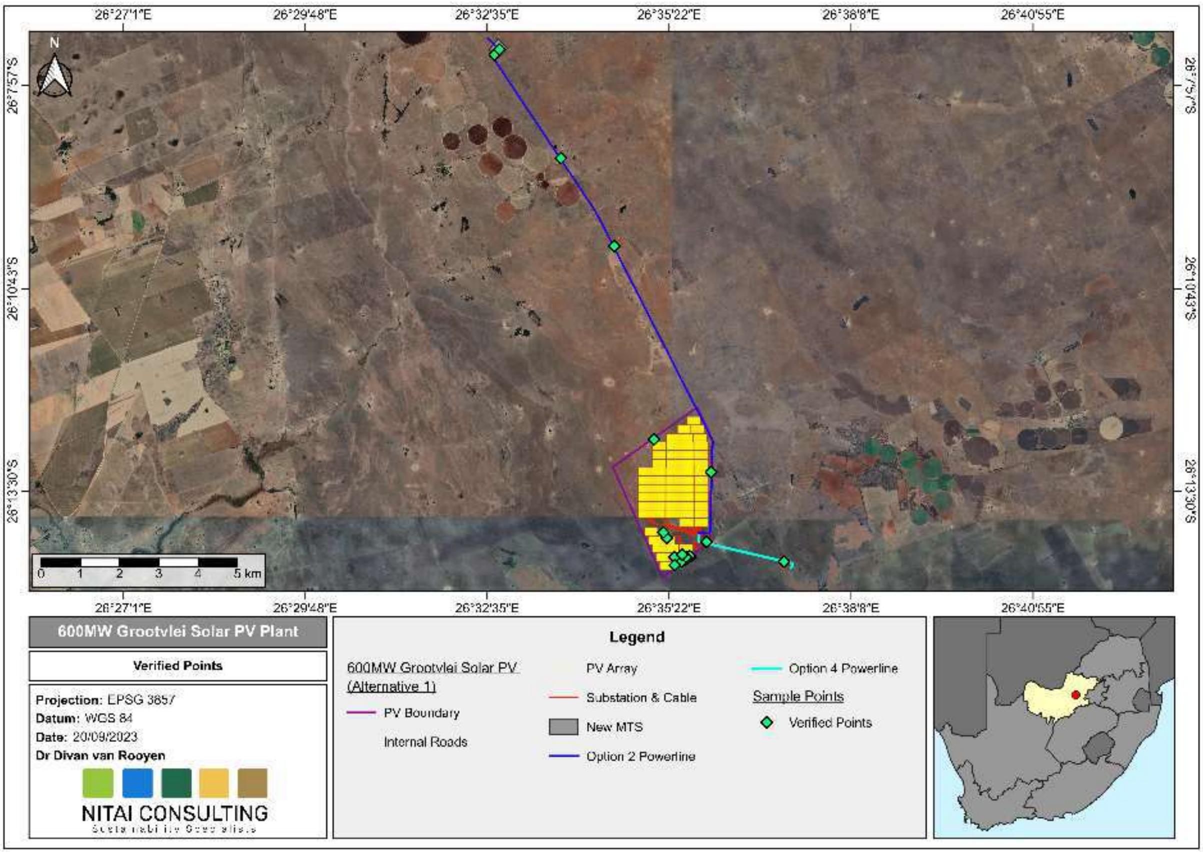

Figure 23: Map indicating the flagged potential wetland areas within the study area (Alternative 1)

6.2 Available information (Rivers and wetlands)

To date, no previous aquatic and wetland specialist studies have been conducted within the proposed study area. Additionally, no river (perennial or non-perennial) is located within or in close proximity to the study area.

6.3 Ecological findings of the Assessment

During site visits to the study area in the late rainy season and in Fall (22 March 2023 & 24 April 2023), one wetland was identified with the proposed 600MW Grootvlei Solar Plant footprint. A large Dep wetland was found in the southern portion of the PV footprint before extending to outside the southern PV boundary. As a result, the proponent has revised the layout for the 600MW Grootvlei Solar Plant and associated infrastructure. Therefore, this report has assessed both alternative layouts for the proposed 600MW Grootvlei Solar Plant.

Alternative 1:

One watercourse has been identified within the proposed Alternative 1 Layout (**Error! Reference source not found.**). A large Dep wetland was observed in the southern portion of the proposed Alternative and extends past the southern boundary. In addition, no agricultural dams were identified, however, one large broken cement reservoir is located within the central parts of the study area. Furthermore, no perennial, non-perennial or drainage line was further observed within the proposed Alternative. Moreover, no watercourse was identified along both proposed powerline routes and the new MTS (Figure 24). Importantly, the remaining portion of the wetland outside the PV boundary was delineated based on visual observations and latest Google Earth Satellite Imagery.

Alternative 2:

As a result of the large Dep found, the proponent has revised the layout of the 600MW solar facility (Figure 25). As such, the new revised Alternative 2 layout of the facility has accommodated the presence of the wetland in the southern portion of the PV plant.

6.3.1 Wetlands

6.3.1.1 Alternative 1:

One HGM unit was identified during two site visits to the study area. A large Dep wetland was recorded near and along the southern boundary of the PV Plant (Figure 24).

6.3.1.2 Alternative 2:

The revised Alternative 2 layout of the PV Plant has accommodated the presence of the Dep wetland located near and along the southern boundary of the PV Plant (Figure 25).

6.3.2 Rivers

6.3.2.1 Alternative 1:

No rivers (perennial and/or non-perennial) were identified during two site visits to the study area.

6.3.2.2 Alternative 2:

No rivers (perennial and/or non-perennial) were identified during two site visits to the study area.

6.3.3 Other watercourses

No dams were recorded within the PV site, however, one large broken cement reservoir is found within the central parts of the study area (Figure 26). In addition, a few cattle troughs were found across the study area (Figure 27). Figure 28 below highlights the general environment around the areas of interest within the study area.

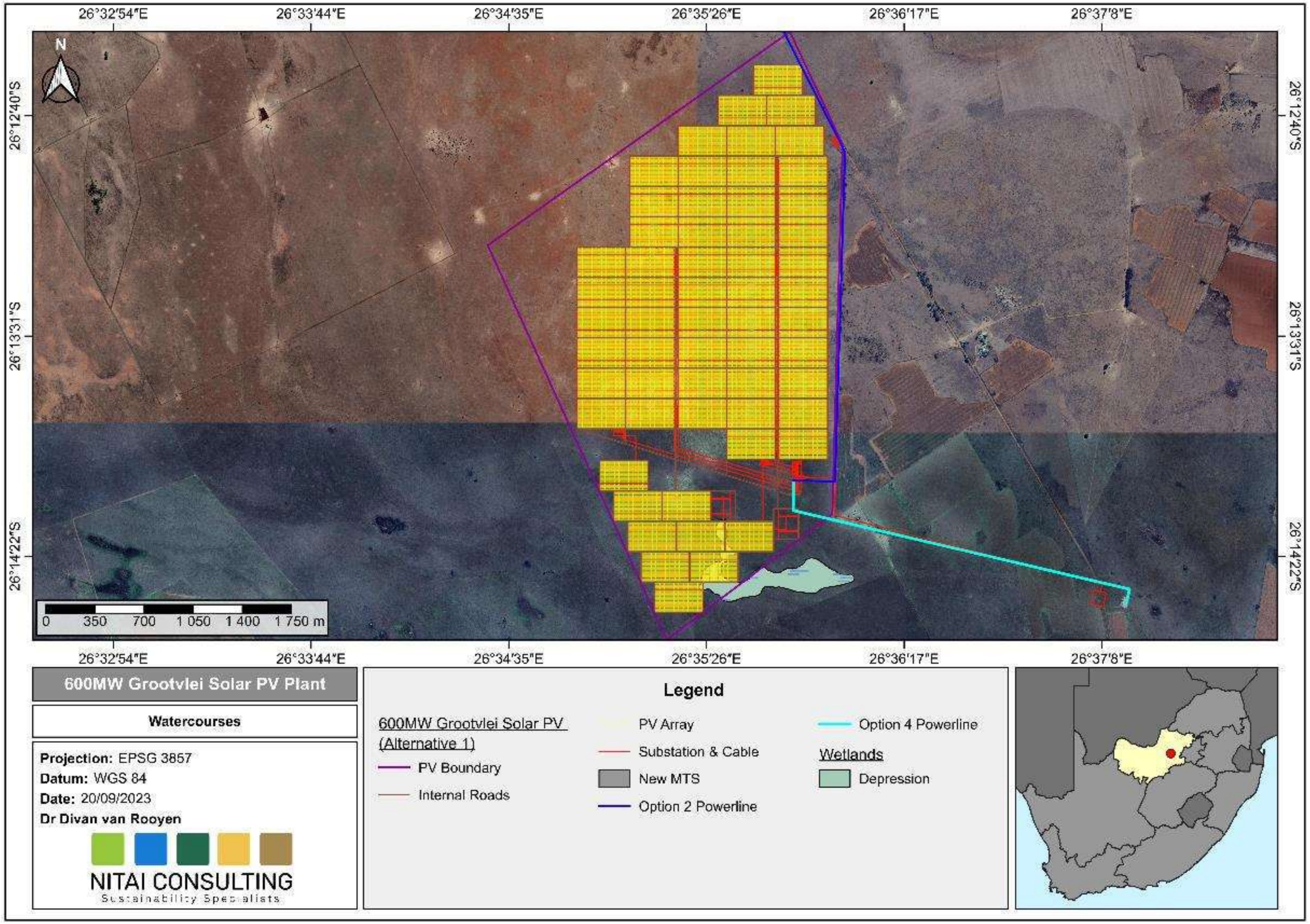

Figure 24: The large Depression associated with the Alternative 1 layout of the 600MW Grootvlei Solar PV Plant (Not all project components are shown due to scale)

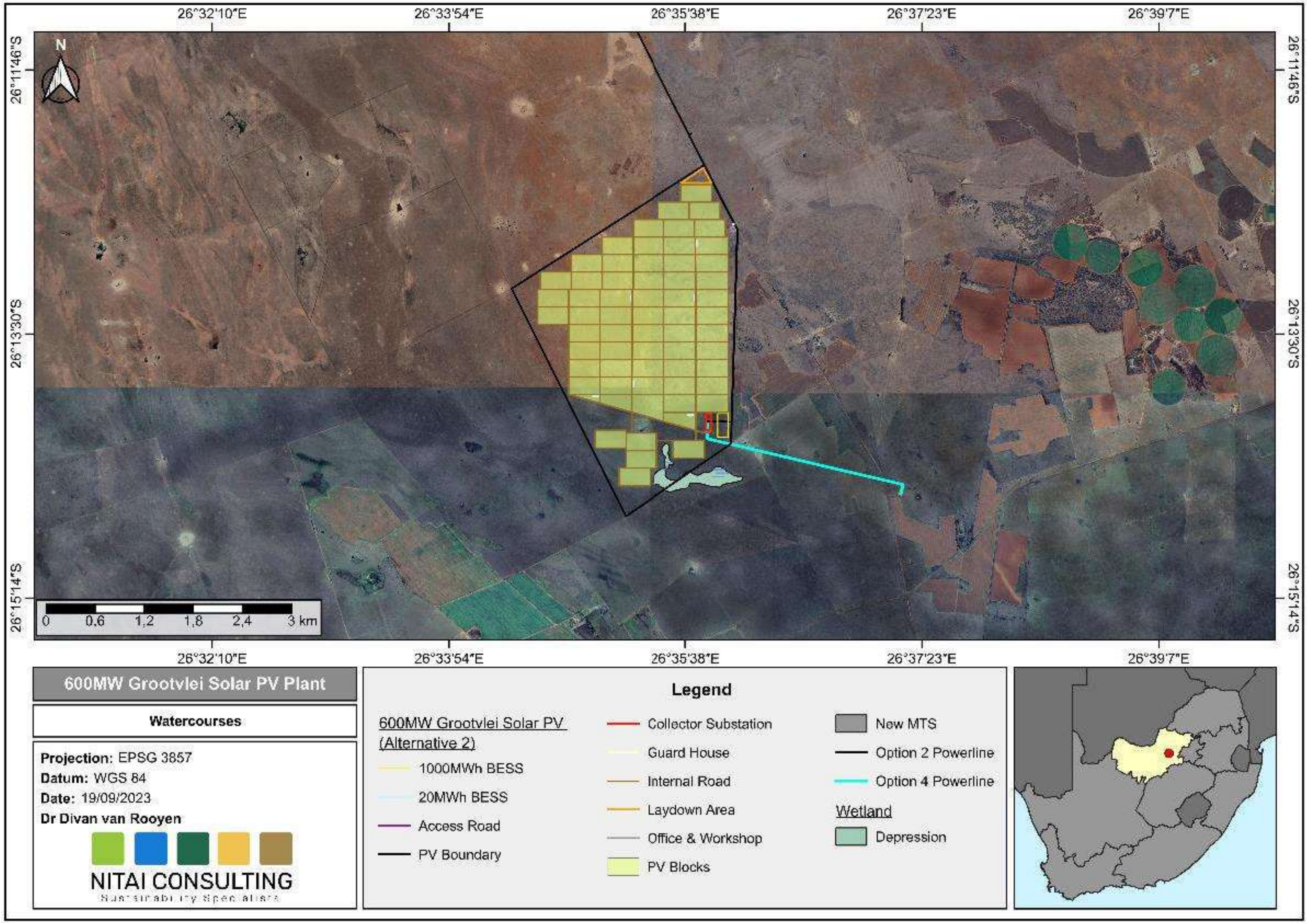

Figure 25: The large Depression associated with the Alternative 2 and Preferred layout of the 600MW Grootvlei Solar PV Plant (Not all project components are shown due to scale)

Figure 26: Photograph of the large broken cement reservoir located within the study area

Figure 27: Photographs showing some of the cattle troughs located within study area

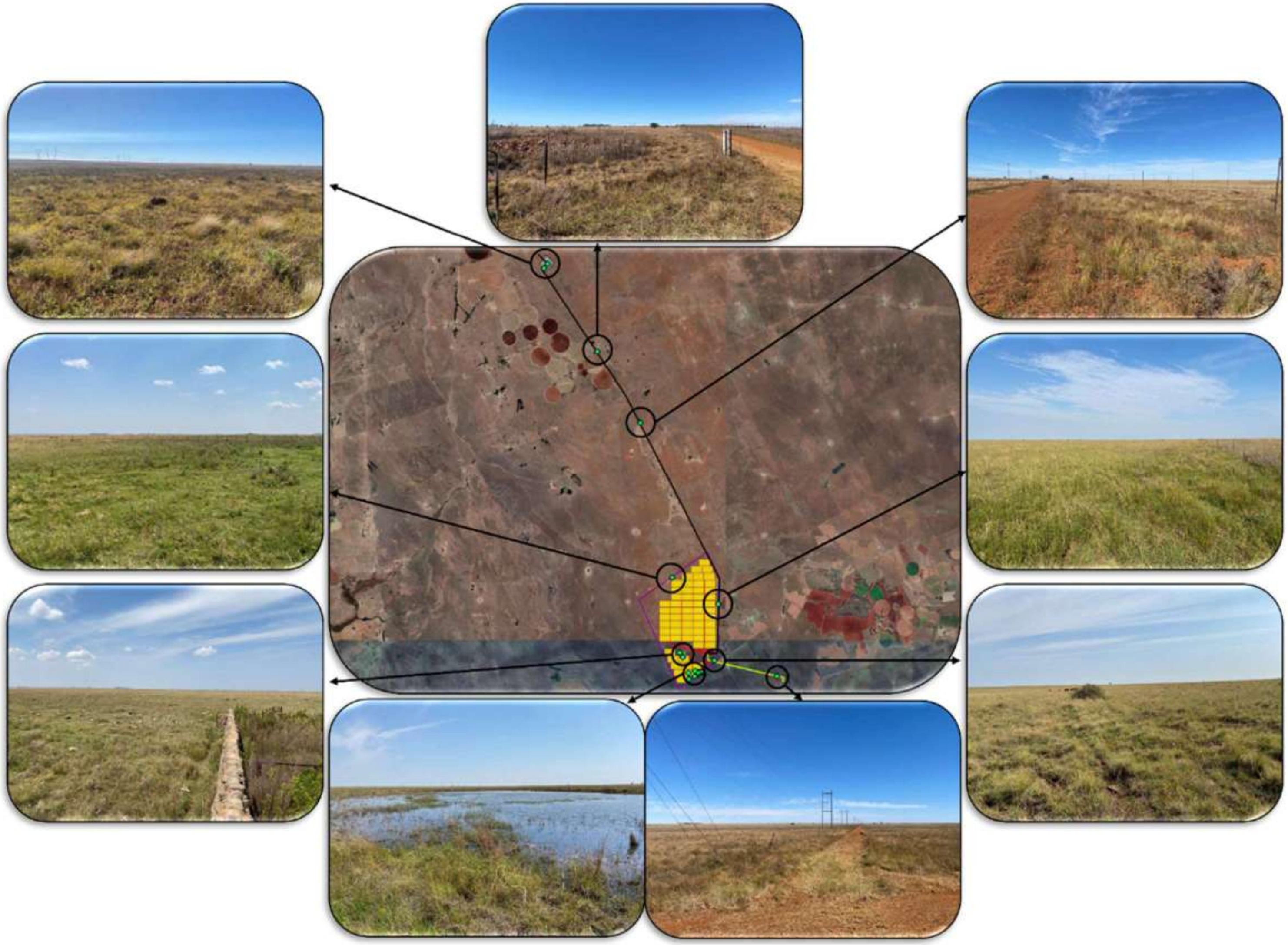

Figure 28: Photographs indicating the general environment around areas of interest within the study area (Alternative 1)

6.3.4 Vegetation characteristics

During the site visit, vegetation characteristics indicative of wetland habitats were observed within the study area. Typical vegetation species indicating wetness included *Cyperus eragrostis*, *Cyperus marginatus*, *Persicaria lapathifolia*, *Schoenoplectus corymbosus*, *Paspalum dilatatum* and *Andropogon schirensis* (Figure 29).

6.3.5 Soil characteristics

The soil samples that were sampled did indicate the presence of wetland soil near the perimeter of the Dep wetland (Figure 30). In addition, majority of the soil collected in and near the wetland did exhibit red-yellow mottling within the 50 cm. This soil was identified as Glenrosa soils and as explained earlier, these soil forms can exhibit mottling characteristics (van der Waals *et al*., 2019). Majority of the study area did not conform to the DWAF Guideline soil forms indicating wetlands as no mottling or redox morphology characteristics were observed (DWAF, 2005). In addition, this soil was identified as Hutton soils which does not exhibit any mottling and is a well-drained soil form not associated with wetlands (Figure 31).

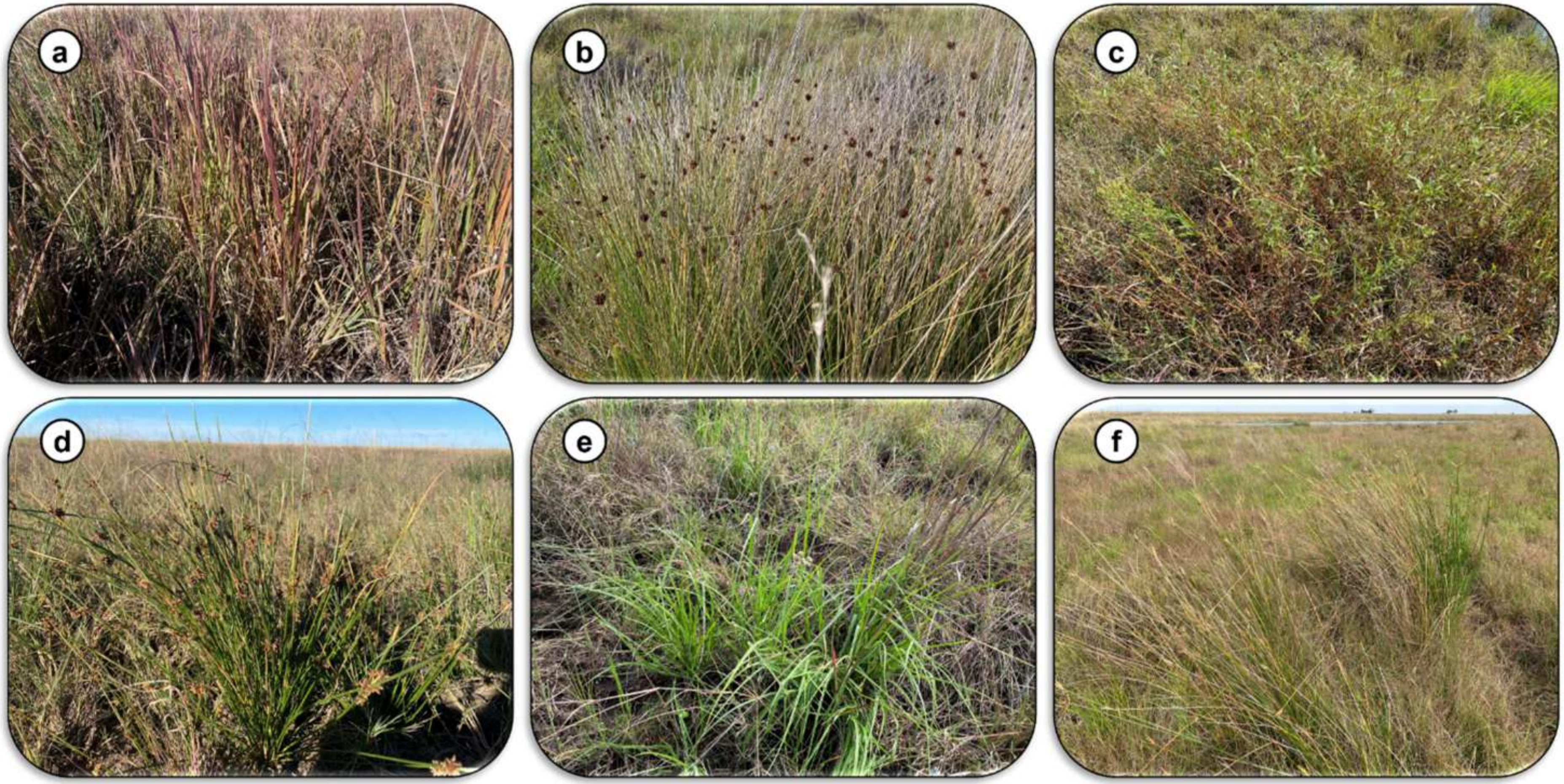

Figure 29: Vegetation characteristics associated with the study area. Photographs highlight the different species (a) Andropogon schirensis, (b) Schoenoplectus corymbosus, (c) Persicaria lapathifolia, (d) Cyperus marginatus, (e) Paspalum dilatatum and (f) Cyperus eragrostis

Figure 30: Soil samples collected showing the strong clay content in soil as well red-yellow mottling. Soil types is mostly comprised of Glenrosa soils

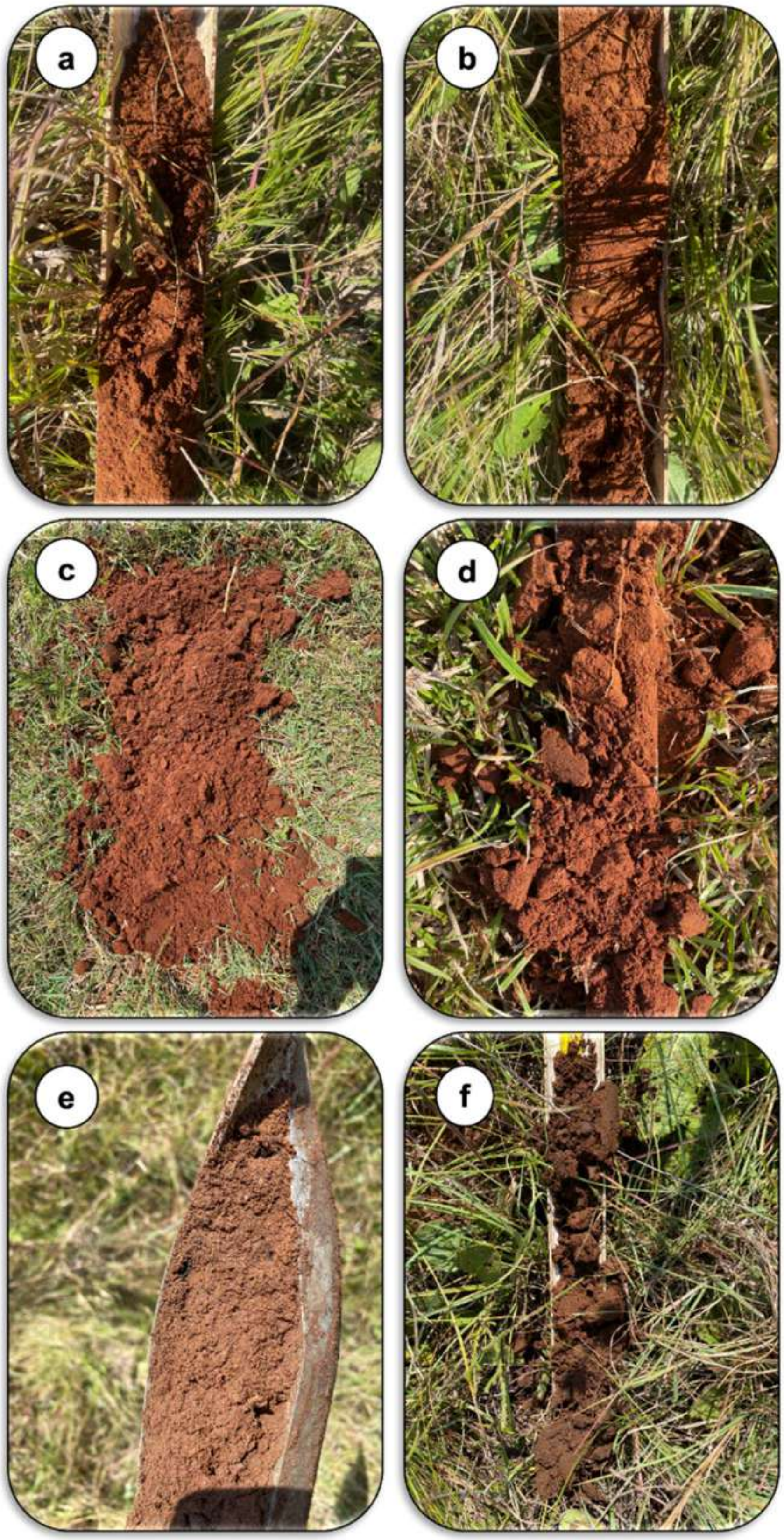

Figure 31: Soils indicating no moisture or clay content and highlights its well-drained characteristics. These soils were identified as Hutton soils. Photographs (a) – (d) showing the Hutton soils around the study area. Photographs (e) and (f) showing the soils just outside the wetland and highlighting how soil has changed from in the wetland

6.3.6 Present Ecological State (PES)

The PES (Macfarlane *et al*., 2020) has only been determined for the wetlands verified on site during the site visit. The PES score was calculated for the one HGM unit found on site. Present Ecological State categories were calculated for the Dep as C (Moderately modified) (Table 6). Water quality was not included in the PES calculations as water quality did not form part of the overall assessment.

Table 6: Present Ecological State scores calculated for the one HGM unit

HGM Unit	Hydrology	Geomorphology	Vegetation	Overall
Depression	C (Moderately modified) Impact Score: 3.7	C (Moderately modified) Impact Score: 3.1	D (Largely modified) Impact Score: 3.5	C (Moderately modified) Impact Score: 3.6

6.3.7 Ecological Importance and Sensitivity (EIS)

The EIS (Rountree *et al*., 2013) has been determined for all the wetlands verified on site during the site visit. Ecological Importance and Sensitivity for the Dep were calculated as 1.21 which translates to a **C** category (**Moderate**) (see Table 7 below). A small section of the Dep wetland is situated within an ESA 1 of the NW Biodiversity Sector Plan while the other remaining parts of the wetland is situated in Other Natural Areas (refer to Figure 22).

Table 7: Ecological Importance and Sensitivity of the one HGM unit

HGM Unit	Ecological Importance and Sensitivity
Depression	**Moderate (1.21)** • Ecological Importance & Sensitivity: 1.7 • Hydrological/Functional Importance: 1.6 • Direct Human Benefits: 0.3

6.3.8 Wetland Ecosystems Services

The Wetland Ecosystem Services (Kotze *et al*., 2020) for the Dep wetland identified during the site visit are shown in Table 8 below (see Table 9 for description of impact category ratings). The Dep wetland does not hold very high value for Ecosystem services and is of moderate importance for agriculture in terms of food for livestock (Table 8).

Table 8: Wetland Ecosystem Services calculated for the one HGM unit

Ecosystem Services		Score	
		Depression Score	Importance
Regulating and Supporting Services	Flood attenuation	0.0	Very Low
	Stream flow regulation	0.0	Very Low
	Sediment trapping	0.0	Very Low
	Erosion control	0.0	Very Low
	Phosphate assimilation	0.0	Very Low
	Nitrate assimilation	0.0	Very Low
	Toxicant assimilation	0.0	Very Low
	Carbon storage	0.4	Very Low
	Biodiversity maintenance	0.6	Very Low
Provisioning services	Water for human use	0.0	Very Low
	Harvestable resources	0.5	Very Low
	Food for livestock	2.0	Moderate
	Cultivated foods	1.0	Low
Cultural Services	Tourism and Recreation	0.0	Very Low
	Education and Research	0.0	Very Low
	Cultural and Spiritual	0.0	Very Low

Table 9: Importance Category ratings

Importance Category		Description
Very Low	0-0.79	The importance of services supplied is very low relative to that supplied by other wetlands.
Low	0.8 – 1.29	The importance of services supplied is low relative to that supplied by other wetlands.
Moderately-Low	1.3 – 1.69	The importance of services supplied is moderately-low relative to that supplied by other wetlands.
Moderate	1.7 – 2.29	The importance of services supplied is moderate relative to that supplied by other wetlands.
Moderately-High	2.3 – 2.69	The importance of services supplied is moderately-high relative to that supplied by other wetlands.
High	2.7 – 3.19	The importance of services supplied is high relative to that supplied by other wetlands.
Very High	3.2 - 4.0	The importance of services supplied is very high relative to that supplied by other wetlands.

6.4 Site Sensitivity Verification and Buffer Zones

6.4.1 Desktop sensitivity assessment (DFFE Screening Tool)

During the Desktop study for the CCUS drilling and seismic survey an Environmental Screening tool from Department of Forestry, Fisheries & the Environment (DFFE) were queried. The Screening Tool allows for the generation of a Screening Report referred to in Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended, whereby a Screening Report is required to accompany any application for Environmental Authorisation.

The DFFE Screening Tool Report has identified that Aquatic Biodiversity Theme for the study area is of very high sensitivity (Figure 32). The very high sensitivity is due to the proposed development being situated within the Groundwater SWSA of Southern Africa as well as Aquatic CBA’s. Due to the nature of the proposed works, it is of the opinion that the proposed activities do not pose significant risks to aquatic features given that the recommendation and mitigation measures are followed

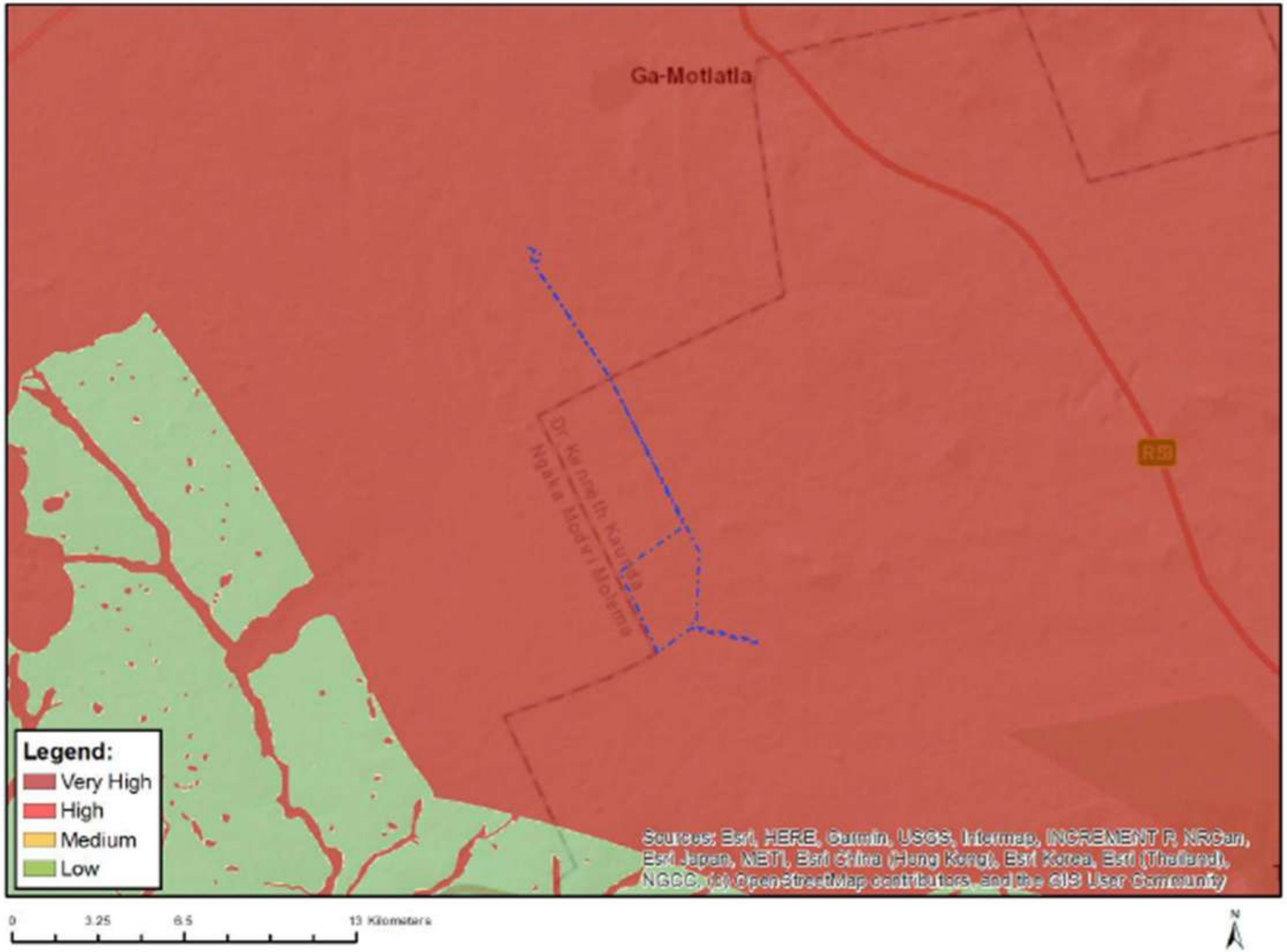

Figure 32: Aquatic Biodiversity Sensitivity Theme from the Department of Forestry, Fisheries & the Environment Screening To

6.4.2 Ground Truthing

Ground truthing the Alternative 1 layout with site visits, the study area could be classified as **Medium** sensitivity due to the PV site encroaching into the large Dep wetland located in the southern portion of the PV site. In addition, majority of the Alternative 1 layout was classified as **Low** sensitivity whereas the wetland and its associated buffer zone was classified as **High** and **Medium** sensitivity, respectively (Figure 33). Moreover, as a result, the PV site layout has been revised and the Alternative 2 layout (preferred layout) is outside the Dep wetland as well as its buffer zones (discussed below) (Figure 34). Therefore, the Alternative 2 layout has an overall **Low** sensitivity to freshwater features. Importantly, based on these sensitivity classifications, the **Preferred Alternative for the proposed development is Alternative 2**.

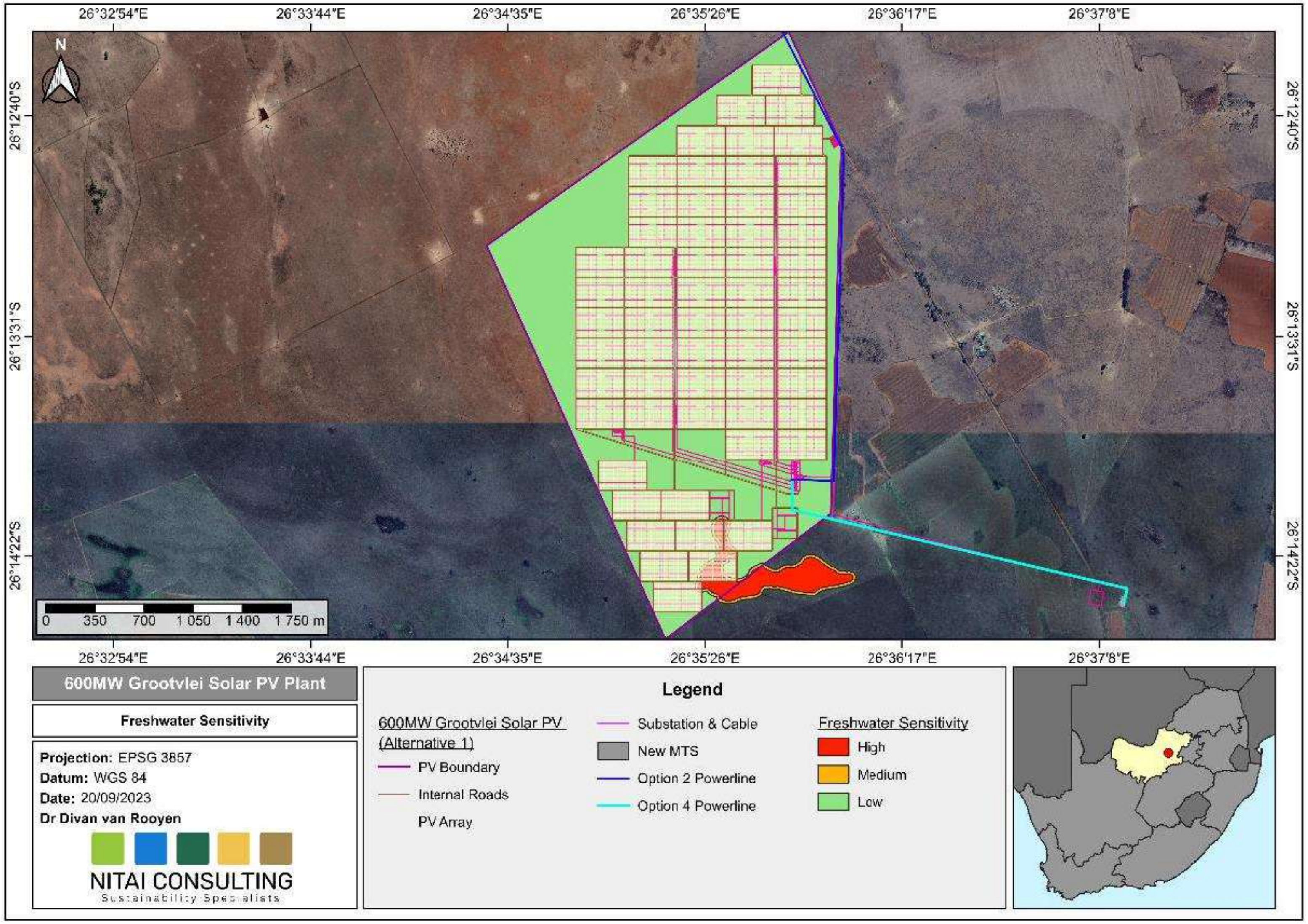

Figure 33: Freshwater Sensitivity surrounding the proposed Alternative 1 Layout of the 600MW Grootvlei Solar PV Plant (Not all project components are shown due to scale)

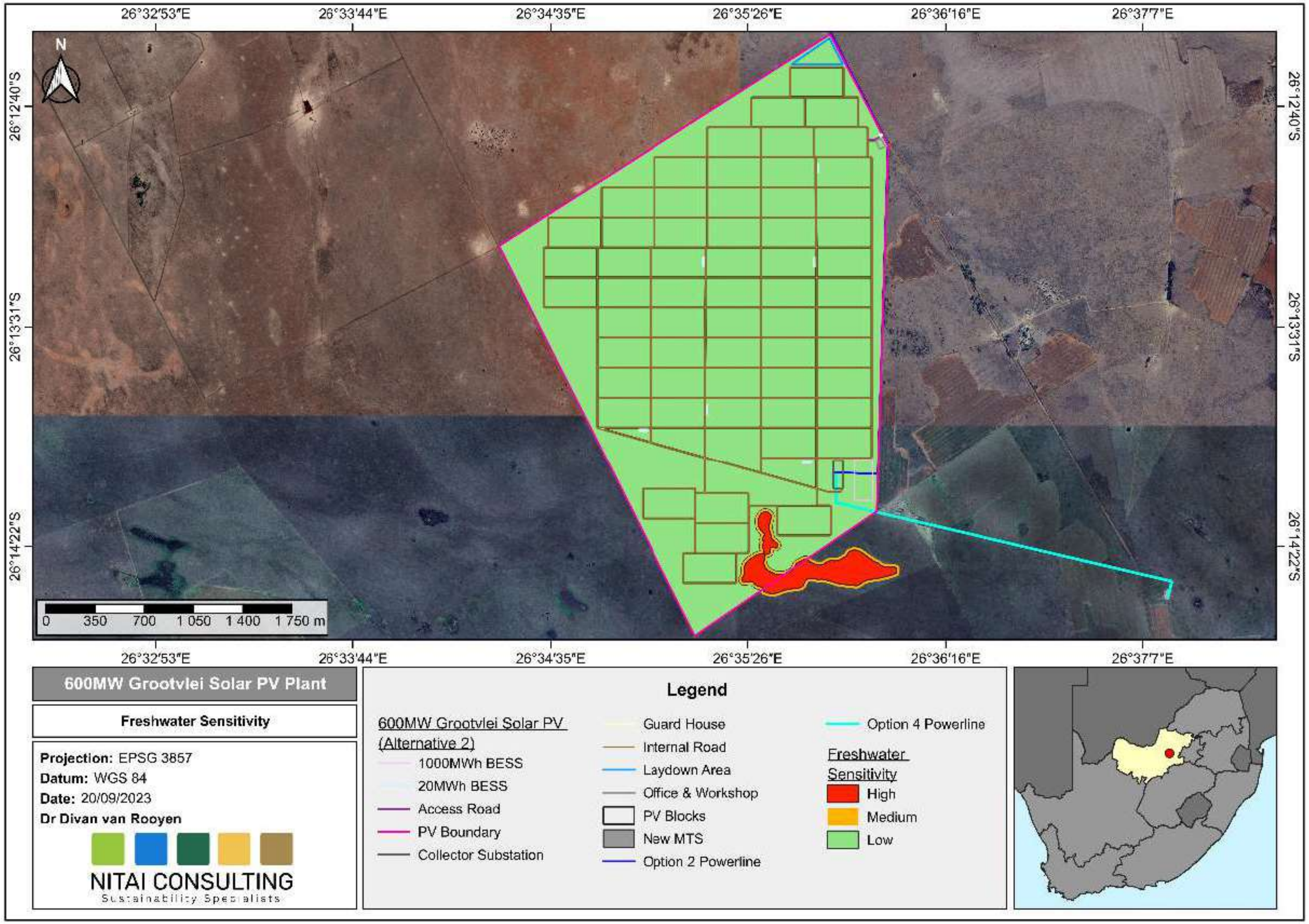

Figure 34: Freshwater Sensitivity surrounding the proposed Alternative 2 and Preferred Layout of the 600MW Grootvlei Solar PV Plant (Not all project components are shown due to scale)

6.4.3 Buffer Zone

Buffer zones for the Dep wetland was determined based on the current condition of these watercourses. These buffer zones and the wetland itself indicate “no-go” areas. The buffer zones determined for the wetland was based on the Macfarlane and Bredin (2017) guidelines and includes the 32 m NEMA Zone of Regulation. The buffer zone determined using the above-mentioned guidelines is 20 m (Figure 35 and Figure 36).

Between the two alternatives of the 600MW Grootvlei Solar PV Plant and associated infrastructure, Alternative 1 encroaches into both the 20 m and the 32 m buffer zones. Also, the layout not only encroaches into the buffer zones but the wetland as well (Figure 35). Alternative 2 has made provision for the Dep wetland and its associated buffer zones and is therefore outside of **High** and **Medium** sensitive areas (Figure 36).

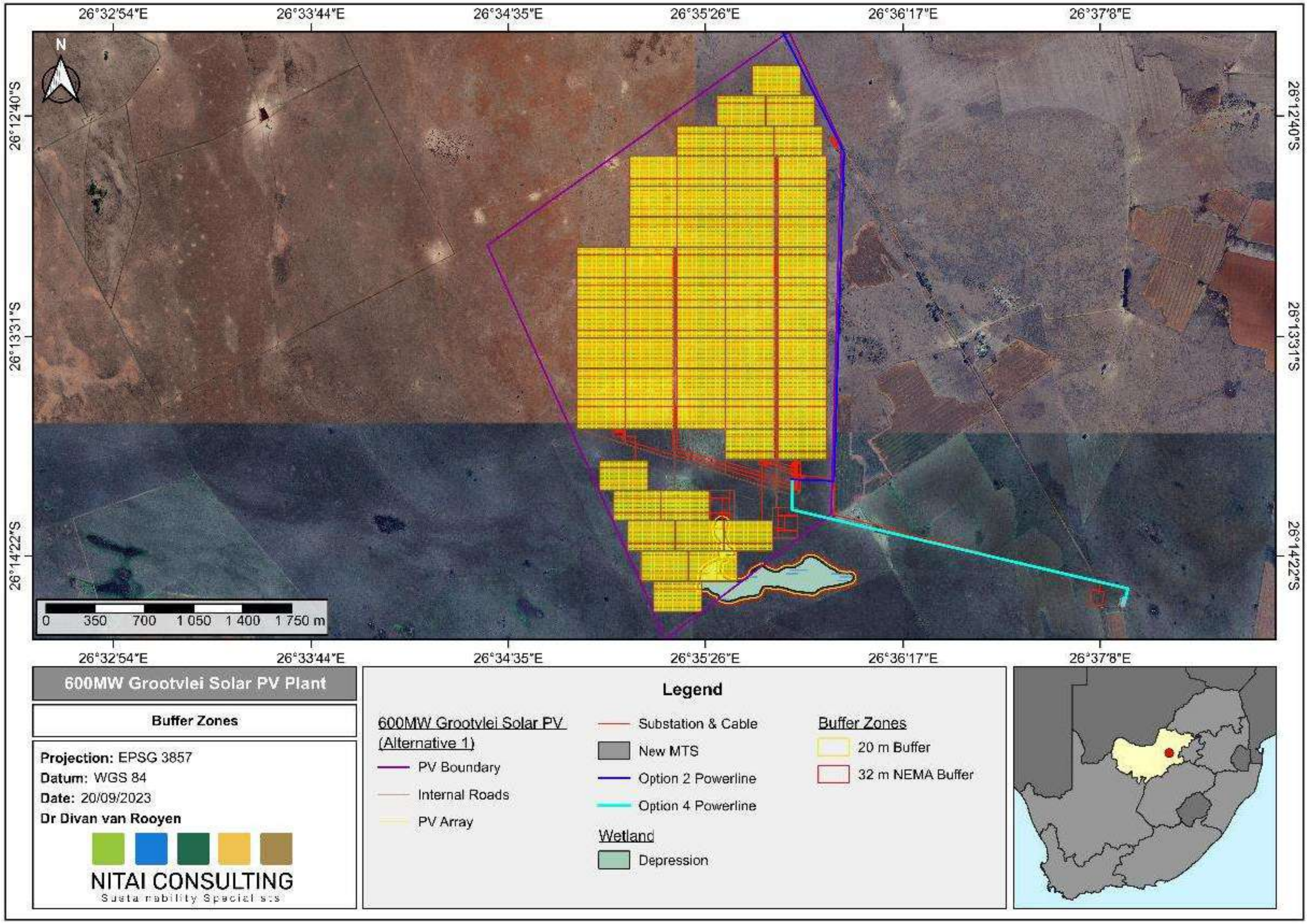

Figure 35: Buffer zones determined for all watercourses associated with the Alternative 1 layout of the study area (Not all project components are shown due to scale)

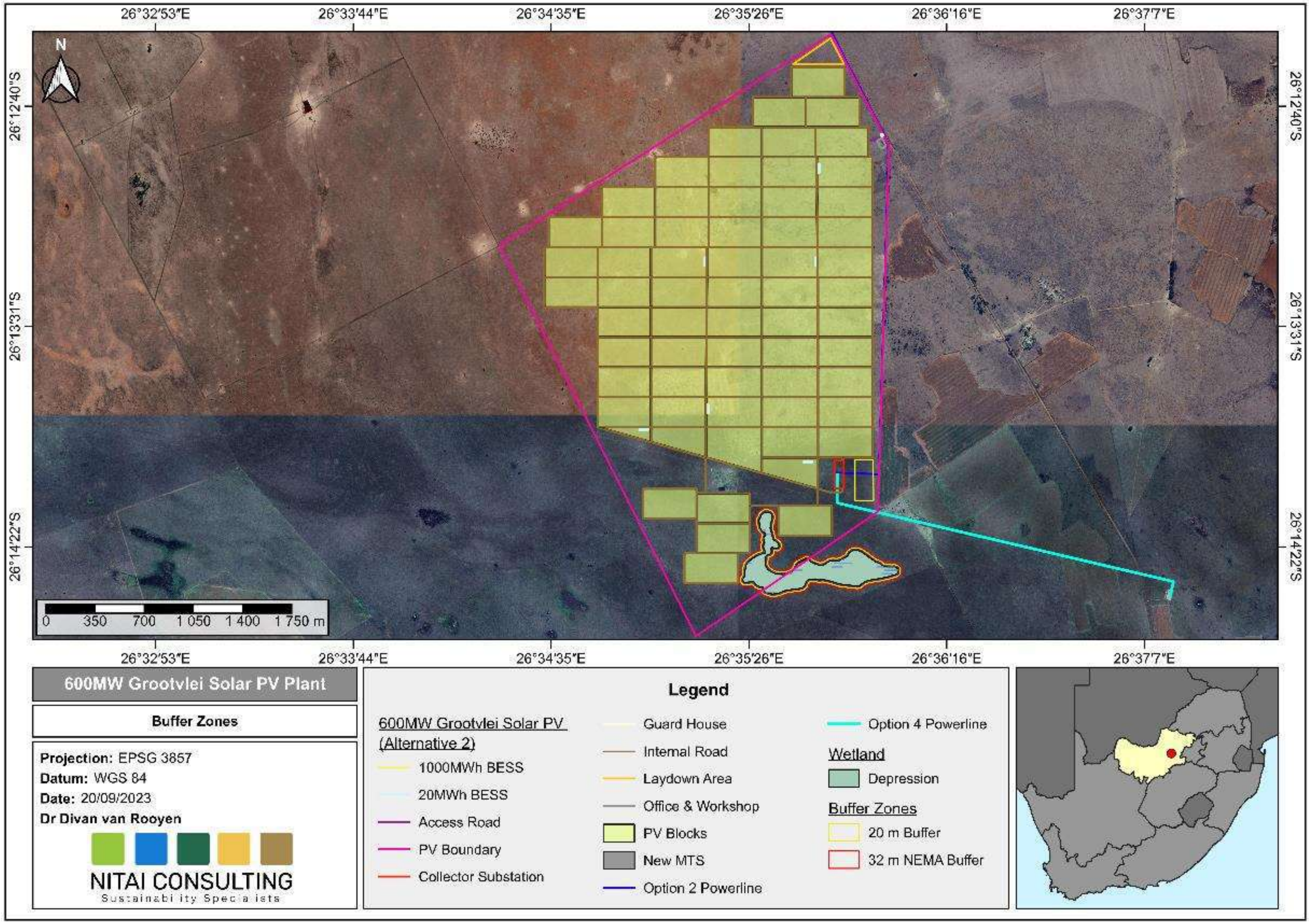

Figure 36: Buffer zones determined for all watercourses associated with the Alternative 2 and Preferred layout of the study area (Not all project components are shown due to scale)

7 RISK-BASED IMPACT ASSESSMENT

7.1 Impacts and Mitigation Framework

Since watercourses have been identified within the footprint of the study area that could be potentially significantly affected by the 600MW Grootvlei Solar Plant and associated infrastructure, a Risk-based Impact Assessment were conducted.

All impacts are analysed in the section to follow with regard to their nature, probability, duration, extent, magnitude, likelihood and significance.

The following criteria for nature, probability, duration, extent, magnitude and significance were used:

Table 10: Probability descriptors, definitions and rating scores

Descriptors	Definitions	Score
Rare/Remote	May occur only in exceptional circumstances.	**1**
Unlikely	Could occur at some time.	**2**
Moderate	Should occur at some time.	**3**
Likely	Will probably occur in most circumstances.	**4**
Almost certain	Expected to occur in most circumstances.	**5**

Table 11: Duration descriptors, definitions and rating scores

Descriptors	Definitions	Score
Temporary	Impact is only for a short period (0-1 years).	**1**
Short term	Impact is for a period of 1 – 5 years.	**2**
Medium	Impact is for a period of 5 – 15 years.	**3**
Long term	Impact ceases after operational life cycle of the activity either because of natural processes or by human intervention.	**4**
Permanent	Impact will continue indefinitely.	**5**

Table 12: Extent descriptors, definitions and rating scores

Descriptors	Definitions	Score

Site only	Impact on the extent of the site only.	**1**
Local	Impact on the immediate surroundings.	**2**
Regional	Impact on the region but within the province.	**3**
National	Impact on an interprovincial scale.	**4**
International	Impact outside South Africa.	**5**

Table 13: Magnitude descriptors, definitions and rating scores

Descriptors	Definitions	Score
Negligible	Ecosystem pattern, process and functioning are not affected, although there is a small negative impact on quality of the ecosystem.	**1**
Minor	A minor impact on the environment and processes will occur.	**2**
Low	Natural and socio-economic functions and processes are not affected or minimally affected.	**4**
Moderate	Valued, important, sensitive or vulnerable systems or communities are negatively affected, but ecosystem pattern, process and functions can continue albeit in a slightly modified way.	**6**
High	Natural or socio-economic functions or processes could be substantially affected altered to the extent that they could temporarily cease.	**8**
Very High	Natural or socio-economic functions or processes could be substantially affected altered to the extent that they could permanently cease.	**10**

The significance of impacts will be calculated through the combination of the above-mentioned criteria using the following formula:

Significance = (Extent + Duration + Magnitude) x Probability

Descriptors	Definitions	Score
Low	Perceived impact will not have a noticeable negative impact on the environment. Unlikely to require management intervention.	**0 – 19**

Low to Moderate	Perceived impact is acceptable, and application of recommended mitigation measures recommended.	**20 – 39**
Moderate	Perceived impact is likely to have negative impact on the environment, and is likely to influence decision to approve the activity. Implementing recommended mitigation measures are required as a routine monitoring to ensure effectiveness of recommended mitigation measures.	**40 – 59**
Moderate to High	Perceived impact will have significant impact on the environment and will likely influence the decision-making process. Strict implementation of provided mitigation measures is required. Strict monitoring and high levels of compliance and enforcement in respect of the impact are required.	**60 – 79**
High	Perceived impact on the environment will be significantly high and likely to be irreversible and therefore will result in a highly likely fatal flaw for the project. Any alternatives for the proposed activity should be considered as the impact will influence the decision-making process.	**80 – 100**

7.1.1 NEMA (2014) Impact Assessment

Table 14 to Table 17 below indicate the impact scores for the potential groundwater impacts surrounding the construction and operational phases of the 600MW Grootvlei Solar Plant and associated infrastructure.

Table 14: Impacts to hydrological function

Nature: Changes to flood regimes of the watercourse through, for example, flood suppression, unseasonal flooding or the loss of flood attenuation capacity.				
ACTIVITY: Sources include the compaction of soil, vegetation removal, redirecting surface water, changes to the surface water characteristics or through construction of roads.				
	Alternative 1		**Alternative 2**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Construction Phase				
Probability	Moderate (3)	Unlikely (2)	Unlikely (2)	Unlikely (2)
Duration	Medium (3)	Short term (2)	Short term (2)	Short term (2)
Extent	Regional (3)	Local (2)	Regional (3)	Local (2)
Magnitude	Moderate (6)	Low (4)	Low (4)	Minor (2)
Significance	**36 (Low to Moderate)**	**16 (Low)**	**18 (Low)**	**12 (Low)**
Status (positive or negative)	Negative	Negative	Negative	Negative

Operational Phase				
Probability	Moderate (3)	Unlikely (2)	Minor (1)	Rare (1)
Duration	Medium term (3)	Short term (2)	Short term (2)	Short term (2)
Extent	Regional (3)	Local (2)	Local (2)	Local (2)
Magnitude	Moderate (6)	Low (4)	Minor (2)	Minor (2)
Significance	**36 (Low to Moderate)**	**16 (Low)**	**12 (Low)**	**6 (Low)**
Status (positive or negative)	Negative	Negative	Negative	Positive
Reversibility	Low	Moderate	Moderate	High
Irreplaceable loss of resources?	High	Low	Low	Low
Can impacts be mitigated?	Yes		Yes	

Mitigation:

- The entire footprint should avoid the delineated boundaries of watercourses as well as its buffer zones;
- Effective stormwater management plans should be in place during both the construction and operational phases. This should also be monitored as part of the EMPr;
- Appropriate stormwater structures should be in place to control run-off and minimize the risk of pollution;
- Panels should be fitted with stormwater gutters to control the runoff in an ecologically sensitive manner to prevent erosion;
- All areas where vegetation was cleared should be re-vegetated in order to limit the erosion potential;
- Sedimentation protection measures (such as sand bags, silt traps and fences) should be installed prior to construction;
- Prevent uncontrolled access of vehicles in and around the watercourse which can impact the hydrology and alluvial soil structure; and,
- All no-go areas should be clearly demarcated prior to commencement of construction activities.

Cumulative impacts: Low to moderate and could possibly include edge effects to remaining natural vegetation as the footprint activities may result in vegetation clearing. This could lead to increase in sedimentation as well as introduction of alien and invasive species.

Residual Risks: Expected to be low given that all structures are situated outside the delineated sensitive areas and that stormwater is managed effectively.

Table 15: Impacts to sediment

Nature: Change in sedimentation patterns, changes in sediment in watercourses and sub-catchment due to the removal of soil.		
ACTIVITY: Construction activities and maintenance of solar plant would result in earthworks as well as causing soil and vegetation disturbances. Loss of topsoil, sedimentation in rivers that would cause an increase in turbidity. Other potential impacts include; earthworks, clearing of vegetation would result in bare soil that could be washed into the wetland, disturbance of slopes through road works next to watercourses.		
	Alternative 1	**Alternative 2**

	Without mitigation	With mitigation	Without mitigation	With mitigation
Construction Phase				
Probability	Likely (4)	Moderate (3)	Unlikely (2)	Unlikely (2)
Duration	Medium term (3)	Short term (2)	Short term (2)	Short term (2)
Extent	Local (2)	Local (2)	Local (2)	Local (2)
Magnitude	Moderate (6)	Low (4)	Low (4)	Minor (2)
Significance	**44 (Moderate)**	**24 (Low to Moderate)**	**16 (Low)**	**12 (Low)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Operational Phase				
Probability	Moderate (3)	Unlikely (2)	Unlikely (2)	Rare (1)
Duration	Medium term (3)	Short term (2)	Short term (2)	Short term (2)
Extent	Local (2)	Local (2)	Local (2)	Local (2)
Magnitude	Moderate (6)	Low (4)	Low (4)	Minor (2)
Significance	**33 (Low to Moderate)**	**16 (Low)**	**16 (Low)**	**6 (Low)**
Status (positive or negative)	Negative	Negative	Negative	Positive
Reversibility	Low	Moderate	Moderate	High
Irreplaceable loss of resources?	High	Low	Low	Low
Can impacts be mitigated?	Yes		Yes	

Mitigation:

- Install sediment traps;
- Remove topsoil and keep topsoil stockpiles free of any weeds to keep topsoil viable for rehabilitation;
- All stockpiles should be safeguarded against rain wash;
- Ensure that stockpiles are covered during windy conditions
- Remove only vegetation in areas essential for construction;
- Excess water flow should be managed efficiently to avoid any impacts on the wetland;
- All soil and topsoil removed should not be stockpiled within any watercourse and should take place outside delineated watercourses. All stockpiles should be protected from erosion and stored on flat surfaces;
- Avoid using chemicals for cleaning of solar panels to lower the risk of polluting soils, and in times of flow will pollute surface runoff from contaminated soils;
- Monitor sediment pollution;
- Construction activities should take place in low flow period (as much as possible). This will lower the risk of sedimentation and polluting the wetland;
- All stationary vehicles should be equipped with drip trays;
- Avoid parking of vehicles close to any watercourses;
- No dumping of waste or any other materials near delineated and buffered areas; and
- All areas affected by construction activities should be rehabilitated upon completion of the construction phase. Areas where vegetation was removed, should be reseeded with indigenous grasses as per recommendations from Terrestrial Report.

Cumulative impacts: Low to moderate and could possibly include edge effects to remaining natural vegetation as the footprint activities may result in vegetation clearing. This could lead to increase in sedimentation as well as introduction of alien and invasive species.
Residual Risks: Expected to be low given that all structures are situated outside the delineated sensitive areas and that stormwater is managed effectively.

Table 16: Introduction and spread of alien and invasive species

Nature: Introduction and spread of alien and invasive species.				
ACTIVITY: The removal and movement of soil and vegetation could result in opportunistic invasions after such disturbances as well as the introduction of seed in building materials and on vehicles. In addition, invasions of alien vegetation species can have an impact on hydrology through reducing the water quantity entering a watercourse and it can outcompete natural vegetation and therefore decrease natural biodiversity.				
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Construction Phase				
Probability	Likely (3)	Unlikely (2)	Unlikely (2)	Rare (2)
Duration	Short term (2)	Short term (2)	Short term (3)	Short term (2)
Extent	Local (2)	Local (2)	Local (2)	Local (2)
Magnitude	Low (4)	Low (4)	Low (4)	Low (4)
Significance	**24 (Low to Moderate)**	**16 (Low)**	**16 (Low)**	**8 (Low)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Operational Phase				
Probability	Rare (1)	Rare (1)	Rare (1)	Rare (1)
Duration	Short term (2)	Short term (2)	Short term (2)	Short term (2)
Extent	Local (2)	Site-only (1)	Local (2)	Site-only (1)
Magnitude	Low (4)	Minor (2)	Low (4)	Minor (2)
Significance	**8 (Low)**	**5 (Low)**	**8 (Low)**	**5 (Low)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Low	Moderate	Moderate	Moderate
Irreplaceable loss of resources?	Low	Low	Low	Low
Can impacts be mitigated?	Yes		Yes	
Mitigation: • Monitor for early detection, to find species when they first appear on site. This should be as per the frequency specified in the management plan and should be conducted by an experienced person. Early detection should provide a list of species and locations where they have been detected. Summer (vegetation maximum growth period) is usually the most appropriate time, but monitoring can be adaptable, depending on local conditions – this must be specified in the management plan;				

• Monitor for the effect of management actions on target species, which provides information on the effectiveness of management actions. Such monitoring depends on the management actions taking place. It should take place after each management action; and, • Monitor for the effect of management actions on non-target species and habitats.
Cumulative impacts: Limited alien and Invasive plant species were observed on site, cumulative impacts can be Low to Moderate. As such, continuous monitoring should be implemented during the different phases of development and rehabilitation as well as a period after rehabilitation is completed.
Residual Risks: Expected to be limited given that a recommendations from Terrestrial Assessment is followed.

Table 17: Activities causing pollution

Nature: Surface water, groundwater and sediment pollution.				
ACTIVITY: Accidental spillages of wet concrete, chemical hazardous substances, oil and diesel spillages may result in surface water, groundwater and sediment pollution.				
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Construction Phase				
Probability	Likely (4)	Unlikely (2)	Unlikely (2)	Unlikely (2)
Duration	Medium term (3)	Medium term (3)	Medium term (3)	Short term (2)
Extent	Local (2)	Local (2)	Local (2)	Local (2)
Magnitude	Moderate (6)	Moderate (6)	Low (4)	Low (4)
Significance	**44 (Moderate)**	**22 (Low to Moderate)**	**18 (Low)**	**16 (Low)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Operational Phase				
Probability	Likely (4)	Unlikely (2)	Unlikely (2)	Unlikely (2)
Duration	Short term (2)	Short term (2)	Short term (2)	Short term (2)
Extent	Local (2)	Local (2)	Local (2)	Local (2)
Magnitude	Moderate (6)	Low (4)	Low (4)	Minor (2)
Significance	**40 (Moderate)**	**16 (Low)**	**16 (Low)**	**12 (Low)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Low	Moderate	Moderate	Moderate
Irreplaceable loss of resources?	High	Low	Low	Low
Can impacts be mitigated?	Yes		Yes	
Mitigation: • The development footprint should remain outside the delineated wetland and buffer zones; • Concrete mixing should be done outside the buffer zones and should be done on an impermeable surface;				

• All stationary vehicles should be equipped with drip trays; • No servicing of vehicles or construction equipment should take place near delineated or buffer areas and should be done on an impermeable surface area; • No washing of construction equipment is allowed in any watercourse; • All hazardous substances should be safely stored on an impermeable surface within the construction site camp; • No ablution facilities should be located within 50 m of watercourses and should be outside the 1:100 year flood line; • Construction camp, storage of construction equipment and materials, and chemicals should be located outside the 1: 100 year flood line; • No dumping of waste near or within delineated watercourses and should be adequately stored and removed from site by waste facility; • All waste and refuse should be removed from site and disposed in adequate storage containers before being disposed at a registered landfill site; • All accidental spillages should be rehabilitated immediately and contaminated soil should be adequately disposed off; • No vehicle or construction machinery are allowed within the watercourse; and, • Only use clean water in the washing of the solar panels.
Cumulative impacts: Impacted water quality will only affect local water quality. This is considered as a Moderate cumulative impact.
Residual Risks: Since pollution can be controlled and to a large extent be prevented, the impact of spillages will have a significant residual impact on local watercourses and as such should be considered a significant residual risk.

8 CONCLUSION AND RECOMMENDATIONS

The proposed 600MW Grootvlei Solar 3 PV Plant and associated infrastructure is situated north west of Ventersdorp and in the JB Marks Local Municipality, near Ventersdorp, North West Province, South Africa. According to the spatial data, there are no perennial or non-perennial rivers within the proposed 600MW Grootvlei Solar PV Plant. Also, spatial data indicated no wetlands within the study area. During site visits to the study area, one large HGM unit (Dep) was identified in the southern portion of the study area. This was verified with vegetation species indicating a moisture gradient as well as soil indicators (red-yellow mottling). Several different vegetation species were identified and soils in and around the wetland were identified as Glenrosa soils. The study area is largely comprised of well-drained Hutton soils. The Alternative 1 layout of the 600MW Grootvlei Solar Plant encroaches into the large Dep. Furthermore, no watercourse was identified along the proposed two powerline routes as well as the new MTS.

Due to these freshwater sensitivities and the 32 m buffer zone around this wetland, the proponent has revised the layout for the 600MW Grootvlei Solar PV Plant. Based on this revised layout, Alternative 2 has accommodated the presence of the wetland and its subsequent 32 m buffer zone. Therefore, it is of the opinion that the proposed works will have a low impact on all associated freshwater features given that the mitigation measures in this report are followed and best practise pollution control. Importantly, based on the current condition of the surrounding habitat of the proposed 600MW Grootvlei Solar PV Plant and the mitigations provided above, the surrounding areas can be successfully rehabilitated back to its current condition.

The DFFE Screening Tool has identified the area as a **High** sensitivity from an Aquatic Biodiversity Theme perspective. This is due to the study area being in the Groundwater SWSA of South Africa as well as Aquatic CBA's. However, a wetland was identified within the footprint of the Alternative 1 layout. Therefore, the **High** sensitivity was confirmed (by the specialist), however, if Alternative 2 layout is used then the site sensitivity is **Low**. **As such, the specialist recommends that the development of the PV facility with the use of Alternative 2 as layout may proceed with low impacts on the freshwater features.**

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APPENDIX 1: SPECIALIST DETAILS, QUALIFICATIONS AND EXPERTISE

1 PERSONAL PARTICULARS

Profession:	Aquatic and Wetland Specialist
Date of Birth:	20 December 1993
Name of Firm:	Nitai Consulting
Name of Staff:	Divan van Rooyen
Nationality:	RSA
Membership of Professional Societies	SACNASP (Can. Sci. Nat. 151272), IAIAsa (7063)

2 EDUCATION:

- Ph.D. Environmental Science (Aquatic Ecosystem Health), NWU, South Africa, 2022
- M. Sc. Environmental Science (Ecological Remediation and Sustainable Development), NWU, South Africa, 2017
- B.Sc. Hons Environmental Science (Ecological Remediation and Sustainable Development), NWU, South Africa, 2015
- B.Sc. Tourism, Geography and Zoology, NWU, South Africa, 2014

Publications:

- Schaeffner, B.C. van Rooyen, D., Gerber, R., Scholz, T. & Smit, N.J. 2020. *Wenyonia gracilis* sp. n. (Cestoda: Caryphyllidea) from *Synodontis zambezensis* (Siluriformes: Mochokidae): the first native caryophyllidean tapeworm from southern Africa. Folia Parasitologica, 67: 035.
- van Rooyen, D., Gerber, R., Smit, N.J. & Wepener, V. 2022. An assessment of water and sediment quality of aquatic ecosystems within South Africa's largest floodplain. *African Journal of Aquatic Sciences, 474 – 488.*
- van Rooyen, D., Erasmus, J.H., Gerber, R., Nachev, M., Sures, B., Wepener, V. & Smit, N.J. 2023. Bioaccumulation and trophic transfer of total mercury through the aquatic food webs of an African sub-tropical wetland system. *Science of the Total Environment, https://doi.org/10.1016/j.scitotenv.2023.164210*

3 EMPLOYMENT RECORD:

- 2022 – Present Aquatic and Wetland Specialist, Nitai Consulting

  Conduct Wetland Delineations and Impact Assessments;

  Conduct Aquatic Ecological Assessments;

  SASS5 Assessments;

  Aquatic and Wetland Monitoring Programs; and,

  GIS Mapping

- March 2022 – November 2022 Environmental Consultant and Aquatic Specialist, Enviroworks

  Environmental Control Officer;

  Water Use Licensing;

  Environmental Auditing;

  Report Writing.

- January 2022 – February 2022 Environmental Intern, ABS-Africa (PTY) Ltd

  Environmental Auditing;

  Groundwater quality monitoring;

  Data interpretation and evaluation; and

  Report writing

- 2017 – 2021 Research and Field Assistant, North West University (NWU-Water Research Group)

  Assisting UNISA and NWU Zoology students with module practical's;

  Supervisor to 3rd year Zoology students on a Water Quality Project;

  Fish specialist for a fish translocation study at Lethabo Power Station (ESKOM);

  Junior Aquatic Specialist for aquatic biomonitoring at Khumba Iron Ore Mining (Joint Amanzi Aquatics and NWU-WRG);

  Junior Aquatic Specialist for biomonitoring at a WWTW (Ecosphere & NWU-WRG); and

  Assisted students with aquatic biomonitoring assessments (FRAI, MIRAI, FROC, Fish identification and SASS under the supervision of Dr. Wynand Malherbe).

4 SELECTED CONSULTANCIES

4.1 Fish Translocation study (NWU – WRG), Lethabo Power Station (ESKOM)

2016 - 2021 – Fish Specialist, Fish Translocation at ESKOM, South Africa, Sampling of fish species in ESKOM Cooling Towers and translocating them to the NWU.

4.2 Aquatic Biomonitoring at Khumba Iron Ore Mining (Joint with Amanzi Aquatics and NWU – WRG)

2019, Junior Aquatic Specialist, Aquatic Biomonitoring at Khumba Iron Ore Mining (Joint Amanzi Aquatics and NWU – WRG), South Africa, Undertake aquatic biomonitoring in nearby rivers surrounding Khumba Iron Ore to assess fish community structures.

4.3 Aquatic Biomonitoring at a WWTW near Greylingstad (Joint with Ecosphere and NWU – WRG)

2022, Junior Aquatic Specialist, Aquatic biomonitoring (SASS5, water and sediment quality and fish community structure), South Africa, Undertake aquatic biomonitoring in nearby rivers surrounding Khumba Iron Ore to assess fish community structures.

4.4 Kroonstad Solar PV Facilities

2022, Aquatic and Wetland Specialist, Development of three Solar PV facilities near Kroonstad, Free State Province, South Africa, Assess and map all wetlands associated with the three solar PV facilities as well as perform aquatic biomonitoring of the Vals River.

4.5 Kroonstad South Solar PV Facilities

2022, Aquatic and Wetland Specialist, Development of five Solar PV facilities near Kroonstad, Free State Province, South Africa, Assess and map all wetlands associated with the five solar PV facilities as well as perform aquatic biomonitoring of the Blomspruit.

4.6 Proposed Nketoana Regional Bulk Water Scheme Project

2022, Aquatic and Wetland Specialist, Nketoana Local Municipality is experiencing severe water shortages in its towns Reitz/Petsana/ Petrus Steyn/ Mamafubedu/ Arlington/ Leratswana and Lindley. Solutions to the water shortages are the proposed Nketoana Regional Bulk Water Scheme Pipeline, South Africa, Perform aquatic biomonitoring and assessing all wetlands within a 500m radius of the bulk water scheme project.

4.7 Rustenburg Solar PV Facilities

2022, Aquatic and Wetland Specialist, Development of three Solar PV facilities near Rustenburg, North West Province, South Africa, Assess and map all wetlands associated with the three solar PV facilities as well as perform aquatic biomonitoring of the Elands River.

4.8 Grootvlei Solar PV Facility

2022, Aquatic and Wetland Specialist, Development of three Solar PV facilities near Carletonville, North West Province, South Africa, Assess and map all wetlands associated with the one solar PV facility.

4.9 400kV Transmission and 132kV distribution power lines for the Apollo-Lepini-Mesong Project

2023, Aquatic and Wetland Specialist, Proposed development of a 400kV transmission and 132kV power lines for the Apollo-Lepini-Mesong Project, Gauteng Province, South Africa, Undertake and Aquatic and Wetland Impact Assessment along the proposed routes for the 400kV and 132kV power lines.

4.10 CCUS 3D Seismic Survey & Drilling

2023, Wetland Specialist. Proposed 3D Seismic Survey within the Leandra area, Mpumalanga Province, South Africa, Assess and map all wetlands within the footprint of the survey area.

4.11 Paulputs 400 kV Strengthening (Transmission Line Loop in Loop Out) Project

2022, Aquatic and Wetland Specialist, Proposed Paulputs 400kv Strengthening Project (Transmission Line Loop In Loop Out From Aries – Kokerboom Transmission Line), South Africa, Assess and map all wetlands associated with the power line as well as aquatic biomonitoring.

4.12 Seelo Solar PV Facilities

2022, Aquatic and Wetland Specialist, Development of three Solar PV facilities near Carletonville, North West Province, South Africa, Assess and map all wetlands associated with the three solar PV facilities as well as perform aquatic biomonitoring of the Mooirivierloop.

5 LANGUAGES:

English - excellent speaking, reading, and writing

Afrikaans – excellent speaking, reading and writing

APPENDIX 2: REVIEWERS DETAILS, QUALIFICATIONS AND EXPERTISE (ELZET HUMAN)

1. PERSONAL PARTICULARS

Profession:	Biodiversity Specialist
Date of Birth:	13 March 1987
Name of Firm:	Nitai Consulting
Name of Staff:	Elzet Human
Nationality:	RSA
Membership of Professional Societies	SACNASP (Pr. Sci. Nat. 147031)

2. EDUCATION:

- M-Tech Nature Conservation, (Plant DNA Barcoding and phylogenetics), TUT, South Africa, 2021
- B-Tech Nature Conservation, (Resource Management, Vegetation ecology and rehabilitation) TUT, South Africa, 2011
- N. Dip Nature Conservation, TUT, South Africa, 2008

3. EMPLOYMENT RECORD:

- 2022 – Present Biodiversity Specialist, Nitai Consulting

  Conduct Biodiversity Impact Assessments.

  Conduct Plant Ecological Assessments.

  Conduct Animal Ecological Assessments

  Biodiversity monitoring programs; and,

  GIS Mapping

- 2013 – 2022 Lecturer: Nature Management, Centurion academy

  Lectured various subjects for undergraduate students in Nature Management:

  Botany and Vegetation Ecology, Zoology, Animal Health, Conservation Development, Ecology, Game Ranch Management, Biostatistics, Research Methodology, Genetics, Soil Science

- 2009 – 2013 HOD Rangers Department, Zebula Gold Estate and Spa

  Ecological Monitoring, Reserve Maintenance, Animal Husbandry, Neonatal care of Endangered carnivore species, Zoological display, and permit compliance

- 2008 – Conservation Student, Ann van Dyk Cheetah Research Centre

  Neonatal Care of Carnivore species,

  Veterinary assistance work – vaccine, diets, Endo scoping, pregnancy tests, health monitoring, quarantine care of species, emergency c-sections, bleeding procedures on vultures

  Enclosure Maintenance

  Tracking wild cheetahs

  Rewilding cheetahs

  Anatolian Shepard project assistance

4. SELECTED CONSULTANCIES

4.1 Ecological assessment for Victorius Game farm, Visgat, Ellisras, Limpopo

2018, Ecologist, Ecological condition assessment and game carrying capacity for game farm. Habitat evaluation and rehibition program for problem areas

4.2 Elephant impact study on Mabula Game Reserve, Bela-Bela, Limpopo,

2019, Ecologist, Ecological impact study on Private Nature reserve to see extent of elephant utilisation and impact. Woody species analysis – structure classification and net primary production. Elephant movement patterns and carrying capacity. Identification of vulnerable habitats and management program.

4.3 Faan Meintjies Municipal Nature Reserve, Matlosana, North West

2018-2022, Ecologist, Habitat assessments, game carrying capacities, ecological condition assessments, game counts and game recommendations, ecological rehabilitation programs, white rhino monitoring, anti-poaching programs, Environmental Education programs.

4.4 Kroonstad Solar PV Facilities

2022, Biodiversity Specialist. Development of three Solar PV facilities near Kroonstad, Free State Province, South Africa, Assess and map all wetlands associated with the three solar PV facilities as well as perform aquatic biomonitoring of the Vals River.

4.5 Kroonstad South Solar PV Facilities

2022, Biodiversity Specialist. Development of five Solar PV facilities near Kroonstad, Free State Province, South Africa, Assess and map all wetlands associated with the five solar PV facilities as well as perform aquatic biomonitoring of the Blomspruit.

4.6 Proposed Nketoana Regional Bulk Water Scheme Project

2023, Biodiversity Specialist. Nketoana Local Municipality is experiencing severe water shortages in its towns Reitz/Petsana/ Petrus Steyn/ Mamafubedu/ Arlington/ Leratswana and Lindley. Solutions to the water shortages are the proposed Nketoana Regional Bulk Water Scheme Pipeline, South Africa, Assess and map all biodiversity, plant and animal features associated within the footprint of the bulk water scheme project.

4.7 Rustenburg Solar PV Facilities

2023, Biodiversity Specialist. Development of three Solar PV facilities near Rustenburg, North West Province, South Africa, Assess and map all biodiversity, plant and animal features associated with the three solar PV facilities.

4.8 Grootvlei Solar PV Facility

2023, Biodiversity Specialist. Development of three Solar PV facilities near Carletonville, North West Province, South Africa, Assess and map all biodiversity, plant and animal features associated with the one solar PV facility.

4.9 400kV Transmission and 132kV distribution power lines for the Apollo-Lepini-Mesong Project

2023, Biodiversity Specialist. Proposed development of a 400kV transmission and 132kV power lines for the Apollo-Lepini-Mesong Project, Gauteng Province, South Africa, undertake assessments and map all biodiversity, plant, and animal features along the proposed routes for the 400kV and 132kV power lines.

4.10 CCUS 3D Seismic Survey & Drilling

2023, Biodiversity Specialist. Proposed 3D Seismic Survey within the Leandra area, Mpumalanga Province, South Africa Assess and map all biodiversity, plant and animal features within the footprint of the survey area.

4.11 Paulputs 400 kV Strengthening (Transmission Line Loop in Loop Out) Project

2023, Biodiversity Specialist. Proposed Paulputs 400kv Strengthening Project (Transmission Line Loop In Loop Out From Aries – Kokerboom Transmission Line), South Africa, Assess and map all biodiversity, plant and animal features within the power line footprint as well as perform biodiversity monitoring.

4.12 Seelo Solar PV Facilities

2023, Biodiversity Specialist. Development of three Solar PV facilities near Carletonville, North West Province, South Africa, Assess and map all biodiversity, plant, and animal features within the three solar PV facilities as well as perform biodiversity monitoring.

5 LANGUAGES:

English - excellent speaking, reading, and writing

Afrikaans – excellent speaking, reading and writing

APPENDIX 2: REVIEWERS DETAILS, QUALIFICATIONS AND EXPERTISE (ANTOINETTE BOOTSMA)

1. PROFESSIONAL AFFILIATIONS

- Professional Natural Scientist (SACNASP) # 400222-09 Botany and Ecology
- South African Wetland Society # NA6RY2FP
- Grassland Society of South Africa

2. QUALIFICATIONS

- **M.SC** (Environmental Science), University of South Africa, 2017. *Awarded with distinction*. Project Title: Natural mechanisms of erosion prevention and stabilization in a Marakele peatland; implications for conservation management.

3. PUBLICATIONS

- A.A. Boostma, S. Elshehawi, A.P. Grootjans, P.L Grundling, S. Khosa, M. Butler, L. Brown, P. Schot. 2019. Anthropogenic disturbances of natural ecohydrological processes in the Matlabas mountain mire, South Africa. South African Journal of Science Volume 115| Number 5/6, May/June 2019, P1 to 8.

4. EMPLOYMENT HISTORY

- Director at Limosella Consulting (Pty) Ltd - 2009 – ongoing
- Senior Wetland Specialist at Strategic Environmental Focus – 2007 to 2009
- Technical Assistant at the Conservation Ecology Research Unit, University of Pretoria, Richards Bay field station, 2005 to 2007.

5. SUMMARY OF KEY SKILLS

- Management of projects in terms of specialist input, including quotations, planning, technical review, submission of reports and invoicing;
- Fine scale wetland delineations and functional assessments;
- Strategic wetland assessments and open space management and planning;
- General Rehabilitation, Monitoring and Mitigation assessments;
- Wetland offset strategies;
- Hydropedological investigations; and
- Implementation of wetland assessment tools including the DWS (2016) Risk Assessment, Present Ecological Status (PES) Macfarlane et al, (2020), Ecological Importance and Sensitivity (EIS) (DWAF, 1999), Recommended Ecological Category (REC) Rountree et al (2013), Riparian Vegetation Response Assessment Index (VEGRAI) (Kleynhans et al, 2007) and QHI (Quick Habitat Integrity).

6. SHORT SUMMARY OF EXPERIENCE

- Numerous external peer reviews as part of mentorship programs for companies including Galago Environmental Consultants, Lidwala Consulting Engineers, Bokamoso Environmental Consultants, Gibb, 2009 – ongoing;
- Wetland specialist input into the Kloof Mine wetland sediment interim management, remediation and rehabilitation plan, 2022;
- Wetland Assessments for the upgrade of 7 culverts and bridges in Vereeniging, Gauteng, July 2021
- Input into the Environmental Management Plan for repair to 90 bridges in the City of Johannesburg, 2020;
- Wetland specialist input into the City of Tshwane Open Space Framework, 2019;
- Wetland specialist input into the North West Environmental Outlook, 2018;
- Wetland specialist input into the Gauteng Environmental Outlook, 2017;
- Wetland specialist input into the Open Space Management Framework for Kyalami and Ruimsig, City of Johannesburg, 2016;
- Kangra Maquasa East and Maquasa West and Nooitgesien Mine, Mpumalanga Province: Rehabilitation and Monitoring Assessment. June 2018; and
- Mbuyelo Coal Welstand Reserve Amendment: Wetland assessment. June 2017.

APPENDIX 3: SIGNED DECLARATION INDEPENDENCE

I, **Divan van Rooyen**, declare that –

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

I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

29/05/2023

Dr. Divan van Rooyen (Can. Sci. Nat. 151272) **Date**

Aquatic and Wetland Specialist

I, **Elzet Human**, declare that –

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

I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

29/05/2023

Elzet Human (Pri. Sci. Nat. 147031) **Date**

Terrestrial Ecologist

I, **Antoinette Bootsma**, declare that –

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

I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

________________________________ **31/05/2023**

Antoinette Bootsma (Pri. Sci. Nat. 400222-09) **Date**

Wetland Specialist

APPENDIX D2: Terrestrial Biodiversity Compliance Statement

Proposed Solar project for Grootvlei, Ventersdorp, North west Province, RSA

TERRESTRIAL BIODIDVERSITY SPECIALIST STATEMENT

20 Spetember 2023

Submitted to: Nemai Green

NEMAI GREEN

Environmental Solutions for a Sustainable Future

Prepared by:

Helena Elizabeth Human (Pr. Sci. Nat 147031)

Nitai Consulting (PTY) Ltd.

147 Bram Fischer Drive

Ferndale

2194

NITAI CONSULTING

Sustainability Specialists

Executive Summary

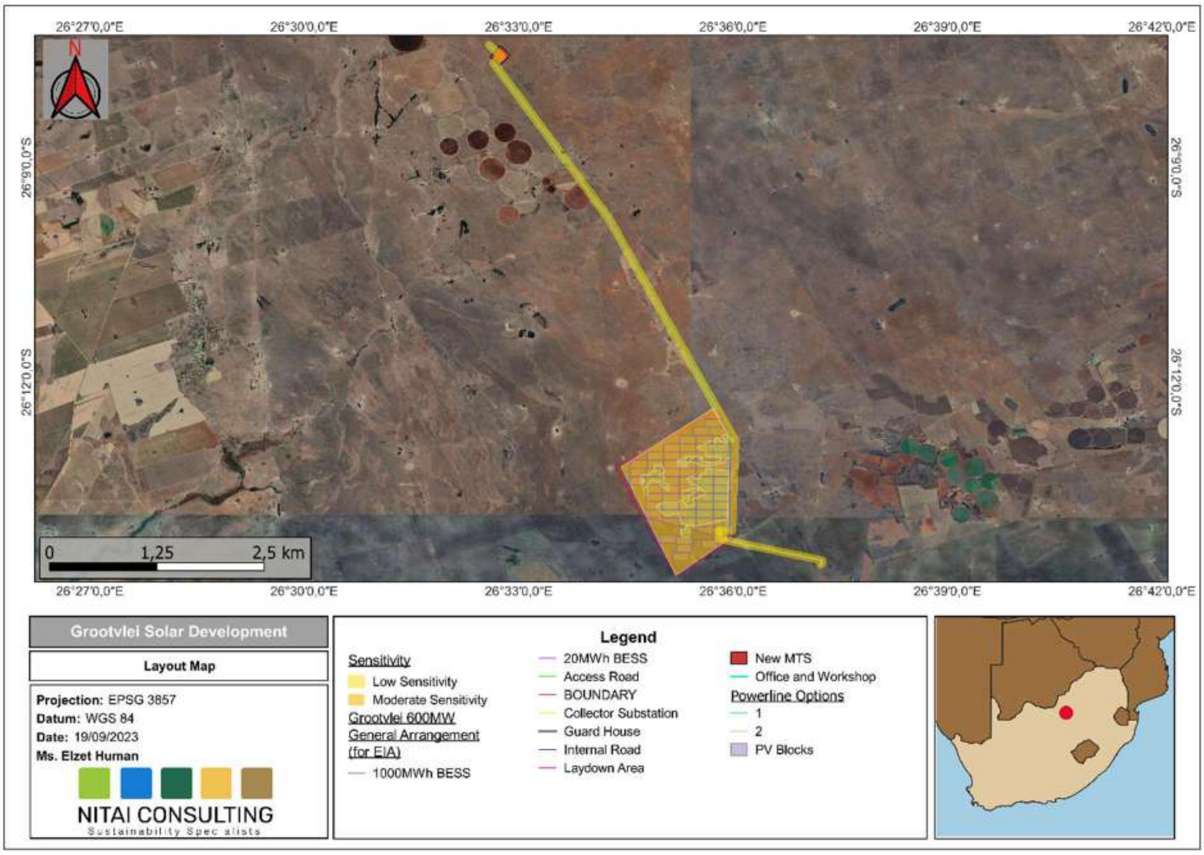
Nitai Consulting (Pty) Ltd. was appointed by Nemai Green (Pty) Ltd. to undertake a terrestrial biodiversity assessment for the proposed Grootvlei Solar (Pty) Ltd project, near Ventersdorp in the North west Province, South Africa.

According to the The National Web based Environmental Screening Tool the terrestrial biodiversity sensitivity theme is very high (Figure 22) due the fact it forms part of Critical Biodiversity areas (CBA 2), Ecological support area 1 & 2 (ESA 1&2), and Protected Areas Expansion Strategy.

Several biodiversity features were identified in terms of corridor linkages that could host various faunal and floral species.

The biodiversity importance for all the habitat units were identified and these are rated as moderate to low sensitivity. The ecological impacts were calculated and with mitigation measures in place the impact of the project footprint ranges from moderate to low for the development.

These moderate sensitivity features include CBA 2 areas.



As a result of the very high sensitivity according to the DFFE Screening Tool, an assessment was conducted in order to identify and mitigate possible loss of biodiversity and corridor linkages, ecological structure and functioning as well as curbing habitat fragmentation during the construction and operational phases.

The completion of the terrestrial biodiversity assessment found that the Disturbed Grassland, Old lands, Alien Invasives and Transformed habitats does not corroborate the screening tool's 'Very High' sensitivity of the biodiversity theme and should rather be considered of low sensitivity since the area has evidence of degradation and disturbance. The natural habitat does not contain any SCC species but is in a healthy condition albeit slightly disturbed and should be considered medium. The plant sensitivity was found to be low and does not corroborate the screening tool's results. No SCC plant species were found at all. The animal sensitivity theme is disputed since there were no suitable habitat found for SCC animal species to be resident and consequently the sensitivity should be low and not medium as the screening tool suggests.

Possible impacts to the loss of biodiversity areas associated with the proposed project is destruction of floral communities and spread of alien invasive species. In addition, loss of wetland habitat could result due to construction activities while the possibility for erosion is increased if proper mitigation measures are not followed. The impact on the receiving environment is perceived to be high to moderate and can be further lowered if mitigation measures described in this report are followed.

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List of Abbreviations

CBA	Critical Biodiversity Area
CR	Critical
DFFE	Department of Forestry, Fisheries & the Environment
DWS	Department of Water and Sanitation
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	Geographic Information System
GN	Government Notice
ha	Hectares
km	Kilometer (1 000m)
LC	Least Concern
MAP	Mean Annual Precipitation
m	Meters
NEMA	National Environmental Management Act (No. 107 of 1998)
NFEPA	National Freshwater Priority Areas
NWA	National Water Act
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
VU	Vulnerable

1 INTRODUCTION

1.1 Background

The South African Government ratified the Paris Agreement in 2016, and thereby showed the country's commitment to contribute to the global effort to address the challenge of climate change. Electricity generation sources need to be diversified to ensure security of supply and reduction in the carbon footprint created by the current heavy reliance of South Africa (SA) on coal to produce electricity. The electricity demand is increasing in SA, and to match that demand there is a need to supply a diversified power generation that includes renewable energy technologies. These technologies include solar, wind, small utility scale hydro, biomass, biogas, and energy storage that the Department of Mineral Resources and Energy (DMRE) intends to develop and implement as identified in the approved Integrated Resource Plan (IRP) 2019.

The Applicant has proposed the development of Grootvlei 600MW Solar Plant, Battery Energy Storage Systems (BESS) and Grid Connection Project north west of Ventersdorp within the JB Marks Local Municipality in the North West Province.

The electricity generated by the Project will be transmitted through either Option 1 which consists of 2 x 132kV powerlines, approximately 14km kilometres (km) in length, from the new facility 33kV substation to new 400/132kV Main Transmission Substation (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line or Option 2 that comprises of 2.8km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation.

The Applicant intends to bid for the current and future Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) bid windows and/or other renewable energy markets within SA.

This assessment was conducted in accordance with the amendments to the Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices (GN) 320 (20 March 2020): "Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation" (Reporting Criteria).

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

1.2 Project information

The proposed Solar PV Projects include the following infrastructure:

The proposed Grootvlei Solar facility will cover approximately 490 ha 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 8 m 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
- Facility grid connection infrastructure

The proposed integrated grid connection infrastructure will include the following:

- 33 kV cabling between the project components and the facility substation
- A 132 kV facility substation
- 33 kV or 132 kV cabling or powerline between the facility substation and the Eskom collector switching station.

The proposed Solar PV Projects have a design life of a minimum of 25 years. The extension of the life of the plant will be considered when assessing the plant's economic viability to remain operational after its end of life.

1.3 Technical Details of the PV Plants

Capacity of on-site substation	Medium voltage (up to 33 kV) to high voltage (132 kV) 132/275kV Main Transmission substation and 275kV LILO powerlines. Each facility will require inverter-stations, transformers, switchgear, and internal electrical reticulation (underground cabling).
PV array	Monofacial or Bifacial PV panels, mounted on either fixed-tilt, single-axis tracking, and/or double-axis tracking systems. Area: Up to 490 ha

Area occupied by both permanent and construction laydown areas	Temporary construction laydown area up to 7 ha. Permanent laydown area up to 1 ha (to be located within the area demarcated for the temporary construction laydown)
Area occupied by buildings	Approximately 1.5 ha
Length of internal roads	15 km – internal
Width of internal roads	The internal roads will be up to 5 m wide. The access roads will be up to 8 m wide.
Height of fencing	Up to 3 m

1.4 Location

The Project is located approximately 20km to the north west of Ventersdorp central business district (CBD) and falls within Ward 34 of the JB Marks Local Municipality, in the North West Province. The site can be accessed via the N14 (main access) and the R53 (gravel road). The property earmarked for the Solar Project covers a combined area of approximately 655 hectares (ha) (Figure 1 and Figure 2Figure 1:Project Locality (Alternative 1)). The PV Site will be situated on the farm Grootvlei 161 IP. The new Main Transmission substation will be situated on Portion 1 of the farm Houtkop 152. Powerline route option 1 will comprise the following properties: Portions 1, 9, 11 and 12 of the Fram Houtkop 152, Portions 3, 4, and 7 of the farm Vogelstruispan 151, Farm Lucky find 158 and the Fram Grootvlei 161 IP. Powerline Route option 2 will be situated on the following properties: Grootvlei 161 IP, remaining extent of Farm Beta 159 IP and on the Fram Boschkop.

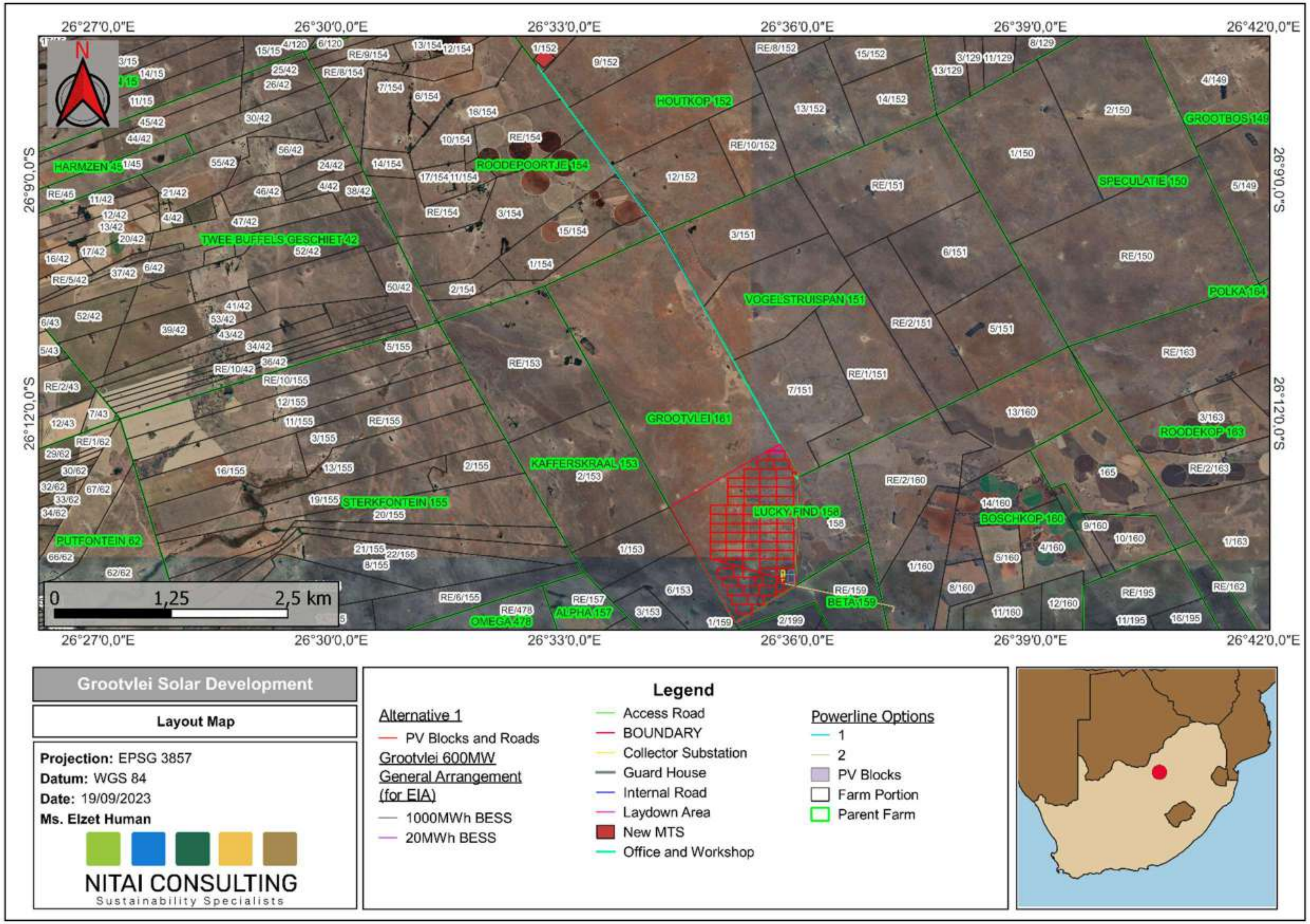


Figure 1:Project Locality (Alternative 1)

Figure 2: Project locality (Preferred alternative).

2 Scope of Work

2.1 Terms of Reference

The specialist study is required to follow the published Protocols, for the assessment of impacts on Terrestrial Biodiversity, Terrestrial Plants Species and Terrestrial Animal Species. Note that the Protocols require determination of the level of sensitivity, which then determines the level of assessment required, either a full assessment, or a Compliance Statement.

This site sensitivity assessment follows the requirements of The Environmental Impact Assessment Regulations, as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), published in GN. No. 320 dated 20 March 2020.

The principle aim of the assessment was to provide information to inform on the risk that the proposed activity has on the terrestrial ecosystems within the PAOI. This was achieved through the following:

- Identification and description of any sensitive receptors that occur in the Project Area of Influence, and the manner in which these sensitive receptors may be affected by the proposed activity;
- Conducting of a desktop assessment to identify the relevant ecologically important geographical features within or nearby to the Project Area of Influence;
- Conducting of a desktop assessment to compile an expected species list and identify flora and fauna Species of Conservation Concern (SCC) that may occur within the Project Area of Influence;
- Conducting of a field survey to ascertain the baseline species composition of the present flora and fauna community within the Project Area of Influence;
- Delineation and mapping of the habitats and their respective sensitivities that occur within the Project Area of Influence;
- Identification of the manners in which the proposed project impacts the flora and fauna communities, and an evaluation of the level of risk that these potential impacts present; and
- The prescription of mitigation measures and associated recommendations for the identified risks.

3 Legislation

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

Table 1: A list of key legislative acts and guidelines relevant to biodiversity and conservation for the project area.

Level	Legislation
International	Convention on Biological diversity (CBD)
National	National Environmental Management Act, Act No. 107 of 1998 (NEMA)
	National Environmental Management: Biodiversity Act, Act No. 10 of 2004 (NEM:BA)
	Government Notice No. 47526 of 2022: The revised National List of ecosystems that are threatened and in need of protection.
	GNR 151: Critically Endangered, Endangered, Vulnerable and Protected Species List Published under Section 56(1) of NEMBA.
	GNR 1187: Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List Published under Section 56(1) of NEMBA.
	National Environmental Management Act, 1998 (Act No. 107 of 1998): The National Biodiversity Offset Guideline published for implementation [G48841 – GoN 3569]
	National Forests Act, Act no. 84 of 1998
	Conservation of Agricultural Resources, Act No. 43 of 1983 as amended in 2001
	National Veld and Forest Fire Act, Act No. 101 of 1998
	Constitution of the Republic of South Africa (Act No. 108 of 1996)
	The National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
	The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)

	Threatened or Protected Species Regulations and lists (No. R. 152 of Government Gazette No. 29657 of 23 February 2007, and No. R. 1187 of Government Gazette No. 30568 of 14 December 2007)
	Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, GNR 320 of Government Gazette 43110 (March 2020); and GNR 1150 of Government Gazette 43855 (October 2020)
	Natural Scientific Professions Act (Act No. 27 of 2003)
	World Heritage Convention Act (Act No. 49 of 1999)
	Municipal Systems Act (Act No. 32 of 2000)
	Alien and Invasive Species Regulations and Alien and Invasive Species List 2014-2020, published under NEM:BA
Provincial	North West Biodiversity Management Act No 4 of 2016
	North West Biodiversity Sector Plan of 2015

3.1 Definitions

3.1.1 Species of Conservation Concern

In accordance with the National Red List of South African Plants website, managed and maintained by the South African National Biodiversity Institute (SANBI), a Species of Conservation Concern (SCC) is a species that has a high conservation importance in terms of preserving South Africa's rich biodiversity. This classification covers a range of red list categories as illustrated in Figure 3 below.

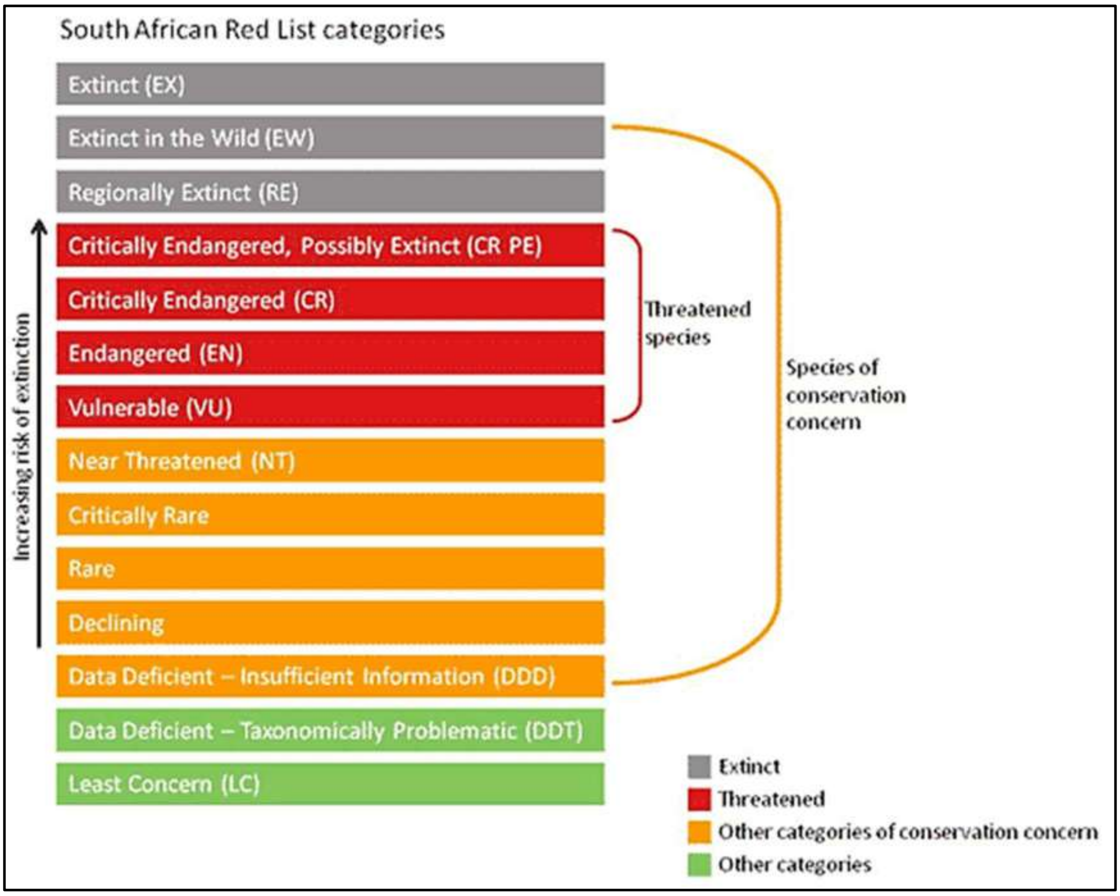


Figure 3: Threatened species and Species of Conservation Concern (SANBI, 2016)

South Africa uses the internationally endorsed International Union for Conservation of Nature (IUCN) Red List Categories and Criteria (IUCN, 2012). This scientific system is designed to measure species' risk of extinction and its purpose is to highlight those species that need critical conservation action. As this system has been adopted from the IUCN, the definition of an SCC as described and categorised above is extended to all red list classifications relevant to fauna as well as the IUCN categories, for the purposes of this report.

3.1.2 Protected Species

Protected species include both flora and fauna species that are protected according to some form of relevant legislation, be it provincial, national, or international. Provincial legislation may include that published in the form of a provincial ordinance, bill, or act, and national legislation includes that which is published in terms of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) or the National Forests Act (Act No. 84 of 1998). Relevant international legislation includes the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2021).

4 METHODS

4.1 Desktop Assessment

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

4.1.1 Ecologically Important Landscape features

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

- Critical Biodiversity Areas of the North West, 2016 (READ Northwest, 2015);
- 2018 National Biodiversity Assessment (NBA, 2018) (Skowno et al., 2019);
- Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018);
- South Africa Protected and Conservation Areas Databases, 2022 (DFFE, 2023; DFFE, 2023a);
- Red List of Ecosystems 2022 (SANBI & DFFE, 2021).
- National Protected Areas Expansion Strategy, 2016 (DEA, 2016);
- Important Bird and Biodiversity Areas, 2015 (Birdlife South Africa, 2015);

Descriptions of these datasets, and their associated relevance to terrestrial biodiversity, are provided below.

4.1.1.1 Provincial Conservation Plan

The Critical Biodiversity Areas of the North West database classifies areas within the province based on their contributions to reaching the associated conservation targets within the province. These areas are primarily classified as either Critical Biodiversity Areas (CBAs) or Ecological Support Areas (ESAs). These biodiversity priority areas, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species, as well as the long-term ecological functioning of the landscape.

- CBAs are areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and healthy functioning of important species and ecosystems and the delivery of ecosystem services. Thus, if these areas are not maintained in a natural or near natural state then provincial biodiversity targets cannot be met (SANBI, 2017).
- ESAs are areas that are not essential for meeting biodiversity representation targets but play an important role in supporting the ecological functioning of ecosystems as well as adjacent Critical Biodiversity Areas, and/or in delivering ecosystem services that support socio-economic development (SANBI, 2017).

Provincial CBAs and ESAs are often further classified into sub-categories, such as CBA1 and CBA2 or ESA1 and ESA2. These present fine scale habitat and biodiversity area baseline requirements and associated land management objectives or outcomes. The highest categorisation level is often referred to as an 'Irreplaceable Critical Biodiversity Area' which usually represents pristine natural habitat that is very important for conservation.

4.1.1.2 National Biodiversity Assessment 2018

The National Biodiversity Assessment (NBA) was completed as a collaboration between the South African National Biodiversity Institute (SANBI), the then Department of Environmental Affairs (DEA), and other stakeholders including scientists and biodiversity management experts throughout the country over a three-year period (Skowno et al., 2019).

The purpose of the NBA is to assess the state of South Africa's biodiversity with a view to understanding trends over time and informing policy and decision-making across a range of sectors. The two headline indicators assessed in the NBA are Ecosystem Threat Status and Ecosystem Protection Level (Skowno et al., 2019).

- **Ecosystem Threat Status (ETS)** outlines the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function, and composition, on which their ability to provide ecosystem services ultimately depends. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Concern (LC), based on the proportion of each ecosystem type that remains in a good or healthy ecological condition (Skowno et al., 2019). CR, EN, or VU ecosystem types are collectively referred to as threatened ecosystems.
- **Ecosystem Protection level (EPL)** informs on whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Not Protected (NP), Poorly Protected (PP), Moderately Protected (MP) or Well Protected (WP), based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act (Skowno et al., 2019).

NP, PP or MP ecosystem types are collectively referred to as under-protected ecosystems.

4.1.1.3 Red List of Ecosystems

The revised list of threatened ecosystems was developed between 2016 and 2021 incorporating the best available information on terrestrial ecosystem extent and condition, pressures, and drivers of change.

The revised list (Red List of Ecosystems 2022) is based on assessments that followed the International Union for Conservation of Nature (IUCN) Red List of Ecosystems Framework (version 1.1) and covers all 456 terrestrial ecosystem types described in South Africa (Mucina and Rutherford 2006; updates in

Dayaram et al., 2019). The revised list identifies 120 threatened terrestrial ecosystem types (55 Critically Endangered, 51 Endangered and 14 Vulnerable types).

Following a series of consultations with conservation authorities and the public in 2020/21 the Revised list of terrestrial ecosystems that are threatened and in need of protection was the approved by the Minister for implementation in August 2022. The revised list was published in the Government Gazette (Gazette Number 47526, Notice Number 2747) and came into effect on 18 November 2022.

4.1.1.4 South Africa Protected and Conservation Areas

The South African Protected Areas Database (SAPAD) and the South Africa Conservation Areas Database (SACAD) contains spatial data critical for the conservation of South Africa's natural resources. It includes spatial and attribute information for both formally protected areas and areas that have less formal protection, such as conservation areas. These databases are updated regularly and form the basis for the Register of Protected Areas, which is a legislative requirement under the National Environmental Management: Protected Areas Act (Act 57 of 2003).

Formally protected areas are categorised according to several different types, and each type is subject to specific legislative restrictions and management guidelines, many of which restrict development to some degree. Generally, these areas are assigned a buffer of influence of between 5 and 10 km (the latter pertaining to National Parks and World Heritage Sites), within which certain laws and management actions may apply. Many of the protected area types are further classified into sub-types as well.

Formally protected area types include:

- National Parks;
- Nature Reserves;
- Special Nature Reserves;
- Mountain Catchment Areas;
- World Heritage Sites;
- Protected Environments;
- Forest Nature Reserves;
- Forest Wilderness Areas;
- Specially Protected Forest Areas; and
- Marine Protected Areas.

4.1.1.5 National Protected Areas Expansion Strategy

The Department of Environmental Affairs (now the Department of Forestry, Fisheries, and the Environment) led the development of the National Protected Areas Expansion Strategy (NPAES) in consultation with the protected area agencies and other key private and public sector stakeholders.

The need for the development of the NPAES was established in the National Biodiversity Framework in 2009. The NPAES is a 20-year strategy with 5-year implementation targets aligned with a 5-year revision cycle. (DEA, 2016).

South Africa's protected area network currently falls far short of representing all ecosystems and maintaining healthy functioning ecological processes. In this context, the goal of the NPAES is to achieve cost effective protected area expansion thus enabling better ecosystem representation, ecological sustainability, and resilience to climate change. A comprehensive set of priority areas was compiled based on the priorities identified by provincial and other agencies in their respective protected area expansion strategies. These focus areas are generally large, intact and unfragmented and are therefore of high importance for biodiversity, climate resilience and freshwater protection (DEA, 2016).

4.1.1.6 Important Bird and Biodiversity Areas

Important Bird & Biodiversity Areas (IBAs) are sites of international significance for the conservation of the world's birds, and other conservation significant species, as identified through multi-stakeholder processes using globally standardised, quantitative, and scientifically agreed criteria. These sites are also Key Biodiversity Areas; sites that contribute significantly to the global persistence and health of biodiversity (BirdLife International, 2022).

The selection of IBAs is achieved through the application of quantitative ornithological criteria, grounded in up-to-date knowledge on the sizes and trends of bird populations. The criteria ensures that sites selected as IBAs have true significance for the international conservation of bird populations, and it also ensures classification consistency among sites at all geographic levels.

IBAs constitute a global network of over 13 500 sites, of which 112 sites are found in South Africa. Approximately 60% of the IBA network is unprotected, leaving these sites vulnerable to habitat transformation and mismanagement. Additionally, habitats within many IBAs are poorly managed, leading to habitat degradation, especially in unprotected sites (Birdlife SA, 2022).

4.1.2 Desktop Flora Assessment

The desktop vegetation and botanical assessment encompassed an assessment of all the vegetation units and habitat types within the project area. The focus was on an ecological assessment of pre-anthropogenic habitat types as well as the identification of any Red Data and protected species within the known distribution of the project area. The South African National Biodiversity Institute (SANBI) provides an electronic database system, namely the Botanical Database of Southern Africa (BODATSA-POSA, 2019), which was used to access distribution records on Southern African plants and generate an expected species list (Figure 4). This new database replaces the old Plants of Southern Africa database which provided distribution data of flora at the quarter degree square resolution. The Red

List of South African Plants website (SANBI, 2016) was used to provide the most current account of the national conservation status of flora.

Additional information regarding ecosystems, vegetation types, protected flora and Species of Conservation Concern (SCC) was obtained from the following sources:

- The Vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2012);
- Red List of South African Plants (Raimondo *et al.,* 2009; SANBI, 2016); and
- List of Protected Tree Species (South African Government, 2014).

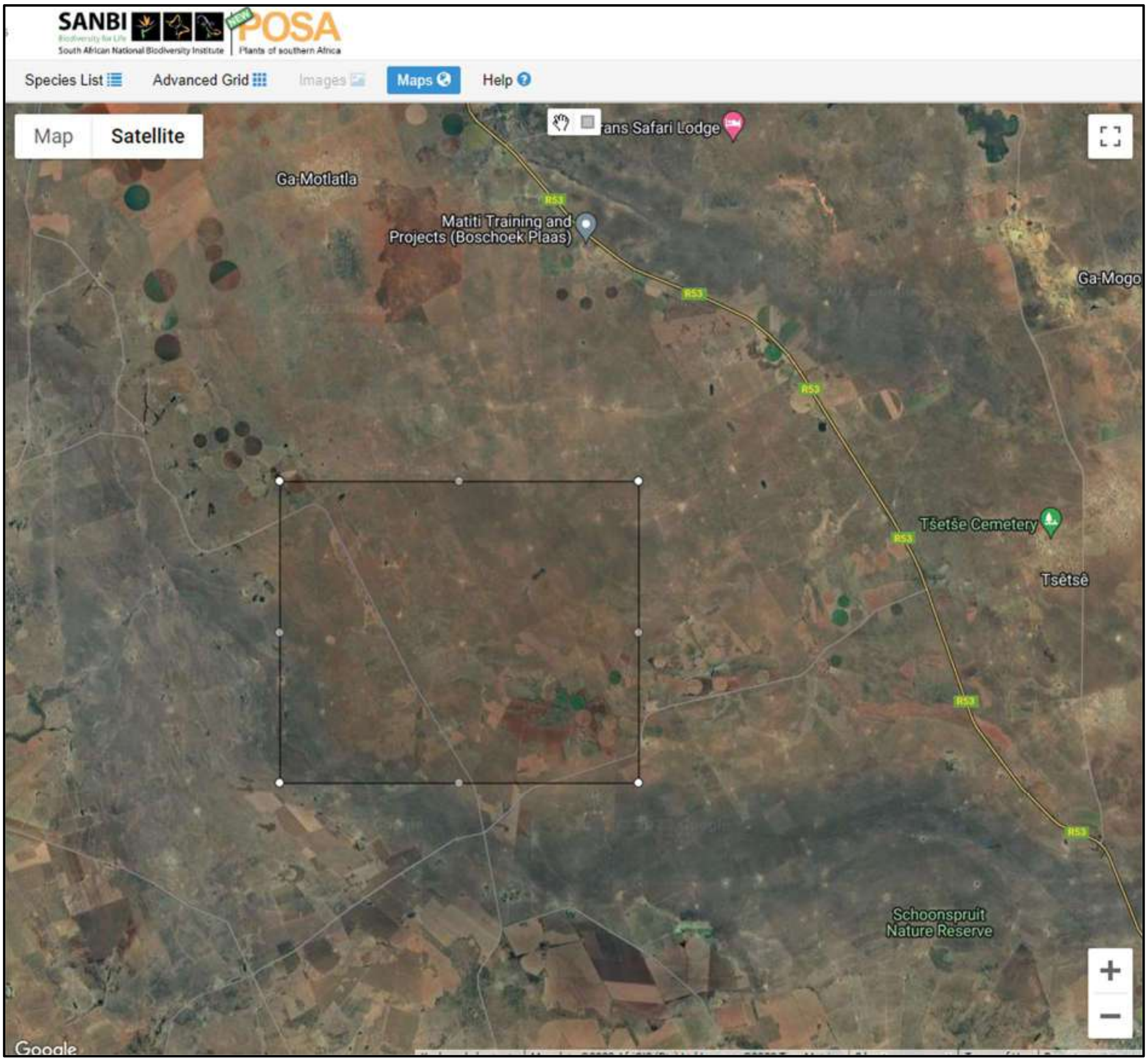


Figure 4: Map illustrating extent of area used to obtain the expected flora species list from the

4.1.3 Desktop Faunal Assessment

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

- Amphibian list, generated from the IUCN spatial dataset (2017)
- Reptile list, generated from the IUCN spatial dataset (2017)
- Mammal list from the IUCN spatial dataset (2017)

4.2 Biodiversity Field Assessment

A field survey was undertaken in January and April 2023, to determine the presence of Species of Conservation Concern (SCC). Effort was made to cover all the different habitat types, within the limits of time and access.

4.2.1 Flora Survey

Based on preliminary interpretation of satellite imagery (Google Corporation) and GIS analysis (which included the most recent applicable biodiversity datasets available prior to the fieldwork), the fieldwork and sample sites were located within specific areas (i.e., target sites) perceived as ecologically sensitive. To maximize coverage and navigate to each target location in the field, the fieldwork's main goal was to quickly analyse the vegetation and ecology at each sample site. Sensitive habitats were highlighted, particularly those that overlapped with the proposed project area.

Using satellite photos and current land cover maps, homogenous vegetation units were subjectively determined. Within representative habitat units identified during the scoping fieldwork, timed meanders were used to assess floristic diversity and look for flora SCC. The focus was mostly on sensitive ecosystems that overlapped with the areas of the proposed project. For conducting floristic analysis, the timed random meander method is especially effective in identifying flora SCC and maximizing floristic coverage. A rapid indicator of flora diversity is provided by the method's efficiency in terms of time and money as well as its suitability for producing lists of plant species.

The timed meander search was performed based on the original technique described by Goff et al. (1982). Suitable habitat for SCC were identified according to Raimondo et al. (2009) and targeted as part of the timed meanders.

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

4.2.2 Fauna Survey

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

- Visual and auditory searches - This typically comprised of meandering and using binoculars to view species from a distance without them being disturbed; and listening to species calls;
- Active hand-searches - are used for species that shelter in or under micro-habitats (typically rocks, exfoliating rock outcrops, fallen trees, leaf litter, bark etc.); and
- Utilization of local knowledge. Relevant field guides and texts consulted for identification purposes included the following:
  - Field Guide to Snakes and other Reptiles of Southern Africa (Branch, 1998);
  - A Complete Guide to the Snakes of Southern Africa (Marais, 2004);
  - Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates et al, 2014);
  - A Complete Guide to the Frogs of Southern Africa (du Preez and Carruthers, 2009);
  - Smithers' Mammals of Southern Africa (Apps, 2000);
  - A Field Guide to the Tracks and Signs of Southern and East African Wildlife (Stuart and Stuart, 2000).

4.3 Terrestrial Site Ecological Importance

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

Site Ecological importance (SEI) is a function of the biodiversity importance (BI) of the receptor (e.g., species of conservation concern, the vegetation/fauna community or habitat type present on the site) and its resilience to impacts (receptor resilience [RR]) as follows:

SEI = BI + RR

BI in turn is a function of conservation importance (CI) and the functional integrity (FI) of the receptor as follows:

BI = CI + FI

Conservation importance (CI) is evaluated in accordance with recognised established internationally acceptable principles and criteria for the determination of biodiversity-related value, including the IUCN Red List of Species, Red List of Ecosystems and Key Biodiversity Areas (KBA; IUCN, 2016; Table 2).

Table 2:Conservation importance (CI) criteria

Conservation importance	Fulfilling criteria
Very high	Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare[23] or Critically Rare[24] species that have a global EOO of < 10 km².
	Any area of natural habitat[25] of a CR ecosystem type or large area (> 0.1% of the total ecosystem type extent[26]) of natural habitat of EN ecosystem type.
	Globally significant populations of congregatory species (> 10% of global population).
High	Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km². IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining.
	Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type.
	Presence of Rare species.
	Globally significant populations of congregatory species (> 1% but < 10% of global population).
Medium	Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals.
	Any area of natural habitat of threatened ecosystem type with status of VU.
	Presence of range-restricted species.
	> 50% of receptor contains natural habitat with potential to support SCC.
Low	No confirmed or highly likely populations of SCC.
	No confirmed or highly likely populations of range-restricted species.
	< 50% of receptor contains natural habitat with limited potential to support SCC.
Very low	No confirmed and highly unlikely populations of SCC.
	No confirmed and highly unlikely populations of range-restricted species.
	No natural habitat remaining.

[23] For butterflies, as per Armstrong *et al*. (2013).
[24] For plants, as per Raimondo *et al*. (2009).
[25] This excludes areas of transformed habitat within a defined ecosystem even if these are partially restored, e.g. Highveld grasslands that have been converted to maize fields and then abandoned so that some form of functional grassland is restored; this is not natural habitat as it does not and will not in the future have species composition representative of the original natural habitat.
[26] This can be calculated from the threatened ecosystem of South Africa shapefile available from the SANBI (current available version 2011: http://bgis.sanbi.org/Projects/Detail/49).
[27] Persistent ecological disruptors must not include components that landowners are legally obliged to address or that should be addressed as norm for best practice. Wilful neglect of these legal obligations or the presence of invasive alien species that can practically be controlled through management actions should not negatively influence the FI score to a major extent.

Functional integrity (FI) of the receptor (e.g. the vegetation/fauna community or habitat type) is defined here as the receptors' current ability to maintain the structure and functions that define it, compared to its known or predicted state under ideal conditions (Table 3).

Table 3:Functional integrity (FI) criteria (South African National Biodiversity Institute, 2020).

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

Recalling that biodiversity importance (BI) is a function of conservation importance (CI) and the functional integrity (FI) of a receptor, BI can be derived from a simple matrix of CI and FI as follows (Table 4):

Table 4:Determining the BI (South African National Biodiversity Institute, 2020).

Biodiversity importance		Conservation importance				
		Very high	High	Medium	Low	Very low
Functional integrity	Very high	Very high	Very high	High	Medium	Low
	High	Very high	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very low
	Low	Medium	Medium	Low	Low	Very low
	Very low	Medium	Low	Very low	Very low	Very low

Receptor resilience (RR) is defined here as: 'The intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention.' See Table 5.

Table 5: Resilience criteria (South African National Biodiversity Institute, 2020).

Resilience	Fulfilling criteria
Very high	Habitat that can recover rapidly (~ less than 5 years) to restore > 75%[28] of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed.
High	Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.
Medium	Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.
Low	Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.
Very low	Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed.

Finally, after the successful evaluation of both BI and RR as described above, it is possible to evaluate SEI from the final matrix as follows (Table 6) and interpreted accordingly (Table 7):

Table 6: Determining the SEI (South African National Biodiversity Institute, 2020).

Site ecological importance		Biodiversity importance				
		Very high	High	Medium	Low	Very low
Receptor resilience	Very low	Very high	Very high	High	Medium	Low
	Low	Very high	Very high	High	Medium	Very low
	Medium	Very high	High	Medium	Low	Very low
	High	High	Medium	Low	Very low	Very low
	Very high	Medium	Low	Very low	Very low	Very low

Table 7: Guidelines for interpreting SEI in the context of the proposed development activities (South African National Biodiversity Institute, 2020).

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

5 Assumptions and Limitations

The following assumptions and limitations are applicable for this assessment:

- The assessment area was based on the area provided by the client and any alterations to the route and/or missing GIS information pertaining to the assessment area would have affected the area surveyed;
- The area was only surveyed during a single season and therefore, this assessment does not consider temporal trends;
- Only a single season survey will be conducted for the respective studies, this would constitute a wet season survey with its limitations;
- Some winter flowering plants could have been missed due to the wet season survey timing
- It must be noted that during the survey, only a fraction of the expected geophytes was visible due to their variable emergence patterns.
- Whilst every effort is made to cover as much of the project area as possible, representative sampling is completed and by its nature, it is possible that some plant and animal species that are present across the project area were not recorded during the field investigations.

6 Desktop Information

6.1 Desktop Assessment

6.1.1 Ecologically Important landscape features

The GIS analysis pertaining to the relevance of the proposed project to ecologically important landscape features are summarised in Table 8.

Table 8: Summary of relevance of the proposed project to ecologically important landscape

Desktop Information Considered	Relevance	Section
Ecosystem Threat Status	Relevant	6.1.1.1
Protected Areas	Relevant	6.1.1.2
Renewable Energy Development Zones	Not relevant	6.1.1.4
Powerline Corridor	Relevant	6.1.1.4
Critical Biodiversity Areas	Relevant	6.1.1.5
National Protected Areas Expansion Strategy	Relevant	6.1.1.6
Important Bird and Biodiversity Areas	Not Relevant	_

6.1.1.1 Ecosystem Threat Status

Based on a scientific approach used at national level by SANBI (Driver et al., 2005), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation relative to the expected extent of each vegetation type (Table 9). The status of a habitat or vegetation type is based on how much of its original area remains intact relative to various thresholds. The original extent of a vegetation type is as presented in the most recent national vegetation map (SANBI, 2012) and is the extent of the vegetation type in the absence of any historical human impact. On a national scale the thresholds are as depicted in Table 3 below, as determined by best available scientific approaches (Driver et al., 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver et al., 2005).

Table 9: Determining ecosystem status (Driver et al., 2005).

Habitat remaining (%)	80 -100	Least Threatened	LT/ LC
	60 - 80	Vulnerable	VU
	Biodiversity target - 60	Endangered	EN
	0 – Biodiversity Target	Critically Endangered	CR

DFFE has published the revised national list of ecosystems that are threatened and in need of protection. The revised list has been published in Government Gazette 47526 (Notice No.689) on 18 November 2022 in terms of the National Environmental Management: Biodiversity Act (NEMBA). By listing the ecosystems that are threatened or in need of protection, anyone wanting to undertake any activity will require environmental authorisation to do so. The list of ecosystems is used to support decision-making and to inform bioregional planning. The revised national list of ecosystems that are threatened or in need of protection was developed between 2016 and 2020 and incorporates the best available information on terrestrial ecosystem extent and condition, pressures, and drivers of change (DFFE, 2022).

A total of 120 of the 456 terrestrial ecosystem types assessed are categorised as threatened. Together these threatened ecosystem types make up approximately 10% of the remaining natural habitat in the country. Of the 120 terrestrial ecosystems 55 are critically endangered, 51 endangered and 14 have been found to be vulnerable (DFFE, 2022).

The site forms part of an area with uncertainty regarding endemic classification (Figure 6) but the main development is on an area of least concern in terms of conservation status, (Figure 5)(SANBI & DFFE, 2021).

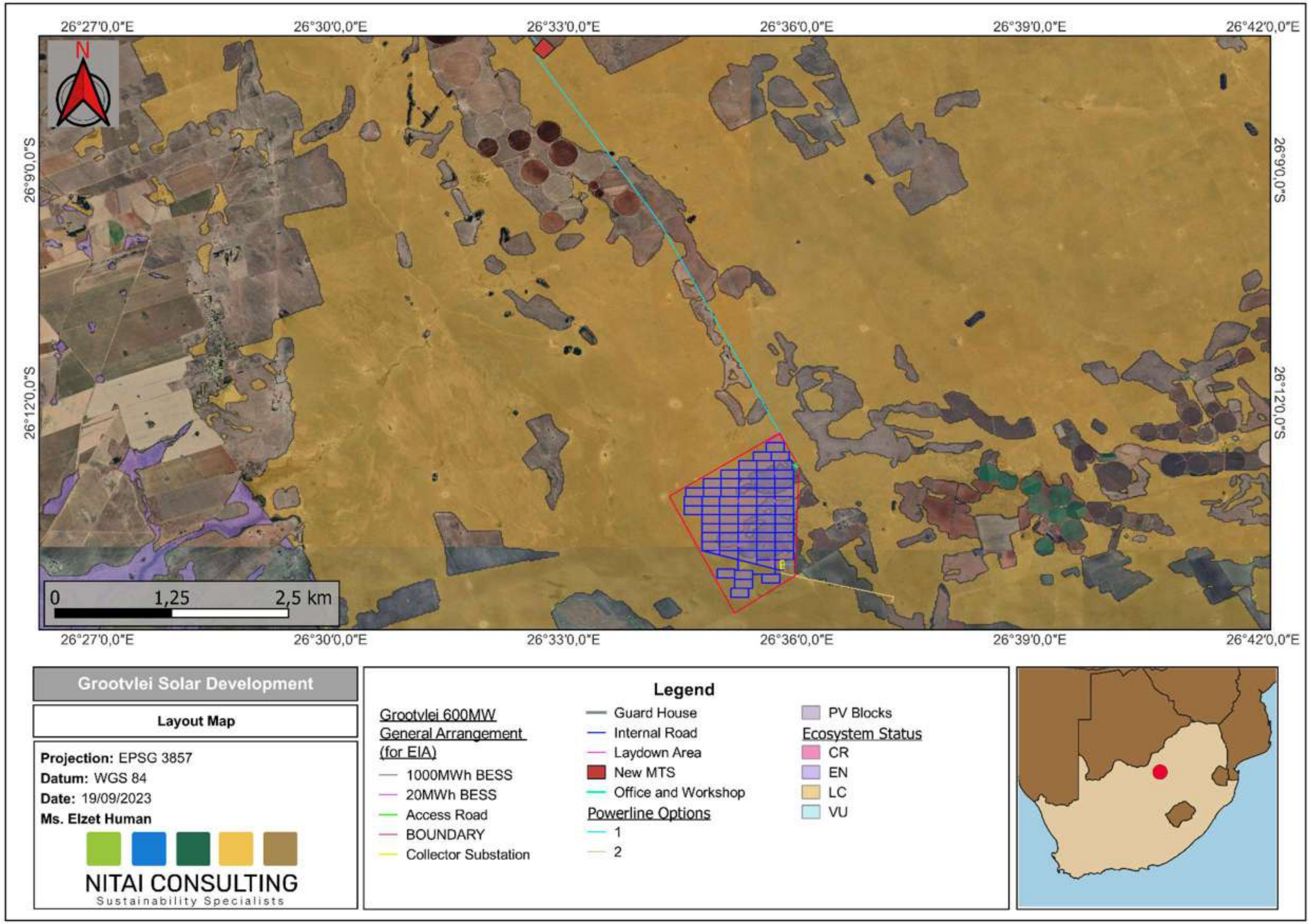


Figure 5: Study site with Least Concern ecosystem.

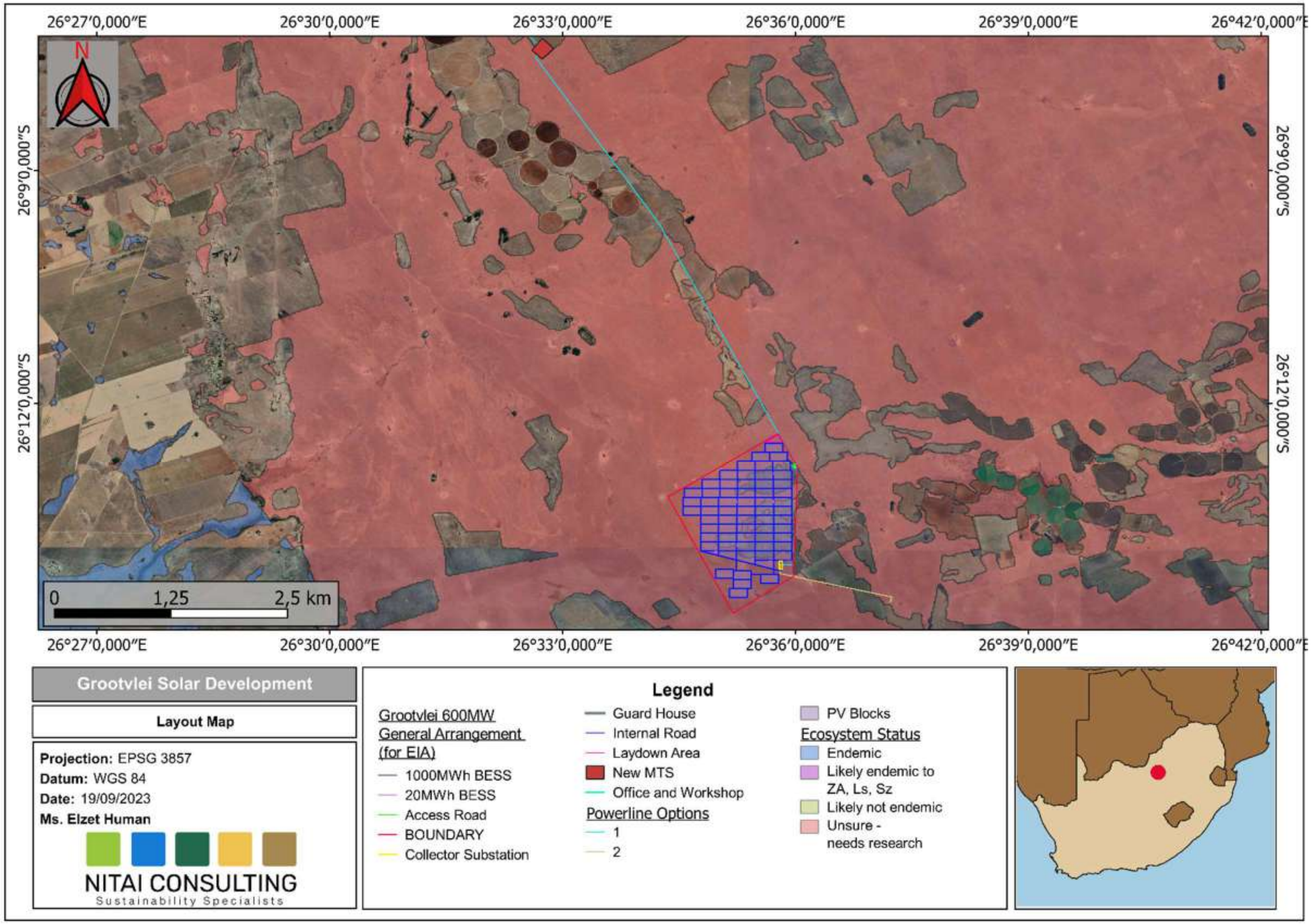


Figure 6:Study site with uncertainty regarding endemic classification.

6.1.1.2 Ecosystem Protection Level

The dataset indicates that the PAOI overlaps with 'Poorly Protected' ecosystems (**Error! Reference source not found.**). According to SANBI (2019), the following definitions apply:

- 'Not Protected' ecosystem types have less than 5% of their biodiversity target included in one or more protected areas;
- 'Poorly Protected' ecosystems are those which have between five per cent and 50% of their biodiversity target included in one or more protected areas; and
- 'Moderately Protected' has between 50 and 100% of its biodiversity target included in one or more protected areas.

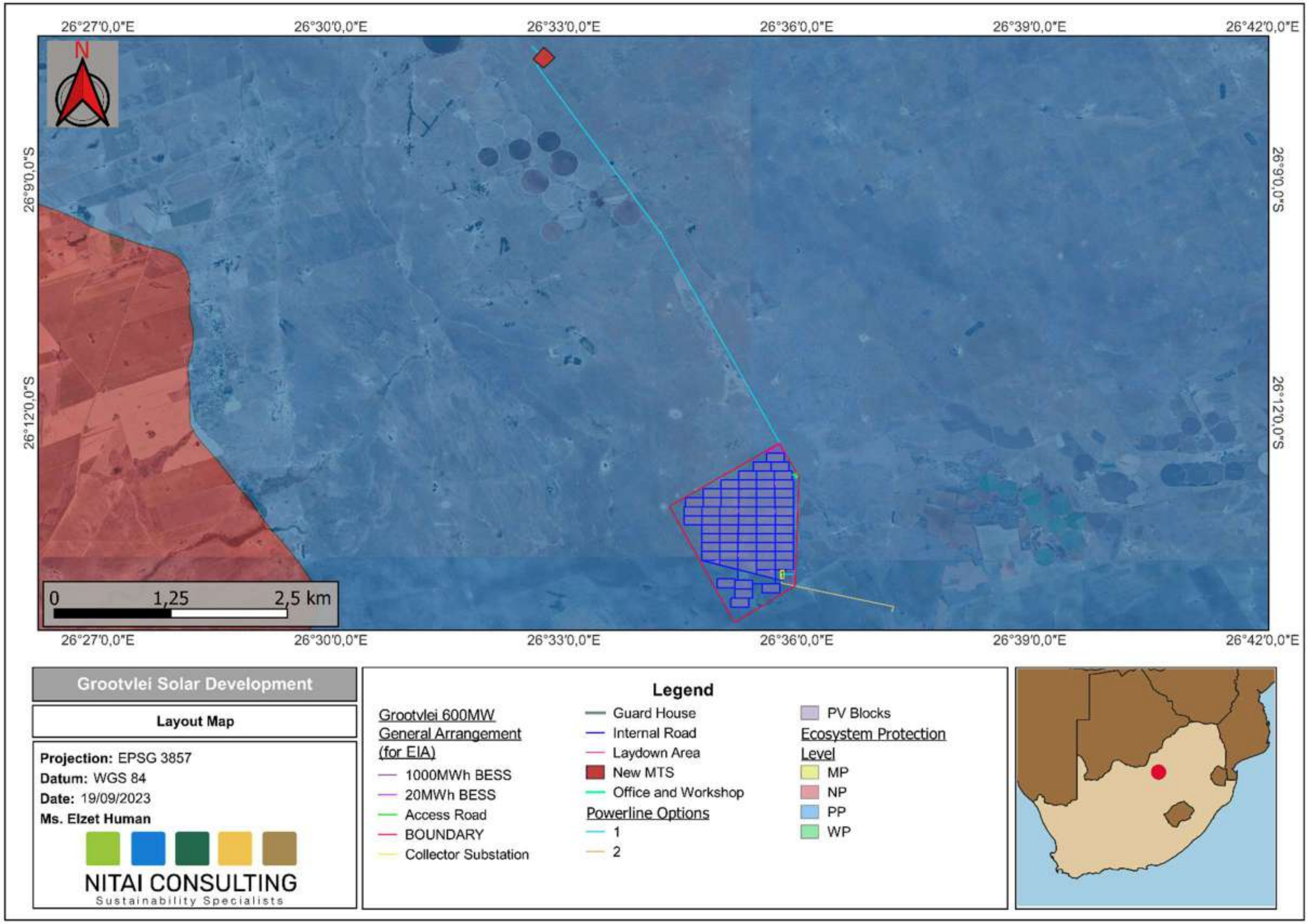


Figure 7: Project area in relation to Ecosystem Protection Level.

6.1.1.3 Protected Areas

According to the spatial data for SAPAD (2022) and SACAD (2022), the main project area lies outside the 5 km buffer for Klipstraat Private Nature Reserve but a small portion of the powerline route option to the south of the project is found within the regulated area (Figure 8).

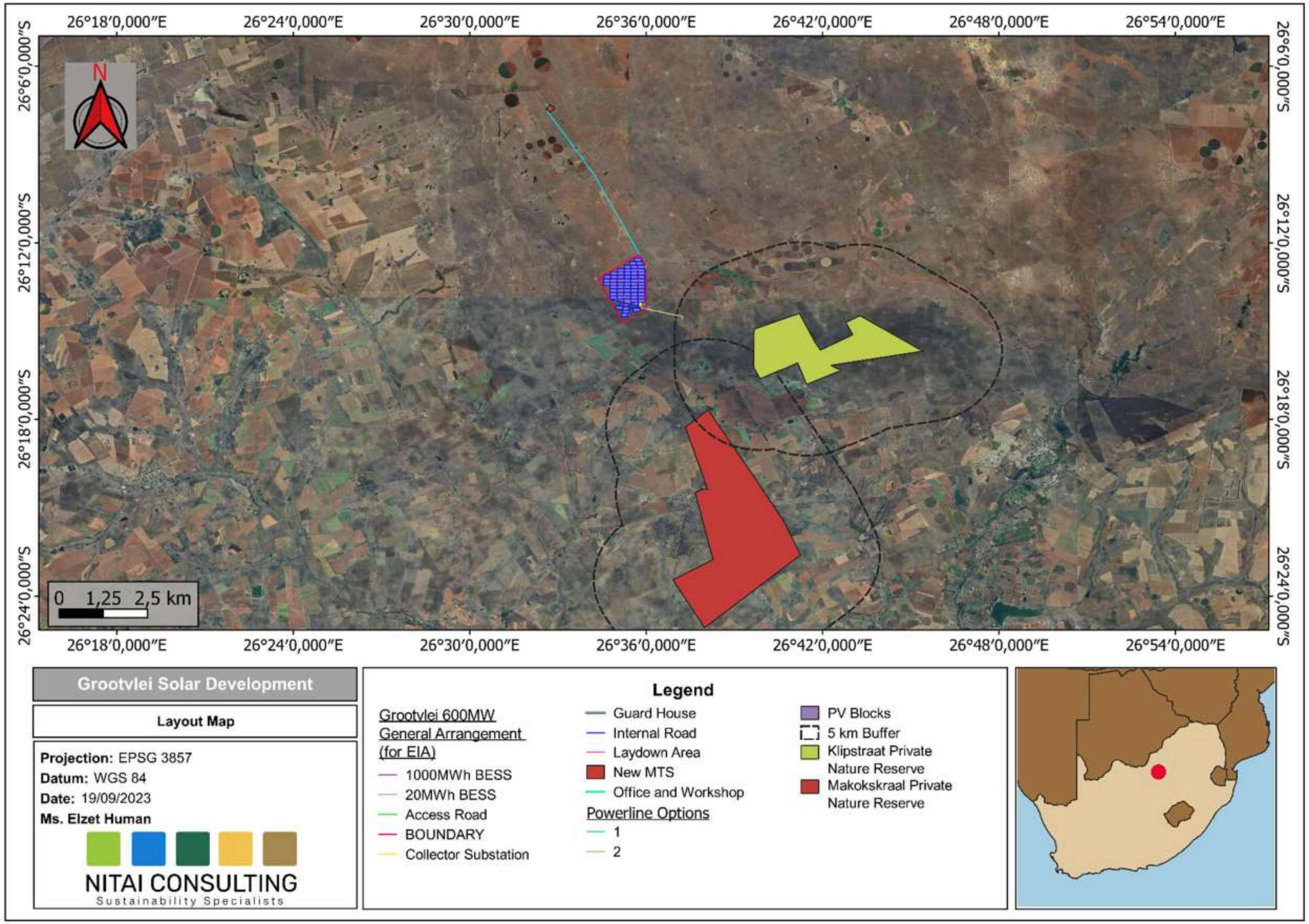


Figure 8: Map illustrating the project area in relation to the nearest protected areas.

6.1.1.4 Renewable Energy Development Zones (REDZ)

In 2018 the Government Notice No. 114 in Government Gazette No. 41445 was published where 8 renewable energy development zones important for the development of large-scale wind and solar photovoltaic facilities were identified. In 2021 an additional 3 sites were included. The REDZs were identified through the undertaking of 2 Strategic Environmental Assessments. The spatial dataset indicated that the project area does not overlap with any REDZ areas but does fall within the Northern Power line Corridors (Figure 9 and Figure 10).

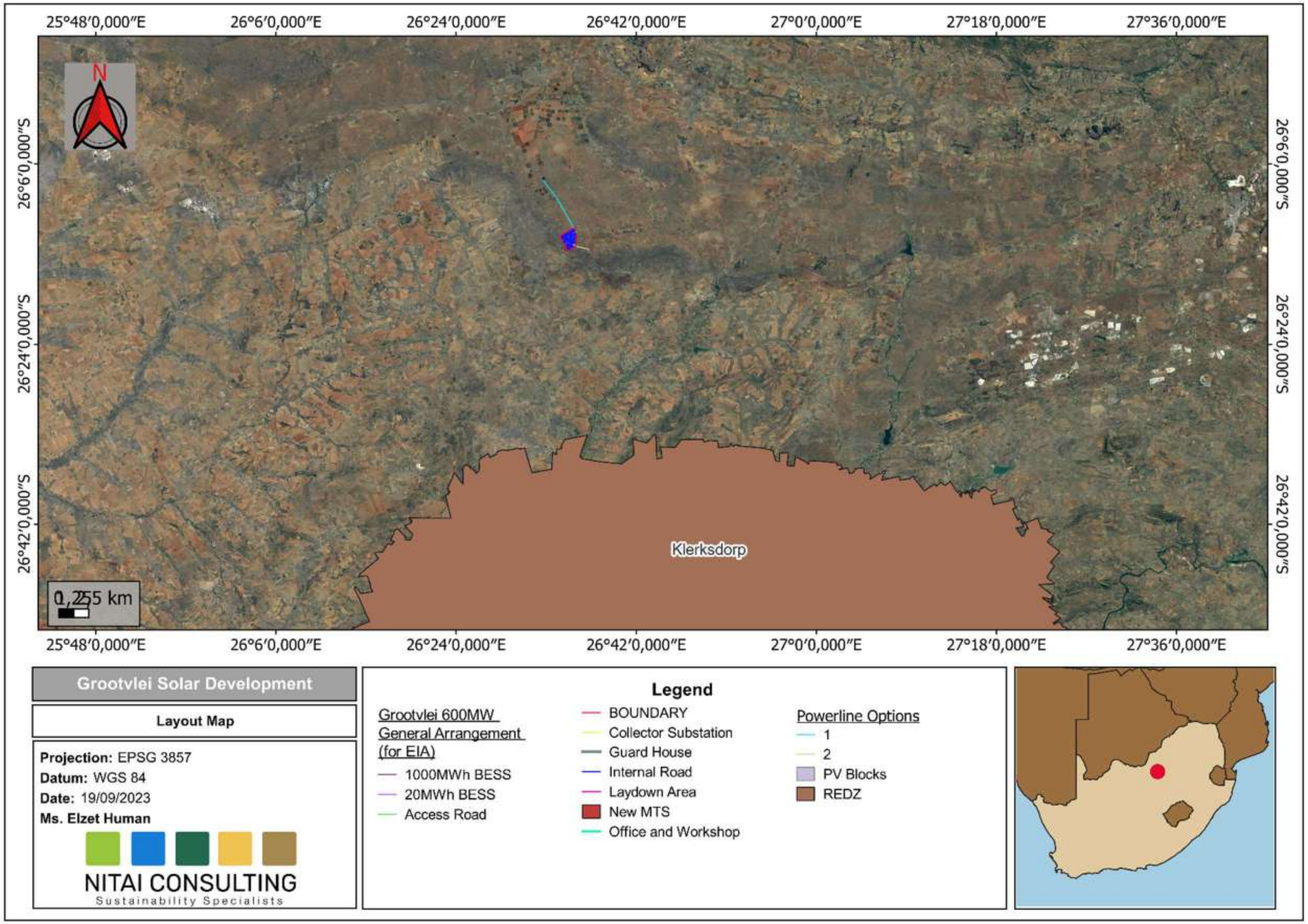


Figure 9: Project area in relation to REDZ areas.

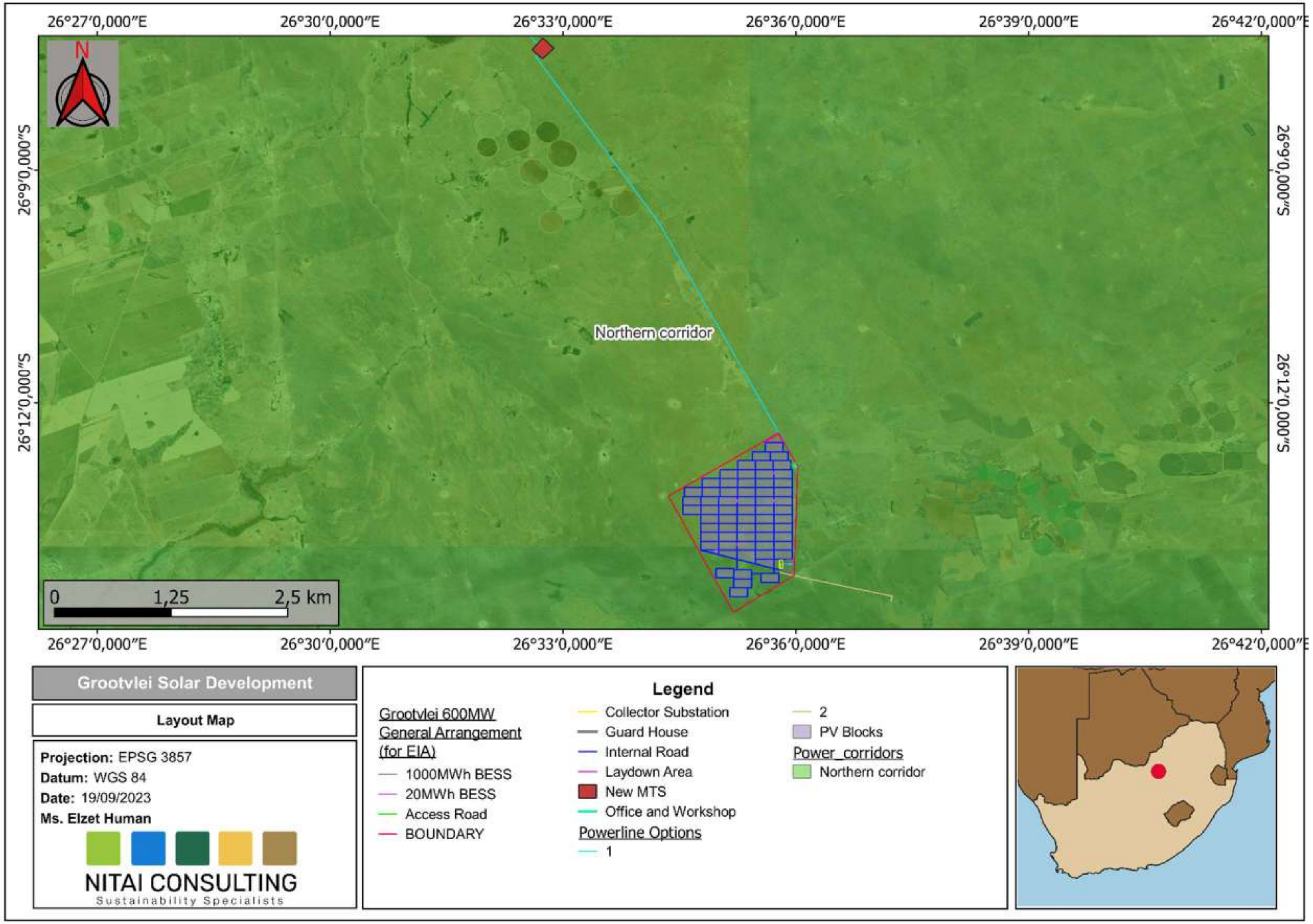


Figure 10: Project area in relation to Powerline Corridors.

6.1.1.5 Critical Biodiversity Areas end Ecological Support Areas

The key output of a systematic biodiversity plan is a map of biodiversity priority areas. The CBA map delineates Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), Other Natural Areas (ONAs), Protected Areas (PAs), and areas that have been irreversibly modified from their natural state.

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species. Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI-BGIS, 2017).

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

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

Figure 11 shows the project area superimposed on the Terrestrial CBA map. The project area overlaps with CBA2, an ESA1, and ESA 2 areas.

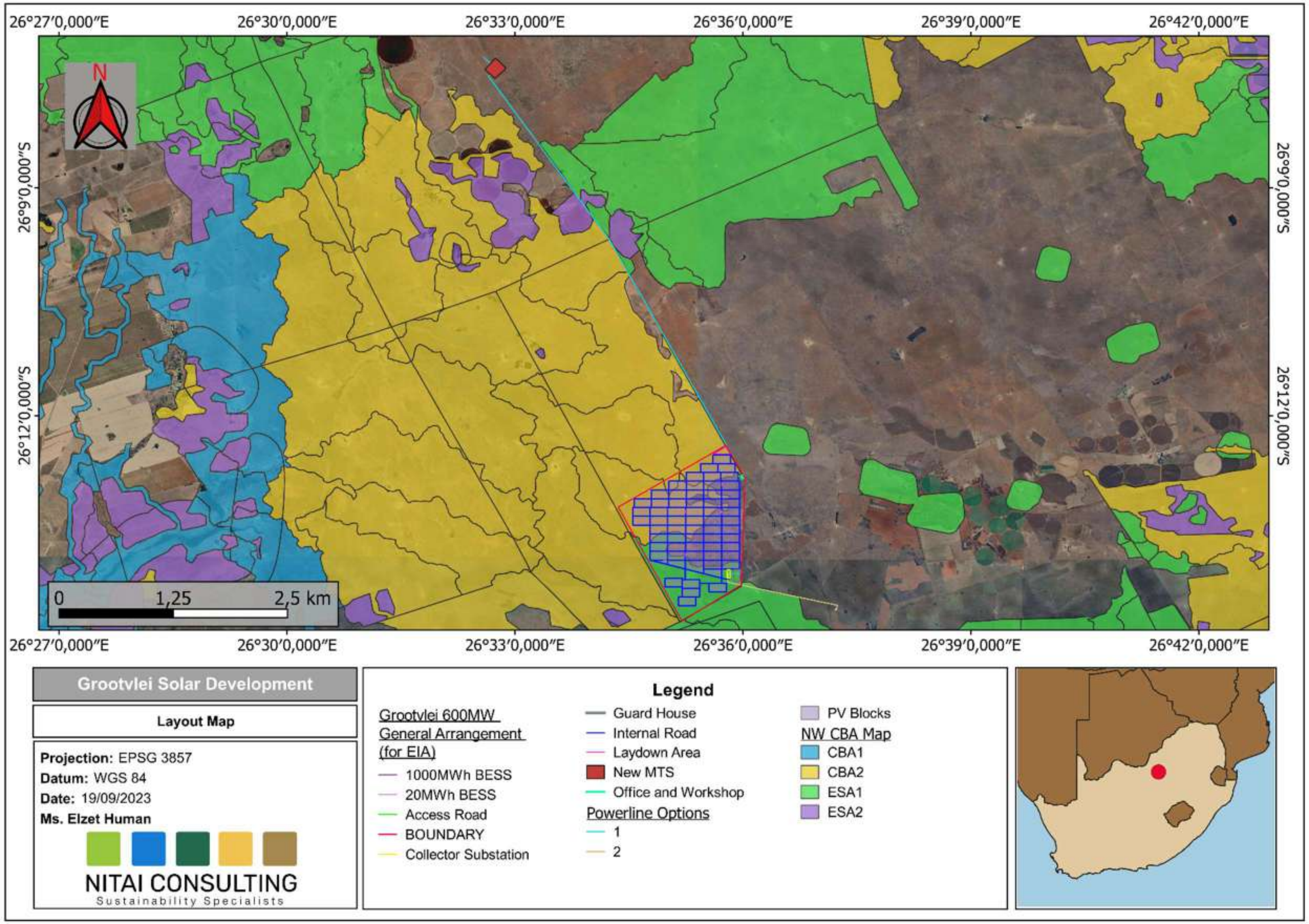


Figure 11: Map illustrating the locations of CBAs in the project area.

6.1.1.6 National Protected Areas expansion Strategy

National Protected Area Expansion Strategy 2017 (NPAES) were identified through a systematic biodiversity planning process. They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with strong emphasis on climate change resilience and requirements for protecting freshwater ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for fine scale planning which may identify a range of different priority sites based on local requirements, constraints, and opportunities (NPAES, 2017). The project area does overlap with the Priority Focus Areas, as per the NPAES (Figure 12).

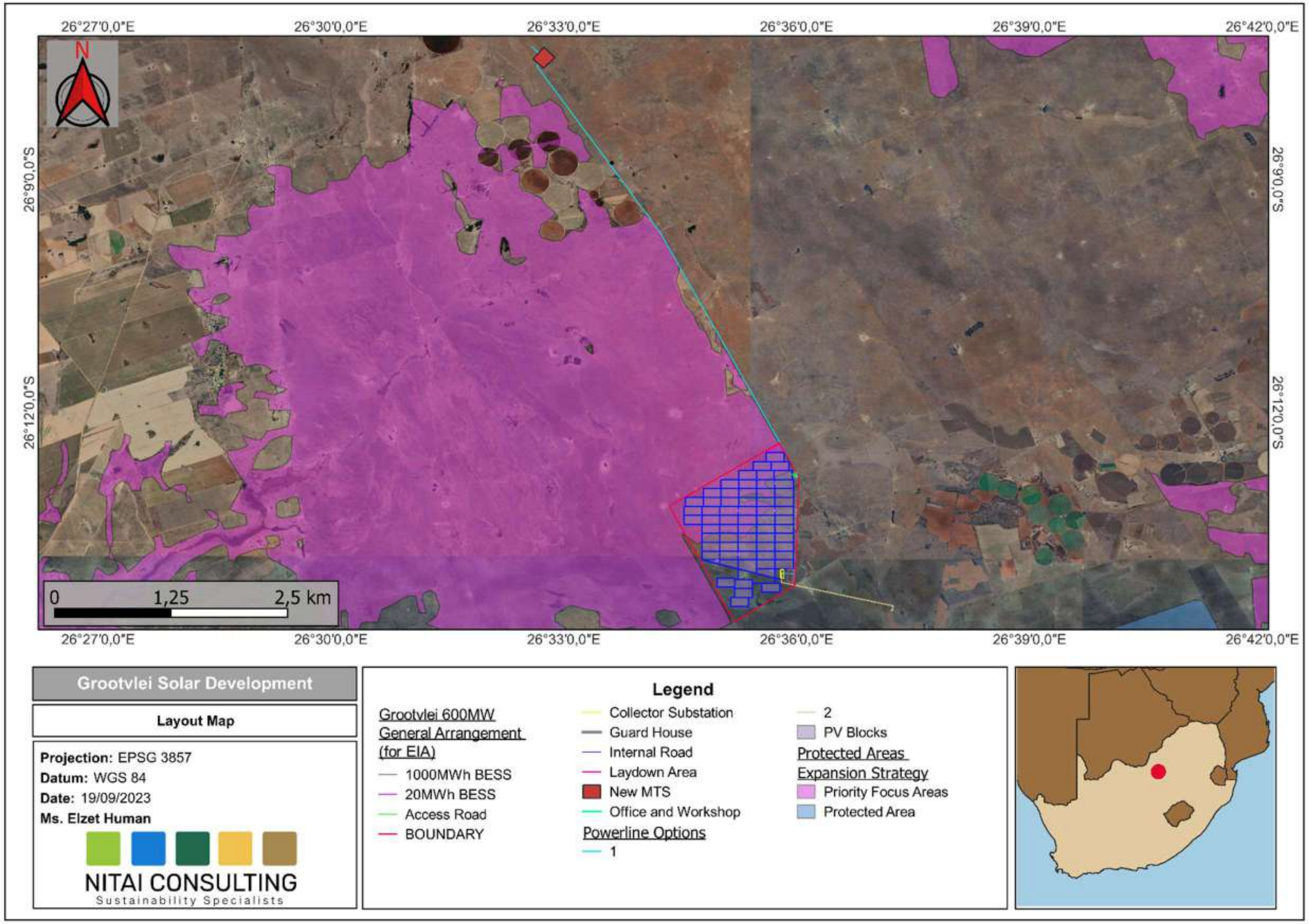


Figure 12: The project area in relation to the National Protected Area Expansion Strategy.

6.1.1.7 Renewable Energy projects

The South African Renewable Energy EIA Application Database (REEA) contains spatial data for renewable energy applications for environmental authorisation. It includes spatial and attribute information for both active (in process and with valid authorisations) and non-active (lapsed or replaced by amendments) applications. Data is captured and managed on a parcels level as well as aggregated to the project level. Only outer boundaries are provided in this release. The purpose of the spatial data is to produce and maintain a comprehensive spatial database on renewable energy EIA applications in the country. The database is suitable for a wide range of planning, assessment, analysis, and display purposes. One existing and approved application for developments are found within 39 km of the project site (Figure 13). The data used to determine the number of applications in the nearby area were obtained from SA Renewable Energy EIA Application Database (REEA) (https://egis.environment.gov.za/) and were accurate as per 4 May 2023.

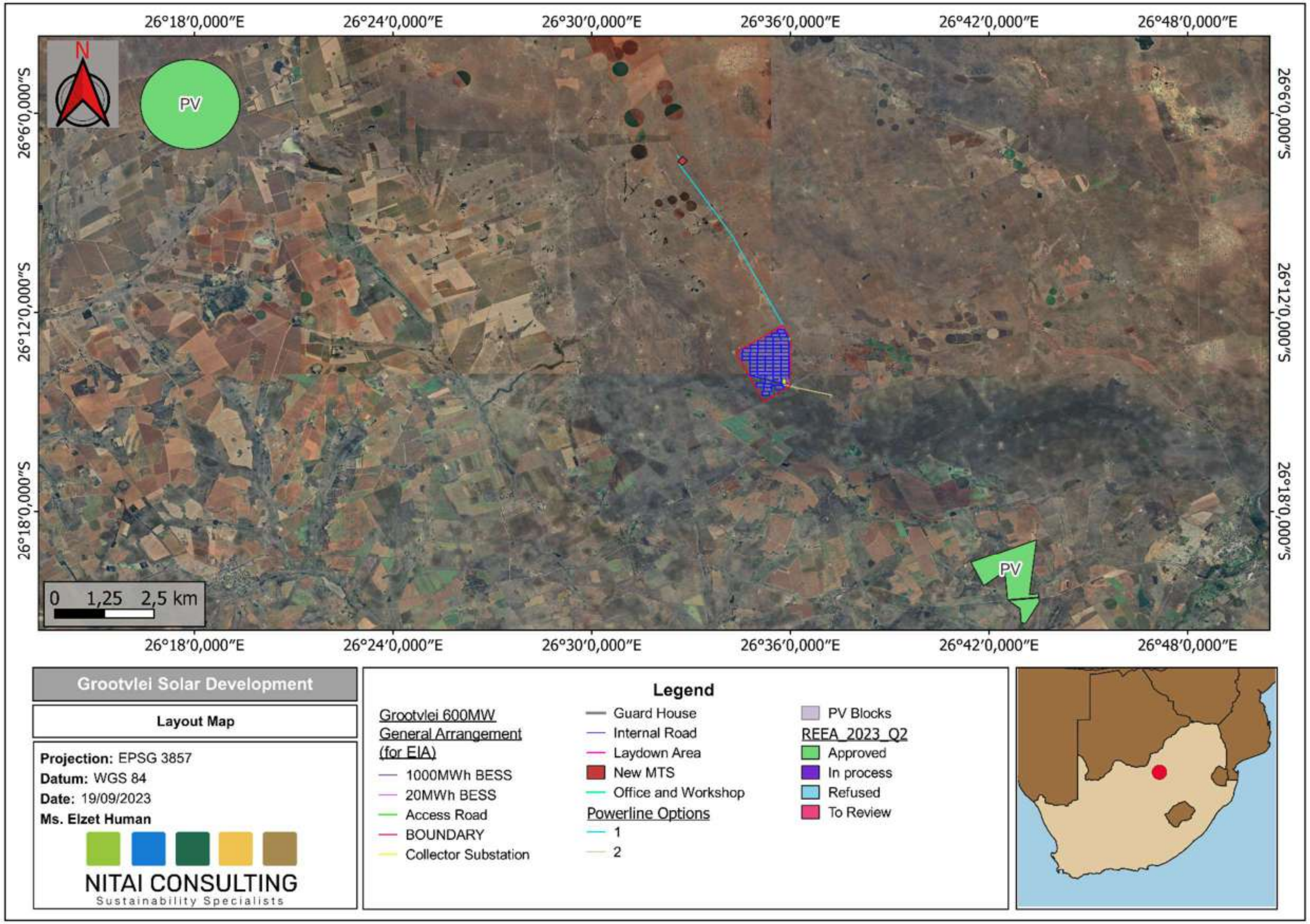


Figure 13: Existing, approved Renewable Energy EIA project.

6.1.2 Flora Assessment

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

6.1.2.1 Vegetation Type

The project area is situated within the Grassland Biome. In South Africa, the Grassland Biome occurs mainly on the high central plateau (Highveld), the inland areas of the eastern seaboard, the mountainous areas of KwaZulu-Natal (KZN) and the central parts of the Eastern Cape (Mucina & Rutherford, 2006). However, grasslands can also be found below the Drakensberg, both in KZN and the Eastern Cape, with floristic links to the high-altitude Drakensberg grassland (Mucina & Rutherford, 2006).

The topography is mainly flat to rolling, but also includes mountainous regions and the Escarpment (Mucina & Rutherford, 2006). Altitude is mostly from about 300 to 400 m.a.s.l, but reaches up to 3 482 m on Thabana Ntlenyana, the highest mountain in southern Africa (Mucina & Rutherford, 2006). In terms of climate, the temperate grasslands of the Highveld in South Africa have cold and dry conditions, with rainfall during the summer (which can sometimes be a strong summer rainfall) and winter drought (Mucina & Rutherford, 2006).

Frost is common and there is a high risk of lightning-induced fires (Mucina & Rutherford, 2006). In terms of vegetation structural composition, grasslands are characteristically dominated by grasses of the Poaceae Family (Mucina & Rutherford, 2006). On the Lesotho Plateau and highest peaks of the Drakensberg, grassland plants xeromorphic characteristics due to the severity of the climate in these places (Mucina & Rutherford, 2006).

On a fine-scale vegetation type, the project area overlaps with the Carletonville Dolomite Grassland (Figure 14).

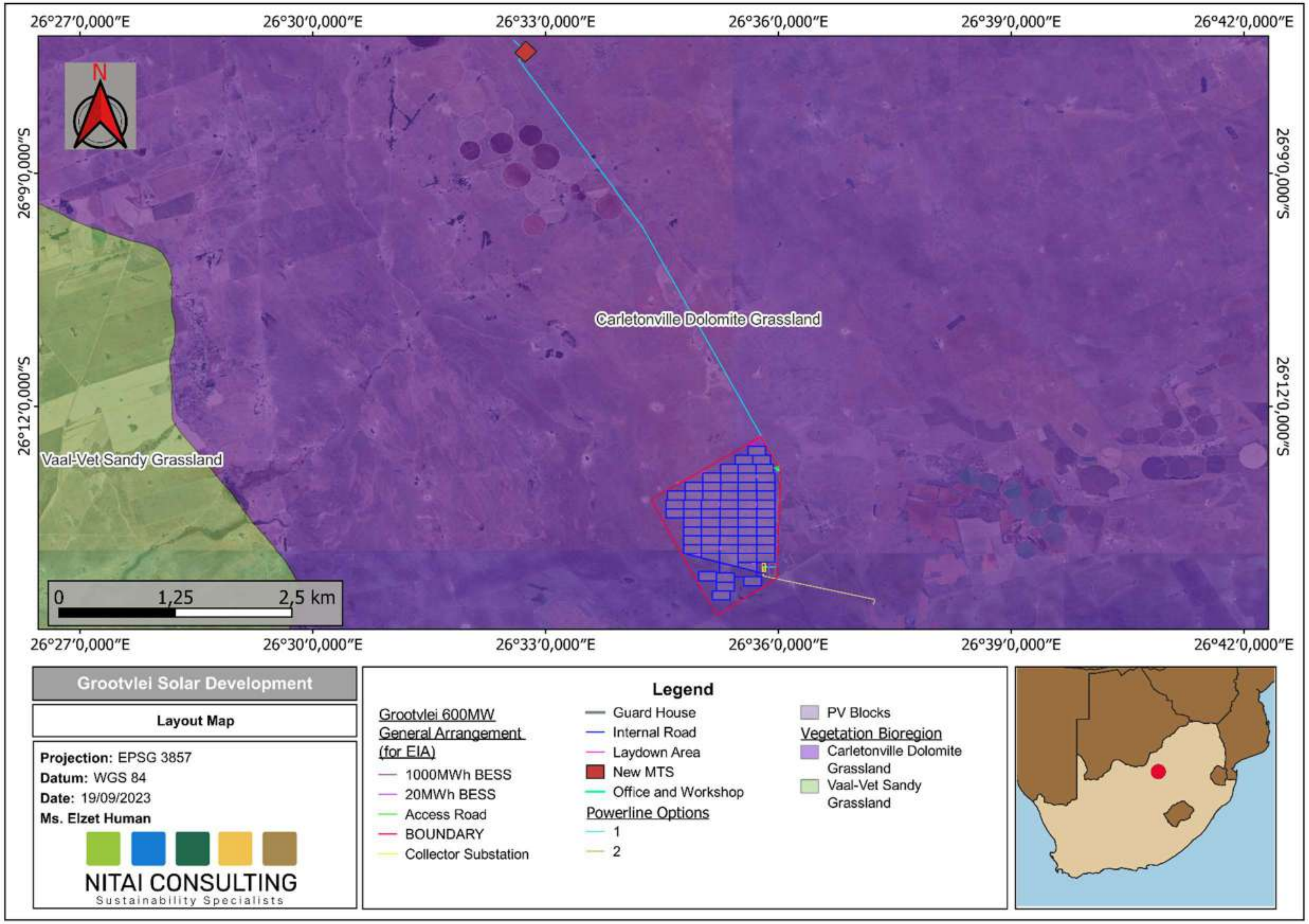


Figure 14: Map illustrating the vegetation type associated with the project area.

<u>**Carletonville Dolomite Grassland**</u>

Distribution: North-West (mainly) and Gauteng and marginally into the Free State Province: In the region of Potchefstroom, Ventersdorp and Carletonville, extending westwards to the vicinity of Ottoshoop, but also occurring as far east as Centurion and Bapsfontein in Gauteng Province.

Altitude: 1 360–1 620 m.

Vegetation & Landscape Features

Slightly undulating plains dissected by prominent rocky chert ridges. Species-rich grasslands forming a complex mosaic pattern dominated by many species.

Geology & Soils

Dolomite and chert of the Malmani Subgroup (Transvaal Supergroup) supporting mostly shallow Mispah and Glenrosa soil forms typical of the Fa land type, dominating the landscapes of this unit. Deeper red to yellow apedal soils (Hutton and Clovelly forms) occur sporadically, representing the Ab land type.

Important Taxa

<u>Graminoids:</u> *Aristida congesta (d), Brachiaria serrata (d), Cynodon dactylon (d), Digitaria tricholaenoides (d), Diheteropogon amplectens (d), Eragrostis chloromelas (d), E. racemosa (d), Heteropogon contortus (d), Loudetia simplex (d), Schizachyrium sanguineum (d), Setaria sphacelata (d), Themeda triandra (d), Alloteropsis semialata subsp. eckloniana, Andropogon schirensis, Aristida canescens, A. diffusa, Bewsia biflora, Bulbostylis burchellii, Cymbopogon caesius, C. pospischilii, Elionurus muticus, Eragrostis curvula, E. gummiflua, E. plana, Eustachys paspaloides, Hyparrhenia hirta, Melinis nerviglumis, M. repens subsp. repens, Monocymbium ceresiiforme, Panicum coloratum, Pogonarthria squarrosa, Trichoneura grandiglumis, Triraphis andropogonoides, Tristachya leucothrix, T. rehmannii.*

<u>Herbs:</u> *Acalypha angustata, Barleria macrostegia, Chamaecrista mimosoides, Chamaesyce inaequilatera, Crabbea angustifolia, Dianthus mooiensis, Dicoma anomala, Helichrysum caespititium, H. miconiifolium, H. nudifolium var. nudifolium, Ipomoea ommanneyi, Justicia anagalloides, Kohautia amatymbica, Kyphocarpa angustifolia, Ophrestia oblongifolia, Pollichia campestris, Senecio coronatus, Vernonia oligocephala.*

<u>Geophytic Herbs:</u> *Boophone disticha, Habenaria mossii.*

<u>Low Shrubs:</u> *Anthospermum rigidum subsp. pumilum, Indigofera comosa, Pygmaeothamnus zeyheri var. rogersii, Rhus magalismontana, Tylosema esculentum, Ziziphus zeyheriana*.

<u>Geoxylic Suffrutices:</u> *Elephantorrhiza elephantina, Parinari capensis subsp. capensis*

<u>Endemic Taxon</u>: Succulent Shrub: *Delosperma davyi*

Conservation Status: The ecosystem is rated as Least concern according to the 2022 Red List ecosystem (Table 10) data since there is 61% remaining of this ecosystem. It has experienced low rates of natural habitat loss and biotic disruptions, placing this ecosystem at low risk of collapse (DFFE, 2022).

Table 10: Conservation status of different Central Free State Grassland types occurring in the study area (SANBI, Rates and patterns of habitat loss across South Africa's vegetation biomes., 2021)

Ecosystem Detail	Carletonville Dolomite Grassland
Reference number	Gh15
Threat status	LC (Least Concern)
Listed under criterion	(No Criteria for LC)
Biome	Grassland
Original area	920045 (ha)
Remaining area	61 %
Protected area	6.1 %
Description	In the region of Potchefstroom, Ventersdorp and Carletonville, extending westwards to the vicinity of Ottoshoop, but also occurring as far east as Centurion and Bapsfontein in Gauteng Province. Slightly undulating plains dissected by prominent rocky chert ridges. Species-rich grasslands forming a complex mosaic pattern dominated by many species. Pressures & threats: This ecosystem has a broad range of pressures. Agriculture is a key pressure on this ecosystem type, with 1815.11 km^2 of the ecosystem consisting of croplands and a further 1046.95 km^2 of old fields (Mucina et al. 2006). Additionally, urban development has contributed to the pressures with 520.31 km^2 of the ecosystem consisting of built-up areas (Mucina et al. 2006). Mining has also transformed 42.21 km^2 of the ecosystem.
Notes	Carletonville Dolomite Grassland has experienced low rates of natural habitat loss and biotic disruptions, placing this ecosystem at low risk of collapse. Scope: National status (type not endemic - extent beyond South Africa, Lesotho and eSwatini not yet assessed)

6.1.2.2 Expected Flora Species

Based on the Plants of Southern Africa (BODATSA-POSA, 2019) and the IUCN spatial database, 40 plant species could potentially occur on the study site. There are no SCC in this potential occurrence list. The screening tool identifies no potential SCC species and rated the area “Low”.

Appendix 3: 14 provides the list of species found through the survey and their respective conservation status and endemism. Three SCC species were identified as occurring on the study site, these species are provincially protected.

6.1.3 Faunal Assessment

6.1.3.1 Amphibians

Based on the IUCN Red List Spatial Data, 18 amphibian species are expected to occur within the area (Appendix 4: 15.1). None are regarded as threatened.

6.1.3.2 Reptiles

Based on the IUCN Red List Spatial Data, 27 reptile species are expected to occur within the area (Appendix 4: 15.2). None are regarded as threatened.

6.1.3.3 Mammals

The IUCN Red List Spatial Data lists 71 mammal species that could be expected to occur within the area (Appendix 4: 15.3). This list excludes large mammal species that are limited to protected areas. Two of these expected species are regarded as vulnerable and two are considered near threatened (Table 11). None of these species have a likelihood of occurrence due to the disturbed nature of most of the project area which makes the habitat unsuitable to sustain these species.

Table 11: Threatened mammal species that are expected to occur within the project area.

Family	Taxon	Common name	Status
Felidae	*Felis nigripes*	Black footed cat	Vulnerable (2016)
Nesomyidae	*Mystromys albicaudatus*	South African Vlei-rat	Vulnerable (2016)
Hyaenidae	*Parahyaena brunnea*	Brown Hyena	Near Threatened (2016)
Muridae	*Otomys auratus*	Southern Vlei-rat	Near Threatened (2016)

Mystromys albicaudatus

The White-tailed Rat is a Highveld grassland specialist (whilst also marginally occurring in Succulent Karoo and Fynbos biomes; Dean 1978) and is endemic to South Africa and Lesotho. Although it occurs widely across the assessment region, it has an extremely patchy and fragmented area of occupancy due to its preference for microhabitats within vegetation types and transitory habitats created after fire.

Within South Africa, it occurs in the following provinces: southern Mpumalanga, Free State, the high-lying areas of KwaZulu-Natal (KZN), Eastern Cape, south-eastern North-West, and marginally into Northern Cape (Skinner, 2005; Avery & Avery, 2011).

The habitat requirements and ecology of White-tailed Rats merits further research. They are often associated with calcrete soils within grasslands. They are never found on soft, sandy substrate, rocks, wetlands, or river banks. They do not occur in transformed habitat (croplands, fallow fields, or old fields). However, as they select microhabitats, such as slopes and ridges, small numbers may survive in non-arable patches within an agricultural matrix. It is unlikely that this species is found within the study site.

Otomys auratus

The species is widely distributed throughout the Highveld grasslands and Drakensberg Escarpment of South Africa, Lesotho and Swaziland, with isolated populations in the Soutpansberg Mountains of northern Limpopo and the Eastern Highlands of Zimbabwe (Monadjem et al. 2015).

This species is associated with mesic grasslands and wetlands within alpine, montane and sub-montane regions (Monadjem et al. 2015), typically occurring in dense vegetation in close proximity to water (for example, Wandrag et al. 2002, Watson 2006).

Vlei rats are important food for a number of mammalian predators, as well as raptors such as marsh owls and barn owls (Skinner and Chimimba 2005, Monadjem et al. 2015). For example, Vlei rats are favoured food by the Serval (Bowland 1990), so their range expansion could be interrelated (Power 2014). It is unlikely that this species is found within the study site.

Parahyaena brunnea

The Brown Hyaena is widespread within the assessment region, but it is absent from Lesotho and Swaziland. It faces multiple threats across unprotected areas, especially in regions dominated by livestock and game ranching. The species is difficult to census due to it occurring at low density and due to its nocturnal and secretive nature. Despite the evidence of locally stable and increasing populations, the species does face persistent threats of direct and indirect persecution within the assessment region.

Brown Hyaenas occupy a range of ranch land, but typically avoid agricultural and heavily urbanised habitats (Thorn et al. 2011). It is unlikely that this species is found within the study site

Felis nigripes

Black-footed Cats are endemic to the arid regions of southern Africa, occurring widely across the western reaches of the assessment region, and have a relatively restricted and patchy distribution. The historical paucity of data has led to inconsistencies and perpetuated inaccuracies in current literature, which in turn has affected the accuracy of conservation measures.

The naturally rare, cryptic colouring, small size and secretive nocturnal nature of this species has contributed considerably to the lack of information. Black-footed Cats are known to occur at low densities, and it is difficult to establish population sizes. The stronghold of the species is suspected to be in the central Karoo region where highest densities are reached, whereas other regions (Kalahari, North West Province, northern KwaZulu-Natal Province, Free State Province, and the Lowveld) are suspected to have medium or low densities.

Black-footed Cats have the most restricted distribution of any of the African felid species (Nowell & Jackson 1996). The species is endemic to the arid grasslands, dwarf shrub, and savannah of the Karoo and Kalahari in southern Africa. Most of the range occurs within the boundaries of South Africa, thinning out northwards into Botswana, Namibia, and Zimbabwe. It is unlikely that this species is found within the study site.

7 RESULTS

7.1 Field Assessment

This section details the observations recorded during an on-site field survey conducted to ground truth the floral, faunal, and habitat features of the project area. Sampling took place on the 17th, 18th and 28th of April 2023 from 7:00 to 15:00.

7.1.1 Flora Assessment

This section is divided into two sections:

- Indigenous flora; and
- Invasive Alien Plants (IAPs).

7.1.1.1 Indigenous Flora

The vegetation assessment was conducted throughout the extent of the project area. A total of 70 tree, shrub, herbaceous and graminoid plant species were recorded in the project area during the field assessment (**Error! Reference source not found.**) (Appendix 3: Plant species list). Plants listed as

Category 1 alien or invasive species under the NEMBA appear in green text. Plants listed in Category 2 or as 'not indigenous' or 'naturalised' according to NEMBA, appear in blue text. Protected species are marked in red. The list of plant species recorded is by no means comprehensive, and repeated surveys during different phenological periods not covered, may likely yield up to 30% additional flora species for the project area. However, floristic analysis conducted to date is however regarded as a sound representation of the local flora for the project Area.

Table 12: Trees, shrub and herbaceous plant species recorded in the project area.

Family	Taxon	Common name	Protection Status	Endemism	Invasive/ Protected
Acanthaceae	*Barleria macrostegia*			Indigenous	
Amaranthaceae	*Gomphrena celosioides*	Batchelor's button		Not indigenous; Naturalised	
Amaryllidaceae	*Boophone disticha*	Poison bulb		Indigenous	
Asclepiadaceae	*Gomphocarpus fruticosus*	Milkweed		Indigenous	
Asphodelaceae	*Bulbine narcissifolia*	Strap-leaved Bulbine		Indigenous	
Asteraceae	*Berkheya radula*	Boesmansrietjie		Indigenous	
Asteraceae	*Bidens formosa*	Kosmos		Not indigenous; Naturalised	
Asteraceae	*Dicoma anomala*	Grassveld Karmedik		Indigenous	
Asteraceae	*Geigeria burkei*	Vermeerbossie		Indigenous	
Asteraceae	*Helichrysum nudifolium*	Hottentot's tea		Indigenous	
Asteraceae	*Lasiosiphon sericocephalus*	Hairy curry flower		Indigenous	

Asteraceae	*Schkuhria pinnata*	Spanish blackjack		Not indigenous; Naturalised	
Asteraceae	*Seriphium plumosum*	Bankrupt bush		Indigenous	
Asteraceae	*Tagetes minuta*	Khaki bush		Not indigenous; Naturalised	
Asteraceae	*Vernonia oligocephala*	Bicoloured vernonia		Indigenous	
Asteraceae	*Zinia peruviana*	Peruvian zinnia		Not indigenous; Naturalised	
Campanulaceae	*Wahlenbergia undulata*	African Bluebell		Indigenous	
Caryophyllaceae	*Pollichia campestris*	Waxberry		Indigenous	
Colchicaceae	*Ornithoglossum vulgare*	Common Slangkop		Indigenous	
Commelinaceae	*Commelina africana*	Common yellow dayflower		Indigenous	
Commelinaceae	*Commelina benghalensis*	Benghal dayflower		Indigenous	
Convolvulaceae	*Ipomoea obscura*	Obscure Morning Glory		Indigenous	
Convolvulaceae	*Ipomoea ommanneyi*	Ox Morning Glory		Indigenous	
Crassulaceae	*Crassula lanceolata transvaalensis*	Spear Stonecrop		Indigenous	
Cucurbitaceae	*Cucumis zeyheri*	Spiny cucumber		Indigenous	
Cyperaceae	*Bulbostylis hispidula*	Slender sedge		Indigenous	
Fabacea	*Vachelia karroo*	Sweet thorn		Indigenous	

Hyacinthaceae	*Albuca suaveolens*	Striped tamarak		Indigenous	
Hyacinthaceae	*Ledebouria ovatifolia*	Flat leaved African hyacinth		Indigenous; Endemic	
Hypoxidaceae	*Hypoxis rigidula*	Silverleaf Stargrass		Indigenous	
Iridaceae	*Babiana hypogea*	Bushmanland Bobbejaantjie		Indigenous	
Juncaceae	*Juncus effusus*	Soft Rush		Indigenous	
Lamiaceae	*Leucas sexdentata*	Bushveld Tumbleweed		Indigenous	
Myrtaceae	*Eucalyptus grandis*	Flooded Gum		Not indigenous; Cultivated; Naturalised; Invasive	Nemba 1b
Orobanchaceae	*Striga elegans*	Witchweed		Indigenous	
Poaceae	*Andropogon schirensis*	Stab grass		Indigenous	
Poaceae	*Aristida congesta congesta*	Tassel Three-awn		Indigenous	
Poaceae	*Brachiaria serrata*	Velvet Signal grass		Indigenous	
Poaceae	*Cymbopogon caesius*	Broadleaved Turpentine grass		Indigenous	
Poaceae	*Cynodon dactylon*	Couch grass		Indigenous	
Poaceae	*Digitaria eriantha*	Finger grass		Indigenous	
Poaceae	*Elionurus muticus*	Copper wire Grass		Indigenous	
Poaceae	*Eragrostis chloromelas*	Curly leaf		Indigenous	

Poaceae	*Loudetia simplex*	Common Russet grass		Indigenous	
Poaceae	*Melinis repens*	Natal red Top		Indigenous	
Poaceae	*Sporobolus africanus*	Rat's tail dropseed		Indigenous	
Poaceae	*Themeda triandra*	Red Grass		Indigenous	
Poaceae	*Urochloa mossambicensis*	Bushveld signal grass		Indigenous	
Ranunculaceae	*Clematis brachiata*	Traveller's joy		Indigenous	
Rhamnaceae	*Ziziphus zeyheriana*	Dwarf buffalo thorn		Indigenous	
Rubiaceae	*Pygmaeothamnus zeyheri*	Sand Apple		Indigenous	
Solanaceae	*Datura ferox*	White stinkweed		Not indigenous; Naturalised; Invasive	Nemba 1b
Solanaceae	*Solanum elaeagnifolium*	Silverleaf Nightshade		Not indigenous; Naturalised; Invasive	Nemba 1b
Verbenaceae	*Lippia javanica*	Fever tea		Indigenous	
Verbenaceae	*Verbena bonariensis*	Purple top Vervain		Not indigenous; Naturalised; Invasive	Nemba 1b

7.1.1.2 Invasive Alien Plants

IAPs (Invasive Alien Plants) tend to encroach on or displace native vegetation, altering the structure, makeup, and functioning of ecosystems. Consequently, it is crucial that these plants be managed through an eradication and monitoring program. Some invasive plants may also harm ecosystems by displacing native plant species through their superior competitive abilities.

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

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

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

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

Nine (9) IAP species were recorded within the project area. Four (4) of these species are listed under the Alien and Invasive Species List 2020, Government Gazette No. GN1003 as Category 1b. These IAP species must be controlled by implementing an IAP Management Programme, in compliance of section 75 of the NEMBA, as stated above.

7.1.2 Faunal Assessment

Herpetofauna and mammal observations and recordings fall under this section. A separate Avifauna impact assessment was conducted for the avifauna species associated with the project area.

7.1.2.1 Amphibians and reptiles

No reptile species was recorded in the project area during survey period. However, there is the possibility of several species being present, as certain reptile species are secretive and longer-term surveys are required to ensure adequate sampling. No amphibian species were recorded during the survey period. However, due to the presence of a wetland in the project area providing suitable habitat there is a possibility of more amphibian species being present.

7.1.2.2 Mammals

Three (3) mammal species were observed during this survey of the project area (Table 13) based on either direct observation or the presence of visual tracks and signs. None of the species recorded are regarded as a SCC. Five mammal species are provincially protected.

Table 13: Summary of mammal species recorded within the project area.

Family	Taxon	Common name	Status	North West Biodiversity Management Act
Sciuridae	*Xerus inauris*	Ground Squirrel	Least Concern (2016)	Schedule 3 (Ordinary species)
Bovidae	*Oryx gazella*	Gemsbuck	Least Concern (2016)	Schedule 2 (Specially Protected)
Bovidae	*Damaliscus dorcas pygargus*	Blesbok	Least Concern (2016)	Schedule 2 (Specially Protected)
Bovidae	*Antidorcas marsupialis*	Springbuck	Least Concern (2016)	Schedule 3 (Ordinary species

8 HABITAT AND SITE ECOLOGICAL IMPORTANCE

8.1 Habitat Assessment

The main habitat types identified across the project area were initially identified largely based on aerial imagery. These main habitat types were refined based on the field coverage and data collected during the survey; the delineated habitats can be seen in Figure 15. Emphasis was placed on limiting timed meander searches along the proposed project area within the natural habitats and therefore habitats with a higher potential of hosting SCC. The site is within an area of grassland with sensitive features in the form of natural vegetation, and less sensitive features with disturbed habitats and old lands adjacent to these areas. A general view over the site is given in Figure 16.

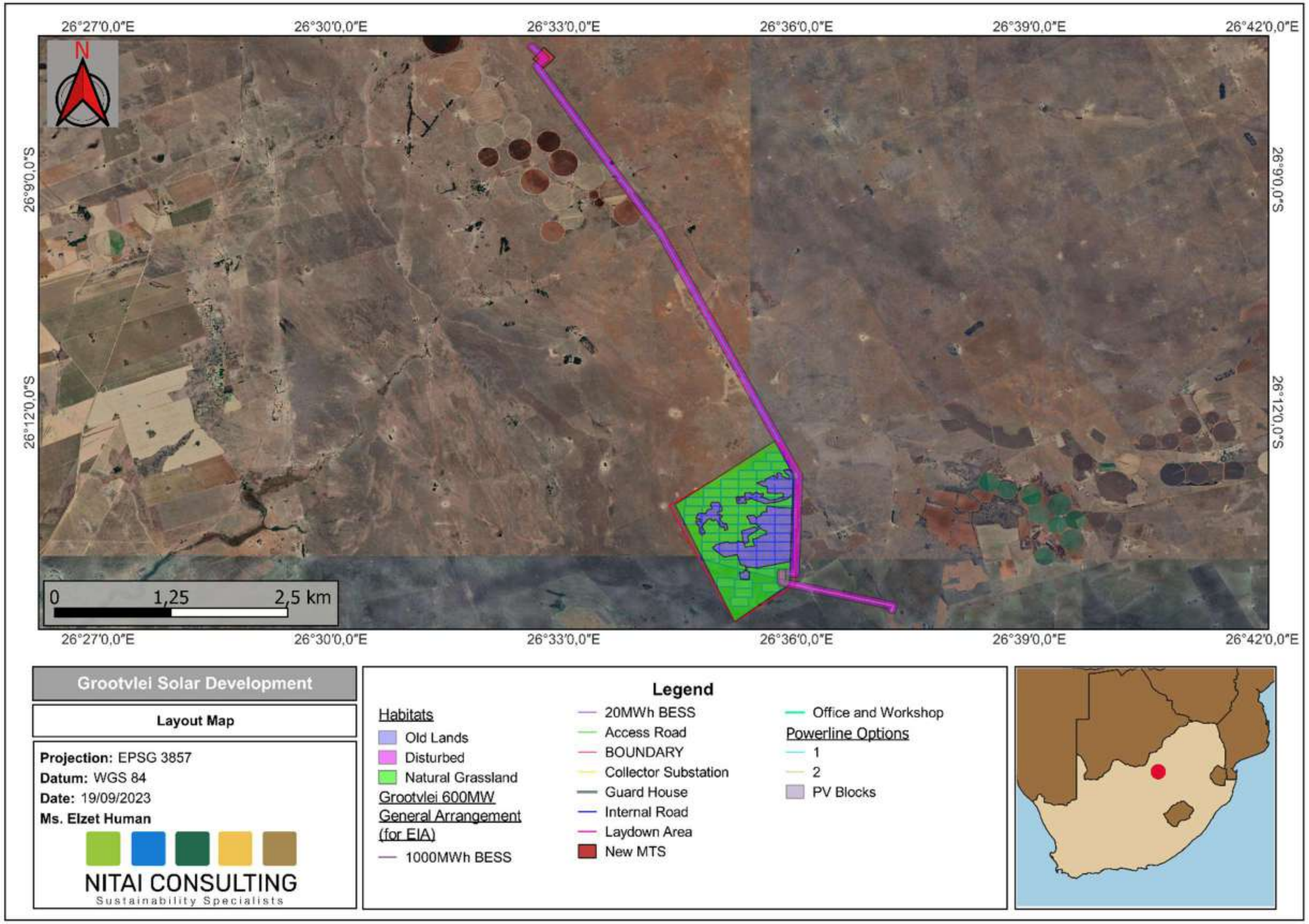


Figure 15: Habitat units found on site.

Figure 16: General view of the dominant features

The grassland areas contain variation due to changes in topography, slope inclination, surface rockiness and the influence of water-flow and water retention in the landscape. A broad classification of the habitat unit on site, which also reflects relatively uniform plant species compositional units, is as follows:

8.1.1 Natural vegetation (Grassland)

This habitat type is dominated by perennial grass swards of good condition and no erosion (Figure 17). Overall, this habitat has a high species richness and is characteristic of the vegetation bioregion. Forb diversity is high with a few geophytic forbs found throughout the area as well. Dominant grass species are *Themeda triandra*, *Cynodon dactylon, Brachiaria serrata, Urochloa mossambicensis, Melinis repens and Loudetia simplex.* Dominant forb species were *Barleria macrostegia*, *Pollichia campestris, Dicoma anomala, Commelina benghalensis, Crassula lanceolata transvaalensis, Bulbostylis hispidula, Scabiosa columbaria, Hypoxis rigidula, Ipomoea ommanneyi* and *Wahlenbergia undulata*.

Figure 17: Plants found in the Natural habitats.

8.1.2 Disturbed Grasslands

Any areas where the original vegetation is modified due to disturbance, such as trampling, over- or under grazing, or some other factor (Figure 18), is mapped as disturbed. These areas will take longer to restore to natural grassland, even with removal of the drivers of the disturbance. These areas are mainly categorized by the presence of some pioneer plants as well as opportunistic first invaders due to subclimax states and secondary succession. Non-grass species diversity usually consists of re-seeding species filling the seedbank, and sometimes animal- and/or bird-dispersed woody species. The seeds of these plants are long lived and have well established seed dormancy and can survive in the seebank for extended periods of time contributing to slower recovery. Plants found in these areas are: *Sporobolus africanus, Eragrostis chloromelas, Cymbopogon caesius, Aristida congesta congesta, Gomphrena celosioides, Lasiosiphon sericocephalus, Ornithoglossum vulgare, Vernonia oligocephala and Ziziphus zeyheriana.*

Figure 18: Disturbed Grassland.

8.1.3 Old lands

These are habitat areas that were previously cultivated. It is in a constant state of high disturbance and is characterised by invasive species, pioneer plants and weeds (Figure 19). This area is undergoing old land succession and will never recover to a state comparable to the original habitat. These areas are characterised by species such as *Aristida congesta congesta, Cymbopogon caesius, Elionurus muticus, Eragrostis chloromelas, Melinis repens, datura ferox, Bidens formosa, Tagetes minuta, Lippia javanica, Helichrysum nudifolium, Schkuhria pinnata* and *Gomphocarpus fruticosus*.

Figure 19: Old land habitats.

8.1.4 Aquatic Habitats/ Wetlands

The wetlands were mapped and delineated by and aquatic specialist using various databases and ground truthing. There are wetlands within the study area scattered through the footprint. These wetlands are in moderate condition with some erosion and only some exotic plants. This habitat forms part of the Aquatic specialist report and is mentioned here mainly because of the habitat discussion (Figure 20).

The following vegetation was found: *Bulbostylis hispidula, Cyperus congestus, Juncus effusus, Schoenoplectus sp.*

The aquatic habitat includes drainage areas that are seasonally wet with clay soils. The banks are mostly stable with moderate visible erosion and piospheres found around them in a degradation gradient. This habitat forms part of the Aquatic specialist report and is mentioned here mainly because of the habitat discussion.

Common plants found in the area are: *Andropogon schirensis, Juncus effusus, Bulbostylis hispidula, Verbena bonariensis,* and *Cynodon dactylon.*

Figure 20: General view of aquatic habitats

8.1.5 Alien species

These species are found throughout the site but with fairly low densities but especially around disturbed areas (Figure 21). The presence of *Seriphium plumosum* and is worrying since this is an aggressive invader of grassy areas. *Plantago media* was also found in vast areas over the disturbed habitat unit. The natural habitat will become lost due to the presence of the invasive and alien species if an intensive eradication plan is not followed.

Figure 21: General view of areas with alien species

8.1.6 Transformed areas.

Areas where natural habitat no longer exists due to development of infrastructure, such as roads, buildings, and other hard surfaces.

Habitat	Status	Size	Proportion of total area
Natural Habitat	Natural	461.87 ha	49.3 %
Disturbed Grassland	Moderate	263.17 ha	28.11 %
Old lands	Degraded	201.09	21.4
Wetlands/ Aquatic Habitats	Disturbed	2 ha	0.002%

Alien species	Degraded	6 ha	0.006%
Transformed areas	Transformed	4 ha	0.004%

8.2 Site sensitivity Verification

The national web-based Environmental Screening Tool was queried in relation to the following infrastructure:

- Utilities Infrastructure|Electricity|Generation|Renewable|Solar|PV

According to the The National Web based Environmental Screening Tool the terrestrial biodiversity sensitivity theme is very high (Figure 22) due the fact it forms part of Critical Biodiversity areas (CBA 2), Ecological support area 1 & 2 (ESA 1&2), and Protected Areas Expansion Strategy.

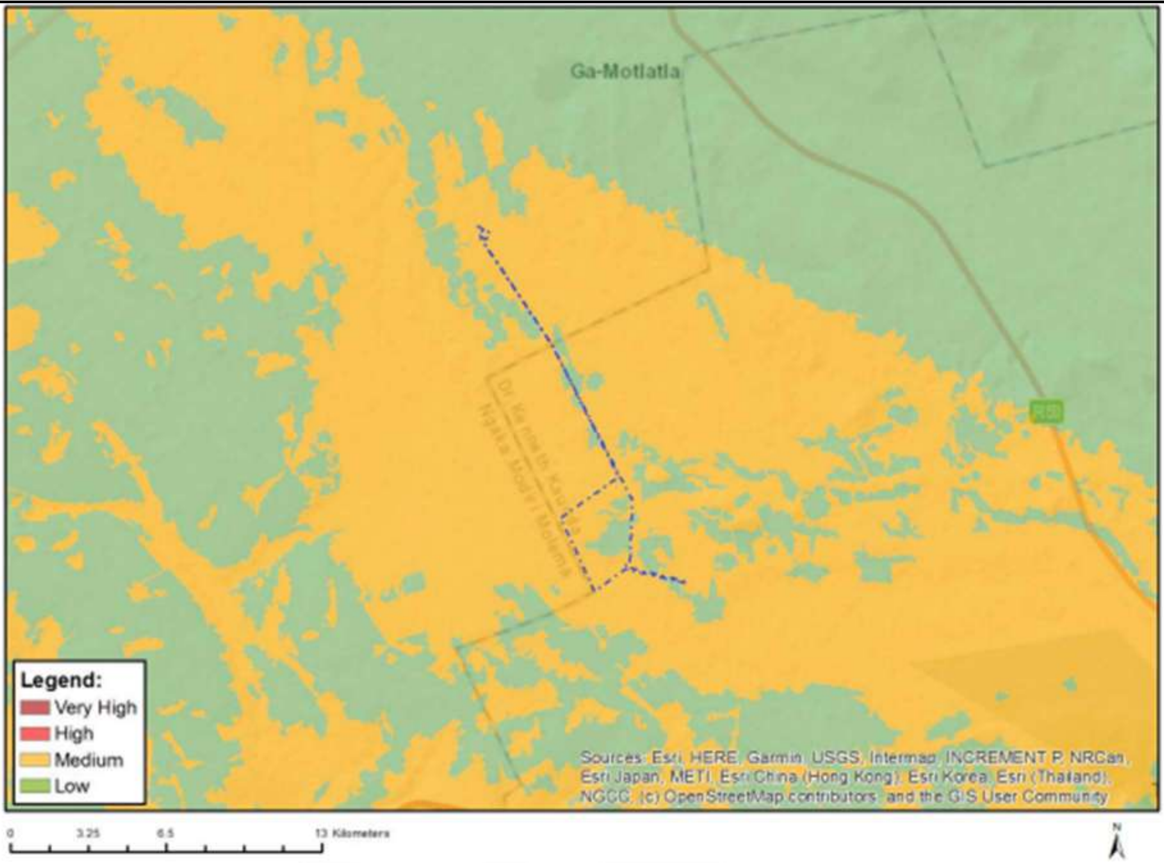
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Very High	CBA 2
Very High	ESA 1
Very High	ESA 2
Very High	National Protected Area Expansion Strategy (NPAES)

Figure 22: Terrestrial biodiversity sensitivity.

According to the The National Web based Environmental Screening Tool the Plant species theme is medium due to the potential presence of Sensitive species nr 1261 (Figure 23).



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

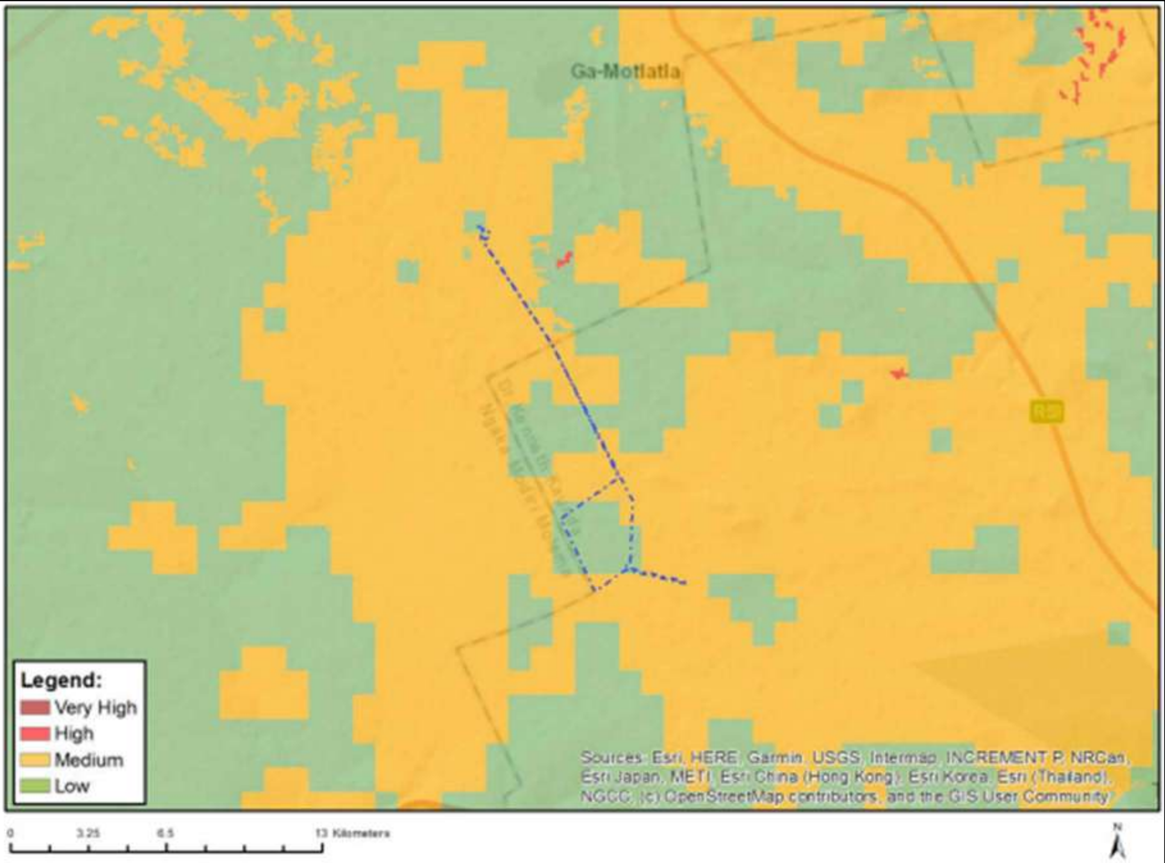
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Medium	Sensitive species 1261

Figure 23: Plant Theme Sensitivity, National Web based Environmental Screening Tool.

According to the The National Web based Environmental Screening Tool the Animal species theme is medium (Figure 24) due to potential presence of *Eupodotis sengalensis* and *Crocidura maquassiensis.*



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

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Subject to confirmation
Medium	Aves-Eupodotis senegalensis
Medium	Mammalia-Crocidura maquassiensis

Figure 24: Animal species theme sensitivity

Section 2.2 of the Site Sensitivity Verification requirements were addressed in Section 6.1 and 6.2 of this report. Section 2.3 a) of the Site Sensitivity Verification requirements were addressed in Section 7.2 of this report. Section 2.3 b) of the Site Sensitivity Verification requirements were addressed in Section 7 of this report. This report fulfils the requirements of Section 2.3 c) of the Site Sensitivity Verification. The completion of the terrestrial biodiversity assessment found that the Disturbed

Grassland, Old lands, Alien Invasives and Transformed habitats does not corroborate the screening tool's 'Very High' sensitivity of the biodiversity theme and should rather be considered of low sensitivity since the area has evidence of degradation and disturbance. The natural habitat does not contain any SCC species but is in a healthy condition albeit slightly disturbed and should be considered medium. The plant sensitivity was found to be low and does not corroborate the screening tool's results. No SCC plant species were found at all. The animal sensitivity theme is disputed since there were no suitable habitat found for SCC animal species to be resident and consequently the sensitivity should be low and not medium as the screening tool suggests.

As per the terms of reference for the project, GIS sensitivity maps are required to identify sensitive features in terms of the relevant specialist discipline/s within the project area. The sensitivity scores identified during the field survey for each terrestrial habitat are mapped. Six (6) different terrestrial habitat types were delineated within the project area. Based on the criteria provided in Section 4.4 of this report, all habitats within the assessment area of the proposed project were allocated a sensitivity category (Figure 25, **Error! Reference source not found.**)(Table 14, Table 15). The sensitivities of the habitat types delineated are illustrated in Figure 25.Figure 25: Sensitivity of the project area.

8.2.1 Biodiversity Importance

Table 14: BI Summary of habitat types delineated within field assessment area of project.

Habitat type	Conservation Importance	Functional Integrity	Biodiversity Importance
Natural Habitat	Medium	High	Medium
Disturbed Grassland	Low	Medium	Low
Old lands	Low	Medium	Low
Wetlands/ Aquatic Habitats	Medium	Medium	Medium
Alien species	Low	Low	Low
Transformed areas	Low	Low	Low

8.2.2 Site ecological Importance

Table 15: SEI Summary of habitat types delineated within field assessment area of project.

	Receptor resilience	Biodiversity Importance	Site Ecological Importance
Natural Habitat	Medium	Medium	Medium
Disturbed Grassland	Low	Low	Medium
Old lands	Low	Low	Low
Wetlands/ Aquatic Habitats	Medium	Medium	Medium
Alien species	Medium	Low	Low
Transformed areas	Medium	Low	Low

8.2.3 Guidelines for interpreting SEI in the context of the proposed development activities

The calculation of Site Ecological Importance matches the sensitivity classification given in the previous section of this report but includes an explicit recognition of the ability of each ecosystem to tolerate and recover from disturbance. Guidelines for development activities within different importance levels are given in the below:

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

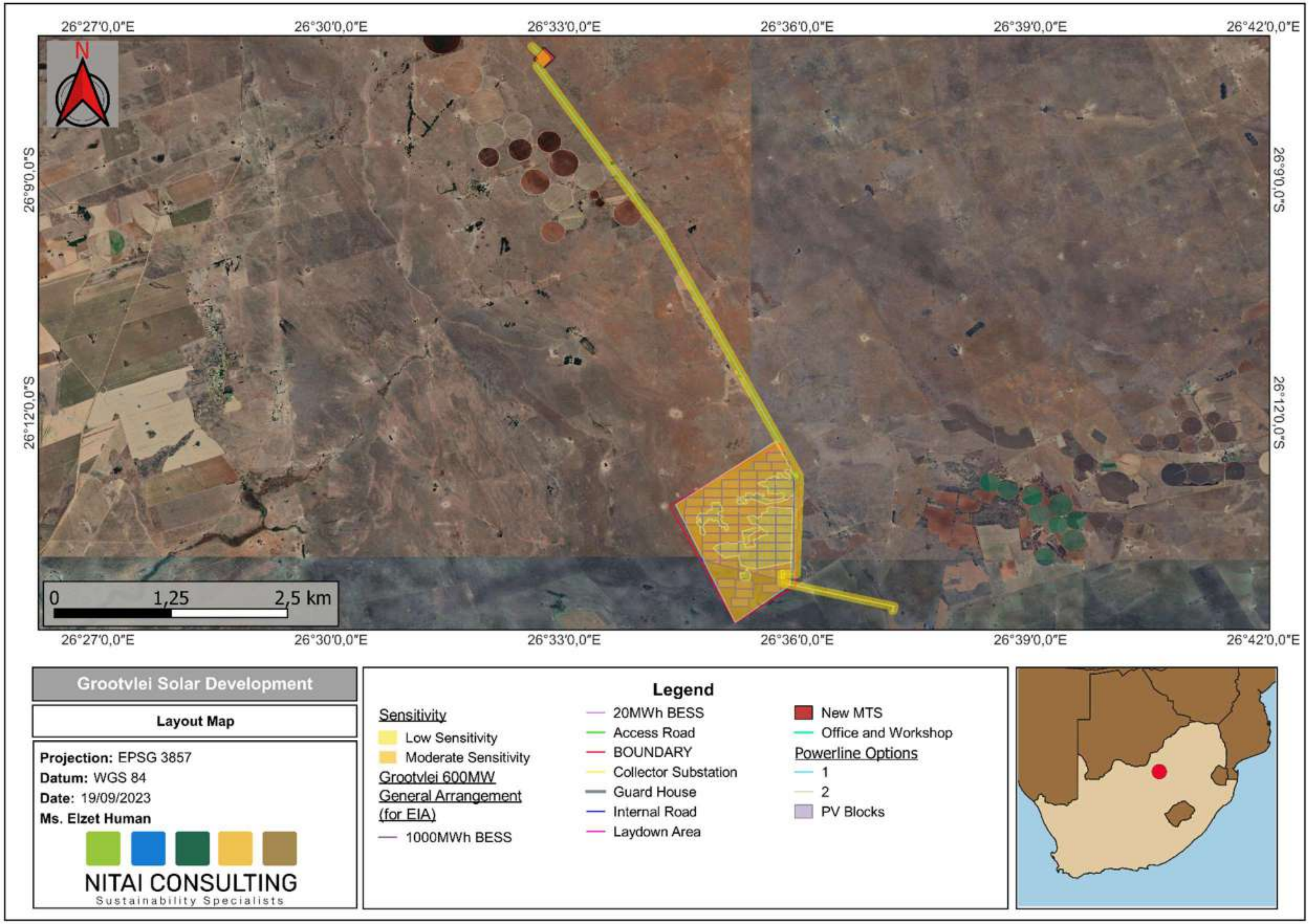


Figure 25: Sensitivity of the project area.

9 Impact Risk Assessment

The section below and associated tables serve to indicate and summarise the significance of perceived impacts on the terrestrial ecology of the project area. Potential impacts were evaluated against the data captured during the desktop and field assessment to identify relevance to the project area. The relevant impacts associated with the proposed construction of the development were then subjected to a prescribed impact assessment methodology and is available on request. The impact assessment was undertaken based on the two alternative layouts provided, and sections were only duplicated where the impact between the two layouts were considered different.

9.1 Biodiversity Risk Assessment

9.1.1 Current Impacts to Biodiversity

Considering the anthropogenic activities and influences within the landscape, several negative impacts to biodiversity were observed within the project area

These include:

- Agricultural practises;
- Farm roads and main roads (and associated traffic and wildlife road mortalities);
- Grazing and trampling of natural vegetation by livestock;
- Invasive species; and
- Fences and associated maintenance.

9.1.2 Terrestrial Impact assessment

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

9.1.3 Alternatives Considered

Two layout alternatives were provided and considered within the project area. Table 18 sets out the impacts and mitigation for the two alternatives.

9.1.4 Loss of Irreplaceable Resources

With Alternative 1, a wetland habitat is impacted and more of the natural habitat that is healthy will be destroyed.

9.1.5 Anticipated Impacts

The impacts anticipated for the proposed activities are considered to predict and quantify these impacts and assess & evaluate the magnitude on the identified terrestrial biodiversity (Table 16).

Table 16: Anticipated impacts for the proposed activities on terrestrial biodiversity.

Main Impact	**Project activities that can cause loss/impacts to habitat (especially about the proposed infrastructure areas):**	**Secondary impacts anticipated**
1. Destruction, fragmentation and degradation of habitats and ecosystems	Physical removal of vegetation, including protected species.	Displacement/loss of flora & fauna
	Access roads and servitudes	Increased potential for soil erosion
	Soil dust precipitation	Habitat fragmentation
	Dumping of waste products	Increased potential for establishment of alien & invasive vegetation
	Random events such as fire (cooking fires or cigarettes)	Erosion
Main Impact	**Project activities that can cause the spread and/or establishment of alien and/or invasive species**	**Secondary impacts anticipated**
2. Spread and/or establishment of alien and/or invasive species	Vegetation removal	Habitat loss for native flora & fauna
	Vehicles potentially spreading seed	Spreading of potentially dangerous diseases due

		to invasive and pest species
	Unsanitary conditions surrounding infrastructure promoting the establishment of alien and/or invasive rodents	Alteration of fauna assemblages due to habitat modification
	Creation of infrastructure suitable for breeding activities of alien and/or invasive birds	
Main Impact	**Project activities that can cause direct mortality of fauna**	**Secondary impacts anticipated**
	Clearing of vegetation	Loss of habitat
3. Direct mortality of fauna	Roadkill due to vehicle collision	Loss of ecosystem services
	Pollution of water resources due to dust effects, chemical spills, etc.	Increase in rodent populations and associated disease risk
	Intentional killing of fauna for food (hunting)	
Main Impact	**Project activities that can cause reduced dispersal/migration of fauna**	**Secondary impacts anticipated**
4. Reduced dispersal/migration of fauna	Loss of landscape used as corridor	Reduced dispersal/migration of fauna
	Compacted roads	Loss of ecosystem services
	Removal of vegetation	Reduced plant seed dispersal

Main Impact	Project activities that can cause disruption/alteration of ecological life cycles due to sensory disturbance.	Secondary impacts anticipated
5. Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to noise, dust and light pollution.	Operation of machinery (Large earth moving machinery, vehicles)	Disruption/alteration of ecological life cycles due to noise
		Loss of ecosystem services
	Project activities that can cause disruption/alteration of ecological life cycles due to dust	Secondary impacts associated with disruption/alteration of ecological life cycles due to dust
	Vehicles	Loss of ecosystem services
Main Impact	**Project activities that can cause staff to interact directly with potentially dangerous fauna**	**Secondary impacts anticipated**
6. Staff and others interacting directly with fauna (potentially dangerous) or poaching of animals	All unregulated/supervised activities outdoors	Loss of SCCs

9.1.6 Unplanned Events

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

Table 17 is a summary of the findings of an unplanned event assessment from a terrestrial ecology perspective. Note, not all potential unplanned events may be captured herein, and this must therefore be managed throughout all phases according to recorded events.

Table 17: Summary of unplanned events for terrestrial biodiversity.

Unplanned Event	Potential Impact	Mitigation
Spills into the surrounding environment	Contamination of habitat as well as water resources associated with a spillage.	A spill response kit must be always available. The incident must be reported on and if necessary, a biodiversity specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Fire	Uncontrolled/unmanaged fire that spreads to the surrounding natural areas.	Appropriate/Adequate fire management plan need to be implemented.
Erosion caused by water runoff from the surface	Erosion on the side of the road	Storm water management plan must be compiled and implemented.

9.1.7 Identification of Additional Potential Impacts

9.1.7.1 Assessment of Impact Significance

The assessment of impact significance considers pre-mitigation as well as implemented of post mitigation scenarios. The mitigation actions required to lower the risk of the impact are provided in Section 8.1.8 of this report.

9.1.7.2 Construction Phase

The following potential main impacts on the biodiversity (based on the framework above) were considered for the construction phase of the proposed development. This phase refers to the period during construction when the proposed features are constructed; and is considered to have the largest direct impact on biodiversity. The main anticipated impact includes the clearing of vegetation, proliferation of alien plant species along the roads and cleared areas as well as the severing of movement corridors for fauna, and the fragmentation of habitat. The following potential impacts to terrestrial biodiversity were considered:

- Destruction, further loss and fragmentation of the of habitats, ecosystems and vegetation community;
- Introduction of alien species, especially plants;
- Destruction of protected plant species;

- Displacement of faunal community due to habitat loss, direct mortalities, and disturbance (road collisions, noise, dust, vibration and poaching); and
- Chemical pollution associated with dust suppressants.

9.1.7.3 Operational Phase

The operational phase of the impact of daily activities is anticipated to further spread the IAP, as well as the deterioration of the habitats due to the increase of dust and edge effect impacts. Dust reduces the ability of plants to photosynthesize and thus leads to degradation/retrogression of the veld. Moving maintenance vehicles do not only cause sensory disturbances to fauna, affecting their life cycles and movement, but will lead to direct mortalities due to collisions. The use of non-environmentally friendly chemical for the cleaning of the PV panels can lead to the pollution of water sources and ultimately death of fauna and flora. The following potential impacts were considered:

- Continued fragmentation and degradation of habitats and ecosystems ;
- Spread of alien and/or invasive species;
- Ongoing displacement and direct mortalities of faunal community due to disturbance (road collisions, collisions with substation, noise, light, dust, vibration);
- Reduced dispersal of fauna;
- Chemical pollution associated with measures to keep PV clean; and
- Fencing of PV site.

Assessment of Significance

The assessment of impact significance considers pre-mitigation as well as implemented of post-mitigation scenarios.

Construction Phase

Table 18 summarises the significance of potential impacts associated with the project on fauna and flora before and after implementation of mitigation measures. The loss of habitat and the degradation of habitat were rated as ‘Moderate’ prior to mitigations being implemented for Alternative 1 and as ‘Moderately High’ prior to mitigations being implemented for Alternative 2. Through the implementation of mitigations such as the restriction and demarcation of the project footprint this can only be lowered to ‘Low’ for both Alternatives 1 and 2, it can however not be mitigated completely as habitat will still be lost. The habitat and vegetation type recorded are not restricted and is well represented in the general area.

Operational Phase

Table 18 summarises the significance of the operational phase impacts on biodiversity before and after implementation of mitigation measures. The continued loss of habitat and the degradation of habitats within the area were rated as 'Moderately' prior to mitigations being implemented for Alternative 1 and as 'Moderately' prior to mitigations being implemented for Alternative 2. Through the implementation of mitigations this can be reduced to a 'Low' level for both Alternatives 1 and 2. The impact significance of displacement and direct mortalities of fauna were rated as 'Moderately High' prior to mitigation for the project. Implementation of mitigation measures reduced the significance of the impact to a 'Low' level.

Table 18: Assessment of significance of potential impacts on the terrestrial fauna and flora associated with the construction phase.

Impact 1	**Destruction, fragmentation and degradation of habitats and ecosystems**			
Problem	Construction activities will require clearing of natural habitat, to be replaced by the infrastructure. This will result in permanent local loss of habitat. Daily operational activities will permanently damage habitat and fragment it further.			
Type	Direct			
Nature	Negative			
Phases	Construction			
	Alternative 1		**Alternative 2**	
Criteria	Without mitigation	With mitigation	Without mitigation	With mitigation
Extent	2	1	2	2
Duration	3	2	2	1
Sensitivity	3	2	2	1
Severity	3	2	2	1
Probability	5	5	5	5

Significance	55 Moderate	35 Low to Moderate	40 Moderate	25 Low
Mitigation actions				
Recommendations	1. Restrict impact to development footprint only and limit disturbance in surrounding areas. 2. Prior to commencement of construction, compile a Rehabilitation Plan including monitoring specifications, to be included into the EMPr during final approval. 3. Prior to commencement of construction, compile an Alien Plant Management Plan, to be included into the EMPr during final approval.			
Monitoring				
Recommendations	As per management plans			
Impact 2	Spread and/or establishment of alien and/or invasive species			
Problem	Establishment and continued spread of alien invasive plants due to the clearing and disturbance of indigenous vegetation			
Type	Indirect			
Nature	Negative			
Phases	Construction and Operational			
	Alternative 1		**Alternative 2**	
Criteria	Without mitigation	With mitigation	Without mitigation	With mitigation
Extent	3	2	3	2
Duration	5	5	5	5
Sensitivity	4	2	2	1
Severity	3	2	3	2

Probability	4	3	4	3
Significance	60 Moderately High	33 Low	52 Moderate	30 Low
Mitigation actions				
Recommendations	1. Prior to commencement of construction, compile and implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control, including monitoring specifications. 2. Undertake regular monitoring to detect alien invasions early so that they can be controlled. 3. Implement control measures.			
Monitoring				
Recommendations	As per management plans			
Impact 3	Ongoing displacement and direct mortality of fauna due to disturbance			
Problem	Mortality of fauna due to higher traffic (Vehicles and staff) on site and disturbances including noise, dust, and vibrations			
Type	Direct			
Nature	Negative			
Phases	Construction and Operational			
	Alternative 1		**Alternative 2**	
Criteria	Without mitigation	With Mitigation	Without mitigation	With Mitigation
Extent	3	2	3	2
Duration	4	3	4	3

Sensitivity	3	2	2	2
Severity	3	2	3	1
Probability	5	3	4	3
Significance	65 Moderately High	27 Low	48 Moderate	24 Low
Mitigation actions				
Recommendations	Education and awareness of staff and construction personal regarding importance of faunal populations and ecosystem functioning			
Monitoring				
Recommendations	Continued monitoring of faunal populations and awareness programs as per management plan			
Impact 4	Reduced dispersal/migration of fauna			
Problem	Internal roads, fencing and infrastructure will cut off migratory routes of faunal populations			
Type	Direct			
Nature	Negative			
Phases	Construction and Operational			
	Alternative 1		**Alternative 2**	
Criteria	Without mitigation	With Mitigation	Without mitigation	With Mitigation
Extent	2	1	2	1
Duration	5	5	5	5
Sensitivity	3	2	2	1

Severity	3	2	3	1
Probability	5	4	5	4
Significance	65 Moderately High	44 Moderate	60 Moderate	36 Low
Mitigation actions				
Recommendations	Create corridors during construction phase for faunal species to move through artificial barriers			
Monitoring				
Recommendations	Continuously monitor faunal populations as per management plans			
Impact 5	Environmental pollution due to water runoff, spills from vehicles and erosion			
Problem				
Type	Direct and Indirect			
Nature	Negative			
Phases	Construction and Operational			
	Alternative 1		**Alternative 2**	
Criteria	Without mitigation	With mitigation	Without mitigation	With mitigation
Extent	3	2	2	1
Duration	5	5	5	5
Sensitivity	4	2	3	1
Severity	4	3	3	1

Probability	3	2	3	2
Significance	48 Moderate	24 Low	39 Moderately Low	16 Very Low
Mitigation actions				
Recommendations	Proper storage of harmful fluids or powders			
Monitoring				
Recommendations	Diligence checks as per storage SOP according to management plans			
Impact 6	Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to noise, dust, and light pollution.			
Problem	Construction and maintenance vehicles moving around on site			
Type	Direct and Indirect			
Nature	Negative			
Phases	Construction and Operational			
	Alternative 1		**Alternative 2**	
Criteria	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Extent	2	1	2	1
Duration	5	3	5	3
Sensitivity	3	2	2	1
Severity	4	3	3	2
Probability	5	3	4	2
Significance	70 High	33 Low	48 Moderate	14 Very Low

Mitigation actions				
Recommendations	Keep within footprint, drive within speed limits, do not idle vehicle for unnecessary periods			
Monitoring				
Recommendations	Follow SOP's as set out in Management plan, monitor faunal populations			
Impact 7	Staff and others interacting directly with fauna (potentially dangerous) and flora or poaching of animals and plants			
Problem	Staff interacting/ killing/ poaching fauna or flora species			
Type	Direct			
Nature	Negative			
Phases	Construction and Operational			
	Alternative 1		**Alternative 2**	
Criteria	Without mitigation	With mitigation	Without mitigation	With mitigation
Extent	2	1	2	1
Duration	5	5	5	5
Sensitivity	4	2	3	1
Severity	4	2	3	1
Probability	4	3	4	2
Significance	60 Moderate	30 Low	52 Moderate	16 Very Low
Mitigation actions				
Recommendations	Awareness training for staff on site regarding sensitive fauna and flora species, including relevant laws for protection of species			

Monitoring		
Recommendations	Monitoring of area for snares and disturbed soil (plant poaching), monitoring of personal effects of staff	

9.1.7.4 Cumulative Impacts

Cumulative impacts are assessed in context of the extent of the proposed project area; other developments in the area; and general habitat loss and transformation resulting from other activities in the area.

Localised cumulative impacts include the cumulative effects from operations that are close enough to potentially cause additive effects on the environment or sensitive receivers (such as nearby renewable energy activities within the area). These include dust deposition, noise and vibration, disruption of corridors or habitat, groundwater drawdown, groundwater and surface water quality, and transport.

Long-term cumulative impacts due to extensive solar farm footprint, powerlines and substations can lead to the loss of endemic species and threatened species, loss of habitat and vegetation types and even degradation of well conserved areas, this however needs to be quantified by monitoring.

The PV panels and associated infrastructure are expected to have a moderate cumulative impact when considering the project in isolation, while the cumulative impacts associated with the proposed project as well as other project in the area are also moderate due to planned applications for renewable developments within 39 km of the project area (Table 19).

Cumulatively these developments will be responsible for the destruction of a low portion of Grassland in the area. In isolation this project will only affect 0.0016% of the total area for the remaining extant of Carletonville Dolomite Grassland and 0.015% cumulatively for the ecosystem.

Table 19: Cumulative impacts of Solar Pv Projects around study

Cumulative Impacts	Contribution to cumulative habitat loss, especially in the ecological corridors such as the wetlands which will also have an impact on the water resource and ecological processes in the region
Problem	Continued and extensive habitat loss including ecosystem services
Type	Direct

Nature	Negative	
Phases	Construction and Operational	
Criteria	In isolation	Cumulative
Extent	1	2
Duration	5	5
Sensitivity	2	2
Severity	2	2
Probability	5	5
Significance	50 Moderate	55 Moderate

9.2 Mitigation Measures

9.2.1 Vegetation and habitats

The following mitigation measures are recommended to address known potential impacts:

- Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further. Clearing of vegetation should be minimized and avoided where possible. All activities must be restricted within the low/medium sensitivity areas. It is recommended that areas to be developed be specifically demarcated so that during the construction phase, only the demarcated areas be impacted upon.
- Existing access routes, especially roads must be made use of
- All laydown, chemical toilets etc. should be restricted to medium/low sensitivity areas. Any materials may not be stored for extended periods of time and must be removed from the project area once the construction phase has been concluded. No permanent construction phase structures should be permitted. Construction buildings should preferably be prefabricated or constructed of re-usable/recyclable materials. No storage of vehicles or equipment will be allowed outside of the designated project areas.
- Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood and wind events. This will also reduce the likelihood of encroachment by alien invasive plant species. All livestock must always be kept out of the project area, especially areas that have been recently revegetated.

- A hydrocarbon spill management plan must be put in place to ensure that should there be any chemical spill out or over that it does not run into the surrounding areas. The Contractor shall be in possession of an emergency spill kit that must always be complete and available on site. Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use. No servicing of equipment on site unless necessary. All contaminated soil / yard stone shall be treated in situ or removed and be placed in containers. Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.) in such a way as to prevent them leaking and entering the environment. Construction activities and vehicles could cause spillages of lubricants, fuels and waste material potentially negatively affecting the functioning of the ecosystem. All vehicles and equipment must be maintained, and all re-fuelling and servicing of equipment is to take place in demarcated areas outside of the project area.
- It should be made an offence for any staff to take/ bring any plant species into/out of any portion of the project area. No plant species whether indigenous or exotic should be brought into/taken from the project area, to prevent the spread of exotic or invasive species or the illegal collection of plants.
- Any individual of the protected plants that are present needs a relocation or destruction permit for any individual that may be removed or destroyed due to the development. High visibility flags must be placed near any threatened/protected plants to avoid any damage or destruction of these specimens.
- Infrastructure, development areas and routes where protected plants cannot be avoided, these plants mainly being succulents should be removed from the soil and relocated/ re-planted in similar habitats where they should be able to resprout and flourish again.
- A fire management plan needs to be complied and implemented to restrict the impact fire might have on the surrounding areas.
- Noise must be kept to an absolute minimum during the evenings and at night to minimize all possible disturbances to amphibian species and nocturnal mammals.
- Restrict impact to development footprint only and limit disturbance in surrounding areas.
- Prior to commencement of construction, compile a Rehabilitation Plan including monitoring specifications, to be included into the EMPr during final approval.
- Prior to commencement of construction, compile an Alien Plant Management Plan, to be included into the EMPr during final approval.
- Prior to commencement of construction, compile and implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control, including monitoring specifications.
- Undertake regular monitoring to detect alien invasions early so that they can be controlled.
- Prior to commencement of construction, compile and implement a stormwater management plan including monitoring specifications.
- Monitor surfaces for erosion, repair and/or upgrade, where necessary.

- Prior to decommissioning commencing, compile a Rehabilitation Plan in compliance with the regulatory requirements at the time of decommissioning.

9.2.2 Fauna

The following mitigation measures are recommended to address known potential impacts:

- A qualified environmental control officer must be on site when construction begins. A site walk through is recommended by a suitably qualified person prior to any construction activities, preferably during the wet season. Should animals not move out of the area on their own relevant specialists must be contacted to advise on how the species can be relocated. In situations where the threatened and protected plants must be removed, the proponent may only do so after the required permission/permits have been obtained in accordance with national and provincial legislation. In the abovementioned situation the development of a search, rescue and recovery program is suggested for the protection of these species.
- Outside lighting should be designed and limited to minimize impacts on fauna. Fluorescent and mercury vapor lighting should be avoided, and sodium vapor (green/red/yellow) lights should be used wherever possible.
- Try incorporating motion detection lights as much as possible to reduce the duration of illumination. Heights of light columns to be minimised to reduce light spill. Baffles, hoods or louvres to also be used to reduce light spill.
- All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limits, to respect all forms of wildlife. Speed limits (30km/h) must still be enforced to ensure that road killings and erosion is limited.
- The areas to be developed must be specifically demarcated to prevent movement of staff or any individual into the surrounding environments,
    - Signs must be put up to enforce this.
- No trapping, killing, or poisoning of any wildlife is to be allowed
    - Signs must be put up to enforce this;
- Outside lighting should be designed and limited to minimize impacts on fauna. Fluorescent and mercury vapor lighting should be avoided, and sodium vapor (green/red) lights should be used wherever possible.
- All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limits, to respect all forms of wildlife. Speed limits (30km/h) must still be enforced to ensure that road killings and erosion is limited.
- All areas to be developed must be walked through prior to any activity to ensure no nests or fauna species are found in the area. Should any Species of Conservation Concern not move

out of the area, or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken

- Any holes/deep excavations must be dug and planted in a progressive manner and shouldn't be left open overnight;
    - Should the holes be left open overnight they must be covered temporarily to ensure no small fauna species fall in.
- Ensure that cables and connections are insulated successfully to reduce electrocution risk
- Any exposed parts must be covered (insulated) to reduce electrocution risk.
- Heat generated from the substations must be monitored to ensure it does not negatively affect the local fauna
- Use environmentally friendly cleaning and dust suppressant products
- Fencing mitigations:
    - Wildlife-permeable fencing with holes large enough for mongoose and other smaller mammals should be installed every 50 m along the fence (with a size of 30 x 20 cm), the holes must not be placed in the fence where it is next to a major road as this will increase road killings in the area.

9.2.3 Alien Species

- Compilation of and implementation of an alien vegetation management plan.
- The footprint area of the construction should be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas. Footprint of the roads must be kept to prescribed widths.
- Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site.
- A pest control plan must be put in place and implemented; it is imperative that poisons not be used.

9.2.4 Dust

- Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes wetting of exposed soft soil surfaces.
    - No non environmentally friendly suppressants may be used as this could result in pollution of water sources

9.2.5 Waste Management

- Waste management must be a priority and all waste must be collected and stored effectively

- Litter, spills, fuels, chemicals and human waste in and around the project area
- A minimum of one toilet must be provided per 10 persons. Portable toilets must be pumped dry to ensure the system does not degrade over time and spill into the surrounding area
- The Contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed disposal facility
- Where a registered disposal facility is not available close to the project area, the Contractor shall provide a method statement with regard to waste management. Under no circumstances may domestic waste be burned on site.
- Refuse bins will be emptied and secured. Temporary storage of domestic waste shall be in covered waste skips. Maximum domestic waste storage period will be 10 days.

9.2.6 Environmental Awareness Training

The Contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed disposal facility. All personnel and contractors to undergo Environmental Awareness Training. A signed register of attendance must be kept for proof. Discussions are required on sensitive environmental receptors within the project area to inform contractors and site staff of the presence of protected species, their identification, conservation status and importance, biology, habitat requirements and management requirements as within the Environmental Authorisation and EMPr. The avoidance and protection of the wetland areas must be included into a site induction. Contractors and employees must all undergo the induction and made aware of the “no-go” to be avoided.

9.2.7 Erosion

- Speed limits must be put in place to reduce erosion.
    - Reducing the dust generated by the listed activities above, especially the earth moving machinery, through wetting the soil surface and putting up signs to enforce speed limit as well as speed bumps built to force slow speeds;
    - Signs must be put up to enforce this.
- Where possible, existing access routes and walking paths must be made use of.
- Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood events and strong winds.
- A stormwater management plan must be compiled and implemented.

9.3 Summary of Monitoring recommendations

Specific monitoring recommendations should be provided in the Alien Invasive Management Plan, and the Rehabilitation Plan. The following are broad recommendations:

Alien Invasive Species:

- Monitor for early detection, to find species when they first appear on site. This should be as per the frequency specified in the management plan and should be conducted by an experienced botanist. Early detection should provide a list of species and locations where they have been detected. Summer (vegetation maximum growth period) is usually the most appropriate time, but monitoring can be adaptable, depending on local conditions – this must be specified in the management plan.
- Monitor for the effect of management actions on target species, which provides information on the effectiveness of management actions. Such monitoring depends on the management actions taking place. It should take place after each management action.
- Monitor for the effect of management actions on non-target species and habitats.

Rehabilitated areas:

- Rehabilitation Plan must be compiled by an approved ecologist
- All management actions associated with rehabilitation must be recorded after each management action has taken place.
- All rehabilitated areas should be monitored to assess vegetation recovery. This should be for a minimum of three years after post-construction rehabilitation but depends on the assessed trajectory of rehabilitation (whether it is following a favourable progression of vegetation establishment or not – this depends on the total vegetation cover present, and the proportion that consists of perennial growth of desired species). For each monitoring site, an equivalent comparative site in adjacent undisturbed vegetation should be similarly monitored. Monitoring data collection should include the following:
  - total vegetation cover and height, as well as for each major growth form;
  - species composition, including relative dominance;
  - soil stability and/or development of erosion features;
  - representative photographs should be taken at each monitoring period.
- Monitoring of rehabilitated areas should take place at the frequency and for the duration determined in the rehabilitation plan, or until vegetation stability has been achieved.

10 Conclusion and Impact Statement

10.1 Conclusion

The completion of a comprehensive desktop study, in conjunction with the results from the field survey, suggest there is a good confidence in the information provided. The survey ensured that there was an extensive ground truth coverage of the assessment area, and most habitats and ecosystems were assessed to obtain a general species (fauna and flora) overview and the major current impacts.

Six habitat units were identified during the assessment and included Natural Habitats, Disturbed Grassland, Old Lands, Wetland and Riparian areas, Alien invaded habitats, and Transformed areas. Natural habitats and Wetland areas are of medium terrestrial sensitivity, as the area still provides habitat to various fauna and flora species, while the old lands, Disturbed areas, alien invaded areas and transformed habitat is considered to have a low sensitivity. No SCC species were observed during the site survey.

Two layout alternatives are considered for the proposed project, (Alternative 1 and Alternative 2). Alternative 1 is considered to have high to low impact and alternative 2 is considered to have a moderate to low negative impact on the terrestrial ecosystem associated with the project area after implementation of mitigation measures;

Alternative 1 has the following attributes

- The assessment area possesses a moderate diversity and high density of flora species, which is well represented in the general area. Moreover, fauna is ubiquitous within the assessment area and surrounding landscape.
- This area has a wetland with moderate potential to host various species and more natural habitat remaining than alternative 2

Alternative 2 is, however, the preferred layout alternative due to the following:

- It excludes natural habitat than alternative 1; and
- Makes use of more of the old land habitat than alternative 1.

Biodiversity maintenance is one key ecological service provided by the identified terrestrial biodiversity areas through their ecological integrity, importance, and functioning. As such the preservation of these systems is an important aspect to consider for the proposed project.

Any development in medium sensitivity areas must be minimised and rehabilitated, and minimised in the low sensitivity areas. Development within the medium sensitivity areas within the project area will lead the direct destruction and loss of functional habitats; and the loss of faunal species that are expected to utilise this habitat unless mitigation measures are followed. The mitigation measures, management and associated monitoring regarding the expected impacts will be the most important factor of this project and must be considered by the issuing authority.

10.2 Impact Statement

The main expected impacts of the proposed infrastructure will include the following:

- Habitat loss and fragmentation;
- Degradation of surrounding habitat;
- Disturbance and displacement caused during the construction and maintenance phases; and
- Direct mortality during the construction phase.

Mitigation measures as described in this report must be implemented to reduce the significance of the risk, but there is still a possibility of impacts occurring. Considering that a large part of the area has been identified as being of moderate significance for biodiversity maintenance and ecological processes (Moderate sensitivity), development may proceed but with caution and only with the implementation of mitigation measures in areas of moderate and low sensitivity.

Considering the above-mentioned information, no fatal flaws are evident for the proposed project. It is the opinion of the specialists that the project location, may be favourably considered on condition that all prescribed mitigation measures and supporting recommendations are implemented.

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12 APPENDIX 1: SPECIALIST CV

1. Personal Particulars

Profession:	Biodiversity Specialist
Date of Birth:	13 March 1987
Name of Firm:	Nitai Consulting
Name of Staff:	Elzet Human
Nationality:	RSA
Membership of Professional Societies	SACNASP (Pr. Sci. Nat. 147031)

2. Education:

M-Tech Nature Conservation, (Plant DNA Barcoding and phylogenetics), TUT, South Africa, 2021

B-Tech Nature Conservation, (Resource Management, Vegetation ecology and rehabilitation) TUT, South Africa, 2011

N. Dip Nature Conservation, TUT, South Africa, 2008

3. Employment Record:

2022 – Present Biodiversity Specialist, Nitai Consulting

Conduct Biodiversity Impact Assessments.

Conduct Plant Ecological Assessments.

Conduct Animal Ecological Assessments

Biodiversity monitoring programs; and,

GIS Mapping

2013 – 2022 Lecturer: Nature Management, Centurion academy

Lectured various subjects for undergraduate students in Nature Management:

Botany and Vegetation Ecology, Zoology, Animal Health, Conservation Development, Ecology, Game Ranch Management, Biostatistics, Research Methodology, Genetics, Soil Science

2009 – 2013 HOD Rangers Department, Zebula Gold Estate and Spa

Ecological Monitoring, Reserve Maintenance, Animal Husbandry, Neonatal care of Endangered carnivore species, Zoological display, and permit compliance

2008 – Conservation Student, Ann van Dyk Cheetah Research Centre

Neonatal Care of Carnivore species,

Veterinary assistance work – vaccine, diets, Endo scoping, pregnancy tests, health monitoring, quarantine care of species, emergency c-sections, bleeding procedures on vultures

Enclosure Maintenance

Tracking wild cheetahs

Rewilding cheetahs

Anatolian Shepard project assistance

4. Selected Consultancies

4.1 Ecological assessment for Victorius Game farm, Visgat, Ellisras, Limpopo

2018, Ecologist, Ecological condition assessment and game carrying capacity for game farm. Habitat evaluation and rehibition program for problem areas

4.2 Elephant impact study on Mabula Game Reserve, Bela-Bela, Limpopo,

2019, Ecologist, Ecological impact study on Private Nature reserve to see extent of elephant utilisation and impact. Woody species analysis – structure classification and net primary production. Elephant movement patterns and carrying capacity. Identification of vulnerable habitats and management program.

4.3 Faan Meintjies Municipal Nature Reserve, Matlosana, North West

2018-2022, Ecologist, Habitat assessments, game carrying capacities, ecological condition assessments, game counts and game recommendations, ecological rehabilitation programs, white rhino monitoring, anti-poaching programs, Environmental Education programs.

4.4 Kroonstad Solar PV Facilities

2022, Biodiversity Specialist. Development of three Solar PV facilities near Kroonstad, Free State Province, South Africa, Assess and map all wetlands associated with the three solar PV facilities as well as perform aquatic biomonitoring of the Vals River.

4.5 Kroonstad South Solar PV Facilities

2022, Biodiversity Specialist. Development of five Solar PV facilities near Kroonstad, Free State Province, South Africa, Assess and map all wetlands associated with the five solar PV facilities as well as perform aquatic biomonitoring of the Blomspruit.

4.6 Proposed PPM Regional Bulk Water Scheme Project

2023, Biodiversity Specialist. Nketoana Local Municipality is experiencing severe water shortages in its towns Reitz/Petsana/ Petrus Steyn/ Mamafubedu/ Arlington/ Leratswana and Lindley. Solutions to the water shortages are the proposed Nketoana Regional Bulk Water Scheme Pipeline, South Africa, Assess and map all biodiversity, plant and animal features associated within the footprint of the bulk water scheme project.

4.7 Rustenburg Solar PV Facilities

2023, Biodiversity Specialist. Development of three Solar PV facilities near Rustenburg, North West Province, South Africa, Assess and map all biodiversity, plant and animal features associated with the three solar PV facilities.

4.8 Grootvlei Solar PV Facility

2023, Biodiversity Specialist. Development of three Solar PV facilities near Carletonville, North West Province, South Africa, Assess and map all biodiversity, plant and animal features associated with the one solar PV facility.

4.9 400kV Transmission and 132kV distribution power lines for the Apollo-Lepini-Mesong Project

2023, Biodiversity Specialist. Proposed development of a 400kV transmission and 132kV power lines for the Apollo-Lepini-Mesong Project, Gauteng Province, South Africa, undertake assessments and map all biodiversity, plant, and animal features along the proposed routes for the 400kV and 132kV power lines.

4.10 CCUS 3D Seismic Survey & Drilling

2023, Biodiversity Specialist. Proposed 3D Seismic Survey within the Leandra area, Mpumalanga Province, South Africa Assess and map all biodiversity, plant and animal features within the footprint of the survey area.

4.11 Paulputs 400 kV Strengthening (Transmission Line Loop in Loop Out) Project

2023, Biodiversity Specialist. Proposed Paulputs 400kv Strengthening Project (Transmission Line Loop In Loop Out From Aries – Kokerboom Transmission Line), South Africa, Assess and map all biodiversity, plant and animal features within the power line footprint as well as perform biodiversity monitoring.

4.12 Seelo Solar PV Facilities

2023, Biodiversity Specialist. Development of three Solar PV facilities near Carletonville, North West Province, South Africa, Assess and map all biodiversity, plant, and animal features within the three solar PV facilities as well as perform biodiversity monitoring.

5. Languages:

English - excellent speaking, reading, and writing

Afrikaans – excellent speaking, reading and writing

6. Certification:

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes me, my qualifications, and my experience.

Name of Candidate …Elzet Human………………………………

Signature …………………………… **Date …29/05/2023......**

13 Appendix 2: Declaration of Independence

I, Elzet Human declare that:

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

Elzet Human

Pr. Sci. Nat 147031

May 2023

14 Appendix 3: Plant species list

Family	Taxon	Common name	Protection Status	Endemism	Invasive/ Protected
Acanthaceae	*Barleria macrostegia*		Least Concern	Indigenous	
Amaranthaceae	*Gomphrena celosioides*	Batchelor's button	Least Concern	Not indigenous; Naturalised	
Amaryllidaceae	*Boophone disticha*	Poison bulb	Least Concern	Indigenous	
Asclepiadaceae	*Gomphocarpus fruticosus*	Milkweed	Least Concern	Indigenous	
Asphodelaceae	*Bulbine narcissifolia*	Strap-leaved Bulbine	Least Concern	Indigenous	
Asteraceae	*Berkheya radula*	Boesmansrietjie	Least Concern	Indigenous	
Asteraceae	*Bidens formosa*	Kosmos	Least Concern	Not indigenous; Naturalised	
Asteraceae	*Dicoma anomala*	Grassveld Karmedik	Least Concern	Indigenous	
Asteraceae	*Geigeria burkei*	Vermeerbossie	Least Concern	Indigenous	
Asteraceae	*Helichrysum nudifolium*	Hottentot's tea	Least Concern	Indigenous	
Asteraceae	*Lasiosiphon sericocephalus*	Hairy curry flower	Least Concern	Indigenous	
Asteraceae	*Schkuhria pinnata*	Spanish blackjack	Least Concern	Not indigenous; Naturalised	

Asteraceae	*Seriphium plumosum*	Bankrupt bush	Least Concern	Indigenous	
Asteraceae	*Tagetes minuta*	Khaki bush	Least Concern	Not indigenous; Naturalised	
Asteraceae	*Vernonia oligocephala*	Bicoloured vernonia	Least Concern	Indigenous	
Asteraceae	*Zinia peruviana*	Peruvian zinnia	Least Concern	Not indigenous; Naturalised	
Campanulaceae	*Wahlenbergia undulata*	African Bluebell	Least Concern	Indigenous	
Caryophyllaceae	*Pollichia campestris*	Waxberry	Least Concern	Indigenous	
Colchicaceae	*Ornithoglossum vulgare*	Common Slangkop	Least Concern	Indigenous	
Commelinaceae	*Commelina africana*	Common yellow dayflower	Least Concern	Indigenous	
Commelinaceae	*Commelina benghalensis*	Benghal dayflower	Least Concern	Indigenous	
Convolvulaceae	*Ipomoea obscura*	Obscure Morning Glory	Least Concern	Indigenous	
Convolvulaceae	*Ipomoea ommanneyi*	Ox Morning Glory	Least Concern	Indigenous	
Crassulaceae	*Crassula lanceolata transvaalensis*	Spear Stonecrop	Least Concern	Indigenous	
Cucurbitaceae	*Cucumis zeyheri*	Spiny cucumber	Least Concern	Indigenous	
Cyperaceae	*Bulbostylis hispidula*	Slender sedge	Least Concern	Indigenous	
Fabacea	*Vachelia karroo*	Sweet thorn	Least Concern	Indigenous	

Hyacinthaceae	*Albuca suaveolens*	Striped tamarak	Least Concern	Indigenous	
Hyacinthaceae	*Ledebouria ovatifolia*	Flat leaved African hyacinth	Least Concern	Indigenous; Endemic	
Hypoxidaceae	*Hypoxis rigidula*	Silverleaf Stargrass	Least Concern	Indigenous	
Iridaceae	*Babiana hypogea*	Bushmanland Bobbejaantjie	Least Concern	Indigenous	
Juncaceae	*Juncus effusus*	Soft Rush	Least Concern	Indigenous	
Lamiaceae	*Leucas sexdentata*	Bushveld Tumbleweed	Least Concern	Indigenous	
Myrtaceae	*Eucalyptus grandis*	Flooded Gum	Least Concern	Not indigenous; Cultivated; Naturalised; Invasive	Nemba 1b
Orobanchaceae	*Striga elegans*	Witchweed	Least Concern	Indigenous	
Poaceae	*Andropogon schirensis*	Stab grass	Least Concern	Indigenous	
Poaceae	*Aristida congesta congesta*	Tassel Three-awn	Least Concern	Indigenous	
Poaceae	*Brachiaria serrata*	Velvet Signal grass	Least Concern	Indigenous	
Poaceae	*Cymbopogon caesius*	Broadleaved Turpentine grass	Least Concern	Indigenous	
Poaceae	*Cynodon dactylon*	Couch grass	Least Concern	Indigenous	
Poaceae	*Digitaria eriantha*	Finger grass	Least Concern	Indigenous	

Poaceae	*Elionurus muticus*	Copper wire Grass	Least Concern	Indigenous	
Poaceae	*Eragrostis chloromelas*	Curly leaf	Least Concern	Indigenous	
Poaceae	*Loudetia simplex*	Common Russet grass	Least Concern	Indigenous	
Poaceae	*Melinis repens*	Natal red Top	Least Concern	Indigenous	
Poaceae	*Sporobolus africanus*	Rat's tail dropseed	Least Concern	Indigenous	
Poaceae	*Themeda triandra*	Red Grass	Least Concern	Indigenous	
Poaceae	*Urochloa mossambicensis*	Bushveld signal grass	Least Concern	Indigenous	
Ranunculaceae	*Clematis brachiata*	Traveller's joy	Least Concern	Indigenous	
Rhamnaceae	*Ziziphus zeyheriana*	Dwarf buffalo thorn	Least Concern	Indigenous	
Rubiaceae	*Pygmaeothamnus zeyheri*	Sand Apple	Least Concern	Indigenous	
Solanaceae	*Datura ferox*	White stinkweed	Least Concern	Not indigenous; Naturalised; Invasive	Nemba 1b
Solanaceae	*Solanum elaeagnifolium*	Silverleaf Nightshade	Least Concern	Not indigenous; Naturalised; Invasive	Nemba 1b
Verbenaceae	*Lippia javanica*	Fever tea	Least Concern	Indigenous	
Verbenaceae	*Verbena bonariensis*	Purple top Vervain	Least Concern	Not indigenous;	Nemba 1b

				Naturalised; Invasive	

15 Appendix 4: Animal species list

15.1 Amphibian species expected to occur in the project area

Family	Scientific name	Common name	Red List category
Brevicipitidae	*Breviceps adspersus*	Bushveld Rainfrog	LC 2013
Bufonidae	*Schismaderma carens*	Red Toad	LC 2013
Bufonidae	*Sclerophrys capensis*	Ranger's toad	LC 2013
Bufonidae	*Sclerophrys garmani*	Eastern Olive Toad	LC 2013
Bufonidae	*Sclerophrys gutturalis*	Guttural Toad	LC 2013
Bufonidae	*Sclerophrys poweri*	Western Olive Toad	LC 2013
Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	LC 2013
Microhylidae	*Phrynomantis bifasciatus*	Banded Rubber Frog	LC 2013
Phrynobatrachidae	*Phrynobatrachus natalensis*	Natal Dwarf Puddle Frog	LC 2013
Pipidae	*Xenopus laevis*	Platanna	LC 2016
Ptychadenidae	*Ptychadena anchietae*	Anchieta's ridged Frog	LC 2013
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	LC 2017
Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	LC 2013
Pyxicephalidae	*Pyxicephalus adspersus*	African Bullfrog	LC 2013

Pyxicephalidae	*Strongylopus fasciatus*	Striped Stream Frog	LC 2013
Pyxicephalidae	*Tomopterna cryptotis*	Common Sand frog	LC 2015
Pyxicephalidae	*Tomopterna natalensis*	Natal Sand Frog	LC 2013
Pyxicephalidae	*Tomopterna tandyi*	Tandy's Sand frog	LC 2013

15.2 Reptile Species expected to occur in the study area

Family	Scientific Name	Common name	Red List Category
Amphisbaenidae	*Dalophia pistillum*	Pestle-tailed Worm Lizard	LC 2019
Amphisbaenidae	*Monopeltis capensis*	Cape Worm Lizard	LC 2022
Amphisbaenidae	*Monopeltis infuscata*	Dusky spade-snouted Worm Lizard	LC 2019
Amphisbaenidae	*Zygaspis quadrifrons*	Kalahari dwarf worm lizard	LC 2019
Chamaeleonidae	*Chamaeleo dilepis*	Flapped Necked Chameleon	LC 2014
Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	LC 2019
Elapidae	*Elapsoidea sundevallii*	Sundevall's Garter Snake	LC 2019
Elapidae	*Hemachatus haemachatus*	Rinkals	LC 2022
Elapidae	*Naja mossambica*	Mocambique Spitting Cobra	LC 2022
Elapidae	*Naja nivea*	Cape Cobra	LC 2019
Gekkonidae	*Lygodactylus capensis*	Cape dwarf gecko	LC 2019
Gerrhosauridae	*Gerrhosaurus flavigularis*	yellow-throated Plated lizard	LC 2019

Lacertidae	*Meroles squamulosus*	Common rough-scaled Lizard	LC 2019
Lacertidae	*Nucras holubi*	Holub's Sandveld Lizard	LC 2019
Lacertidae	*Nucras intertexta*	Spotted Sandveld Lizard	LC 2019
Lacertidae	*Pedioplanis lineoocellata*	Spotted Sand Lizard	LC 2019
Lamprophiidae	*Lamprophis aurora*	Aurora House Snake	LC 2022
Lamprophiidae	*Lycophidion capense*	Cape Wolf Snake	LC 2019
Prosymnidae	*Prosymna bivittata*		LC 2019
Psammophiidae	*Psammophis brevirostris*		LC 2019
Psammophiidae	*Psammophis leightoni*	Cape Whip Snake	LC 2019
Scincidae	*Trachylepis punctatissima*	Montane Speckled Skink	LC 2019
Scincidae	*Trachylepis punctulata*	Two-striped Shovel-snout	LC 2019
Scincidae	*Trachylepis varia*	Common Variable Skink	LC 2019
Typhlopidae	*Afrotyphlops bibronii*	Bibron’s blind Snake	LC 2022
Varanidae	*Varanus albigularis*	Rock Monitor	LC 2019
Varanidae	*Varanus niloticus*	Water monitor	LC 2019

15.3 Mammal Species expected to occur in the study area.

Family	**Scientific Name**	**Common name**	**Red List Category**	**Year**
Bovidae	*Alcelaphus buselaphus*	Red Hartebeest	LC	2016
Bovidae	*Antidorcas marsupialis*	Springbuck	LC	2008

Bovidae	*Connochaetes gnou*	Blue wildebeest	LC	2008
Bovidae	*Connochaetes taurinus*	Black wildebeest	LC	2016
Bovidae	*Damaliscus pygargus*	Blesbuck	LC	2008
Bovidae	*Oryx gazella*	Gemsbuck	LC	2008
Bovidae	*Raphicerus campestris*	Steenbuck	LC	2008
Bovidae	*Sylvicapra grimmia*	Common duiker	LC	2008
Bovidae	*Tragelaphus oryx*	Eland	LC	2008
Canidae	*Canis mesomelas*	Black- backed jackal	LC	2008
Canidae	*Otocyon megalotis*	Bat-eared Fox	LC	2014
Canidae	*Vulpes chama*	Side stripe jackal	LC	2008
Cercopithecidae	*Papio ursinus*	Baboon	LC	2019
Equidae	*Equus quagga*	Plains zebra	LC	2016
Erinaceidae	*Atelerix frontalis*	South African Hedgehog	LC	2008
Felidae	*Caracal caracal*	Caracal	LC	2016
Felidae	*Felis lybica*	African Wild cat	LC	2022
Felidae	*Felis nigripes*	Black footed cat	VU	2016
Herpestidae	*Cynictis penicillata*	Yellow mongoose	LC	2008
Herpestidae	*Herpestes sanguineus*	Slender mongoose	LC	2016
Herpestidae	*Ichneumia albicauda*	White-tailed mongoose	LC	2008
Herpestidae	*Mungos mungo*	Banded Mongoose	LC	2016
Herpestidae	*Suricata suricatta*	Meerkat	LC	2008
Hyaenidae	*Parahyaena brunnea*	Brown Hyaena	NT	2015

Hyaenidae	*Proteles cristata*	Aardwolf	LC	2015
Hystricidae	*Hystrix africaeaustralis*	Porcupine	LC	2008
Leporidae	*Lepus capensis*	Cape hare	LC	2019
Leporidae	*Lepus victoriae*	Arican Savanna hare	LC	2019
Macroscelididae	*Elephantulus brachyrhynchus*	Short-snouted elephant shrew	LC	2015
Macroscelididae	*Elephantulus myurus*	Eastern rock elephant-shrew	LC	2015
Molossidae	*Sauromys petrophilus*	Roberts's flat-headed bat	LC	2008
Molossidae	*Tadarida aegyptiaca*	Egyptian free-tailed bat	LC	2017
Muridae	*Acomys selousi*	Southern African spiny mouse	LC	2018
Muridae	*Aethomys ineptus*	Tete veld rat	LC	2016
Muridae	*Desmodillus auricularis*	Cape short-eared gerbil	LC	2008
Muridae	*Gerbilliscus brantsii*	Highveld gerbil	LC	2008
Muridae	*Gerbilliscus leucogaster*	Bushveld gerbil	LC	2008
Muridae	*Mastomys coucha*	Southern multimammate mouse	LC	2008
Muridae	*Micaelamys namaquensis*	Namaqua rock rat	LC	2008
Muridae	*Mus indutus*	Desert pygmy mouse	LC	2008
Muridae	*Mus musculus*	House mouse	LC	2014
Muridae	*Otomys auratus*	Vlei rat	NT	2017

Muridae	*Rattus rattus*	Black rat	LC	2014
Muridae	*Rhabdomys dilectus*	Mesic four-striped grass rat	LC	2019
Muridae	*Thallomys paedulcus*	Acacia rat	LC	2008
Mustelidae	*Ictonyx striatus*	Striped polecat	LC	2008
Mustelidae	*Mellivora capensis*	Honey badger	LC	2016
Mustelidae	*Poecilogale albinucha*	African striped weasel	LC	2008
Nesomyidae	*Dendromus melanotis*	Gray climbing mouse	LC	2016
Nesomyidae	*Mystromys albicaudatus*	White-tailed rat	VU	2008
Nesomyidae	*Saccostomus campestris*	South African pouched mouse	LC	2008
Nesomyidae	*Steatomys krebsii*	Krebs’s fat mouse	LC	2008
Nesomyidae	*Steatomys pratensis*	Fat mouse	LC	2008
Nycteridae	*Nycteris thebaica*	Egyptian slit-faced bat	LC	2017
Orycteropodidae	*Orycteropus afer*	Aardvark	LC	2015
Pedetidae	*Pedetes capensis*	Springhare	LC	2008
Procaviidae	*Procavia capensis*	Rock Dassie	LC	2015
Pteropodidae	*Eidolon helvum*	Straw-coloured fruit bat	NT	2020
Pteropodidae	*Epomophorus wahlbergi*	Epauletted fruit bat	LC	2016
Rhinolophidae	*Rhinolophus clivosus*	Geoffroy's horseshoe bat	LC	2017
Rhinolophidae	*Rhinolophus darlingi*	Darling's horseshoe bat	LC	2017

Sciuridae	*Xerus inauris*	Ground squirrel	LC	2008
Soricidae	*Crocidura cyanea*	Reddish-gray musk shrew	LC	2008
Soricidae	*Crocidura fuscomurina*	Bicolored musk shrew	LC	2008
Soricidae	*Crocidura mariquensis*	Makwassie musk shrew	LC	2008
Soricidae	*Suncus varilla*	Lesser dwarf shrew	LC	2008
Suidae	*Phacochoerus africanus*	Warthog	LC	2016
Vespertilionidae	*Eptesicus hottentotus*	Long-tailed serotine	LC	2017
Vespertilionidae	*Neoromicia capensis*	Cape serotine	LC	2017
Vespertilionidae	*Scotophilus dinganii*	African yellow bat	LC	2017
Viverridae	*Genetta genetta*	Small spotted genet	LC	2008

APPENDIX D3: Avifaunal Impact Assessment

Avifauna Impact Assessment for the proposed Grootvlei Solar Energy Facilities

Ventersdorp, North- West Province

May 2023

CLIENT

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Report Name	**Avifauna Impact Assessment for the proposed Grootvlei Solar Energy Facilities**
Submitted to	NEMAI CONSULTING
Fieldwork	Bianca Coulson
	Avifaunal subcontractor Bianca Coulson is a final year Master of Science in Zoology student at the University of Pretoria. She is specialising in Ornithology with the Hot Birds Research Project with a main focus on the effects of climate change in large forest hornbills and holds a Bachelor of Science (Honours) in Zoology as well as a Bachelor of Science in Zoology. Her interests lie in ecology and animal responses to their environment and has since been qualified with Diploma's in Ecological Impacts and Studies, Remote Sensing as well as Geographic Information Sciences to further her skills. She is a very capable person in and out of the field. Furthermore, Bianca enjoys birding in her spare time and continues to improve her skills.
Report Writing	**Ryno Kemp**
	Ryno Kemp is Pr Sci Nat registered (117462/17) in Zoological Science and is finalising his PhD in Zoology from the University of Pretoria. Ryno is a qualified Avifauna specialist with just over a year's experience, three years of experience in conservation and more than eight years of scientific research experience across South Africa.
Report Reviewer	**Andrew Husted**
	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

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List of Acronyms and Abbreviations

%	**Percent**
ADU	Animal Demography Unit
BESS	Battery Energy Storage System
BI	Biodiversity Importance
CAR	Coordinated Avifaunal Roadcounts
CBA	Critical Biodiversity Area
CI	Conservation Importance
CR	Critically Endangered
CWAC	Coordinated Waterbird Counts
DC	Direct Current
EAP	Environmental Assessment Practitioner
EGI	Electricity Grid Infrastructure
EI	Ecological Importance
EIA	Environmental Impact Assessment
EMPr	Environmental Management Plan report
EN	Endangered
EOO	Extent of occurrence
ESA	Ecological Support Area
EWT	Endangered Wildlife Trust
FFG	Functional Feeding Guild
FI	Functional Integrity
GIS	Geographic Information Systems
ha	hectares
IBA	Important Bird and Biodiversity Area
KBA	Key Biodiversity Area
km	kilometres
kV	kilo Volt
LC	Least Concern
m	metres
m^2	square metres
MTS	Main Transmission Substation
MW	Mega Watt
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem priority Areas
NPAES	National Protected Areas Expansion Strategy
NT	Near Threatened
ONA	Other Natural Areas
PAOI	Project Area of Influence
PV	Photo Voltaic
REDZ	Renewable Energy Development Zones
REEA	Renewable Energy EIA Application
RR	Receptor Resilience
SABAP2	South African Bird Atlas Project 2
SACAD	South African Conservation Areas Database
SAIIAE	South African Inventory of Inland Aquatic Ecosystems
SANBI	South African National Biodiversity Institute
SAPAD	South African Protected Areas Database
SCC	Species of Conservation Concern
SEI	Site ecological Importance
TBC	The Biodiversity Company
V	Volt
VU	Vulnerable

1 Introduction

The Biodiversity Company was appointed to undertake an Avifauna Impact assessment for the proposed development of the Grootvlei 600MW Solar PV and Battery Energy Storage Systems (BESS) Project near the town of Ventersdorp, in the North West Province (the "Project"). The electricity generated by the Project will be transmitted through either Option 1 which consists of 2 x 132kV powerlines, approximately 14km kilometres (km) in length, from the new facility 33kV substation to new 400/132kV Main Transmission Substation (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line or Option 2 that comprises of 2.8km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation.

he Project is located approximately 20km to the north west of Ventersdorp central business district (CBD) and falls within Ward 34 of the JB Marks Local Municipality, in the North West Province. The site can be accessed via the N14 (main access) and the R53 (gravel road). The property earmarked for the Solar Project covers a combined area of approximately 655 hectares (ha).

<u>Components of the Proposed Solar PV Plant</u>

The Project consists of the following systems, sub-systems or components (amongst others):

- 600MW PV solar panels or modules (arranged in arrays);
- Mounting structures to support the PV panels;
- DC-AC current inverters stations, transformers, and internal electrical reticulation (underground cabling);
- Grid Connection: Option 1 which consists of 2 x 132kV powerlines, approximately 14km kilometres (km) in length, from the new facility 33kV substation to new 400/132kV Main Transmission Substation (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line or Option 2 that comprises of 2.8km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation.
- New 400/132kV Main Transmission Substation
- On site switching station/substation;
- Administration Buildings (Offices);
- Workshop areas for maintenance and storage;
- Temporary laydown areas;
- Internal access roads and perimeter fencing of the footprint area;
- Lithium-ion battery energy storage system (BESS);
- Security Infrastructure; and
- Site access from unnamed gravel road via the N14 and/or R53.

The National Web-based Environmental Screening Tool (Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended) indicated that the Animal Species Theme Sensitivity was rated as 'High' due to the possible presence of Species of Conservation Concern (see section 2.2 of this report for the definition), including avifauna species. Accordingly, The Biodiversity Company was sub-contracted to undertake an Avifauna Impact Assessment to inform on the impact of the proposed PV to the avifauna community within the receiving environment. The approach was informed by the Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices 320 (20 March 2020) in terms of NEMA, dated 20 March and 30 October 2020: "*Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation*" (Reporting Criteria). Based on the size of the PV project and the associated risks, a Regime 2 assessment was undertaken. Due to additional data for the area being available and deemed sufficient to supplement the project, only one survey was conducted during the wet season (BirdLife South Africa, 2017).

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision-making, as to the ecological viability of the proposed project.

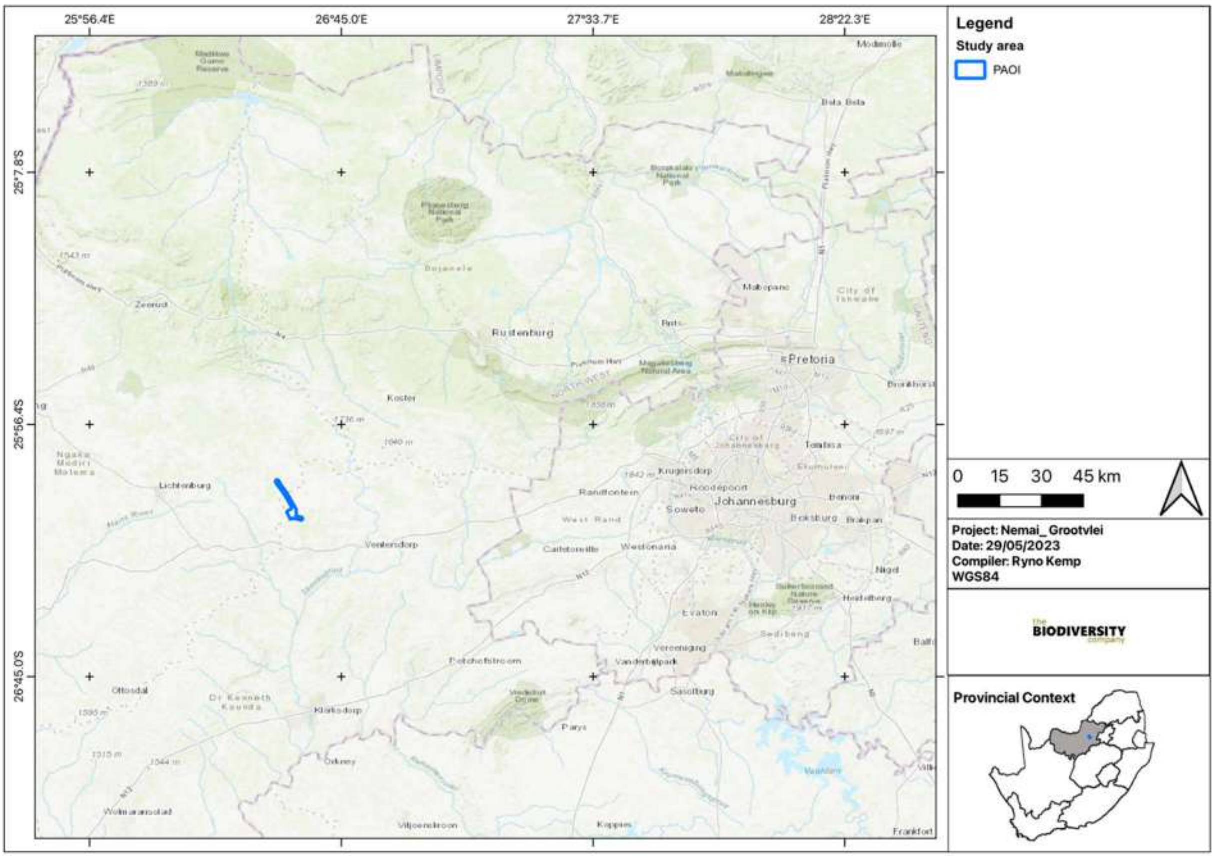

Figure 1-1 Map illustrating the location of the proposed PV Project

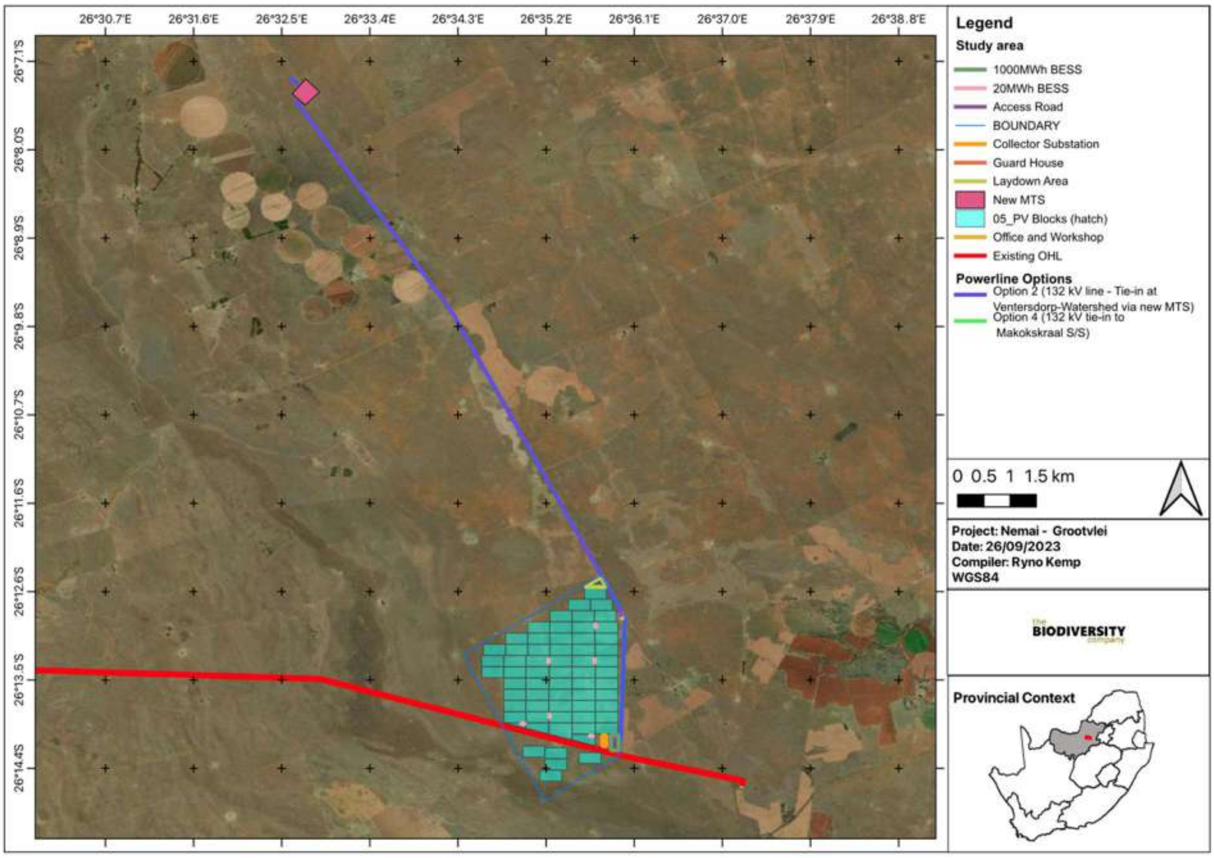

Figure 1-2 Proposed Solar Energy Facility Infrastructure

1.1 Terms of Reference

The assessment was achieved under the Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes in terms of Section 24(5) (a) and (h) and 44 of NEMA ("the Protocols") promulgated in GN No. 320 of 20 March 2020. Where no specific environmental theme protocol has been prescribed, the level of assessment must be based on the findings of the site verification and must comply with Appendix 6 of the EIA Regulations of 2014 (as amended), and the best-practice guidelines and principles for Avifaunal Impact Assessments within the context of PVs as outlined by BirdLife South Africa (2017).

The scope of the Avifaunal Impact Assessment included the following:

- Desktop assessment to identify the relevant ecologically important geographical features within the Project Area of Influence (PAOI) and surrounding landscape
- Desktop assessment to compile an expected species list and possible avifauna Species of Conservation Concern (SCC) that potentially occur within the PAOI;
- Description of the baseline avifauna species and Functional Feeding Guild (FFG) composition assemblage within the PAOI;
- Delineate site sensitivity or sensitivities i.e., the Site Ecological Importance (SEI) within the context of the avifauna species assemblage of the PAOI;
- Identify the manner that the proposed development impacts the avifauna community and evaluate the level of risk of these potential impacts; and

- Provide mitigation measures to prevent or reduce the possible impacts.

1.2 Assumptions and Limitations

The following assumptions and limitations should be noted for the assessment:

- The Project Area of Influence (PAOI) was based on the project footprint area as provided by the client. See section 2.1 of this report for additional details. Any alterations to the area and/or missing Geographic Information Systems (GIS) information pertaining to the assessment area would have affected the area surveyed and hence the results of this assessment;
- Only one site visit was conducted but supplemented by another project ~ 15 southeast of the proposed development for this regime 2 assessment. The field investigation was conducted in Autumn, over 4 days from the 21st to the 24th of April 2023. This one site visit, in addition to supplementary reports and data, is considered sufficient from a seasonal perspective, and no additional season assessment is required.
- Whilst every effort was made to cover as much of the PAOI as possible, it is possible that some species that are present within the PAOI were not recorded during the field investigations due to their secretive behaviour; and
- The GPS used in the assessment has an accuracy of 5 m and consequently, any spatial features delineated may be offset by up to 5 m.

1.3 Key Legislative Requirements

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

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

Region	Legislation / Guideline
National	Constitution of the Republic of South Africa (Act No. 108 of 1996)
	The National Environmental Management Act (NEMA) (Act No. 107 of 1998)
	The National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
	The National Environmental Management: Biodiversity Act (Act No. 10 of 2004), Threatened or Protected Species Regulations
	Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, GNR 320 of Government Gazette 43310 (March 2020)
	Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, GNR 1150 of Government Gazette 43855 (October 2020)
	The National Environmental Management: Waste Act, 2008 (Act 59 of 2008);
	The Environment Conservation Act (Act No. 73 of 1989)
	National Protected Areas Expansion Strategy (NPAES)
	Natural Scientific Professions Act (Act No. 27 of 2003)
	National Biodiversity Framework (NBF, 2009)
	National Forest Act (Act No. 84 of 1998)
	National Veld and Forest Fire Act (101 of 1998)
	National Water Act (NWA) (Act No. 36 of 1998)
	National Spatial Biodiversity Assessment (NSBA)

Region	Legislation / Guideline
	World Heritage Convention Act (Act No. 49 of 1999)
	Municipal Systems Act (Act No. 32 of 2000)
	Alien and Invasive Species Regulations and, Alien and Invasive Species List 20142020, published under NEMBA
	South Africa’s National Biodiversity Strategy and Action Plan (NBSAP)
	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA)
	Sustainable Utilisation of Agricultural Resources (Draft Legislation).
	White Paper on Biodiversity
Provincial	North-West Biodiversity Sector Plan of 2015 (READ, 2015)

2 Definitions

2.1 Project Area of Influence (PAOI)

The Project Area of Influence (PAOI) encompasses the geographical extent of the potential impacts of the proposed development on the receiving environment. Essentially, the PAOI is defined according to the important ecosystem processes and functions that may be plausibly affected by the proposed development and its associated activities. In consideration that the project is not located within the Strategic Transmission Corridor, the PAOI was delineated as the project border.

2.2 Species of Conservation Concern (SCC)

According to the National Red List of South African Plants website, managed and maintained by the South African National Biodiversity Institute (SANBI), a Species of Conservation Concern (SCC) is a species with high conservation importance in terms of preserving South Africa's rich biodiversity. This classification covers a range of conservation status categories, as illustrated in Figure 2-1.

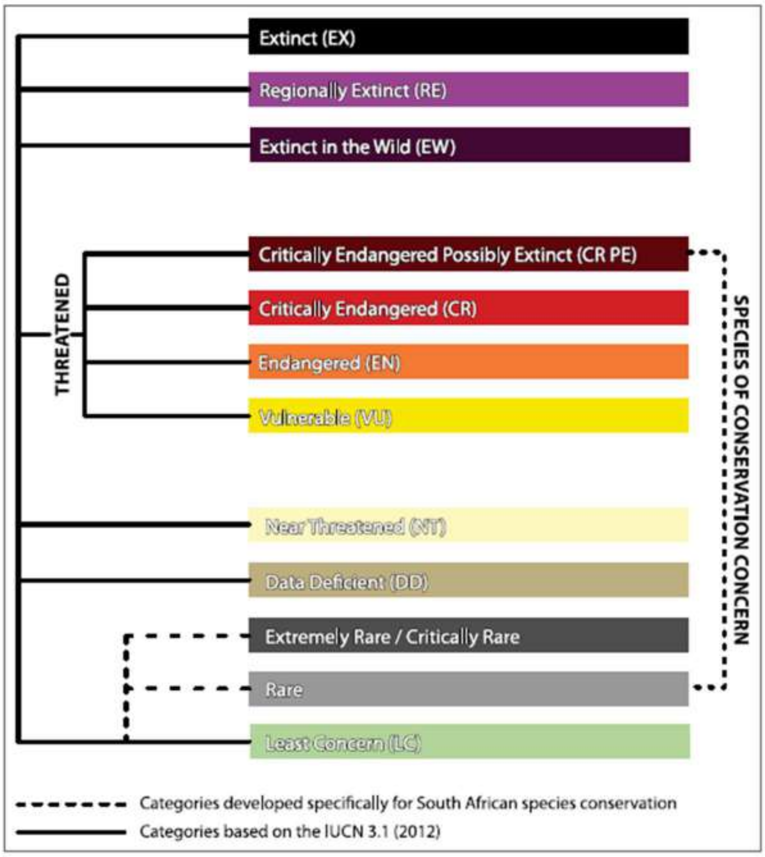

Figure 2-1 The different Species of Conservation Concern categories were modified from the IUCN's extinction risk categories. Source: SANBI (2020)

South Africa uses the internationally endorsed International Union for Conservation of Nature (IUCN) Red List Categories and Criteria (IUCN, 2021). This scientific system is designed to measure species' risk of extinction, and its purpose is to highlight those species that are in need of critical conservation action. As this system has been adopted from the IUCN, the definition of an SCC as described and categorised above is extended to all red list classifications relevant to fauna and the IUCN categories for this report.

2.3 Risk Species

Priority species are susceptible to impacts from energy developments (Ralston Paton *et al.* 2017). These species are typically susceptible to collisions. This list was initially developed for use with Wind Energy Facilities (Ralston Paton et al. 2017); however, the collision, electrocution and habitat loss risks are considered appropriate for renewable energy developments and re-utilised here. Also utilised here is the Eskom and Endangered Wildlife Trust (EWT) poster: Birds and Powerlines (Eskom & EWT, no date), identifying birds most prone to collision and electrocution from powerlines. Some birds are not included in these lists but are considered by the TBC avifauna specialists as risk species for collisions, electrocutions and habitat loss as a result of Solar PV infrastructure. All species are referred to collectively in this report as “Risk Species”.

3 Methods

3.1 Desktop Assessment

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

3.1.1 Ecologically Important Landscape Features

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

- Protected areas:
    - South Africa Protected Areas Database (SAPAD) (DFFE, 2022) – The South African Protected Areas Database (SAPAD) contains spatial data for the conservation of South Africa. It includes spatial and attribute information for both formally protected areas and areas that have less formal protection. SAPAD is updated on a continuous basis and forms the basis for the Register of Protected Areas which is a legislative requirement under the National Environmental Management: Protected Areas Act, Act 57 of 2003.
    - National Protected Areas Expansion Strategy (NPAES) (DFFE, 2021) – The National Protected Area Expansion Strategy (NPAES) provides spatial information on areas that are suitable for terrestrial ecosystem protection. These focus areas are large, intact and unfragmented and are therefore, of high importance for biodiversity, climate resilience and freshwater protection.
- Important Bird and Biodiversity Areas (BirdLife South Africa, 2022) – Important Bird and Biodiversity Areas (IBAs) constitute a global network of over 13 500 sites, of which 112 sites are found in South Africa. IBAs are sites of global significance for bird conservation, identified through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria;
- Coordinated Water Bird Counts (CWAC) – The Animal Demography Unit (ADU) launched the Coordinated Waterbird Counts (CWAC) project in 1992 as part South Africa's commitment to international waterbird conservation. The primary aim of CWAC is to act as an effective long-term waterbird monitoring tool. This is being done by means of a programme of regular mid-summer and mid-winter censuses at several wetlands. The database is located at https://cwac.birdmap.africa/index.php.
- Coordinated Avifaunal Roadcounts (CAR) – The Coordinated Avifaunal Roadcounts (CAR) were pioneered in July 1993 in a joint Cape Bird Club/Animal Demography Unit (ADU) project to monitor the populations of two threatened species: *Anthropoides paradiseus* (Blue Crane) and *Neotis denhamii* (Denham's Bustard). Presently it monitors 36 species of large terrestrial birds along 350 fixed routes covering over 19 000 km using a standardised method.
- North West Biodiversity Sector Plan - The spatial component of the Biodiversity Sector Plan is based on systematic biodiversity planning undertaken by READ. The purpose of a Biodiversity Sector Plan is to inform land use planning, environmental assessments, land and water use authorisations, and natural resource management, undertaken by a range of sectors whose policies and decisions impact biodiversity. This is done by providing a map of biodiversity priority areas, referred to as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), with accompanying land use planning and decision-making guidelines (READ, 2015), and
- Hydrological Context

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

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

3.1.2 Expected Avifauna Species

The following resources were considered during the desktop assessment and for the compilation of the expected species list:

- South African Bird Atlas Project 2 (SABAP2). Full protocol data from 9 relevant pentads (2605_2630; 2605_2635; 2605_2640; 2610_2630; 2610_2635; 2610_2640; 2615_2630; 2615_2635; 2615_2640) were used to compile the expected species list;

- Coordinated Water Bird Counts (CWAC) – The Animal Demography Unit (ADU) launched the Coordinated Waterbird Counts (CWAC) project in 1992 as part of South Africa's commitment to international waterbird conservation. The primary aim of CWAC is to act as an effective long-term waterbird monitoring tool. This is done through a programme of regular mid-summer and mid-winter censuses at several wetlands. The database is located at https://cwac.birdmap.africa/index.php;

- Coordinated Avifaunal Roadcounts (CAR) – The Coordinated Avifaunal Roadcounts (CAR) were pioneered in July 1993 in a joint Cape Bird Club/ADU project to monitor the populations of two threatened species: *Anthropoides paradiseus* (Blue Crane) and *Neotis denhamii* (Denham's Bustard). Presently it monitors 36 species of large terrestrial birds along 350 fixed routes covering over 19 000 km using a standardised method;

- Important Bird and Biodiversity Areas (BirdLife South Africa, 2022) – Important Bird and Biodiversity Areas (IBAs) constitute a global network of over 13 500 sites, of which 112 are found in South Africa. IBAs are sites of global significance for bird conservation, identified through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria;

- Hockey *et al*. (2005), Roberts Birds of Southern Africa (7th edition). The primary source for species identification, geographic range, and life history information;

- Sinclair and Ryan (2010), Birds of Africa South of the Sahara. Secondary source for identification; and

- Taylor *et al*. (2015), Eskom Red Data Book of Birds of South Africa, Lesotho, and Swaziland. Used for conservation status, nomenclature, and taxonomical ordering.

- Additional sources were included to supplement a single field investigation (e.g., Ventersdorp PV Project)

3.2 Field Survey

Only one site visit was conducted but supplemented by another project ~ 15 southeast of the proposed development for this regime 2 assessment. The field investigation was conducted in Autumn, over 4 days from the 21st to the 24th of April 2023. This site visit, besides supplementary reports and data, is considered sufficient from a seasonal perspective. This site was assessed between 27 and 29 July 2021 and 1-3 April 2022. Sampling consisted of Standardised Point Counts as well as random diurnal incidental surveys. Standardised Point Counts (Buckland et al., 1993) were conducted to gather data on the species composition and relative abundance of species within the broad habitat types identified. The Standardized Point Count technique was utilised as it was demonstrated to outperform line routes (Cumming & Henry, 2019). Each point count was run over 10 minutes. The horizontal detection limit was set at 150 m. At each point, the observer would document the date, start time, and end time, habitat, numbers of each species, detection method (seen or heard), behaviour (perched or flying) and general notes on habitat and nesting suitability for conservation important species. Diurnal and nocturnal incidental searches were conducted to supplement the species inventory with cryptic and elusive species that may not be detected during the rigid point count protocol. This involved opportunistic species sampling between point count periods, random meandering and road cruising. The effort was made to cover all the different habitat types within the limits of time and access (Figure 3-1).

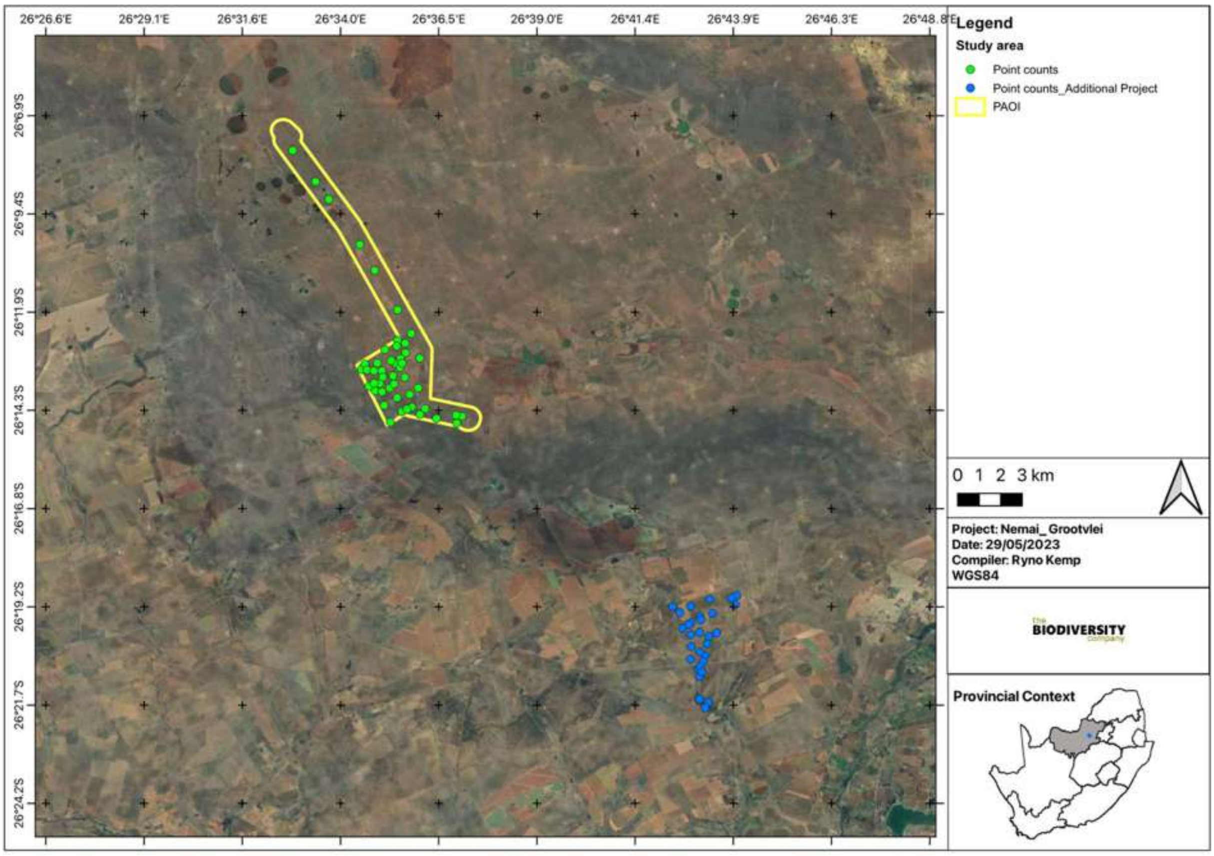

Figure 3-1 ***Map illustrating the field survey area and locations of Standardised Point Counts for the proposed development PAOI***

3.3 Data Analysis

The analyses described below only used the data collected from the Standardised Point Counts for this proposed project. However, if there are any distinct difference between the report it will be highlighted. Raw count data was converted to relative abundance values and used to establish dominant species and calculate the diversity of each habitat. Present, and potentially occurring species were assigned to 13 major trophic guilds loosely based on the classification system developed by González-Salazar *et al.* (2014). Species were first classified by their dominant diet (carnivore, herbivore, granivore, frugivore, nectarivore, omnivore), then by the medium upon / within which they most frequently forage (ground, water, foliage, air) and lastly by their activity period (nocturnal or diurnal).

3.4 Site Ecological Importance (SEI)

The different habitat types within the project area were delineated and identified based on observations during the field assessment, and available satellite imagery. These habitat types were assigned

Ecological Importance (EI) categories based on their ecological integrity, conservation value, the presence of species of conservation concern and their ecosystem processes.

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

BI is a function of Conservation Importance (CI) and the Functional Integrity (FI) of the receptor as follows. The criteria for the CI and FI ratings are provided in Table 3-1 and Table 3-2, respectively.

Table 3-1 Summary of Conservation Importance (CI) criteria

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

Table 3-2 Summary of Functional Integrity (FI) criteria

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

Functional Integrity	Fulfilling Criteria
Very Low	Very small (< 1 ha) area. No habitat connectivity except for flying species or flora with wind-dispersed seeds. Several major current negative ecological impacts.

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

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

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

The fulfilling criteria to evaluate RR are based on the estimated recovery time required to restore an appreciable portion of functionality to the receptor, as summarised in Table 3-4.

Table 3-4 Summary of Receptor Resilience (RR) criteria

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

Subsequent to the determination of the BI and RR, the SEI can be ascertained using the matrix as provided in Table 3-5.

Table 3-5 Matrix used to derive Site Ecological Importance from Receptor Resilience (RR) and Biodiversity Importance (BI)

Site Ecological Importance		Biodiversity Importance (BI)				
		Very high	High	Medium	Low	Very low
sReceptor Resilience (RR)	Very Low	Very high	Very high	High	Medium	Low
	Low	Very high	Very high	High	Medium	Very low
	Medium	Very high	High	Medium	Low	Very low
	High	High	Medium	Low	Very low	Very low
	Very High	Medium	Low	Very low	Very low	Very low

Interpretation of the SEI in the context of the proposed project is provided in Table 3-6.

Table 3-6 Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities

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

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

3.5 Environmental Impact Assessment

The significance of the identified impacts was determined using an accepted methodology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998. As with all impact methodologies, the impact is defined in a semi-quantitative way and was assessed according to methodology as per the scale utilised for the evaluation of Environmental Impact Ratings in Table 3-7,

Table 3-8 and Table 3-9. First, the impact is assigned a score based on Likelihood descriptors Probability and Sensitivity (Likelihood = Probability + Sensitivity) (Table 3-7), and then assigned a Severity rating based on Consequence descriptors Severity, Scope and Duration (Severity = Severity + Scope + Duration) (

Table 3-8). Overall Consequence and Likelihood scores are then used to Determine the Significance Rating (Table 3-9).

Table 3-7 Environmental Impact Assessment: Likelihood Descriptors

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

Table 3-8 Environmental Impact Assessment: Consequence Descriptors

Severity of impact	Rating
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful/ ecosystem structure and function largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	**Rating**
Activity specific/ < 5 ha impacted / Linear features affected < 100m	1
Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear features affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear features affected > 3000m	5
Duration of impact	**Rating**
One day to one month: Temporary	1
One month to one year: Short Term	2
One year to five years: Medium Term	3
Life of operation or less than 20 years: Long Term	4
Permanent	5

Table 3-9 Environmental Impact Assessment: Significance Rating Matrix

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

4 Results & Discussion

4.1 Desktop Assessment

4.1.1 Ecologically Important Landscape Features

The following features describe the general area and habitat. This assessment is based on spatial data from various sources, such as the provincial environmental authority and SANBI. The desktop analysis and its relevance to this project are listed in Table 4-1.

Table 4-1 Summary of the relevance of the proposed development to ecologically important landscape features

Desktop Information Considered	Relevant/Irrelevant	Section
Biodiversity Spatial Plan	Relevant - The PAOI overlaps with CBA2	4.1.1.1
Ecosystem Threat Status	Relevant - The proposed PAOI overlaps with a LC ecosystem	4.1.1.2
Ecosystem Protection Level	Relevant - The proposed PAOI project overlaps mainly with PP ecosystem	4.1.1.3
Protected Areas	Relevant - The PAOI is close proximity to a couple of nature reserves	4.1.1.4
National Protected Areas Expansion Strategy	Relevant - The PAOI does overlap with NPAES areas	4.1.1.5
Important Bird and Biodiversity Areas	Irrelevant - The PAOI does not overlap with any IBA	4.1.1.6
Coordinated Avifaunal Road Count	Irrelevant - The PAOI does not overlap with Coordinated Avifaunal Roadcount	4.1.1.7
Coordinated Waterbird Count	Relevant - The PAOI is in close proximity to 3 Coordinated Waterbird Count	4.1.1.8
Strategic Water Source Areas	Irrelevant - The PAOI does not fall within any Strategic Water Source Areas	4.1.1.9
South African Inventory of Inland Aquatic Ecosystems	Irrelevant - The PAOI does not overlap with any threatened wetlands and	4.1.1.9
National Freshwater Priority Area	Relevant - The PAOI does not overlap with some FEPA wetlands	4.1.1.9
Powerline Corridor	Relevant - The PAOI overlaps with the EGI corridor	4.1.1.10
Renewable Energy Development Zone (REDZ)	Irrelevant - The PAOI does not overlap with any REDZ	4.1.1.11
Renewable Energy EIA Application Database (REEA)	Relevant - The PAOI is in close proximity to already approved REEA project	4.1.1.12

4.1.1.1 North West Conservation Plan

The key output of a systematic biodiversity plan is a map of biodiversity priority areas. The CBA map delineates Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), Other Natural Areas (ONAs), Protected Areas (PAs), and areas that have been irreversibly modified from their natural state.

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species. Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI-BGIS, 2017).

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

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

Relevant - The PAOI overlaps with CBA2 (Figure 4-1).

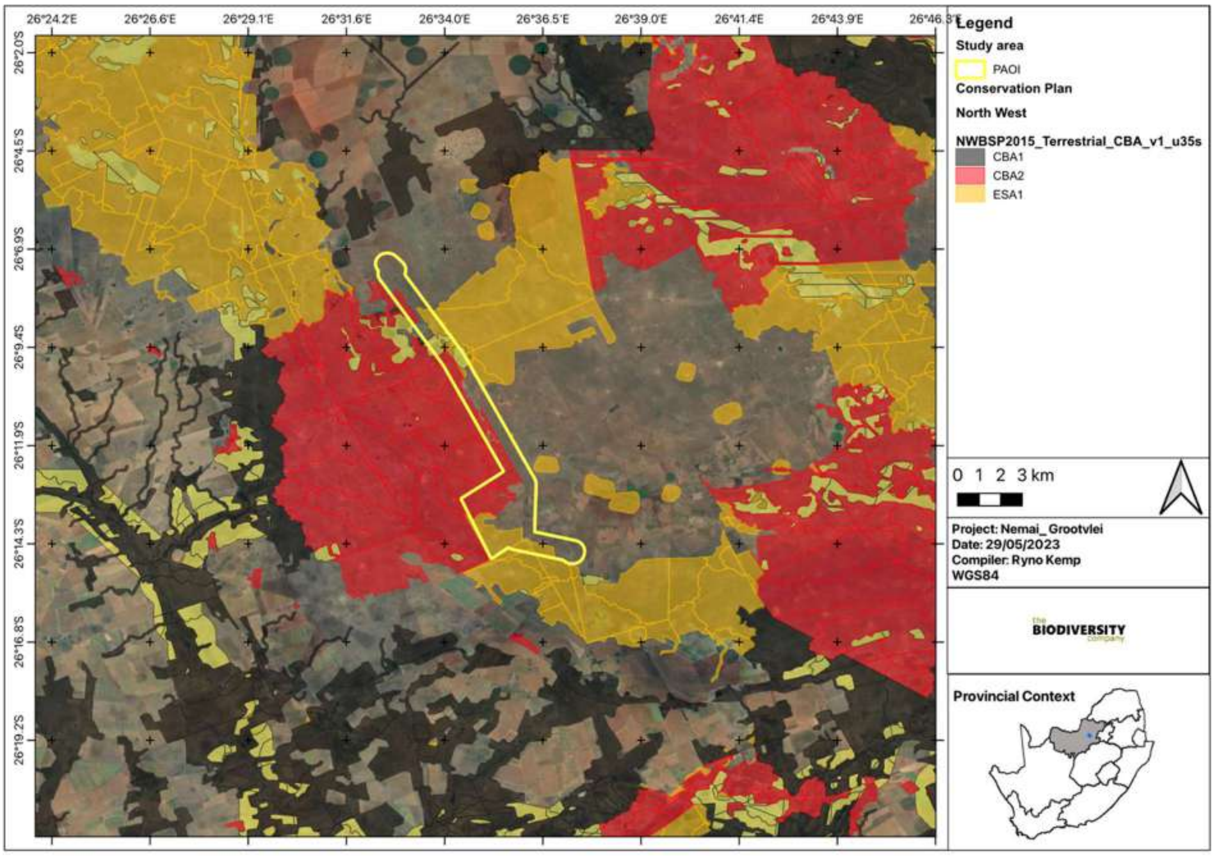

Figure 4-1 ***Map illustrating the location of Critical Biodiversity and Ecological Support Areas proximal to the Project Area of influence.***

4.1.1.2 Ecosystem Threat Status

The Ecosystem Threat Status is an indicator of an ecosystem's well-being based on the level of change in structure, function or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Least Concern (LC), based on the proportion of the original extent of each ecosystem type that remains in good ecological condition. Relevant - The proposed PAOI overlaps with a LC ecosystem (Figure 4-2).

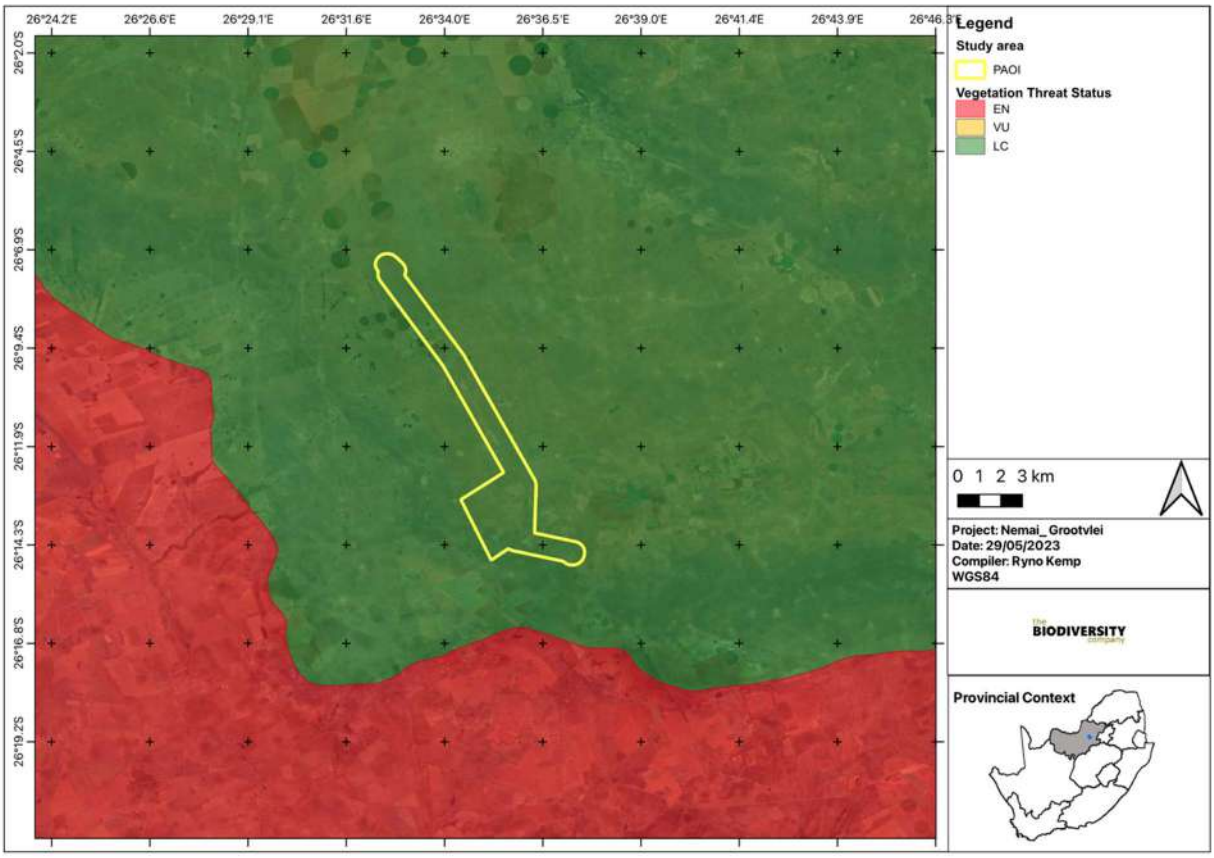

Figure 4-2 Map illustrating the ecosystem threat status associated with the PAOI.

4.1.1.3 Ecosystem Protection Level

This is an indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. NP, PP or MP ecosystem types are collectively referred to as under-protected ecosystems. Relevant - The proposed PAOI project overlaps mainly with PP ecosystem (Figure 4-3).

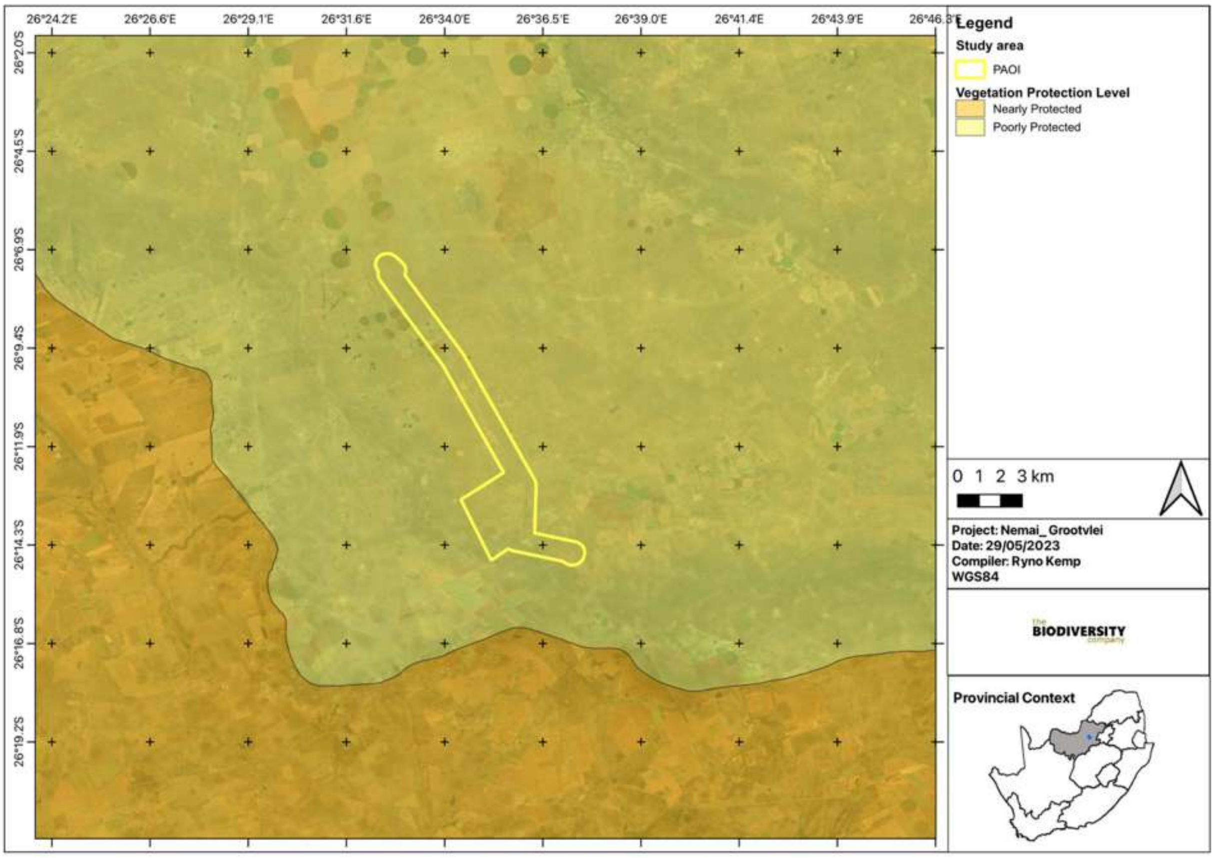

Figure 4-3 ***Map illustrating the ecosystem protection level associated with the PAOI***

4.1.1.4 Protected Areas

According to the protected area spatial datasets from SAPAD (DFFE, 2022) and SACAD (DFFE, 2022). Relevant - The PAOI is close proximity to a couple of nature reserves (Figure 4-4).

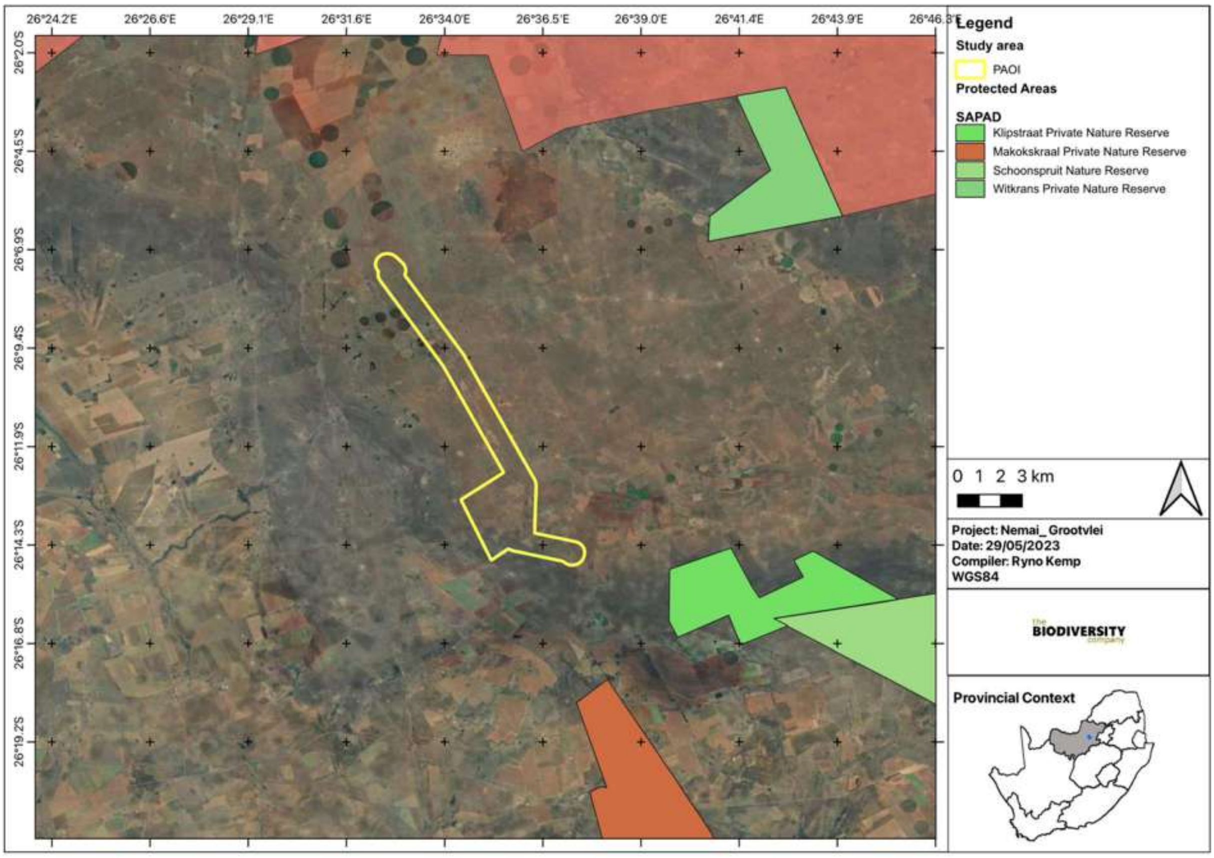

Figure 4-4 Map illustrating the Project Area of Influence (PAOI) in relation to Conservation and Protected Areas

4.1.1.5 National Protected Area Expansion Strategy

National Protected Area Expansion Strategy (NPAES) areas were identified through a systematic biodiversity planning process. They presented the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with a strong emphasis on climate change resilience and requirements for protecting freshwater ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases, only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for fine-scale planning, which may identify different priority sites based on local requirements, constraints and opportunities (DFFE, 2021). Relevant - The PAOI does overlap with NPAES areas (Figure 4-5).

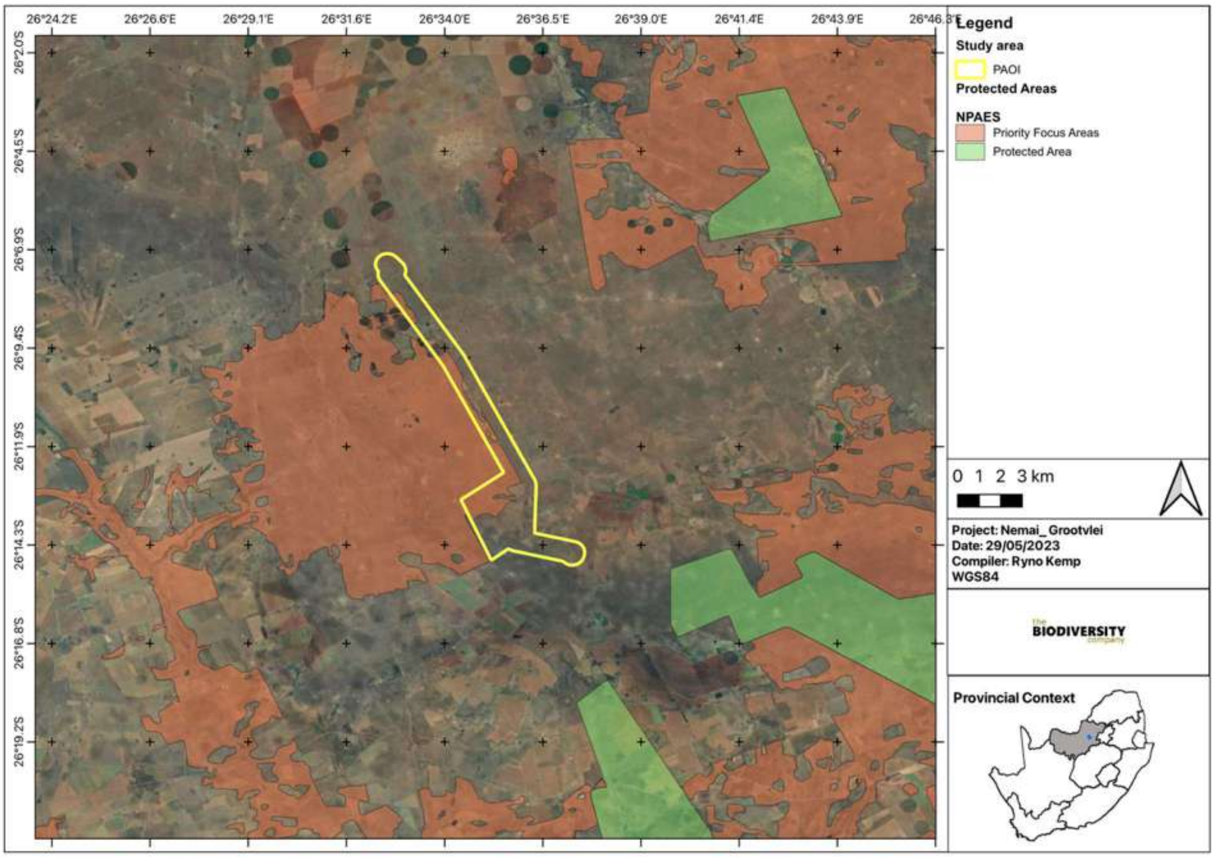

Figure 4-5 Map illustrating the Project Area of Influence (PAOI) in relation to NPAES Focus Areas

4.1.1.6 Important Bird and Biodiversity Area

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

According to Birdlife South Africa (2017), selecting IBAs is achieved by applying quantitative ornithological criteria grounded in up-to-date knowledge of the sizes and trends of bird populations. The criteria ensure that the sites selected as IBAs have true significance for the international conservation of bird populations and provide a common currency that all IBAs adhere to, thus creating consistency among and enabling comparability between sites at national, continental and global levels. Irrelevant - The PAOI does not overlap with any IBA (Figure 4-6).

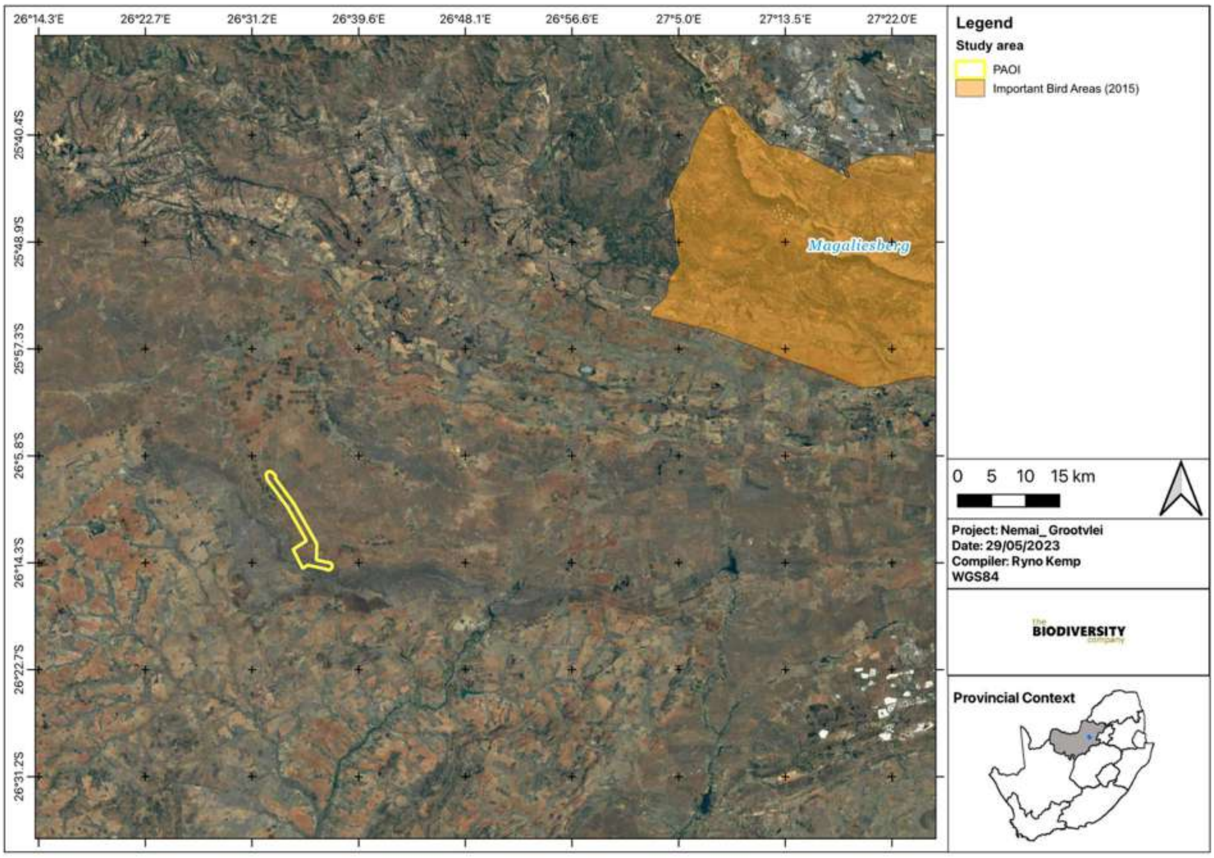

Figure 4-6 Map illustrating the locations of Important Bird and Biodiversity Areas proximal to the Project Area of Influence (PAOI)

4.1.1.7 Coordinated Avifaunal Roadcount (CAR)

The Animal Demographic Unit (ADU)/Cape bird club pioneered the avifaunal road counts of larger birds in 1993 in South Africa. Originally it was started to monitor the Blue Crane (*Anthropoides paradiseus*) and Denham's/Stanley's Bustard (*Neotis Denham*). Today it has been expanded to monitor 36 species of large terrestrial birds (cranes, bustards, korhaans and storks) along 350 fixed routes covering over 19 000 km. Road counts are carried out twice yearly in midsummer (the last Saturday in January) and midwinter (the last Saturday in July) using this standardised method. These counts are essential for conserving these larger species that are under threat due to habitat loss through land use changes, increases in crop agriculture and human population densities, poisoning, and man-made structures like powerlines. With the prospect of increasing wind and solar farms, using renewable energy sources and monitoring these species is most important (CAR, 2020). Irrelevant - The PAOI does not overlap with Coordinated Avifaunal Roadcount Routes (Figure 4-7).

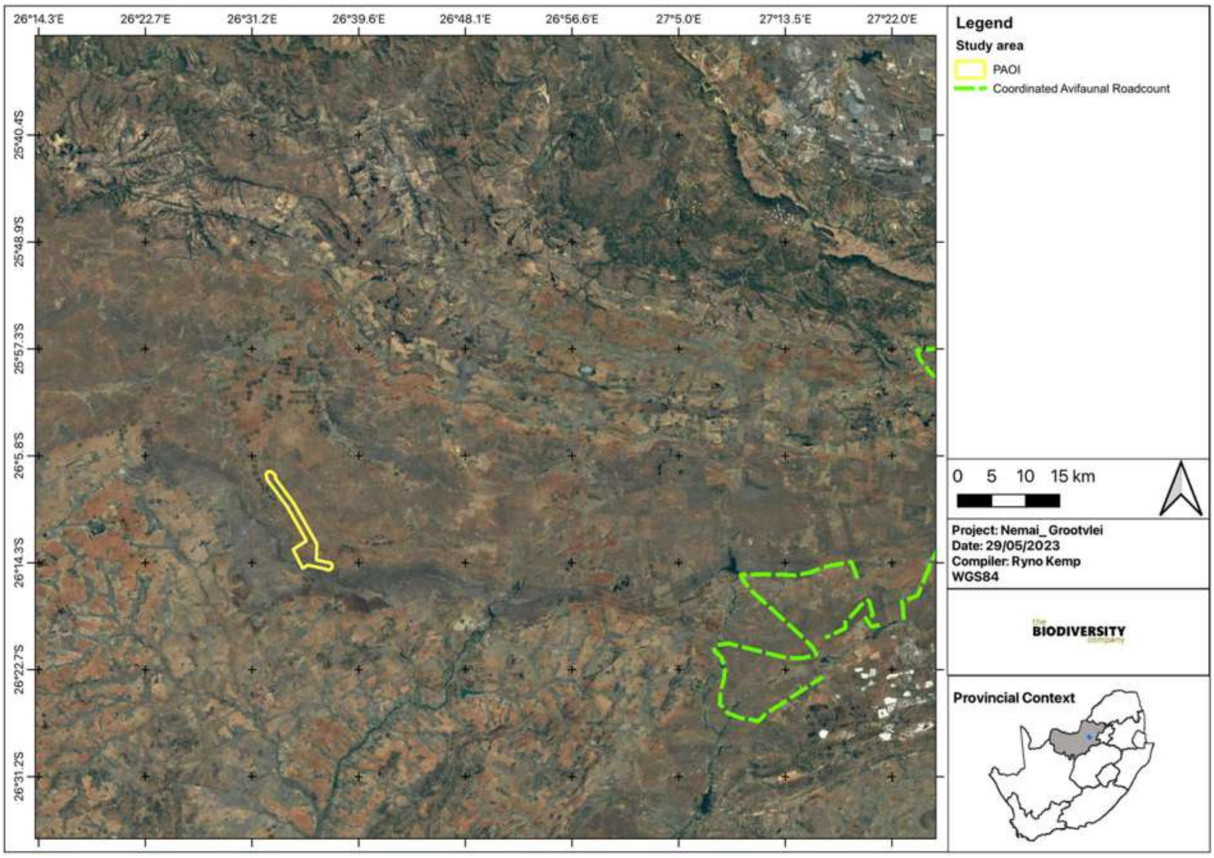

Figure 4-7 Map illustrating the locations of Coordinated Avifaunal Roadcount proximal to the Project Area of Influence (PAOI)

4.1.1.8 Coordinated Waterbird Count

The ADU launched the Coordinated Waterbird Counts (CWAC) project in 1992 as part of South Africa's commitment to international waterbird conservation. Regular mid-summer and mid-winter censuses are done to determine the various features of water birds, including population size, how waterbirds utilise water sources and determining the health of wetlands. For a full description of CWAC, please refer to http://cwac.birdmap.africa/about.php. Relevant - The PAOI is in close proximity to 3 Coordinated Waterbird Count sites (Figure 4-8).

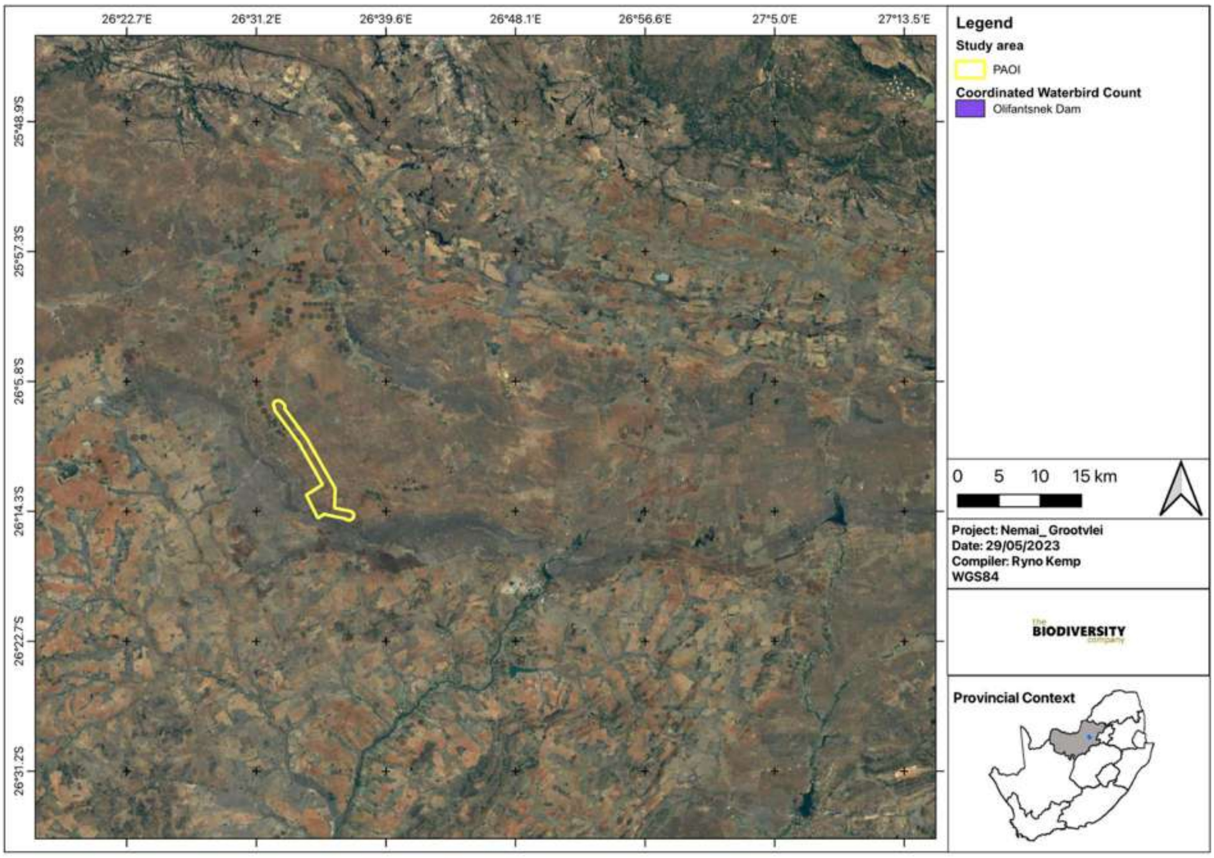

Figure 4-8 ***Map illustrating the locations of Coordinated Waterbird Counts proximal to the Project Area of Influence (PAOI)***

4.1.1.9 Hydrological Context

Irrelevant - The PAOI does not fall within any Strategic Water Source Areas (SWSA).

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was released with the NBA 2018. The ecosystem threat status (ETS) of the river and wetland ecosystem types is based on the extent to which each river ecosystem type has been altered from its natural condition. Ecosystem types are categorised as CR, EN, VU or LT, with CR, EN and VU ecosystem types collectively referred to as 'threatened' (Van Deventer et al., 2019; Skowno et al., 2019). Irrelevant - The PAOI does not overlap with any threatened wetlands and rivers (Figure 4-9).

In an attempt to better conserve aquatic ecosystems, South Africa has categorised its river systems according to set ecological criteria (i.e., ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver et al., 2011). The FEPAs are intended to be conservation support tools and are envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's (NEMBA) biodiversity goals (Nel et al., 2011). Relevant - The PAOI does not overlap with some FEPA wetlands (Figure 4-10).

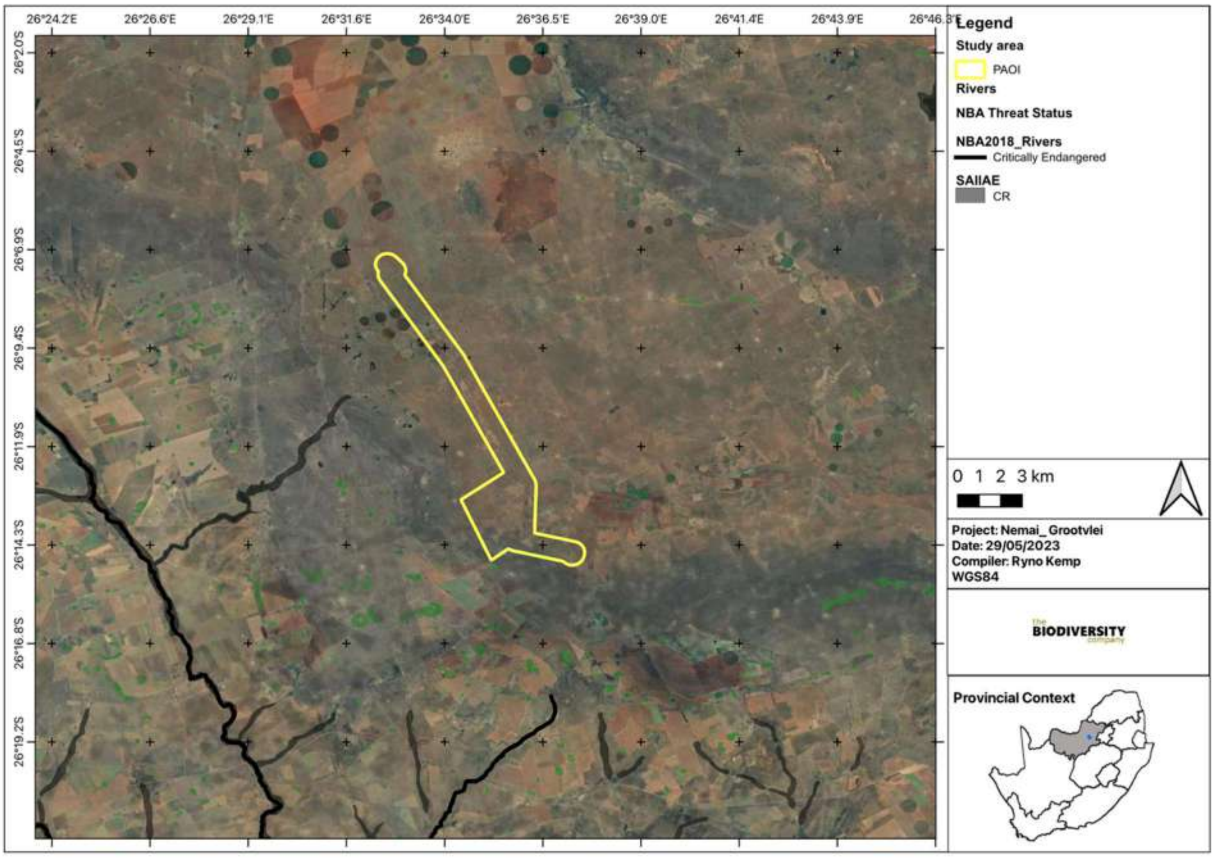

Figure 4-9 ***Map illustrating the Project Area of Influence (PAOI) in relation to South African Inventory of Inland Aquatic Ecosystems (SAIIAE) features***

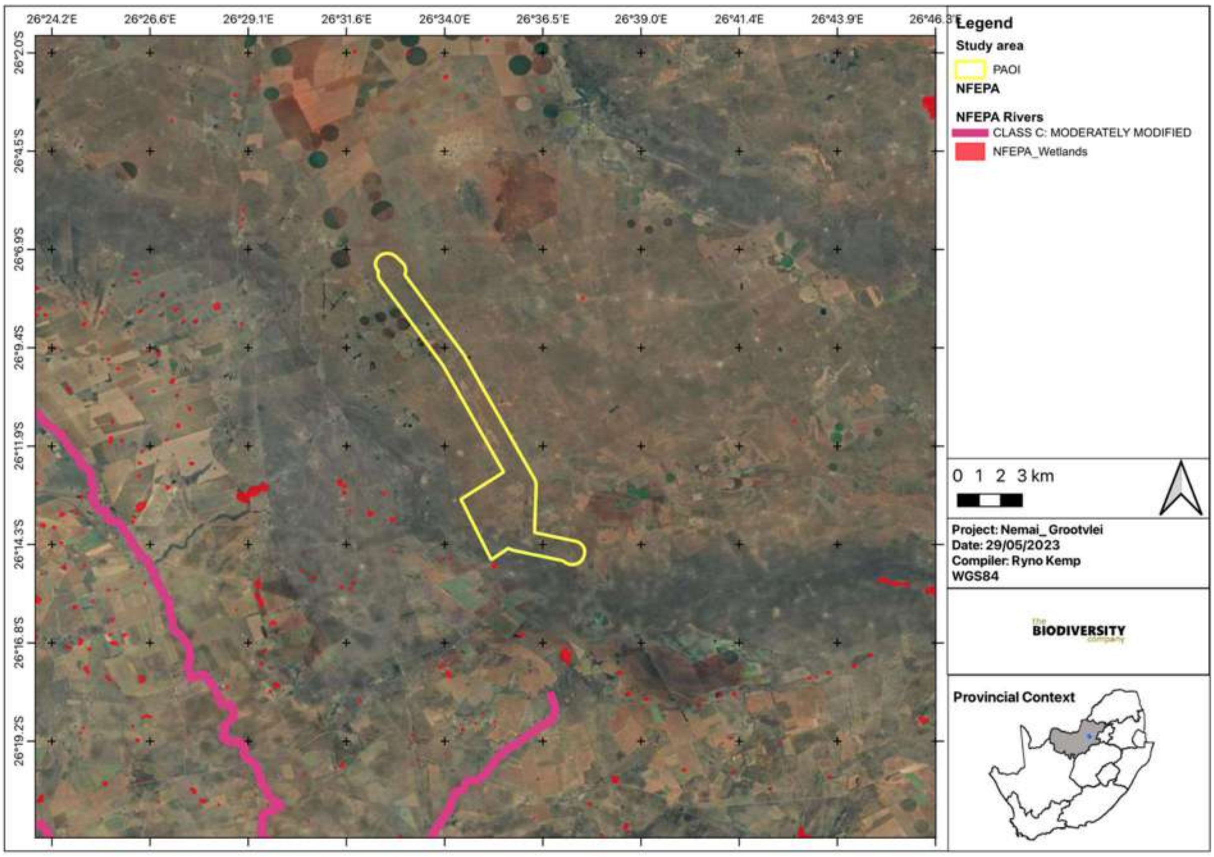

Figure 4-10 Map illustrating the Project Area of Influence (PAOI) in relation to the National Freshwater Ecosystem Priority Areas

4.1.1.10 Strategic Transmission Corridors (EGI)

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

On 29 April 2021, Minister Barbara Dallas Creecy published Government Notice No. 383 in Government Gazette No. 44504, which expanded the eastern and western transmission corridors and gave notice of the applicability of the application procedures identified in Government Notice No. 113, to these expanded corridors. More information on this can be obtained from https://egis.environment.gov.za/egi. Relevant - The PAOI overlaps with the EGI corridor. (Figure 4-11)

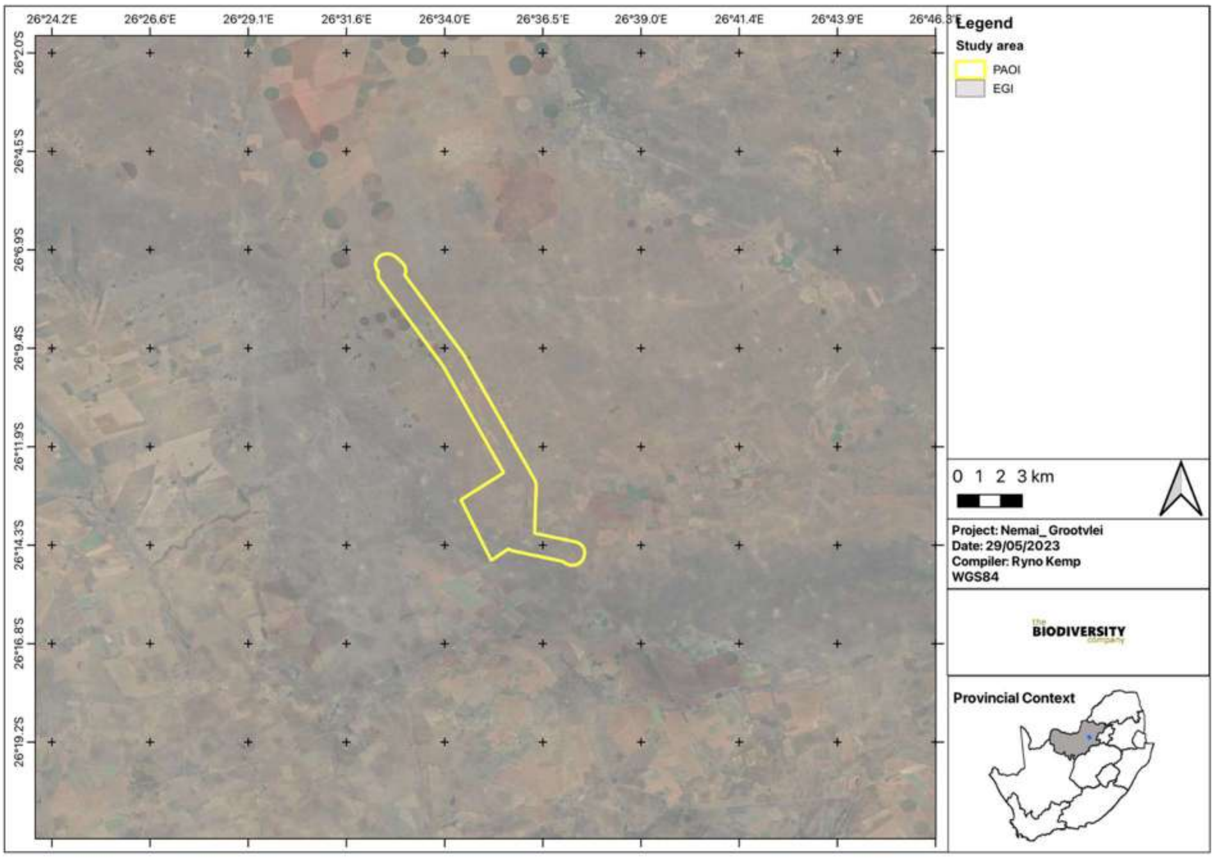

Figure 4-11 Map illustrating the locations of the Strategic Transmission Corridors proximal to the Project Area of Influence (PAOI)

4.1.1.11 Renewable Energy Development Zones (REDZ)

In 2018 the Government Notice No. 114 in Government Gazette No. 41445 was published where 8 renewable energy development zones important for the development of large-scale wind and solar photovoltaic facilities were identified. In 2021 an additional 3 sites were included. The REDZs were identified through the undertaking of 2 Strategic Environmental Assessments. Irrelevant - The PAOI does not overlap with any REDZ (Figure 4-12).

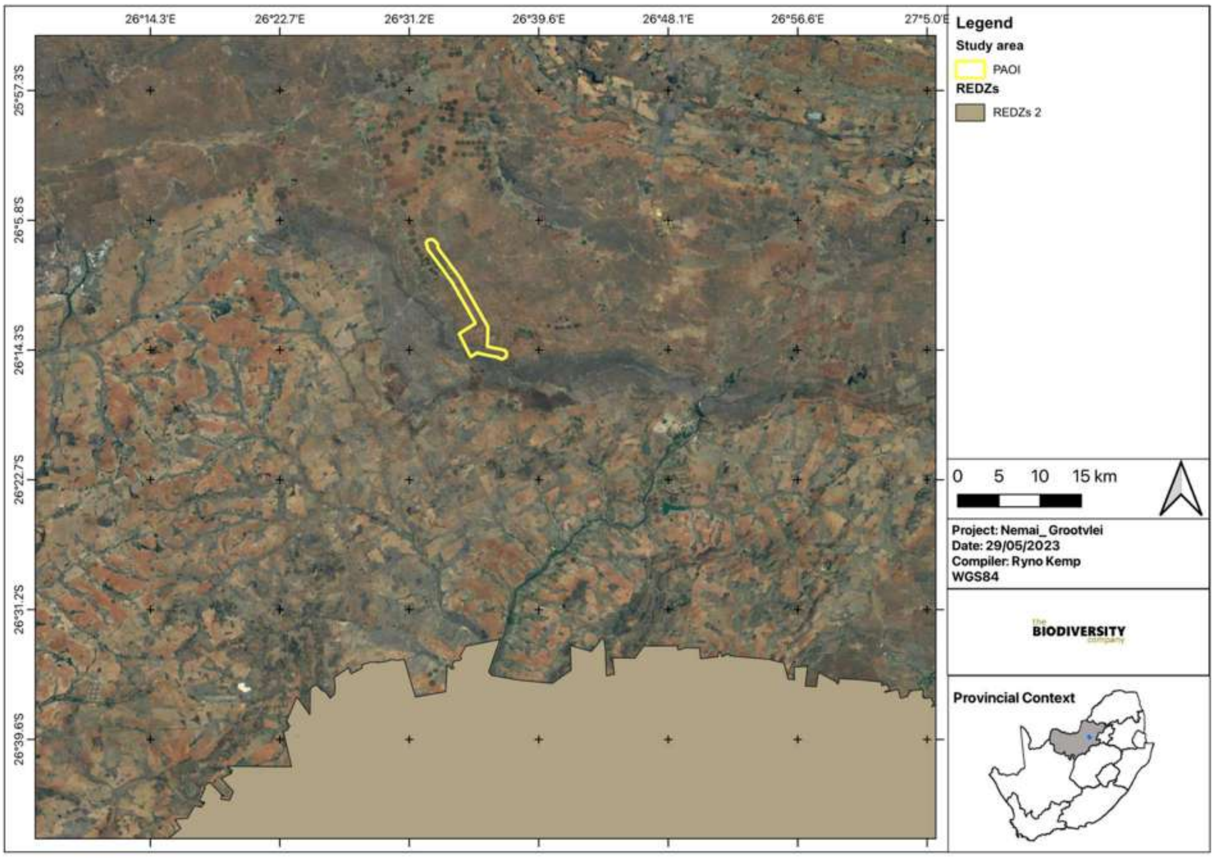

Figure 4-12 Map illustrating the locations of Renewable Energy Development Zones proximal to the Project Area of Influence (PAOI)

4.1.1.12 Renewable Energy EIA Application Database

The Renewable Energy Database (http://egis.environment.gov.za/), shows that there several other projects in the near vicinity (Figure 4-13). This increases the overall impact on the habitats in the area. Relevant - The PAOI is in close proximity to already approved REEA project (Figure 4-13).

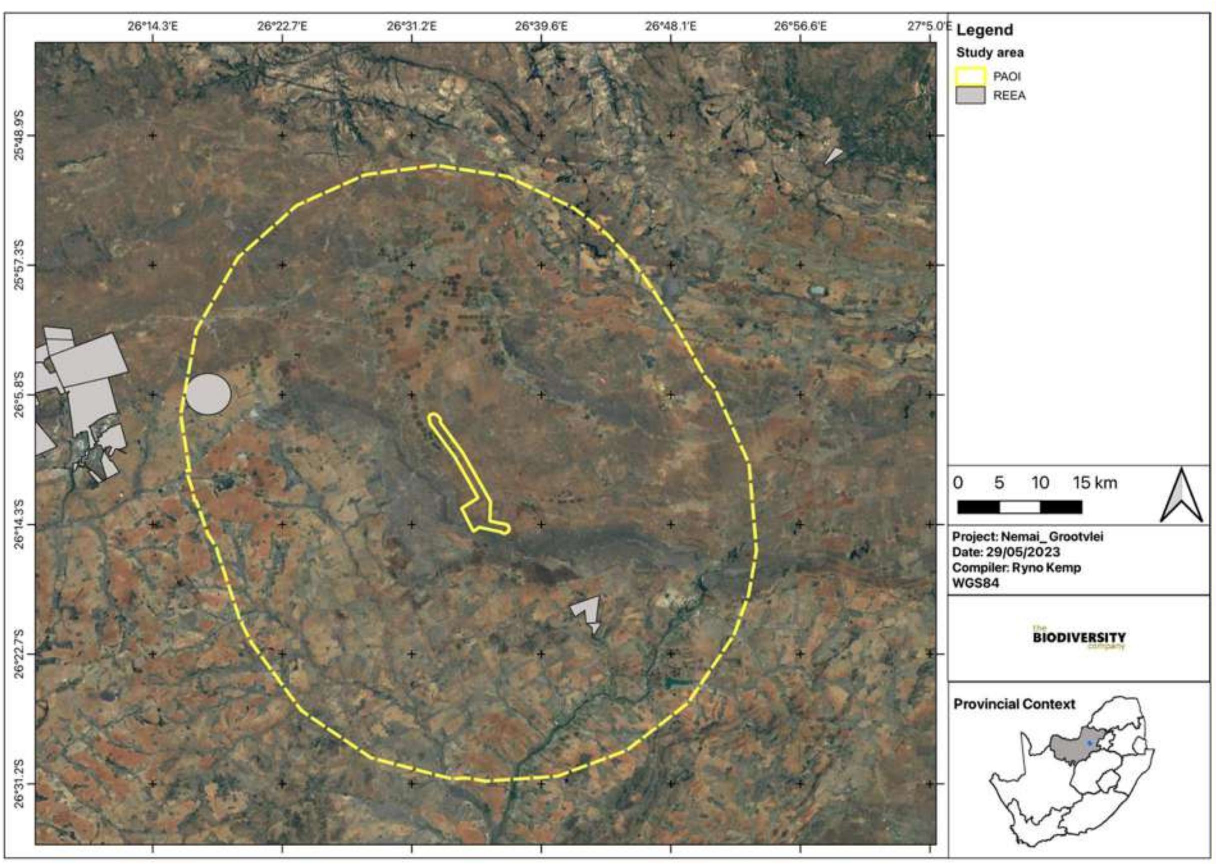

Figure 4-13 ***The PAOI in relation to the Renewable Energy EIA Application Database projects in the area.***

4.2 Expected Species of Conservation Concern

The SABAP2 Data lists 138 indigenous avifauna species that could be expected to occur within the PAOI and surrounding landscape (Figure 4-14; Appendix A). One 1) of these expected species is regarded as SCC (Table 4-2). These species are described below. However, this is not a true representation of the area.

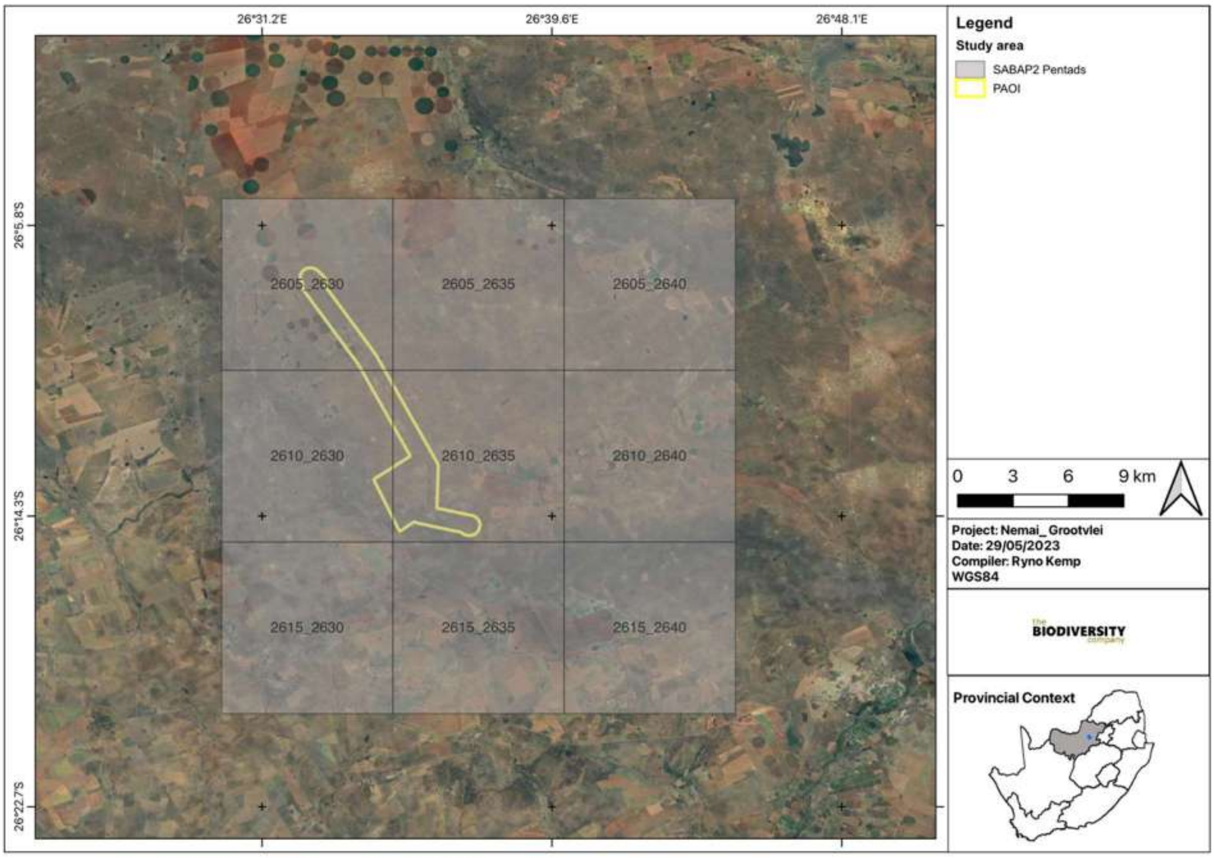

Figure 4-14 Map illustrating the SABAP2 pentads used to compile the expected species list

Table 4-2 Expected avifauna Species of Conservation Concern that are expected to occur within the PAOI. CR = Critically Endangered, EN = Endangered, LC = Least Concern, NT = Near Threatened and VU = Vulnerable

Scientific Name	Common Name	Conservation Status		Likelihood of Occurrence
		Regional	Global (IUCN)	
Sagittarius serpentarius	Secretarybird	VU	EN	Moderate

*(Taylor *et al*. 2015), + (IUCN 2021)

TBC (2022) reported a total 175 avifauna species within their 9 pentads, which could most likely occur at the proposed development. Three (3) were identified in their report (**Error! Reference source not found.**).

Table 4-3 List of bird species of regional or global conservation importance that are expected to occur in the project area (SABAP2, 2021; ESKOM, 2015; IUCN, 2021).

Scientific Name	Common Name	Conservation Status		Likelihood of Occurrence
		Regional	Global (IUCN)	
Ciconia abdimii	Stork, Abdim's	NT	LC	Moderate
Gyps coprotheres	Vulture, Cape	EN	EN	Low
Phoeniconaias minor	Flamingo, Lesser	NT	NT	Low

*(Taylor *et al*. 2015), + (IUCN 2021)

Sagittarius serpentarius (Secretarybird) occurs in sub-Saharan Africa and inhabits grasslands, open plains, and lightly wooded savanna. It is also found in agricultural areas and sub-desert (IUCN, 2017).

Ciconia abdimii (Abdim's Stork) is listed as NT on a local scale and the species is known to be found in open grassland and savanna woodland often near water but also in semi-arid areas, gathering beside pools and water-holes. They tend to roost in trees or cliffs (IUCN, 2017). The existence of wet areas creates the potential for this species to occur in the area but due to the proximity of the urban footprint, the high human density and the degraded state of the environment the likelihood of occurrence was rated as moderate.

Gyps coprotheres (Cape Vulture) is listed as EN on both a regional and global scale. Cape Vultures are long-lived carrion-feeders specialising on large carcasses, they fly long distances over open country, although they are usually found near steep terrain, where they breed and roost on cliffs (IUCN, 2017). Individuals may be seen foraging within the area but are unlikely to be resident. Likelihood of occurrence is rated as low.

Phoenicopterus minor (Lesser Flamingo) is listed as NT on a global and regional scale. This specie breed on large undisturbed alkaline and saline lakes, salt pans or coastal lagoons, usually far out from the shore after seasonal rains have provided the flooding necessary to isolate remote breeding sites from terrestrial predators and the soft muddy material for nest building (IUCN, 2017). Due to the absence of its preferred habitat within the project area, combined the proximity of the urban area, the likelihood of occurrence is low.

4.3 Field Assessment

4.3.1 Species List of the Field Survey

Only one site visit was conducted but supplemented by another project ~ 15 southeast of the proposed development for this regime 2 assessment. The field investigation was conducted in Autumn, over 4 days from the 21st to the 24th of April 2023 (Appendix B). This site visit, besides supplementary reports and data, is considered sufficient from a seasonal perspective. This site was assessed between 27 and 29 July 2021 and 1-3 April 2022 (Appendix C). The total number of individual species accounts for approximately 42.75% of the total number of expected species

No SCC was recorded within the PAOI during the survey period within point counts and no SCC were observed during the surveying period of the other studies (TBC, 2022).

4.3.1.1 Risk Species

As aforementioned, Priority Species are considered threatened, rare or prone to impacts from energy development (Ralston Paton *et al*, 2017). TBC has defined Risk Species as those species that are listed in Ralston Paton *et al* (2017) as Priority Species, as well as those listed in the Eskom poster of Birds and Power Lines (Eskom and EWT, no date), which together include all species, common or red-listed that may be at risk of collision, electrocution or habitat loss as a result of the proposed activity. Ten (10) of the species observed within the PAOI are regarded as priority species (Table 4-4).

Table 4-4 Summary of Priority Species recorded within and around the proposed development

Scientific Name	Common Name	Sources	Collision	Electrocution	Disturbance/Habitat Loss
Afrotis afraoides	Northern Black Korhaan	X	X		X
Alopochen aegyptiaca	Egyptian Goose	O	X	X	
Anas sparsa	African Black Duck	O	X		
Ardea alba	Great Egret	O	X	X	
Ardea cinerea	Grey Heron	O	X	X	
Bubo africanus	Spotted Eagle-Owl	X	X	X	X
Elanus caeruleus	Black-winged Kite	X		X	
Falco rupicoloides	Greater Kestrel	X		X	
Mirafra cheniana	Melodious Lark	X			X
Tadorna cana	South African Shelduck	O	X		

4.3.1.2 Dominant Species

Table 4-5 provides the relative abundance of the dominant species as well as the frequency with which each species appeared in the point count samples. The most abundant species was the Corvus albus (Pied Crow), with a relative abundance of 0.155 and a frequency of occurrence of 23.077% (Table 4-5). Additional ubiquitous species was *Afrotis afraoides* (Northern Black Korhaan), with a frequency of occurrence of 48.077%, respectively.

Table 4-5 Relative abundance and frequency of occurrence of dominant avifauna species recorded during the standardised point counts within and around the proposed development during the field survey.

Scientific Name	**Common Name**	**Relative abundance**	**Frequency**
Corvus albus	Pied Crow	0.155	23.077
Afrotis afraoides	Northern Black Korhaan	0.120	48.077
Ortygospiza atricollis	Quailfinch	0.067	19.231
Macronyx capensis	Cape Longclaw	0.060	26.923
Anthus cinnamomeus	African Pipit	0.039	21.154
Eremopterix verticalis	Grey-backed Sparrow-Lark	0.039	3.846
Quelea quelea	Red-billed Quelea	0.039	1.923
Vanellus coronatus	Crowned Lapwing	0.035	9.615
Pternistis swainsonii	Swainson's Spurfowl	0.035	5.769
Sporopipes squamifrons	Scaly-feathered Weaver	0.028	5.769
Spizocorys conirostris	Pink-billed Lark	0.028	3.846
Bubulcus ibis	Western Cattle Egret	0.021	5.769
Colius striatus	Speckled Mousebird	0.021	1.923
Vanellus armatus	Blacksmith Lapwing	0.014	3.846
Alopochen aegyptiaca	Egyptian Goose	0.014	1.923
Euplectes orix	Southern Red Bishop	0.014	1.923
Ploceus velatus	Southern Masked Weaver	0.011	1.923
Falco rupicoloides	Greater Kestrel	0.011	5.769
Anas sparsa	African Black Duck	0.011	1.923
Elanus caeruleus	Black-winged Kite	0.007	3.846
Oenanthe pileata	Capped Wheatear	0.007	3.846
Oena capensis	Namaqua Dove	0.007	1.923
Columba guinea	Speckled Pigeon	0.007	3.846
Cisticola juncidis	Zitting Cisticola	0.007	3.846
Cisticola aridulus	Desert Cisticola	0.007	3.846
Chersomanes albofasciata	Spike-heeled Lark	0.007	1.923
Cisticola chiniana	Rattling Cisticola	0.007	3.846
Calendulauda sabota	Sabota Lark	0.007	3.846
Coturnix coturnix	Common Quail	0.004	3.846
Ardea cinerea	Grey Heron	0.004	1.923
Streptopelia capicola	Ring-necked Dove	0.004	1.923
Anthus leucophrys	Plain-backed Pipit	0.004	1.923
Cisticola ayresii	Wing-snapping Cisticola	0.004	1.923
Riparia cincta	Banded Martin	0.004	1.923
Cypsiurus parvus	African Palm Swift	0.004	1.923

Euplectes ardens	Red-collared Widowbird	0.004	1.923

4.3.1.3 Trophic Guilds

Trophic guilds are defined as a group of species that exploit the same class of environmental resources in a similar way (González-Salazar *et al,* 2014). The guild classification used in this assessment is as per González-Salazar *et al* (2014); they divided avifauna into 13 major groups based on their diet, habitat, and main area of activity. Although species to tend to exhibit varied diet with invertivores consuming fruit and frugivores consuming insects for example, the dominant composition of the diet was considered.

The analysis of the major avifaunal guilds reveals that the species composition during the survey was dominated by invertivores birds that feed on the ground during the day (IGD). Followed by Granivores (GGD) (Figure 4-15). The species composition is spread throughout the various groups.

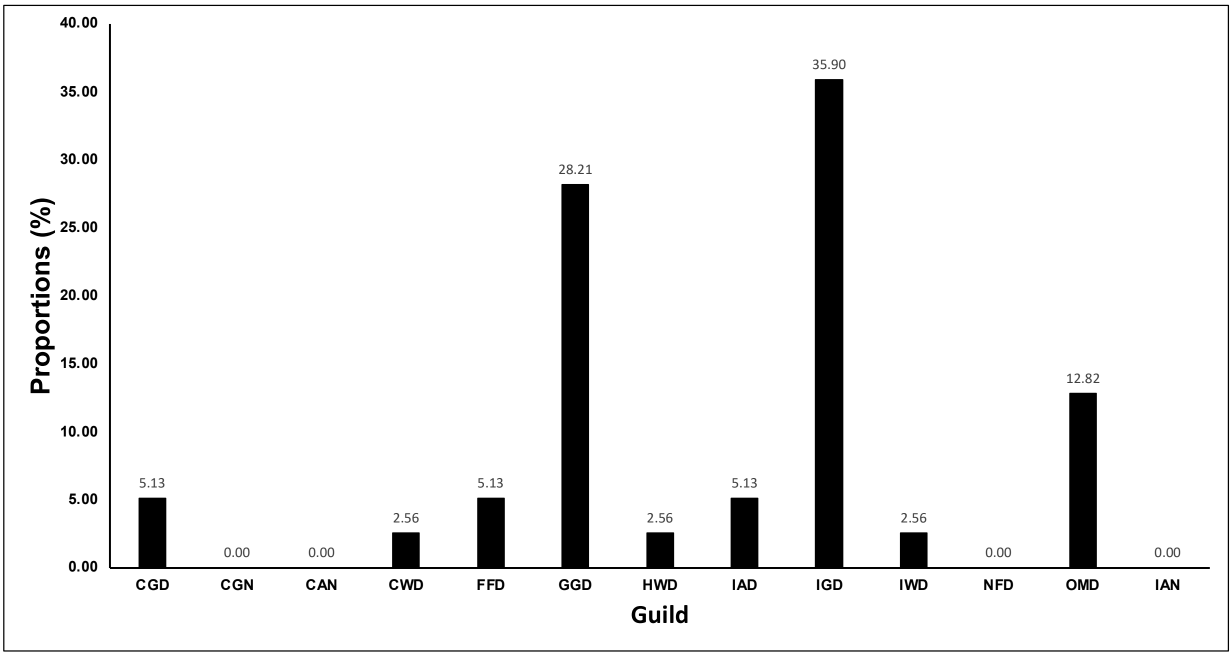

Figure 4-15 Column plot illustrating the proportion of each Functional Feeding Guild to the total abundance. Avifaunal trophic guilds – CGD, Carnivore Ground Diurnal; CGN, Carnivore Ground Nocturnal, CAN, Carnivore Air Nocturnal, CWD, Carnivore Water Diurnal; FFD, Frugivore Foliage Diurnal; GGD, Granivore Ground Diurnal; HWD, Herbivore Water Diurnal; IAD, Invertivore Air Diurnal; IGD, Insectivore Ground Diurnal; IWD, Invertivore Water Diurnal; NFD, Nectivore Foliage Diurnal; OMD, Omnivore Multiple Diurnal; IAN, Invertivore Air Nocturnal.

4.3.1.4 Flight and Nest Analysis

Observing and monitoring flight paths and nesting sites of SCC and/or priority species are important in ascertaining habitat sensitivity and evaluating the impact risk significance of any proposed development. Flight analysis is also important for species that exhibit diel movement between roosting and foraging sites to prevent the risk of collision with infrastructure. A very condensed version of flight path analysis was done, the aim of this was to determine if there is a general direction of most birds on site. This section needs to be interpreted cautiously based on the limited time spent on this component.

No specific flight paths were noted.

No confirmed nest sites were recorded during the second assessment; this is mainly attributed to the point count analysis protocol, which allows for accurate sampling of the avifauna but does not exhaustively cover the site locating nests.

4.4 Fine-Scale Habitat Use

Fine-scale habitats within the landscape are important in supporting a diverse avifauna community as they provide differing nesting, foraging and reproductive opportunities. Four different habitat types were delineated within the PAOI, comprising of Non-perennial rivier and water sources, degraded Grassland and Modified landscape.

4.4.1 Grasslands

Grassland habitat comprised grassland with interspersed bushes and trees some of which formed clumps (described as bush clumps). Grassland provides foraging for seed-eating species as well as roosting areas for some species. This grassland habitat hosts species such as Pin-tailed Whydah (Vidua macroura), African Stonechat (Saxicola torquatus), Common Waxbill (Estrilda astrild), Ant-eating Chat (Myrmecochla formicivore), Northern Black Korhaan (Afrotis afraoides) and Eastern Clapper Lark (Mirafra fasciolata) among others.

Figure 4-16 Photograph illustrating an example of intact grasslands observed in the PAOI

4.4.2 Degraded Grassland

This habitat unit can be regarded as important, not only within the local landscape, but also regionally. The unit functions as remaining greenlands which supports viable indigenous plant species populations and is also used for foraging. The unit also serves as a movement corridor for fauna within a landscape mainly fragmented by agricultural practices. Avifauna species utilising this habitat type included, but not limited to *Sagittarius serpentarius* (Secretarybird), *Bubulcus ibis* (Western Cattel Egret), *Euplectes progne* (Long-tailed Widowbird), *Cisticola juncidis* (Zittign Cisticola), *Vanellus coronatus* (Crowned Lapwing), *Numida melaegis* (Helmeted guineafowl) and *Afrotis afraoides* (Northern Black Korhaan).

Figure 4-17 Photograph illustrating an example of the Degraded grassland habitat observed in the PAOI

4.4.3 Transformed Areas (Old lands, Agricultural and modified)

The Modified Area consisted primarily of urban development and existing electricity infrastructure and roads (Figure 4-18). These areas were mostly void of avifauna species, with the species recorded here being those resilient to disturbance. Species occurring here included *Vanellus armatus* (Blacksmith Lapwing), *Lamprotornis nitens* (Cape Glossy Starling), *Passer melanurus* (Cape Sparrow), *Streptopelia capicola* (Cape Turtle Dive), *Acridotheres tristis* (Common Myna), and *Dicrurus adsimilis* (Fork-tailed Drongo).

Figure 4-18 Photograph illustrating an example of the transformed habitats observed in the broader assessment area

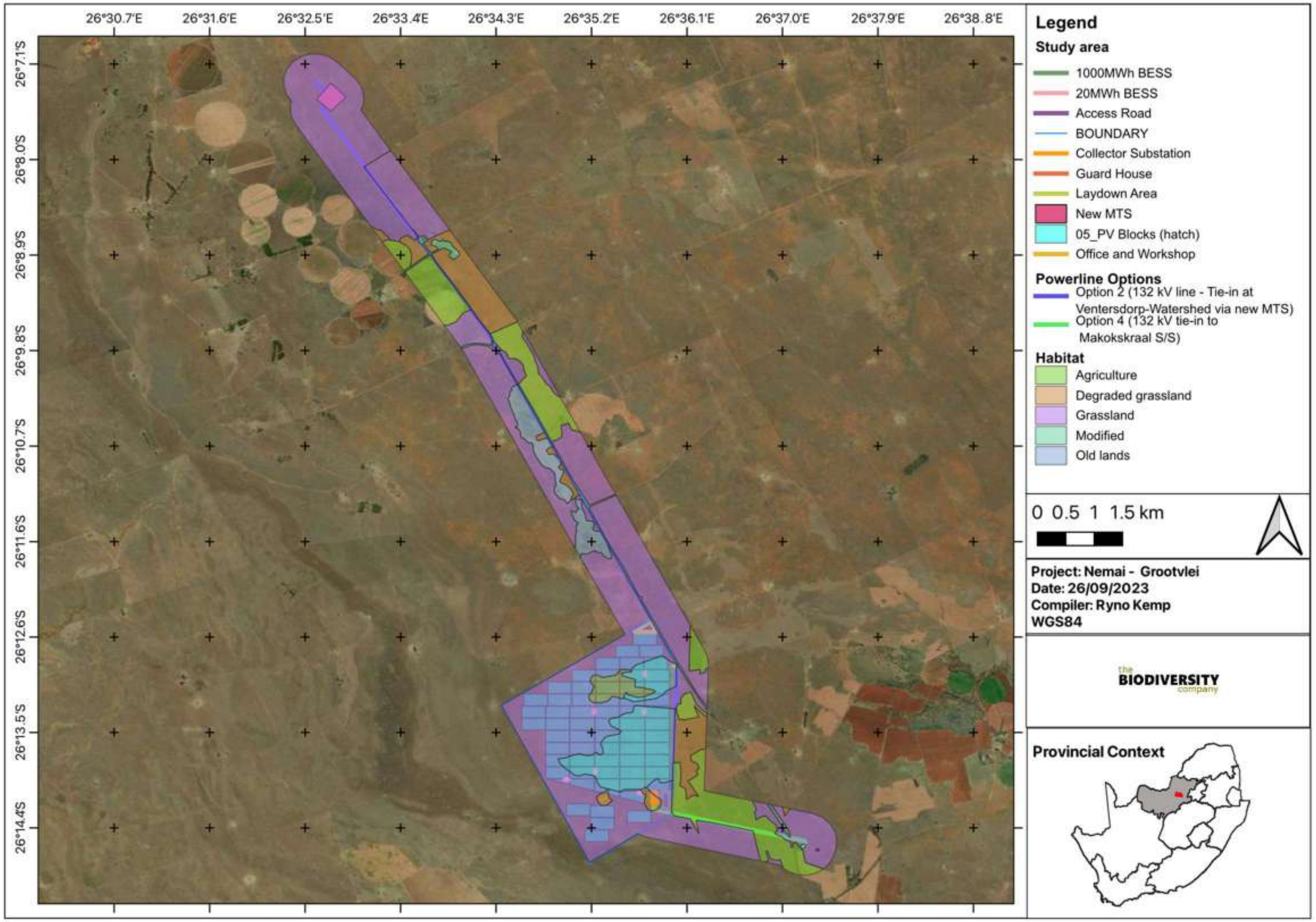

Figure 4-19 Map illustrating the habitat types delineated within the proposed development PAOI

5 Site Ecological Importance (SEI)

5.1 Environmental Screening Tool

The terrestrial biodiversity theme sensitivity as indicated by the screening tool report for the project area of influence was derived to be 'Very High' as the proposed development PAOI overlaps with CBA2 and Ecological supporting areas (Figure 5-1).

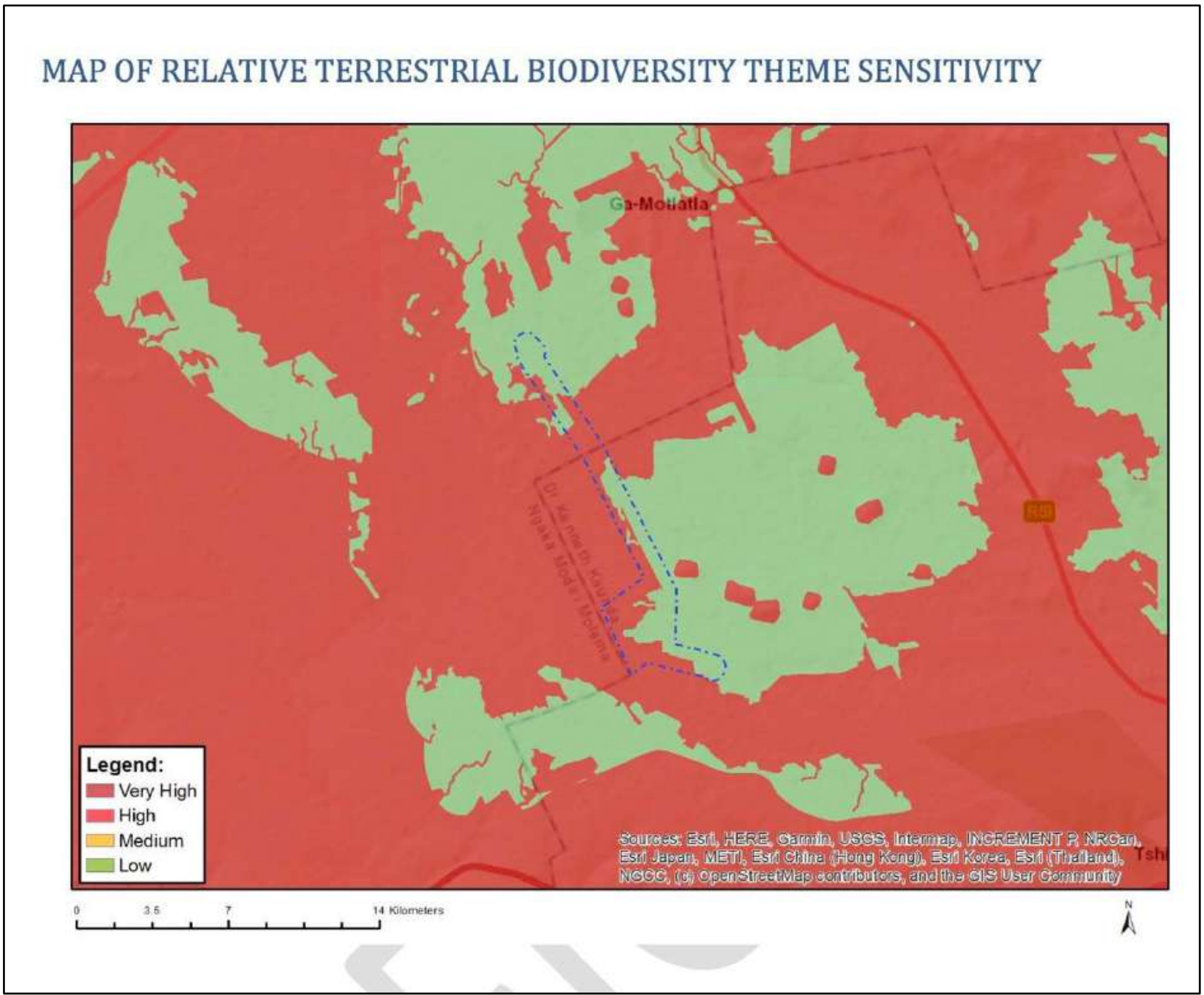

Figure 5-1 Terrestrial Biodiversity Theme Sensitivity for the PAOI, National Web based Environmental Screening Tool

As indicated in the screening report, the Animal Species Theme sensitivity was derived from being 'High' for the PAOI (Figure 5-2). The medium sensitivity for a portion of the project area was due to the likely presence of *Eupodotis senegalensis* (White-bellied Korhaan).

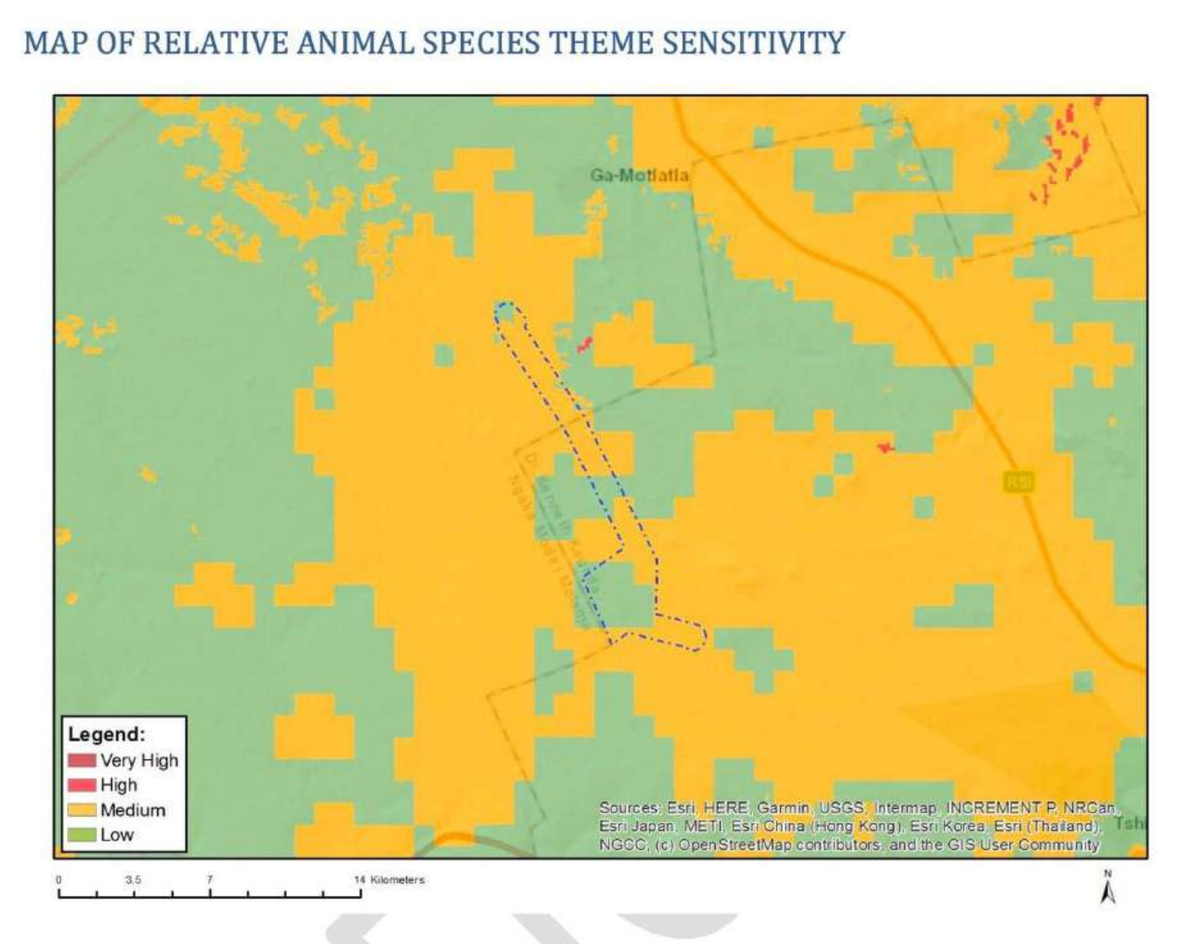

Figure 5-2 Fauna Theme Sensitivity for the PAOI, National Web based Environmental Screening Tool

5.2 Site Ecological Importance (SEI)

Based on the criteria provided in Section 3.4 of this report, all habitats within the assessment area of the proposed project were allocated a sensitivity or SEI category (Table 5-1).The SEI of the PAOI within an avifauna context was based on both the field results and desktop information. The SEI of the habitat types delineated is illustrated in Figure 5-3. The degraded grassland was given a medium rating based on the high likelihood of supporting SCCs. Only three SCC was recorded close to the PAOI, but a medium diversity of species in the Degraded Grasslands and Open Savannah was assigned a medium SEI and the modified area a very low SEI.

Table 5-1 SEI Summary of habitat types delineated within field assessment area of project area

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance	Site Ecological Importance (SEI) Guidelines for interpreting SEI in the context of the proposed development activities
Grasslands	Medium	High	**Medium**	Medium	**Medium**	Minimisation and restoration mitigation – development activities of medium
	> 50% of receptor contains natural habitat	Only minor current negative ecological impacts with no		Will recover slowly (~ more than 10 years) to		

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance	Site Ecological Importance (SEI) Guidelines for interpreting SEI in the context of the proposed development activities
	with potential to support SCC.	signs of major past disturbance and good rehabilitation potential.		restore > 75% of the original species composition and functionality of the receptor functionality		impact acceptable followed by appropriate restoration activities.
Degraded Grassland	Medium	Medium	**Medium**	Medium	**Medium**	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
	> 50% of receptor contains natural habitat with potential to support SCC.	Mostly minor current negative ecological impacts with some major impacts and a few signs of minor past disturbance. Moderate rehabilitation potential.		Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality		
Old Lands	Medium	Low	**Medium**	High	**Low**	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
	> 50% of receptor contains natural habitat with potential to support SCC.	Several minor and major current negative ecological impacts.		Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor		
Agriculture	Low	Low	**Low**	High	**Low**	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
	< 50% of receptor contains natural habitat with limited potential to support SCC.	Several minor and major current negative ecological impacts.		Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor		
Modified	Very Low	Very Low	**Very Low**	Very High	**Very Low**	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.
	No confirmed and highly unlikely populations of SCC. No confirmed and highly unlikely populations of range-restricted species. No natural habitat remaining.	Several major current negative ecological impacts.		Habitat that can recover rapidly		

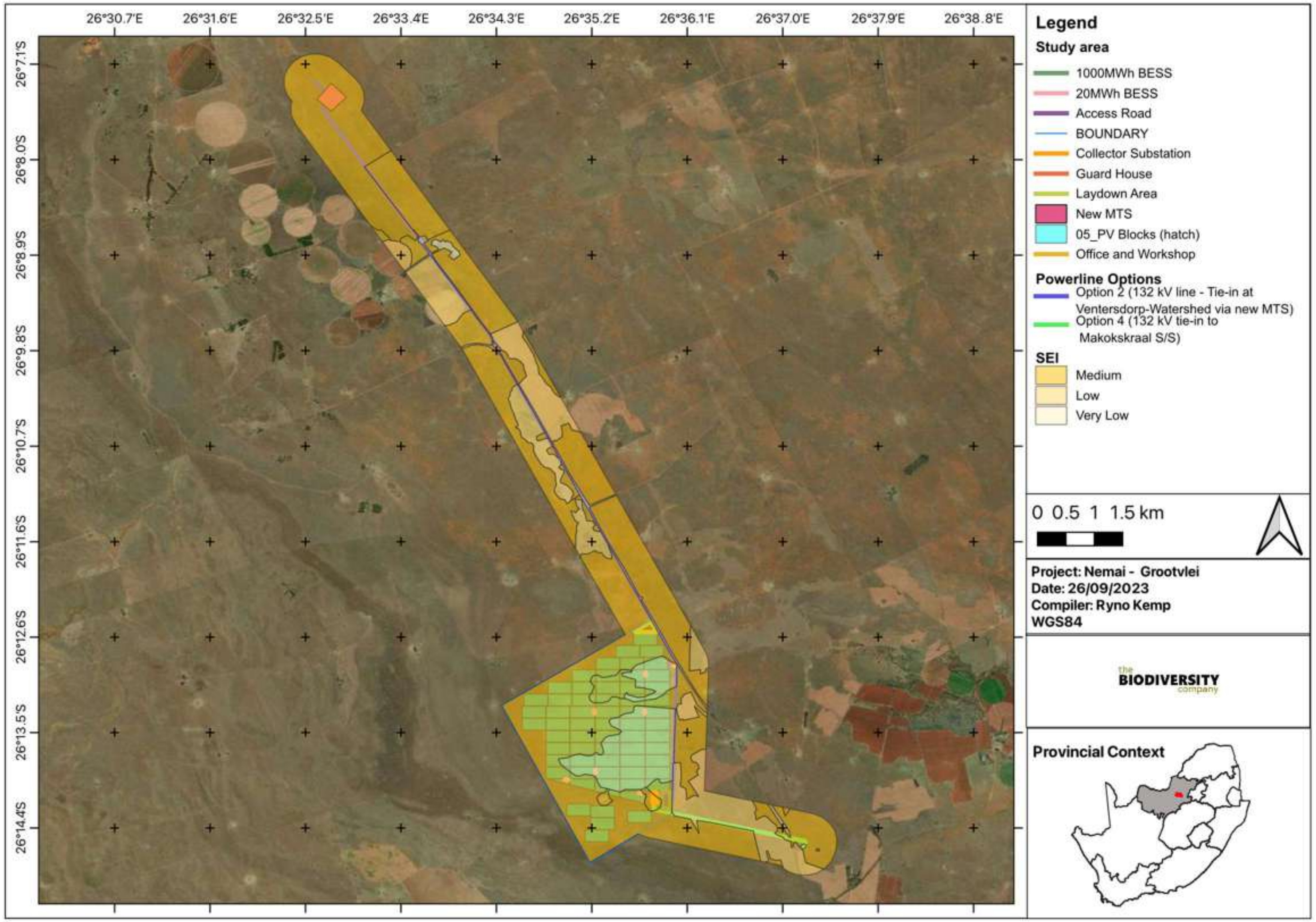

Figure 5-3 Map illustrating the Site Ecological Importance of the proposed development within an avifauna context

6 Impact Assessment

Potential impacts were evaluated against the data captured during the fieldwork and from a desktop perspective to identify relevance to the project site, specifically the proposed development footprint area. The assessment of the significance of direct, indirect and cumulative impacts was undertaken. Bennun *et al* (2021) describes three broad types of impacts associated with solar energy development:

- Direct impacts – Impacts that result from project activities or operational decisions that can be predicted based on planned activities and knowledge of local biodiversity, such as habitat loss under the project footprint, habitat fragmentation as a result of project infrastructure and species disturbance or mortality as a result of project operations.
- Indirect impacts – Impacts induced by, or 'by-products' of, project activities within a project's area of influence.
- Cumulative impacts – Impacts that result from the successive, incremental and/or combined effects of existing, planned and/or reasonably anticipated future human activities in combination with project development impacts.

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

- Construction Phase;
- Operational Phase; and
- Closure/Rehabilitation Phase.

6.1 Present Impacts to Avifauna

In consideration that there are anthropogenic activities and influences are present within the landscape, there are several negative impacts to biodiversity, including avifauna (Figure 6-1). These include:

- Existing energy infrastructure;
- Noise pollution;
- Minor and major gravel roads and associated vehicle traffic;
- Invasive Alien Plants;
- Livestock agriculture; and
- Fences and associated infrastructure.

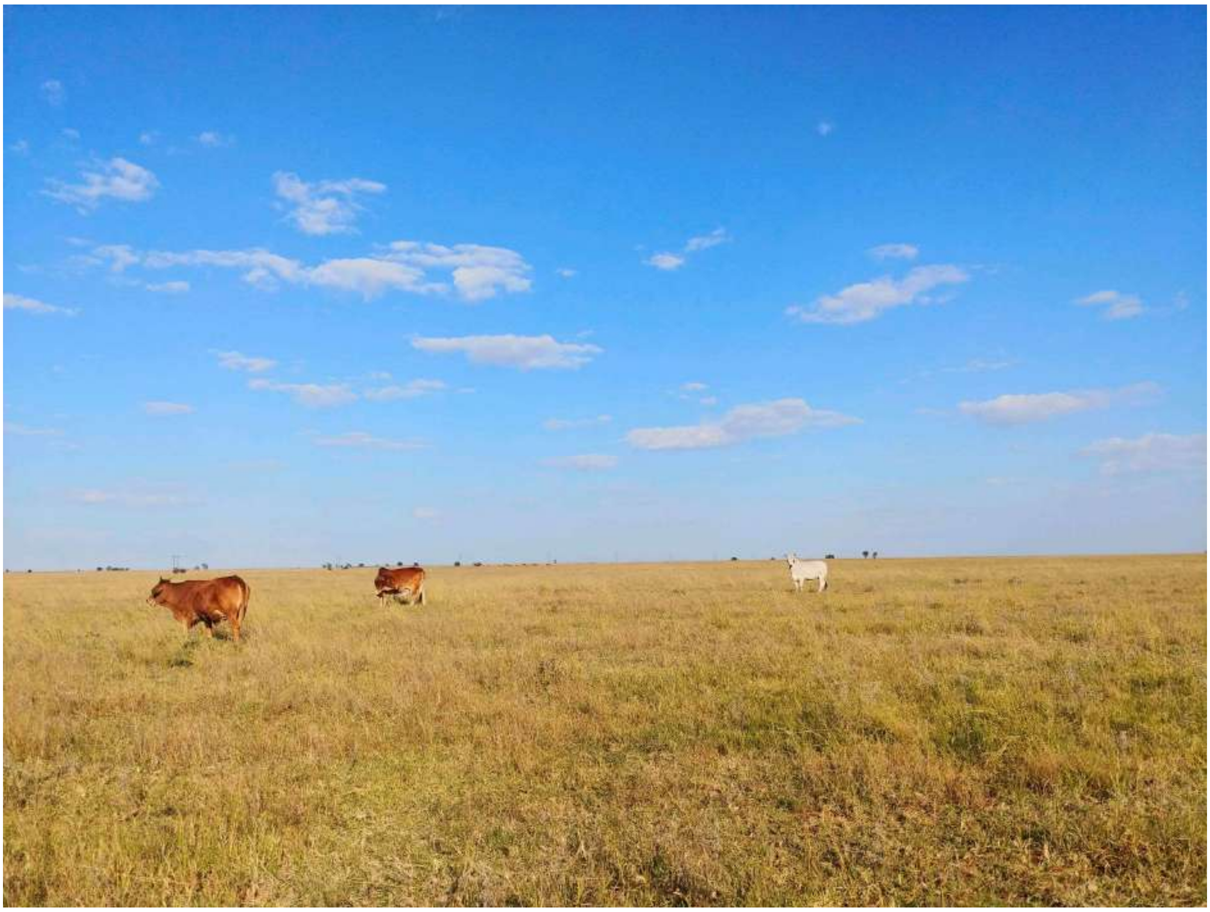

Figure 6-1 Photograph illustrating an example of impacts observed within the proposed development.

6.2 Anticipated Impacts

This section describes the potential impacts on avifauna associated with the construction and operational phases of the proposed development and is only relevant to the PV site and associated infrastructure.

During the construction phase vegetation clearing for the associated infrastructure will lead to direct habitat loss. Vegetation clearing will create a disturbance and will therefore potentially lead to the displacement of avifaunal species. The operation of construction machinery on site will generate noise pollution. Increased human presence can lead to poaching and the increase in vehicle traffic and heavy machinery will potentially lead to roadkill.

The principal impacts of the operational phase are electrocution, collisions, fencing, chemical pollution due to chemical cleaning of the PV panels and habitat loss. Solar panels have been implicated as a potential risk for bird collisions. Collisions are thought to arise when birds (particularly waterbirds) mistake the panels for waterbodies, known as the “lake effect” (Lovich & Ennen, 2011), or when migrating or dispersing birds become disorientated by the polarised light reflected by the panels. This “lake-effect” hypothesis has not been substantiated or refuted to date (Visser *et al,* 2019). It can however be said that the combination of powerlines, fencing and large infrastructure will influence avifauna species. Visser *et al* (2019) performed a study at a utility-scale PV SEF in the Northern Cape and found that most of the species affected by the facility were passerine species. This is due to collisions with solar panels from underneath. During a predator attack while foraging under the panels, individuals may alight and then collide with the panel. Larger species were said to be more influenced by the facilities when they were found foraging close by and were disturbed by predators which resulted in collisions with infrastructure.

Large passerines are particularly susceptible to electrocution because owing to their relatively large bodies, they are able to touch conductors and ground/earth wires or earthed devices simultaneously. The chances of electrocution are increased when feathers are wet, during periods of high humidity or during defecation. Prevailing wind direction also influences the rate of electrocution casualties.

Fencing of the PV site can influence birds in six ways (BirdLife South Africa, 2015):

- Snagging – occurs when a body part is impaled on one or more barbs or razor points of a fence;
- Snaring – when a bird’s foot/leg becomes trapped between two overlapping wires;
- Impact injuries – birds flying into a fence, the impact may kill or injure the bird;
- Snarling – when birds try and push through a mesh or wire stands, ultimately becoming trapped (uncommon);
- Electrocution – electrified fence can kill or severely injure birds; and
- Barrier effect – fences may limit flightless birds including moulting waterfowl from resources.

Chemical pollution from PV cleaning, if not environmentally friendly will result in either acute or chronic affects. Should this chemical penetrate into the surrounding environment, it would impact populations on a larger scale and not just species found in and around the PV footprint.

6.3 Alternatives considered

Grid Connection: Option 1 which consists of 2 x 132kV powerlines, approximately 14 kilometres (km) in length, from the new facility 33kV substation to new 400/132kV Main Transmission Substation (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line or Option 2 that comprises of 2.8km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation.

6.1 Loss of Irreplaceable Resources

The proposed development will lead to the loss of the following irreplaceable resources:

- Habitat and possible nesting sites for avifauna SCC.

6.2 Assessment of Impact Significance

The assessment of impact significance considers pre-mitigation as well as implemented of post-mitigation scenarios. Although different species and groups will react differently to the development, the risk assessment was undertaken bearing in mind the potential impacts to the priority species listed in this report.

6.2.1 Construction Phase

6.2.1.1 Habitat destruction within the project footprint

Habitat destruction of the proposed development is inevitable. Pre-mitigation the significance of the impact is a Negative Very High Impact but with the implementation of mitigation measures can be reduced to a Negative Medium Impact.

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	4	3	2	4	3	3	
Local/district: Will affect the local area or district.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Complete loss of resources: The impact is result in a complete loss of all resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	**Negative High Impact**
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
1	4	3	2	4	3	2	
Site: The impact will only affect the site.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Complete loss of resources: The impact is result in a complete loss of all resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Medium Impact**

Mitigation Actions:

- Solar panels must be mounted on pile driven or screw foundations, such as post support spikes, rather than heavy foundations, such as trench-fill or mass concrete foundations, to reduce the negative effects on natural soil functioning, such as its filtering and buffering characteristics, while maintaining habitats for both fossorial and epigeic biodiversity (Bennun et al, 2021). If concrete foundations are used that would increase the impact of the project as there would be direct impacts to soil permeability and characteristics, thereby influencing inhabitant fauna. In addition, stormwater runoff and runoff from cleaning the panels would be increased, increasing erosion in the surrounding areas;

- Indigenous vegetation to be maintained under the solar panels to ensure biodiversity is maintained and to prevent soil erosion (Beatty et al, 2017; Sinha et al, 2018). The photographs below are sourced from these documents;


- Vegetation clearing to commence only after the necessary permits have been obtained;

- Environmental Officer (EO) to provide supervision and oversight of vegetation clearing activities;

- Prior to the commencement of the construction, monitoring must be done at the farm dams where the Cape Vultures are said to drink according to the farm owner. This must be done with the utilisation of camera traps. Should the vultures use these water sources an artificial water source will need to be created prior to the construction of the SEF to ensure there is an alternative water source for these SCCs. An avifauna specialist must advise on the location and design of this artificial water source; and

- The Western Barn Owl boxes and their residents, present on the property, must be relocated. This must be done out of the breeding season.

6.2.1.2 Destruction, degradation and fragmentation of surrounding habitats

Construction activities can lead to destruction of surrounding habitats. Pre-mitigation this impact has a Negative High significance, but with the implementation of mitigation measures the significance can be reduced to a Negative Low impact.

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	4	3	2	4	3	3	
Local/district: Will affect the local area or district.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Complete loss of resources: The impact is result in a complete loss of all resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	**Negative High Impact**
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
1	1	1	1	1	1	1	
Site: The impact will only affect the site.	Unlikely: The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).	Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	No loss of resource: The impact will not result in the loss of any resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	**Negative Low Impact**

Mitigation Actions:

- Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, remaining within demarcated construction areas etc;
- All solid waste must be managed in accordance with a Solid Waste Management Plan. Recycling is encouraged;

- All construction activities and roads to be within the clearly defined and demarcated areas;
- Temporary laydown areas must be clearly demarcated and rehabilitated with indigenous vegetation subsequent to end of use;
- Appropriate dust control measures to be implemented;
- Suitable sanitary facilities to be provided for construction staff as per the guidelines in Health and Safety Act;
- No cement/concrete may be mixed on site and must be brought in off site to ensure the water sources does not get polluted and that successful rehabilitation of the construction areas can take place; and
- All hazardous materials, if any, must be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner.

6.2.1.3 Displacement/emigration of avifauna community (including SCC) due to noise pollution

Noise pollution generated from construction activities will lead to the displacement/emigration of the local avifauna community including the proximal surrounding area. This will include SCC that occur or are likely to occur within the area.

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	4	2	2	2	3	3	
Local/district: Will affect the local area or district.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Marginal loss of resource: The impact will result in marginal loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	**Negative Medium Impact**
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	4	2	2	2	2	2	

Local/district: Will affect the local area or district.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Marginal loss of resource: The impact will result in marginal loss of resources.	Low cumulative impact: The impact would result in insignificant cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Low Impact**

Mitigation Actions:

- No construction activity is to occur at night, as nocturnal species are highly dependent on sound and/or vocalisations for behavioural processes;
- All vehicles speed must be restricted to 20 km/h, to reduce the noise emitted by them; and
- If generators are to be used these must be soundproofed.

6.2.1.4 Direct mortality from persecution or poaching of avifauna species and collection of eggs

There is the possibility of construction staff poaching avifauna species and collecting eggs from the project footprint and proximal surrounding area. There is also the possibility of persecution of species that are deemed as negative in folklore. This impact was determined to have a Negative Medium Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	3	2	1	2	4	3	
Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	Marginal loss of resource: The impact will result in marginal loss of resources.	High cumulative impact: The impact would result in significant cumulative effects	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	**Negative Medium Impact**

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	1	1	1	2	1	1	
Local/district: Will affect the local area or district.	Unlikely: The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).	Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	Marginal loss of resource: The impact will result in marginal loss of resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	**Negative Low Impact**

Mitigation Actions:

- All personnel must undergo environmental awareness training that includes educating on not poaching/persecuting species and collecting eggs;
- Prior to commencing work each day, two individuals should traverse the working area in order to disturb any avifauna and so they have a chance to vacate the area; and
- Any avifauna threatened by the construction activities that does not vacate the area should be removed safely by an appropriately qualified environmental officer or removal specialist.

6.2.1.5 Direct mortality from increased vehicle and heavy machinery traffic

The increased vehicle and heavy machinery traffic associated with construction activities will lead to roadkill. This impact was determined to have a Negative Medium Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**

2	3	2	3	3	3	2	
Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Significant loss of resources: The impact will result in significant loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Medium Impact**
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	2	2	1	2	2	1	
Local/district: Will affect the local area or district.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	Marginal loss of resource: The impact will result in marginal loss of resources.	Low cumulative impact: The impact would result in insignificant cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	**Negative Low Impact**

Mitigation Actions:

- All personnel must undergo environmental induction with regards to awareness about speed limits and roadkill; and
- All construction vehicles must adhere to a speed limit of maximum 20 km/h to avoid collisions. Appropriate speed control measures and signs must be erected.

6.2.2 Operational Phase

6.2.2.1 Collisions with infrastructure associated with the PV Facility

The proposed project comprises of components that pose a collision risk to avifauna species. This includes collisions with PV panels, electrical infrastructureand fences. This impact was determined to have a Negative Very High significance but can be reduced to a Negative Medium significance with the implementation of appropriate mitigation measures.

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	3	4	4	4	3	3	
Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Permanent: The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.	Irreversible: The impact is irreversible and no mitigation measures exist.	Complete loss of resources: The impact is result in a complete loss of all resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	**Negative High Impact**
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
1	3	3	3	3	3	3	
Site: The impact will only affect the site.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Significant loss of resources: The impact will result in significant loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of	**Negative Medium Impact**

		action or by natural processes thereafter (10 – 30 years).				rehabilitation and remediation.	

Mitigation Actions:

- The design of the proposed solar plant must be of a type or similar structure as endorsed by the Eskom-Endangered Wildlife Trust (EWT) Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa;
- Non-polarising white tape can be used around and/or across panels to minimise reflection (Bennun et al, 2021). This is especially pertinent to waders and aquatic species that may recognise the panel array as water bodies (lake effect as described above) and collide with the panels, causing mortality;
- The air space used by the gridlines /tie in lines must be minimised by placing them underground as far as possible;
- Fencing mitigations:
  - Top 2 strands must be smooth wire;
  - Routinely retention loose wires;
  - Minimum distance between wires is 300 mm; and
  - Place markers on fences.

6.2.2.2 Electrocution due to infrastructure associated with the PV Facility

Electrocution with SEF connections poses a lower risk than that of the powerlines that are generally associate with the SEF developments. This impact was determined to have a Negative Medium significance but can be reduced to a Negative Low significance with the implementation of appropriate mitigation measures.

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
1	2	3	3	3	3	3	
Site: The impact will only affect the site.	Possible: The impact may occur (Between a 25% to	Long term: The impact and its effects will continue or last for the entire operational life of the	Barely reversible: The impact is unlikely to be reversed even with	Significant loss of resources: The impact will result in significant loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the	**Negative Medium Impact**

	50% chance of occurrence).	development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	intense mitigation measures.			system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
1	2	3	1	2	2	2	
Site: The impact will only affect the site.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	Marginal loss of resource: The impact will result in marginal loss of resources.	Low cumulative impact: The impact would result in insignificant cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Low Impact**

Mitigation Actions:

- The design of the proposed solar plant and grid lines must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa;
- Insulation where energised parts and/or grounded parts are covered with materials appropriate for providing incidental contact protection to birds. It is best to use suspended insulators and vertical disconnectors, if upright insulators or horizontal disconnectors are present, these should be covered; and
- Perch discouragers can be used such as perch guards or spikes. Considerable success achieved by providing artificial bird safe perches, which are placed at a safe distance from the energised parts (Prinsen et al, 2012).

6.2.2.3 Direct mortality from roadkills, persecution or poaching of avifauna species and collection of eggs

There is the possibility of operational staff poaching avifauna species and collecting eggs from the project footprint and proximal surrounding area. There is also the possibility of persecution of species that are deemed as negative in folklore. This impact was determined to have a Negative Medium Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**

2	3	2	3	3	3	2	
Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Significant loss of resources: The impact will result in significant loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Medium Impact**
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	2	2	1	2	1	1	
Local/district: Will affect the local area or district.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	Marginal loss of resource: The impact will result in marginal loss of resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	**Negative Low Impact**

Mitigation Actions:

- All personnel must undergo environmental awareness training that includes educating on not poaching/persecuting avifauna species and collecting eggs.
- Signs must be put up to enforce this, should someone be caught a R1000 fine must be enforced.
- All personnel must undergo environmental induction with regards to awareness about speed limits and roadkill; and

- All vehicles must adhere to a speed limit of maximum 20 km/h to avoid collisions. Appropriate speed control measures and signs must be erected.

6.2.2.4 Pollution of water sources and surrounding habitat due to cleaning products of the PV panels

It is likely that the panels will be cleaned with chemicals in addition to water to ensure they function optimally. This impact was determined to have a Negative High Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	3	3	3	3	3	3	
Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Significant loss of resources: The impact will result in significant loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	**Negative High Impact**
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
1	1	1	1	1	1	1	
Site: The impact will only affect the site.	Unlikely: The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).	Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	No loss of resource: The impact will not result in the loss of any resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	**Negative Low Impact**

		recovery time after construction, thereafter it will be entirely negated (0 – 2 years).					

Mitigation Actions:

- Only environmentally friendly chemicals are to be used for cleaning of the panels.

6.2.2.5 Heat radiation from the BESS and PV panels

Heat radiation form the infrastructure can result in an overall increase of temperature in the surrounding area, it can also lead to veld fires. This impact was determined to have a Negative Medium Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
1	2	3	3	3	3	3	
Site: The impact will only affect the site.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Significant loss of resources: The impact will result in significant loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	**Negative Medium Impact**
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
1	1	3	2	2	2	2	
	Unlikely: The chance of the impact	Long term: The impact and its effects will	Partly reversible: The impact is partly		Low cumulative impact: The impact would result in	Medium: Impact alters the quality, use and integrity	**Negative Low Impact**

Site: The impact will only affect the site.	occurring is extremely low (Less than a 25% chance of occurrence).	continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	reversible but more intense mitigation measures are required.	Marginal loss of resource: The impact will result in marginal loss of resources.	insignificant cumulative effects.	of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	

Mitigation Actions:

- The BESS must be enclosed in a structure with a non-reflective surface;
- A fire management plan needs to be put in place; and
- Grass must be kept under the panels to ensure that additional reflection is not taking place from the surface below the panels.

6.2.2.6 Encroachment of Invasive Alien Plants into disturbed areas

Invasive Alien Plants (IAPs) tend to encroach into disturbed areas and outcompete/displace indigenous vegetation. This will lead to a shift in the vegetation composition and structure, and consequently will cause a negative shift in the wellbeing of the avifauna community. This impact was determined to have a Negative Very High significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	4	4	3	4	3	3	
Local/district: Will affect the local area or district.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Permanent: The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Complete loss of resources: The impact is result in a complete loss of all resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	**Negative High Impact**

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
1	1	1	1	1	1	1	
Site: The impact will only affect the site.	Unlikely: The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).	Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	No loss of resource: The impact will not result in the loss of any resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	**Negative Low Impact**

Mitigation Actions:

- An IAP Management Plan must be written and implemented for the development. The developer must contract a specialist to develop the plan and the developer is responsible for its implementation;
- Regular monitoring for IAP encroachment during the operation phase must be undertaken to ensure that no alien invasion problems have developed as result of the disturbance. This should be every 3 months during the first two years of the operation phase and every six months for the life of the project; and
- All IAP species must be removed/controlled using the appropriate techniques as indicated in the IAP management plan.

6.2.3 Decommissioning Phase

6.2.3.1 Direct mortality due to earthworks, vehicle collisions and persecution

Decommissioning activity will likely lead to direct mortality of fauna due to earthworks, vehicle collisions and persecution. This impact was determined to have a Negative Medium significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	3	2	3	3	3	2	
Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Significant loss of resources: The impact will result in significant loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Medium Impact**
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
1	2	1	2	1	1	1	
Site: The impact will only affect the site.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	No loss of resource: The impact will not result in the loss of any resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	**Negative Low Impact**

		recovery time after construction, thereafter it will be entirely negated (0 – 2 years).					

Mitigation Actions:

- All personnel should undergo environmental awareness training including educating about not harming or collecting species;
- Prior to commencing work each day, two individuals should traverse the working area in order to disturb any fauna and so they have a chance to vacate;
- Any fauna threatened by the construction activities must be removed safely by an appropriately qualified environmental officer or removal specialist;
- All construction vehicles must adhere to a speed limit of maximum 20 km/h to avoid collisions. Appropriate speed control measures and signs must be erected;
- All hazardous materials, if any, should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner;
- Any excavations should not be left open for extended periods of time as fauna may fall in and become trapped in them. Excavations should only be dug when they are required and should be used and filled shortly thereafter;
- All infrastructure must be removed if the facility is decommissioned; and
- The project area must be rehabilitated, and a management plan must be in place to ensure that it is done successfully.

6.2.3.2 Continued habitat degradation due to Invasive Alien Plant encroachment and erosion

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

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	4	4	4	4	3	3	
Local/district: Will affect the local area or district.	Definite: Impact will certainly occur (Greater than a 75%	Permanent: The only class of impact that will be non-transitory. Mitigation either by man	Irreversible: The impact is irreversible and no	Complete loss of resources: The impact is result in a	Medium cumulative impact: The impact would	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or	**Negative High Impact**

	chance of occurrence).	or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.	mitigation measures exist.	complete loss of all resources.	result in minor cumulative effects.	component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
1	2	2	2	2	2	2	
Site: The impact will only affect the site.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Marginal loss of resource: The impact will result in marginal loss of resources.	Low cumulative impact: The impact would result in insignificant cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Low Impact**

Mitigation Actions:

- Rehabilitation in accordance with the Rehabilitation Plan for the development must be undertaken in areas disturbed during the decommissioning phase;
- Monitoring of the rehabilitated area must be undertaken at quarterly intervals for 3 years after the decommissioning phase;
- All erosion problems observed must be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques; and
- There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous flora.

6.3 Unplanned Events

The planned activities will have anticipated impacts as discussed above; however, unplanned events may occur on any project, leading to potential impacts that will require appropriate management.

Table 6-1 is a summary of the findings of an unplanned event assessment conducted from a terrestrial ecology perspective. Note that not all potential unplanned events may be captured herein, and this process must therefore be managed throughout all phases and according to events that take place or have a high likelihood of taking place.

Table 6-1 Summary of unplanned events, potential impacts and mitigations

Unplanned Event	Potential Impact	Mitigation
Spills into the surrounding environment	Contamination of habitat as well as water resources associated with a spillage.	A spill response kit must be available at all times. The incident must be reported on, and if necessary, a biodiversity specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Fire	Uncontrolled/unmanaged fire that spreads to the surrounding natural savannah.	An appropriate fire management plan needs to be compiled and implemented.
Erosion caused by water runoff from the surface	Erosion on the side of the roads and cleared areas.	A storm water management plan must be compiled and implemented.

6.4 Cumulative Impacts

Cumulative impacts are assessed within the context of the extent of the proposed PAOI other developments and activities in the area (existing and proposed) and general habitat loss and disturbance resulting from any other anthropogenic activities in the area. The impacts of projects are often assessed by comparing the post-project situation to a pre-existing baseline. Where projects can be considered in isolation this provides a good method of assessing a project’s impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development or disturbance activities. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a specific point in time may actually represent a significant change from the original state of the system. This section describes the potential cumulative impacts of the project on the local and regional avifauna community.

Localised cumulative impacts include those from operations that are close enough to potentially cause additive effects on the local environment or any sensitive receivers (such as nearby large road networks, other solar PV facilities, and power infrastructure). Relevant activities and impacts include dust deposition, noise and vibration, loss of corridors or habitat, disruption of waterways, groundwater drawdown, groundwater and surface water depletion, and transport activities. Long-term cumulative impacts associated with the site development activities can lead to the loss of endemic and threatened species, including natural habitat and vegetation types, and these impacts can even lead to the degradation of conserved areas such as the adjacent game parks and reserves.

The total area within the 30 km buffer around the project area amounts to 395,565 ha, but when considering the transformation (201,043 ha) that has taken place within this radius, 194,522 ha of intact habitat remains, according to the 2018 National Biodiversity Assessment. Therefore, the area within 30 km of the project has experienced approximately 50.8% loss in natural habitat. Considering this context, the project footprint for the proposed development (according to the provided layout) and similar projects that exist in the 30 km region measuring a maximum of 5543ha (as per the latest South African Renewable Energy EIA Application Database). This means that the total amount of remaining habitat lost as a result of solar projects in the region amounts to 1.2% (the sum of all related developments as a percentage of the total remaining habitat). Table 6-2 outlines the calculation procedure for the spatial assessment of cumulative impacts.

Table 6-2 Loss of habitat within a 30 km radius of the project

	Total Habitat (ha)	Total Loss (ha)	Tot. Remaining Habitat (ha) (Remnants)	Total Historical Loss (%)	Cumulative Projects (ha)	Tot. Remaining Habitat (ha)	Cumulative Habitat Lost (%)
Approximate Solar development cumulative effects (Spatial)	395,565	201,043	194,522	**50.8%**	5543	**192,189**	**1.2%**

The overall cumulative impact assessment is presented in Table 6-3 and Figure 6-2 below. Approximately 50% of the habitat has already been lost, and as discussed above the proposed solar developments will result in a further cumulative loss of approximately 1.2% from only similar developments (Solar, approved and in process) in the area, as such the cumulative impact from the proposed development is rated as medium (Figure 6-2). This means that the entire region's careful spatial management and planning must be a priority, and existing large infrastructure projects must be carefully monitored over the long term.

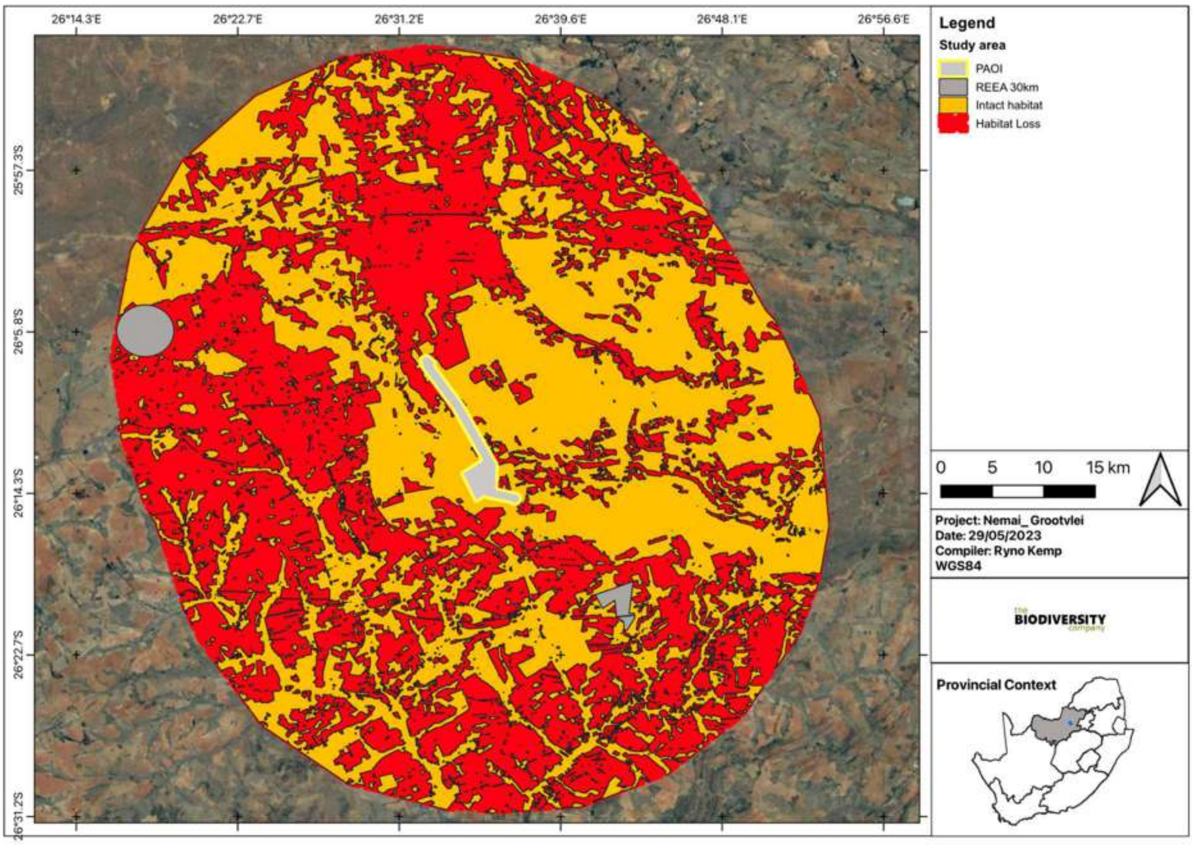

Figure 6-2 ***Map illustrating the additional renewable energy developments within the landscape overlaid onto the remnant vegetation types***

Table 6-3 Cumulative Impacts to avifauna associated with the proposed project

Impact	Project in Isolation						Cumulative Effect					
	Duration of Impact	Extent	Intensity	Frequency	Probability of Impact	Significance	Duration of Impact	Extent	Intensity	Frequency	Probability of Impact	Significance
Loss of habitat, and disruption of surrounding ecological corridors.	4	2	3	3	3	54	5	3	3	3	4	77
	Long term	Area	Medium/slightly harmful	Frequent	Probable	**Medium**	Permanent	Region	Medium/slightly harmful	Frequent	Almost certain	**Medium**

7 Avifauna Impact Management Actions

The purpose of the Biodiversity Impact Management Actions of is to present the mitigations in such a way that they can be incorporated into the Environmental Management Programme (EMPr), allowing for more successful implementation and auditing of the mitigations and monitoring guidelines.

Table 7-1 presents the recommended mitigation measures and the respective timeframes, targets, and performance indicators pertaining to the avifaunal component.

Table 7-1 Summary of management outcomes pertaining to impacts to avifauna and their habitats

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Management outcome: Habitats				
The areas to be developed must be specifically demarcated to prevent movement into surrounding environments.	Life of operation	Project Manager Environmental Officer	Development footprint	Ongoing
High sensitivity areas must be declared No-go areas, they must be demarcated to ensure no vehicles or people move int these areas.	Life of operation	Project Manager Environmental Officer	Development footprint	Ongoing
Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further.	Life of operation	Project Manager Environmental Officer	Areas of indigenous vegetation	Ongoing
Solar panels must be mounted on pile driven or screw foundations, such as post support spikes, rather than heavy foundations, such as trench-fill or mass concrete foundations, to reduce the negative effects on natural soil functioning, such as its filtering and buffering characteristics, while maintaining habitats for both below and above-ground biodiversity.	Life of operation	Project Manager	Solar panels must be mounted on pile driven or screw foundations, such as post support spikes, rather than heavy foundations, such as trench-fill or mass concrete foundations, to reduce the negative effects on natural soil functioning, such as its filtering and buffering characteristics, while maintaining habitats for both below and above-ground biodiversity	Life of operation
Indigenous vegetation to be maintained under the solar panels to ensure biodiversity is maintained and to prevent soil erosion (Beatty et al, 2017; Sinha et al, 2018).	Life of operation	Project Manager	Indigenous vegetation to be maintained under the solar panels to ensure biodiversity is maintained and to prevent soil erosion (Beatty et al, 2017; Sinha et al, 2018).	Life of operation
Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion. This will also reduce the likelihood of encroachment by alien invasive plant species. Topsoil must also be utilised, and any disturbed	Decommissioning /Rehabilitation	Project Manager	Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion. This will also reduce the	Decommissioning /Rehabilitation

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
area must be re-vegetated with plant and grass species which are indigenous to this vegetation type.			likelihood of encroachment by alien invasive plant species. Topsoil must also be utilised, and any disturbed area must be re-vegetated with plant and grass species which are indigenous to this vegetation type.	
A hydrocarbon spill management plan must be put in place to ensure that should there be any chemical spill out or over that it does not run into the surrounding areas. The Contractor shall be in possession of an emergency spill kit that must always be complete and available on site. Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use. No servicing of equipment on site unless necessary. All contaminated soil / yard stone shall be treated in situ or removed and be placed in containers. Appropriately contain any generator diesel storage tanks, machinery spills (e.g., accidental spills of hydrocarbons oils, diesel etc.) in such a way as to prevent them leaking and entering the environment.	Life of operation	Environmental Officer Contractor	Spill events, Vehicles dripping.	Ongoing
No cement/concrete may be mixed on site and must be brought in off site to ensure the water sources does not get polluted and that successful rehabilitation of the construction areas can take place	Planning and Construction	Project Manager Environmental Officer Contractor Engineer	Water pollution and restricted rehabilitation	During phase
Leaking equipment and vehicles must be repaired immediately or be removed from project area to facilitate repair.	Life of operation	Environmental Officer Contractor	Leaks and spills	Ongoing
A fire management plan needs to be complied to restrict the impact of fire.	Life of operation	Environmental Officer Contractor	Fire Management	During Phase

Management outcome: Avifauna

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
All personnel should undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting, or hunting terrestrial species, and owls, which are often persecuted out of superstition. Signs must be put up to enforce this.	Life of operation	Environmental Officer	Evidence of trapping etc	Ongoing
The duration of the construction should be kept to a minimum to avoid disturbing avifauna.	Construction/Operational Phase	Project Manager Environmental Officer	Construction/Closure Phase	Ongoing

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Outside lighting should be designed and limited to minimize impacts on avifauna. All outside lighting should be directed away from highly sensitive areas. Fluorescent and mercury vapor lighting should be avoided, and sodium vapor (red/green) lights should be used wherever possible.	Construction/Operational Phase	Project Manager Environmental Officer Design Engineer	Light pollution and period of light.	Ongoing
All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limit (20 km/h), to respect all forms of wildlife. Speed limits must still be enforced to ensure that road killings and erosion is limited.	Life of Operation	Health and Safety Officer	Compliance to the training.	Ongoing
All project activities must be undertaken with appropriate noise mitigation measures to avoid disturbance to avifauna population in the region	Construction/Operational Phase	Project Manager Environmental Officer	Noise	Ongoing
All areas to be developed must be walked through prior to any activity to ensure no nests or avifauna species are found in the area. Should any Species of Conservation Concern be found and not move out of the area, or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.	Construction	Environmental Officer	Presence of avifauna species and nests	During Phase
The design of the proposed PV and grid lines must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa (Jenkins *et al.*, 2015).	Planning and Construction	Project Manager Environmental Officer Contractor Engineer	Presence of electrocuted birds or bird strikes	During Phase
Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used.	Planning and Construction	Project Manager Environmental Officer Contractor Engineer	Presence of bird collisions	During phase
The loop in loop out lines must join in at the closest point to the existing line as possible.	Planning and Construction	Project Manager Environmental Officer Contractor Engineer	Presence of bird collisions	During phase
All the parts of the infrastructure must be nest-proofed and anti-perch devices placed on areas that can lead to electrocution	Planning and Construction	Environmental Officer Contractor Engineer	Presence of electrocuted birds	During phase
Use environmentally friendly cleaning and dust suppressant products	Construction and Operation	Environmental Officer Contractor Engineer	Chemicals used	During phase

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Fencing mitigations for ClearVu or similar fencing: • If needed, any **top** strands must be smooth wire, barbed wire must be avoided; • Routinely monitor all fencing for any collisions and mortality, as well as trapped fauna. • Place markers/diverters on fences, especially towards the top • A specialist must be consulted if any collisions or mortalities are observed. Conventional fencing mitigations: • Top 2 strands must be smooth wire • Routinely retention loose wires • Minimum 300 mm between wires • Place markers on fences	Life of Operation	Project Manager Environmental Officer Contractor Design Engineer	Presence of birds stuck /dead in fences Monitor fences for collisions or mortalities every second day for the first 6 months.	During phase
As far as possible power cables within the project site should be thoroughly insulated and preferably buried.	Construction and Operation	Project Manager Environmental Officer Design Engineer	Exposed cables	During phase
Any exposed parts must be covered (insulated) to reduce electrocution risk	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of electrocuted birds	During phase
The BESS must be enclosed in a structure with a non-reflective surface	Construction and Operation	Project Manager Environmental Officer Design Engineer	Reflective surfaces on BESS	During phase
Non-polarising white strips must be fitted along the edges of the panels to reduce reflection and therefore similarity to water and deter birds and insects (Horvath *et al,* 2010).	Operational	Project Manager Environmental Officer Design Engineer	Presence of dead birds in the project site. Monitoring must be undertaken in accordance with the BirdLife South Africa best practice guidelines for solar energy facilities (BirdLife South Africa, 2017). The precise location of any dead birds found should be recorded and mapped (using GPS). All carcasses should be photographed as found then placed in a plastic bag, labelled as to the location and date, and preserved (refrigerated or frozen) until identified. Feather spots (e.g., a group of feathers attached to skin)	During phase. The monitoring frequency is based on the collision rate.

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
			and body parts should also be collected.	
Overhead cables/lines must be fitted with bird diverters or flappers (Shaw *et al.* 2021, Prinson *et al* 2012), .	Operational	Project Manager Environmental Officer Design Engineer	Collisions. Monitoring must be undertaken in accordance with the BirdLife South Africa best practice guidelines for solar energy facilities (BirdLife South Africa, 2017).	During phase. The monitoring frequency is based on the collision rate.
There is little to no information on the recovery of the avifauna community subsequent to the closure of Solar PV facilities within South Africa. A post-closure monitoring regime is recommended for the proposed project to document any impacts and this data must be used for improving rehabilitation measures	Closure/Rehabilitation	Project Manager Environmental Officer	Avifauna community	Wet-season and dry-season survey for the initial 3-5 years after closure.
All infrastructure including powerlines must be removed if the facility is decommissioned	Closure/Rehabilitation	Project Manager Environmental Officer	Infrastructure removal	During Process

8 Conclusion and Impact Statement

8.1 Conclusion

This Avifauna Impact Assessment aimed to provide information to guide the risk of the proposed Solar PV project and the associated infrastructure to the Avifauna community likely affected by its development.

Only one site visit was conducted but supplemented by another project ~ 15 southeast of the proposed development for this regime 2 assessment. The field investigation was conducted in Autumn, over 4 days from the 21st to the 24th of April 2023. Besides supplementary reports and data, this site visit is considered sufficient from a seasonal perspective. The additional area was assessed between 27 and 29 July 2021 and 1-3 April 2022. The total number of individual species accounts for approximately 42.75% of the total number of expected species. No SCC was recorded within the PAOI during the survey period within point counts and no SCC was observed during the surveying period of the other studies. However, one of the other specialist reported an *Eupodotis senegalensis* (White-bellied Korhaan) within the PAOI. Ten (10) risk species were recorded in the field investigation. These are species at risk for collisions, electrocutions or sensitive to habitat loss.

The SEI of the proposed PAOI was found to be medium. However, the sensitivity can be assumed to be Impacts were identified as being High to Medium in the Costruction Phase, most of which could be reduced to Medium to Low, and even Absent with the application of mitigation measures. Impacts in the operational phase are expected to be Medium and can be reduced to Medium to Low with mitigation measures. Decommissioning phase impacts are expected to be Medium and can be reduced to Low with mitigation measures. Cumulative impacts are Low for the project in isolation and in consideration with the proposed grid.

Management measures include ensuring the construction footprint is kept small and industry-standard mitigations are put into place for solar panels, fencing and electrical infrastructure, among other measures.

8.2 Impact Statement

The main expected impacts of the proposed PV and associated infrastructure will include the following:

- Habitat loss and fragmentation;
- Electrocutions; and
- Collisions.

Mitigation measures as described in this report, can be implemented to reduce the significance of the risk to an acceptable residual risk level. Considering the above-mentioned information, it is the opinion of the specialist that the project may be favourably considered, on condition that all the mitigation and recommendations provided in this report and other specialist reports are implemented.

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10 Appendix Items

10.1 Appendix A: Expected species

Scientific Name	Common Name	Familie Name	Regional	Global (IUCN)
Telophorus zeylonus	Bokmakierie	Malaconotidae	Unlisted	Unlisted
Nilaus afer	Brubru	Malaconotidae	Unlisted	Unlisted
Cisticola fulvicapilla	Neddicky	Cisticolidae	Unlisted	Unlisted
Ortygospiza atricollis	Quailfinch	Estrildidae	Unlisted	Unlisted
Sagittarius serpentarius	Secretarybird	Sagittariidae	VU	EN
Tricholaema leucomelas	Acacia Pied Barbet	Lybiidae	Unlisted	Unlisted
Lybius torquatus	Black-collared Barbet	Lybiidae	Unlisted	Unlisted
Trachyphonus vaillantii	Crested Barbet	Lybiidae	Unlisted	Unlisted
Batis molitor	Chinspot Batis	Platysteiridae	Unlisted	Unlisted
Batis pririt	Pririt Batis	Platysteiridae	Unlisted	Unlisted
Merops apiaster	European Bee-eater	Meropidae	Unlisted	Unlisted
Merops hirundineus	Swallow-tailed Bee-eater	Meropidae	Unlisted	Unlisted
Euplectes orix	Southern Red Bishop	Ploceidae	Unlisted	Unlisted
Euplectes afer	Yellow-crowned Bishop	Ploceidae	Unlisted	Unlisted
Pycnonotus nigricans	African Red-eyed Bulbul	Pycnonotidae	Unlisted	Unlisted
Pycnonotus tricolor	Dark-capped Bulbul	Pycnonotidae	Unlisted	Unlisted
Emberiza tahapisi	Cinnamon-breasted Bunting	Emberizidae	Unlisted	Unlisted
Buteo buteo	Common Buzzard	Accipitridae	Unlisted	Unlisted
Crithagra atrogularis	Black-throated Canary	Fringillidae	Unlisted	Unlisted
Crithagra flaviventris	Yellow Canary	Fringillidae	Unlisted	Unlisted
Myrmecocichla formicivora	Ant-eating Chat	Muscicapidae	Unlisted	Unlisted
Oenanthe familiaris	Familiar Chat	Muscicapidae	Unlisted	Unlisted
Cisticola textrix	Cloud Cisticola	Cisticolidae	Unlisted	Unlisted
Cisticola aridulus	Desert Cisticola	Cisticolidae	Unlisted	Unlisted
Cisticola tinniens	Levaillant's Cisticola	Cisticolidae	Unlisted	Unlisted
Cisticola chiniana	Rattling Cisticola	Cisticolidae	Unlisted	Unlisted
Cisticola juncidis	Zitting Cisticola	Cisticolidae	Unlisted	Unlisted
Fulica cristata	Red-knobbed Coot	Rallidae	Unlisted	Unlisted
Corvus capensis	Cape Crow	Corvidae	Unlisted	Unlisted
Corvus albus	Pied Crow	Corvidae	Unlisted	Unlisted
Chrysococcyx caprius	Diederik Cuckoo	Cuculidae	Unlisted	Unlisted
Clamator jacobinus	Jacobin Cuckoo	Cuculidae	Unlisted	Unlisted
Streptopelia capicola	Ring-necked Dove	Columbidae	Unlisted	Unlisted
Spilopelia senegalensis	Laughing Dove	Columbidae	Unlisted	Unlisted
Oena capensis	Namaqua Dove	Columbidae	Unlisted	Unlisted
Streptopelia semitorquata	Red-eyed Dove	Columbidae	Unlisted	Unlisted
Columba livia	Rock Dove	Columbidae	Unlisted	Unlisted
Ardea intermedia	Yellow-billed Egret	Cisticolidae	Unlisted	Unlisted
Bubulcus ibis	Western Cattle Egret	Ardeidae	Unlisted	Unlisted
Falco amurensis	Amur Falcon	Falconidae	Unlisted	Unlisted

Amadina erythrocephala	Red-headed Finch	Estriididae	Unlisted	Unlisted
Lagonosticta rhodopareia	Jameson's Firefinch	Estriididae	Unlisted	Unlisted
Lanius collaris	Southern Fiscal	Laniidae	Unlisted	Unlisted
Melaenornis silens	Fiscal Flycatcher	Muscicapidae	Unlisted	Unlisted
Muscicapa striata	Spotted Flycatcher	Muscicapidae	Unlisted	Unlisted
Scleroptila gutturalis	Orange River Francolin	Phasianidae	Unlisted	Unlisted
Alopochen aegyptiaca	Egyptian Goose	Anatidae	Unlisted	Unlisted
Plectropterus gambensis	Spur-winged Goose	Anatidae	Unlisted	Unlisted
Melierax canorus	Pale Chanting Goshawk	Accipitridae	Unlisted	Unlisted
Tachybaptus ruficollis	Little Grebe	Podicipedidae	Unlisted	Unlisted
Numida meleagris	Helmeted Guineafowl	Numididae	Unlisted	Unlisted
Ardea melanocephala	Black-headed Heron	Ardeidae	Unlisted	Unlisted
Ardea cinerea	Grey Heron	Ardeidae	Unlisted	Unlisted
Upupa africana	African Hoopoe	Upupidae	Unlisted	Unlisted
Plegadis falcinellus	Glossy Ibis	Threskiornithidae	Unlisted	Unlisted
Bostrychia hagedash	Hadada Ibis	Threskiornithidae	Unlisted	Unlisted
Falco rupicoloides	Greater Kestrel	Falconidae	Unlisted	Unlisted
Falco naumanni	Lesser Kestrel	Falconidae	Unlisted	Unlisted
Falco rupicolus	Rock Kestrel	Falconidae	Unlisted	Unlisted
Elanus caeruleus	Black-winged Kite	Accipitridae	Unlisted	Unlisted
Afrotis afraoides	Northern Black Korhaan	Otididae	Unlisted	Unlisted
Vanellus armatus	Blacksmith Lapwing	Charadriidae	Unlisted	Unlisted
Vanellus coronatus	Crowned Lapwing	Charadriidae	Unlisted	Unlisted
Mirafra fasciolata	Eastern Clapper Lark	Alaudidae	Unlisted	Unlisted
Certhilauda semitorquata	Eastern Long-billed Lark	Alaudidae	Unlisted	Unlisted
Calandrella cinerea	Red-capped Lark	Alaudidae	Unlisted	Unlisted
Mirafra africana	Rufous-naped Lark	Alaudidae	Unlisted	Unlisted
Calendulauda sabota	Sabota Lark	Alaudidae	Unlisted	Unlisted
Chersomanes albofasciata	Spike-heeled Lark	Alaudidae	Unlisted	Unlisted
Macronyx capensis	Cape Longclaw	Motacillidae	Unlisted	Unlisted
Riparia cincta	Banded Martin	Hirundinidae	Unlisted	Unlisted
Delichon urbicum	Common House Martin	Hirundinidae	Unlisted	Unlisted
Urocolius indicus	Red-faced Mousebird	Coliidae	Unlisted	Unlisted
Colius striatus	Speckled Mousebird	Coliidae	Unlisted	Unlisted
Colius colius	White-backed Mousebird	Coliidae	Unlisted	Unlisted
Acridotheres tristis	Common Myna	Sturnidae	Unlisted	Unlisted
Struthio camelus	Common Ostrich	Struthionidae	Unlisted	Unlisted
Columba guinea	Speckled Pigeon	Columbidae	Unlisted	Unlisted
Anthus cinnamomeus	African Pipit	Motacillidae	Unlisted	Unlisted
Anthus vaalensis	Buffy Pipit	Motacillidae	Unlisted	Unlisted
Anthus nicholsoni	Nicholson's Pipit	Motacillidae	Unlisted	Unlisted
Charadrius tricollaris	Three-banded Plover	Charadriidae	Unlisted	Unlisted
Netta erythrophthalma	Southern Pochard	Anatidae	Unlisted	Unlisted
Prinia flavicans	Black-chested Prinia	Cisticolidae	Unlisted	Unlisted

Pytilia melba	Green-winged Pytilia	Estrildidae	Unlisted	Unlisted
Coturnix coturnix	Common Quail	Phasianidae	Unlisted	Unlisted
Quelea quelea	Red-billed Quelea	Ploceidae	Unlisted	Unlisted
Cossypha caffra	Cape Robin-Chat	Muscicapidae	Unlisted	Unlisted
Pterocles namaqua	Namaqua Sandgrouse	Pteroclidae	Unlisted	Unlisted
Rhinopomastus cyanomelas	Common Scimitarbill	Phoeniculidae	Unlisted	Unlisted
Cercotrichas paena	Kalahari Scrub Robin	Muscicapidae	Unlisted	Unlisted
Laniarius atrococcineus	Crimson-breasted Shrike	Malaconotidae	Unlisted	Unlisted
Lanius minor	Lesser Grey Shrike	Laniidae	Unlisted	Unlisted
Lanius collurio	Red-backed Shrike	Laniidae	Unlisted	Unlisted
Gallinago nigripennis	African Snipe	Scolopacidae	Unlisted	Unlisted
Passer melanurus	Cape Sparrow	Passeridae	Unlisted	Unlisted
Passer domesticus	House Sparrow	Passeridae	Unlisted	Unlisted
Passer diffusus	Southern Grey-headed Sparrow	Passeridae	Unlisted	Unlisted
Eremopterix leucotis	Chestnut-backed Sparrow-Lark	Alaudidae	Unlisted	Unlisted
Eremopterix verticalis	Grey-backed Sparrow-Lark	Alaudidae	Unlisted	Unlisted
Plocepasser mahali	White-browed Sparrow-Weaver	Ploceidae	Unlisted	Unlisted
Accipiter melanoleucus	Black Sparrowhawk	Accipitridae	Unlisted	Unlisted
Pternistis swainsonii	Swainson's Spurfowl	Phasianidae	Unlisted	Unlisted
Lamprotornis nitens	Cape Starling	Sturnidae	Unlisted	Unlisted
Lamprotornis bicolor	Pied Starling	Sturnidae	Unlisted	Unlisted
Creatophora cinerea	Wattled Starling	Sturnidae	Unlisted	Unlisted
Himantopus himantopus	Black-winged Stilt	Recurvirostridae	Unlisted	Unlisted
Saxicola torquatus	African Stonechat	Muscicapidae	Unlisted	Unlisted
Hirundo rustica	Barn Swallow	Hirundinidae	Unlisted	Unlisted
Cecropis cucullata	Greater Striped Swallow	Hirundinidae	Unlisted	Unlisted
Cecropis semirufa	Red-breasted Swallow	Hirundinidae	Unlisted	Unlisted
Petrochelidon spilodera	South African Cliff Swallow	Hirundinidae	Unlisted	Unlisted
Hirundo albigularis	White-throated Swallow	Hirundinidae	Unlisted	Unlisted
Apus affinis	Little Swift	Apodidae	Unlisted	Unlisted
Apus caffer	White-rumped Swift	Apodidae	Unlisted	Unlisted
Tchagra australis	Brown-crowned Tchagra	Malaconotidae	Unlisted	Unlisted
Turdus litsitsirupa	Groundscraper Thrush	Turdidae	Unlisted	Unlisted
Turdus smithi	Karoo Thrush	Turdidae	Unlisted	Unlisted
Motacilla capensis	Cape Wagtail	Motacillidae	Unlisted	Unlisted
Curruca subcoerulea	Chestnut-vented Warbler	Sylviidae	Unlisted	Unlisted
Phylloscopus trochilus	Willow Warbler	Phylloscopidae	Unlisted	Unlisted
Brunhilda erythronotos	Black-faced Waxbill	Estrildidae	Unlisted	Unlisted
Uraeginthus angolensis	Blue Waxbill	Estrildidae	Unlisted	Unlisted
Estrilda astrild	Common Waxbill	Estrildidae	Unlisted	Unlisted
Granatina granatina	Violet-eared Waxbill	Estrildidae	Unlisted	Unlisted
Bubalornis niger	Red-billed Buffalo Weaver	Ploceidae	Unlisted	Unlisted
Sporopipes squamifrons	Scaly-feathered Weaver	Ploceidae	Unlisted	Unlisted
Ploceus velatus	Southern Masked Weaver	Ploceidae	Unlisted	Unlisted

Oenanthe pileata	Capped Wheatear	Muscicapidae	Unlisted	Unlisted
Zosterops virens	Cape White-eye	Zosteropidae	Unlisted	Unlisted
Zosterops pallidus	Orange River White-eye	Zosteropidae	Unlisted	Unlisted
Vidua paradisaea	Long-tailed Paradise Whydah	Viduidae	Unlisted	Unlisted
Vidua macroura	Pin-tailed Whydah	Viduidae	Unlisted	Unlisted
Euplectes progne	Long-tailed Widowbird	Ploceidae	Unlisted	Unlisted
Euplectes ardens	Red-collared Widowbird	Ploceidae	Unlisted	Unlisted
Euplectes albonotatus	White-winged Widowbird	Ploceidae	Unlisted	Unlisted
Phoeniculus purpureus	Green Wood Hoopoe	Phoeniculidae	Unlisted	Unlisted
Dendropicos fuscescens	Cardinal Woodpecker	Picidae	Unlisted	Unlisted

*(Taylor *et al*. 2015), + (IUCN 2021)

10.2 Appendix B

10.2.1 Point count data

Common Name	Scientific Name	Family Name	RD (Regional, Global)
African Pipit	Anthus cinnamomeus	Motacillidae	0
African Stonechat	Saxicola torquatus	Muscicapidae	0
Ant-eating Chat	Myrmecocichla formicivora	Muscicapidae	0
Black-winged Kite	Elanus caeruleus	Accipitridae	0
Blacksmith Lapwing	Vanellus armatus	Charadriidae	0
Brown-throated Martin	Riparia paludicola	Hirundinidae	0
Cape Longclaw	Macronyx capensis	Motacillidae	0
Cape Sparrow	Passer melanurus	Passeridae	0
Capped Wheatear	Oenanthe pileata	Muscicapidae	0
Cloud Cisticola	Cisticola textrix	Cisticolidae	0
Common Quail	Coturnix coturnix	Phasianidae	0
Crowned Lapwing	Vanellus coronatus	Charadriidae	0
Desert Cisticola	Cisticola aridulus	Cisticolidae	0
Egyptian Goose	Alopochen aegyptiaca	Anatidae	0
Greater Kestrel	Falco rupicoloides	Falconidae	0
Grey Heron	Ardea cinerea	Ardeidae	0
Grey-backed Sparrow-Lark	Eremopterix verticalis	Alaudidae	0
Helmeted Guineafowl	Numida meleagris	Numididae	0
Namaqua Dove	Oena capensis	Columbidae	0
Pied Crow	Corvus albus	Corvidae	0
Ring-necked Dove	Streptopelia capicola	Columbidae	0
South African Shelduck	Tadorna cana	Anatidae	0
Southern Fiscal	Lanius collaris	Laniidae	0
Southern Masked Weaver	Ploceus velatus	Ploceidae	0
Southern Red Bishop	Euplectes orix	Ploceidae	0
Speckled Pigeon	Columba guinea	Columbidae	0
Spotted Eagle-Owl	Bubo africanus	Strigidae	0
Spotted Thick-knee	Burhinus capensis	Burhinidae	0
Zitting Cisticola	Cisticola juncidis	Cisticolidae	0
Northern Black Korhaan	Afrotis afraoides	Otididae	0
White-browed Sparrow-Weaver	Plocepasser mahali	Ploceidae	0
Black-chested Prinia	Prinia flavicans	Cisticolidae	0
Orange River Francolin	Scleroptila gutturalis	Phasianidae	0
Brown-crowned Tchagra	Tchagra australis	Malaconotidae	0
Scaly-feathered Weaver	Sporopipes squamifrons	Ploceidae	0
Black-throated Canary	Crithagra atrogularis	Fringillidae	0
Red-billed Quelea	Quelea quelea	Ploceidae	0
Spike-heeled Lark	Chersomanes albofasciata	Alaudidae	0
Western Cattle Egret	Bubulcus ibis	Ardeidae	0
Swainson's Spurfowl	Pternistis swainsonii	Phasianidae	0

Rattling Cisticola	Cisticola chiniana	Cisticolidae	0
Plain-backed Pipit	Anthus leucophrys	Motacillidae	0
Sabota Lark	Calendulauda sabota	Alaudidae	0
Wing-snapping Cisticola	Cisticola ayresii	Cisticolidae	0
Buffy Pipit	Anthus vaalensis	Motacillidae	0
Long-tailed Widowbird	Euplectes progne	Ploceidae	0
Great Egret	Ardea alba	Ardeidae	0
Banded Martin	Riparia cincta	Hirundinidae	0
Melodious Lark	Mirafra cheniana	Alaudidae	0
Red-headed Finch	Amadina erythrocephala	Estriididae	0
African Palm Swift	Cypsiurus parvus	Apodidae	0
Red-collared Widowbird	Euplectes ardens	Ploceidae	0
Quailfinch	Ortygospiza atricollis	Estrildidae	0
Great Reed Warbler	Acrocephalus arundinaceus	Acrocephalidae	0
Yellow-fronted Canary	Crithagra mozambica	Fringillidae	0
Pink-billed Lark	Spizocorys conirostris	Alaudidae	0
Great Sparrow	Passer motitensis	Passeridae	0
African Black Duck	Anas sparsa	Anatidae	0
Speckled Mousebird	Colius striatus	Coliidae	0

10.3 Appendix C: Specialist Declaration of Independence

I, Ryno Kemp, declare that:

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

Ryno Kemp

Biodiversity Specialist

The Biodiversity Company

June 2023

APPENDIX D4: Agricultural Compliance Statement

AGRICULTURAL ASSESSMENT:

COMPLIANCE STATEMENT

Grootvlei 600MW Solar PV Plant, BESS and Grid Connection north west of Ventersdorp, North West Province

Compiled for:

Nemai Consulting

Compiled by

Dr Andries Gouws Index

April 2023 (Revised Sept 2023)

DECLARATION

The observations, conclusions and recommendations made in this report are based on the best available data and on best scientific and professional knowledge of the directors of INDEX (Pty) Ltd. The report is based on GIS programming and utilises satellite tracking to map survey points. Survey points are normally accurate to within 3 metres; which must be considered in the use of the information.

The directors of INDEX (Pty) Ltd exercises due care and diligence in rendering services and preparing documents. However, the company accepts no liability, and the client, by receiving this document, indemnifies INDEX (Pty) Ltd and its directors and employees, by the use of the information contained in this document, against any action, claim, demand, loss, liability, cost, damage and expense arising from or in connection with services rendered.

The property and copyright of this report shall remain vested in INDEX (Pty) Ltd. The client that commissioned the report may use the information as it may think fit; but only for the land for which it was commissioned.

General declaration:

- INDEX acted as the independent specialist in this application;
- Performed 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;
- There were no circumstances that may compromise INDEX's objectivity in performing such work;
- INDEX have expertise in conducting the specialist report relevant to this application, including knowledge of NEMA and its regulations and any guidelines that have relevance to the proposed activity;
- Have no and will not engage in conflicting interests in the undertaking of the activity.
- The study was undertaken by Dr Andries Gouws. He is a registered member of SACNASP in the category of Agriculture.

March 2023

CONTENTS

SUMMARY

Main findings of the study are as follows:

LINE CONNECTION

The footprint of the pylon is the only permanent feature that will lead to land loss.

- Line Option 1: This route runs in a northerly direction. The sensitive portions are cultivated land and land under irrigation on the farm Roodepoortjie.
- Line Option 2: This route consists of veld grazing and pastures. No sensitive land was found

PV SITE

No high potential land was found on the site. The land has a low or medium sensitivity for agriculture. The fallow lands have reverted to veld and is now far advanced in succession status. The entire site is used for grazing of livestock.

SOIL TYPES

The PV site is located on dolomite and chert with many rock outcrops and loose rock and stones. In general, the soils are not arable and only suitable for grazing.

There are only small isolated portions in the south that has moderate potential. The soil capability is Class v and lower, mainly because of depth and mechanical limitations to root development and cultivation.

Mostly rocky soils occur along the OHL. However, because it is a linear structure with only the OHL pylons taking up very little land, a soil survey was not done.

VEGETATION

The land in its natural state is Carletonville Dolomite Grassland with highly palatable grass species. The grazing capacity is at 7ha/large livestock unit. The carrying capacity for the PV site is 100 LSU.

SPECIALIST SITE ANALYSES

The outcome of the site sensitivity verification found that:

- According to DALRRD, the land has low and low/moderate arable potential. This is because of the shallow soils and rock outcrops. It is not arable and more suitable for livestock grazing.
- No land can be regarded as high potential for cropping and which should be protected because it is *highly sensitive* for farming purposes.
- Irrigated land along the Option 1 transmission line on Roodepoortjie could occur if the pylons are placed such that the area under production are not compromised.

IMPACT ASSESSMENT

- There will be no loss of high potential soil and only a small impact on cattle production.
- The potential loss of income from livestock is insignificant if measured against the benefit the region and country can reap from this project.
- The potential loss of irrigated land along the Option 1 transmission line on Roodepoortjie is low if the pylons are placed such that the area under production are not compromised.
- Note that both line option 1 and 2 will be implemented.

GENERAL CONCLUSIONS

- No key issues or triggers were identified.
- There is no high potential sensitive land on the PV Site. The impact on Route Option 1 has some negative impacts, but can be mitigated.

1 SPECIALIST DECLARATION

COMPLIANCE STATEMENT

Main findings of the study are as follows:

LINE CONNECTION

The footprint of the pylon is the only permanent feature that will lead to land loss.

- Line Option 1: This route is approximately 14,6km and runs in a northerly direction. The only sensitive portions are cultivated land and land under irrigation on the farm Roodepoortjie.

  The impact is small, temporary and not significant on a local or regional scale if the mitigation measures are followed.
- Line Option 2: This route is approximately 2,4km and runs in a south-easterly direction. The route consists of mainly veld grazing and pastures.

  The impact of this alignment is small and temporary and not significant on a local or regional scale.

PV SITE

No high potential land was found on the site. According to the criteria of DALRRD the land is Class 7 or poorer and has a low or medium low sensitivity to agricultural development. There will be no impact regarding to loss of sensitive land.

THE AUTHOR OF THE REPORT CONFIRMS THE FOLLOWING:

3.3.1. Details and relevant experience as well as the SACNASP registration number of the soil scientist/agricultural specialist/s preparing the assessment including a curriculum vita;	Dr Andries Gouws is a soil scientist and is registered with SACNASP. Refer to Sections 11.2 and 11.3.
3.3.2. A signed statement of independence by the specialist;	Refer to the preamble of the report.
3.3.3. A map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on the agricultural sensitivity map generated by the national environmental screening tool;	The entire PV site will be developed. See Figure 2.
3.3.4. Calculations of the physical development footprint area for each land parcel as well as the total physical development footprint area of the proposed development including supporting infrastructure;	Total survey area is 668ha of which 487 will be under PV and support infrastructure. The total farm Grootvlei 161 IP, however, is 2 370ha.
3.3.5. Confirmation that the development footprint is in line with the allowable development limits contained in Table 1 above;	The site has a Capability Rating of 6 – 7. The allowable limit is 2,5 ha per MW or 1 500 for the 600MW that the site comprises. The site is within the limit.

3.3.6. confirmation from the specialist that all reasonable measures have been taken through micro-siting to avoid or minimise fragmentation and disturbance of agricultural activities;	No micro siting is possible. The total site will be developed. The development will not disturb any adjacent farming activities. Because the whole site will be developed it will not lead to fragmentation of farm land.
3.3.7. A substantiated statement from the soil scientist or agricultural specialist on the acceptability of the proposed development and a recommendation on the approval of the proposed development;	The PV site development takes place on low potential land that has a low sensitivity related to agriculture. It consists of shallow and rocky soils with few patches of deeper soils. It is the author's opinion that the no reason could be found to prevent the project from being implemented. Further, any measure or project that can help to relieve the country's electricity problems should be encouraged.
3.3.8. Any conditions to which this statement is subjected	There are no conditions imposed on the approval of the project
3.3.9. in the case of a linear activity, confirmation from the agricultural specialist or soil scientist, that in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase.	The proposed transmission line runs along roads or farm boundaries that can provide access during construction. It is my opinion that the disturbance of grassland vegetation when the lines are built will recover within the first rainy season. The pylon footprint will likely have weeds during the first year but will revert to grass during the second and third year.
3.3.10. Where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr; and	No particular management requirements are proposed. It is, however, recommended that a stormwater management plan be implemented. Where fences are removed in order to erect the transmission line, temporary measures should be put in place to contain livestock and game animals. Some of the fences are of game standard and should be repaired or replaced to the same standard.
3.3.11. A description of the assumptions made and any uncertainties or gaps in knowledge or data.	The observations are accepted as representative of the soil conditions. The author feels confident that this is the case. There were sufficient observations made that no gaps in knowledge or data is expected.
The duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Assessment date: April 2023. The duration, date and season of the site inspection and the significance of the season to the outcome of the assessment is not relevant. The main criteria for farming potential are soils, climate and water availability. These are not bound to seasons.
A description of the methodology used to undertake the on-site assessment	Refer to Section 5.

2 BACKGROUND

Nemai Consulting has been appointed for a solar project and grid connection; Grootvlei 600MW Solar PV Plant, BESS and Grid Connection north west of Ventersdorp, North West Province.

INDEX was appointed to do the agricultural compliance statement in terms of Notice 320 of the National Environmental Management Act in May 2020 of the Department of Environmental Affairs.

SITE VERIFICATION

The current use of the land and the environmental sensitivity of the site under consideration as identified by the screening tool was be confirmed by undertaking a site sensitivity verification.

The site sensitivity verification is normally done by desk top analysis, using satellite imagery, a preliminary on-site inspection and any other available and relevant information.

The outcome of the site sensitivity verification found the following:

- It disputes the current use of the land and the environmental sensitivity as identified by the screening tool.
- Evidence that the crop land boundary is incorrect – no land is cultivated on the PV Site. The land indicated as cropping land is actually pastures that were established more than a decade ago. The land environmental sensitivity according to the tool is indicated as high and moderately sensitive. This is not the case; the soil is shallow and rocky with many outcrops that renders the site as not arable and only suitable for grazing. There are no irrigation rights nor is there any land under irrigation.
- There is some cultivated land along the OHL routes, but being a linear structure with only pylons that disturb the land, the impact is low and can be mitigated.
- In line with the provisions of the Protocol, a compliance statement is required for the EIA scoping report.

The findings of the Sensitivity Verification are incorporated into this report.

The location is indicated in Figure 1.

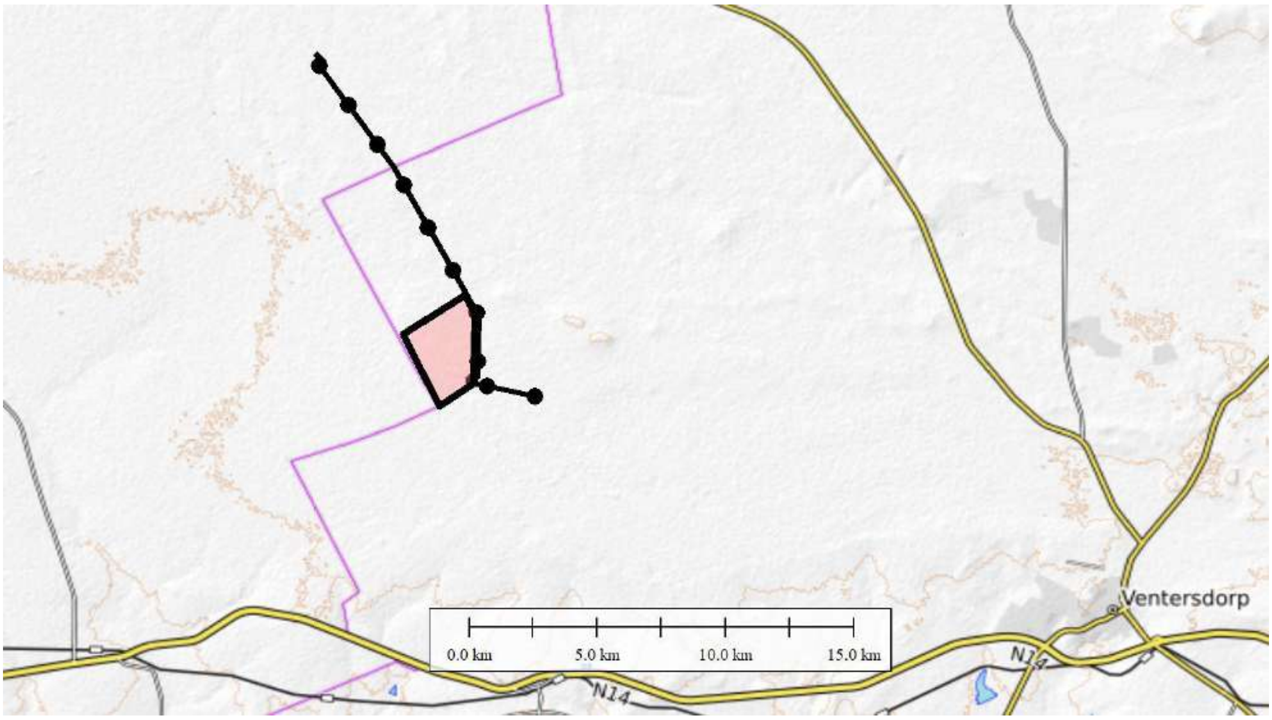


Figure 1. Locality of the project

3 TERMS OF REFERENCE

Nemai Consulting was appointed for a solar project and grid connection; Grootvlei 600MW Solar PV Plant, BESS and Grid Connection north west of Ventersdorp in North West Province.

APPROACH

- Determine agricultural potential in the Project's footprint.
- Determine impacts of the Project from an agricultural perspective.
- Suggest suitable mitigation measures to address the identified impacts.

The following were indicated by the client as particular outputs:

- Indicate Key Issues & Triggers Identified During Scoping
- Indicate loss of agricultural land with high capability due to direct occupation by the development footprint.
- Indicate loss of fertile soil.
- Soil erosion due to inadequate stormwater management.

4 PROPOSED DEVELOPMENT

The project consists of a PV site, two powerline routes, and the associated infrastructure:

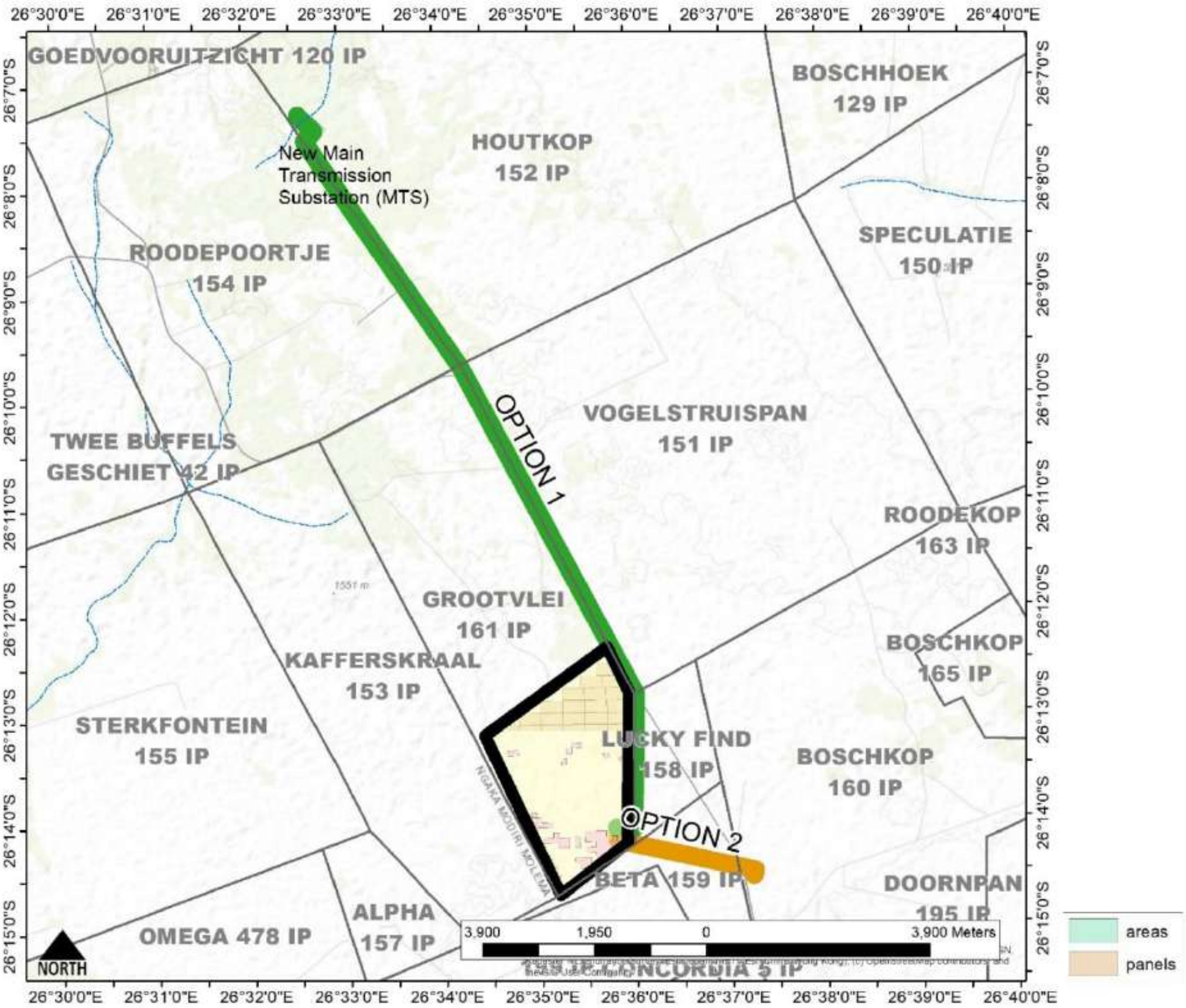


Figure 2. Main components of the development

- 600MW PV solar panels or modules (arranged in arrays);
- DC-AC current inverters stations, transformers, and internal underground cabling electrical reticulation;
- Grid Connection:
  - Route 1 which consists of 2 x 132kV powerlines, approximately 14km, from the new facility 33kV substation to a new 400/132kV Main Transmission Substation to Loop In-Loop Out of the Pluto - Watershed 275kV power line and
  - Route 2 that comprises of 3 km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation
- New 400/132kV Main Transmission Substation;
- Administration Buildings, workshop areas for maintenance and storage, security buildings;
- Temporary laydown areas;
- Internal access roads and perimeter fencing of the footprint area;
- Lithium-ion battery energy storage system (BESS);
- Site access from unnamed gravel road via the N14 and/or R53.

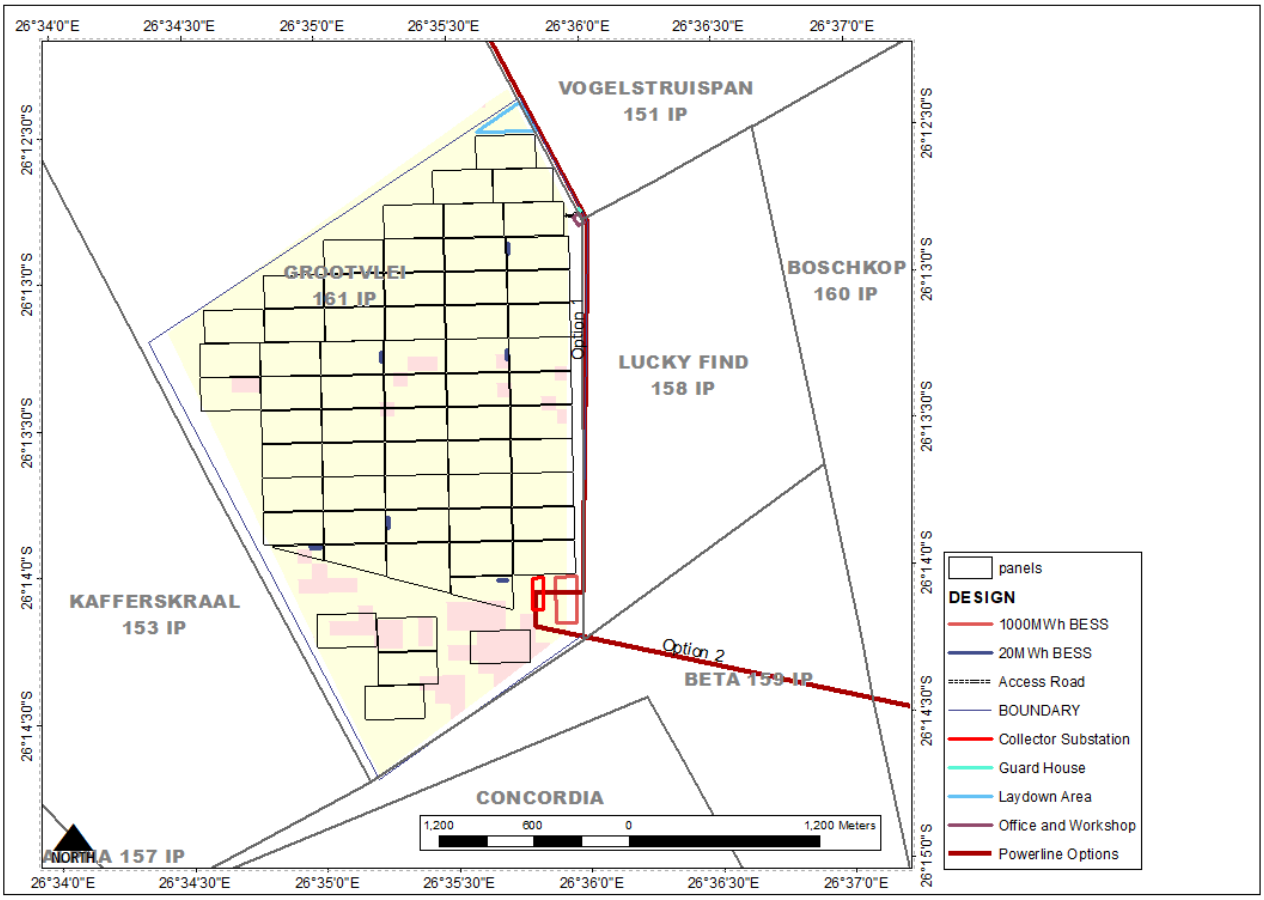


Figure 3. Infrastructure superimposed on the Agricultural Sensitivity

5 METHODS AND PROCEDURES

SITE SENSITIVITY VERIFICATION

The verification is a review of existing information on soils and topography on a desktop level to determine areas with high sensitivity in terms of Notice 320 of the National Environmental Management Act in May 2020 of the Department of Environmental Affairs.

The current use of the land and the environmental sensitivity of the site are available in the screening tool, and were used in assessing the site.

- The desktop verification was done through use of satellite imagery and a site visit took place on 27 March 2023.
- The aim was to verify the findings of the interpretation done on the satellite images and of the data obtained from the Screening Tool.
- The outcome of the site verification is included in this report.

The report compared the current crop land and the environmental sensitivity as identified by the screening tool with the present situation.

The results are indicated in Section 1.

SITE EVALUATION PROCESS

Satellite images were used as backdrop and the present land uses digitised.

Soil profiles were augured to determine soil depth, clay content is land conditions.

Capability classification is according to the guidelines published on the AGIS website of the National Department of Agriculture (NDA) was used to determine the capability of soils and their agricultural potential (DALRRD, 2019).

6 SITE EVALUATION

6.1 PRESENT LAND USES

6.1.1 PV SITE

The entire site is used for grazing. Pastures were established decades ago but which has reverted to natural veld on large portions. Weeds have encroached on some of the natural veld as shown below.

Photo 1. Old *Digitaria Smutsii* pastures

Photo 2. Grazing encroached with weeds

6.1.2 TRANSMISSION LINES

Two routes have been proposed, which are the following:

Note that both route options will be implemented and used for the project to evacuate electricity from the project.

- Route Option 1: two powerlines of approximately 14km kilometres (km). It is from the new substation to a new Main Transmission Substation to Loop In-Loop Out of the Pluto - Watershed power line
- Route option 2: a 3km line from the new facility substation facility to the Makokskraal Substation

The present land uses are indicated below:

Table 1. Land uses along the proposed transmission line routes (indicated in metres)

Land uses	Option 1	Option 2	Total
Grazing	10 192	1 052	11 244
Grazing/cultivated	1 085		1 085
Irrigated/grazing	1 012		1 012
Pastures	163	307	470
Pastures/cultivated	888		888
Pastures/grazing	1 227	1 087	2 314
Total	**14 567**	**2 446**	**17 013**

The map notation indicates the land uses on the left and then on the right side of the route as one move away from the PV site.

LINE EVALUATION

- Line Option 1

  This route is approximately 14,6km and runs in a northerly direction. The sensitive portions are cultivated land and land under irrigation. The latter is particularly sensitive because of the permanent irrigation infrastructure that may be damaged during construction. Approximately one kilometre on the farm Roodepoortjie is irrigated land. There are two centre pivot irrigation machines and an orchard that will be impacted (see Figure 5).
- Line Option 2

  This is the shorter of the two routes and is only of grazing land. Pastures occur on the right-hand side of approximately half of the route. Although it is accepted that the land will be disturbed by the construction activity, experience elsewhere for similar situations find that the grass recovers within following rainy reason and that the impact is small and temporary.

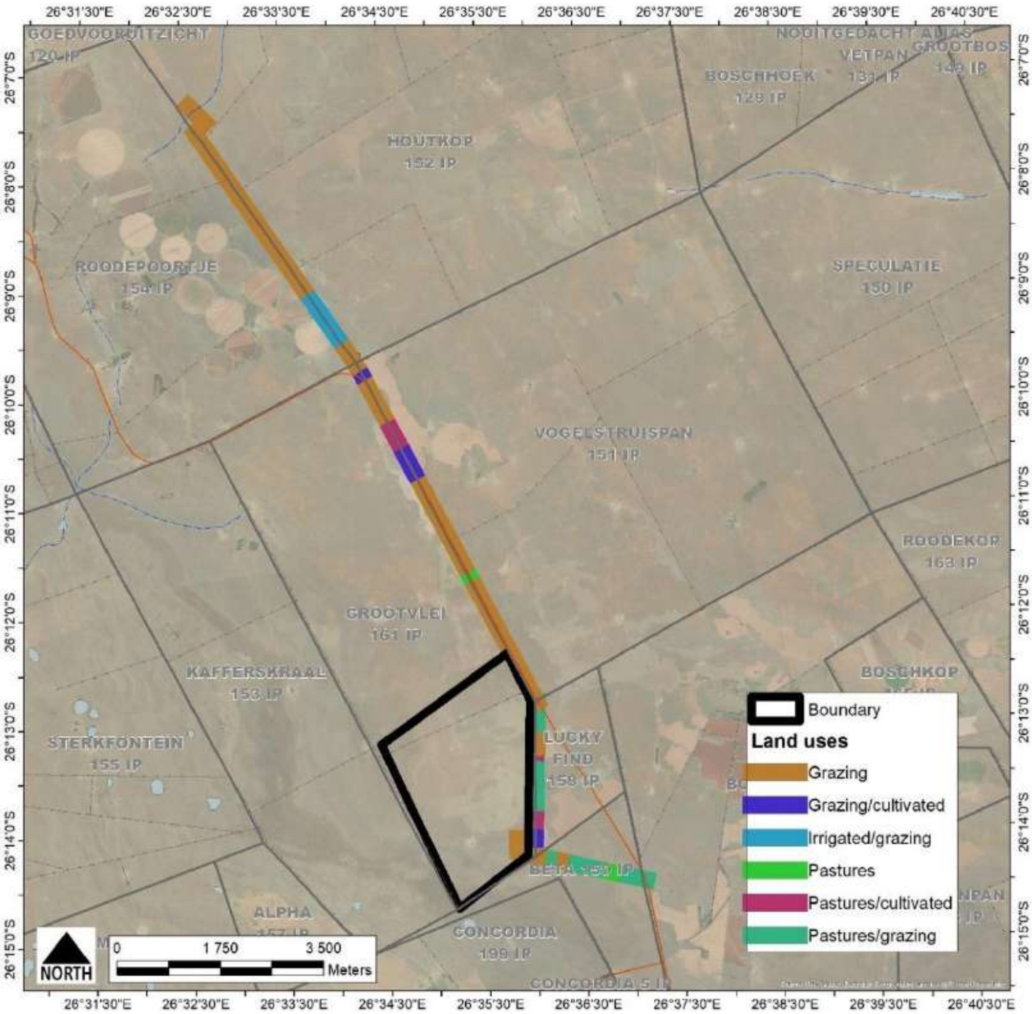


Figure 4. Land uses along the transmission lines

Figure 5. Irrigated land in Route Option 1. The pivot irrigating machines and orchards are clearly visible

PV SITE

The photos below indicate the present land uses. The fallow lands have reverted to veld and is now far advanced in succession status. The total land area is now used for grazing of livestock.

Photo 3. Rocks removed in an attempt to make lands

6.2 CLIMATE

The climate is suitable for adapted crop production practices provided that the soil is suitable for cultivation. In this case, the soils on the PV site are shallow and rocky and not arable. This was also the reason that the farmers abandoned crop production and planted pastures.

6.3 SOIL PROPERTIES

SOIL TYPES

The entire PV site is located on dolomite and chert with many rock outcrops and loose rock and stones. Concretions of iron and manganese are common (refer to photos below).

Soil types identified are Mispah, Glenrosa and Hutton. The Hutton varies in depth between 300mm to more than a metre over very short distances. This is very common on soil that developed on dolomite.

In general, the soils are not arable and only suitable for grazing.

Mostly rocky soils occur along the OHL. However, because it is a linear structure with only the OHL pylons taking up very little land, a soil survey was not done.

SOIL CAPABILITY

In 2002 the Directorate: Land Use and Soil Management within DALRRD developed a national spatial land capability data set to indicate the spatial delineation of the then defined eight land capability classes. The approach followed was based on the approach of Klingebiel and Montgomery (1961) but adapted for South Africa. The aim was to develop a system for soil and land capability classification. It further aimed to incorporate the parameters within a Geographic Information System (GIS). The resulted spatial data set was derived at from a 1:250 000 land type data set being the main input data set for the derived land capability classes together with climatic and terrain parameters.

This dataset is used within the screening tool.

While the new dataset is more complex than that of Klingebiel *et al*, the latter has clear guidelines and is generally still followed when assigning capability to land. A comparison between the two systems is provided below.

Table 2. Relationship between grading of the Screening tool and that of Klingebiel et al.

DALRRD (2016)	Klingebiel	Capability	Arability
1-2	viii	Very low	Not arable
3-4	vii	Very low to low	
5-6	vi	Low	
7	v	Low to moderate	
8	iv	Moderate	Arable
9-10	iii	Moderate to high	
11-12	ii	High	
13-14	i	High to very high	
15	i	very high	

Land capability classes are interpretive groupings of land with similar potential and limitations or similar hazards. Land capability involves consideration of difficulties in land use owing to physical land characteristics, climate and the risks of land damage from erosion and other causes.

The classic eight-class land capability system (Klingebiel & Montgomery, 1961) was adapted for use by the South African Department of Agriculture in their Agriculture Geographic Information System (AGIS).

According to the criteria in AGIS, the arable portions are Class 7 or poorer with only small isolated portions in the south that has moderate potential. According to Klingebiel *et al*, the soil capability is Class v and lower, mainly because of depth and mechanical limitations to root development and cultivation.

According to the soil capability classification, the soils have low capability (or sensitivity as related to the Screening Tool).

6.4 VEGETATION

The land in its natural state is Carletonville Dolomite Grassland with highly palatable grass species.

The grazing capacity according to DALRRD is estimated at 7ha/large livestock unit (LSU). The carrying capacity for the PV site is approximately 100 LSU.

6.5 WATER

There are boreholes on the PV site is used for livestock watering. No water licence is in place for abstracting water for irrigation.

Construction will have no impact on the availability of water for farming purposes.

7 SENSITIVITY ANALYSES

7.1 ECOLOGICAL SENSITIVITY – SCREENING TOOL

BACKGROUND

The Department of Forestry, Fisheries and Environment published Notice 320 in 2020 that describes the minimum criteria when applying for environmental authorisation.

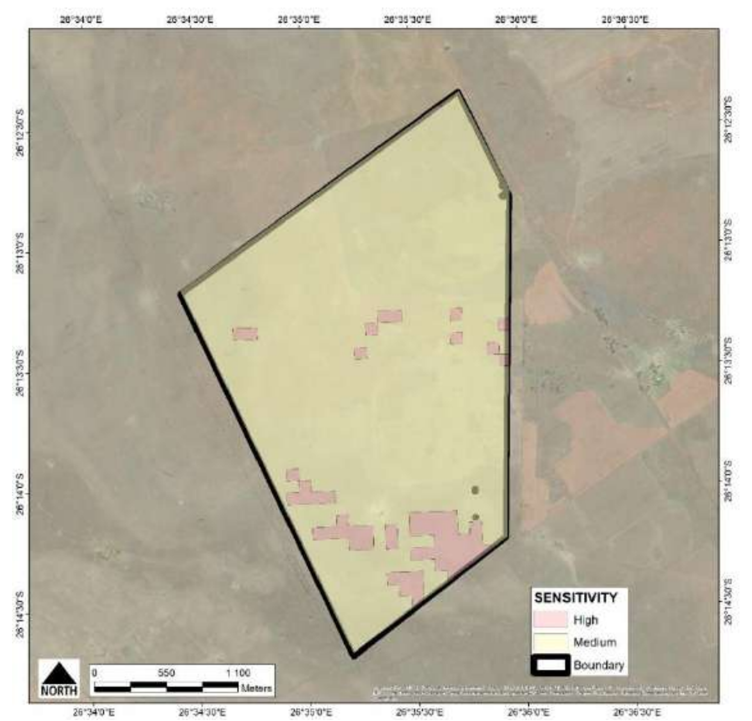
This protocol provides the criteria for the assessment and reporting of impacts on agricultural resources for activities requiring environmental authorisation. The assessments requirements of this protocol are according to the level of environmental sensitivity as indicated by the national web-based environmental screening tool for agricultural resources. It is based on the most recent land capability evaluation as provided by the DALRRD.

According to the protocol, an applicant intending to undertake an activity where it occurs on land with '*very high*' or '*high'* sensitivity for agricultural resources must submit an Agricultural Agro-Ecosystem Specialist Assessment. Alternatively, a Compliance statement will suffice.

- PV Site

  In the case of this project, the Screening Tool indicates that the site sensitivity is *moderate* in general and *high* on small portions in the south.
- OHL

  The only *high* or *very highly* sensitive land occurs on the northern part of the Route Option 1.



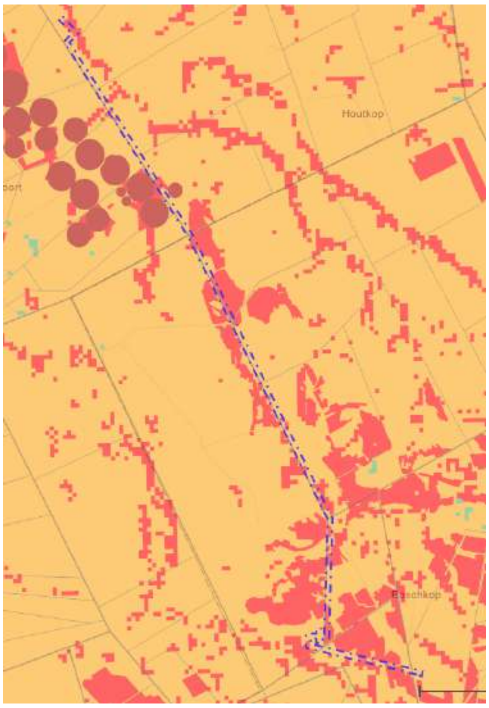


Figure 6. Sensitivity (tool) – red indicates high sensitivity

7.2 SPECIALIST SITE ANALYSES

Sensitivity verification was undertaken by desk top analysis using satellite imagery and a site visit that took place on 4 April 2023.

The outcome of the site sensitivity verification found that:

PV SITE

- According to guidelines in AGIS (DALRRD), the land has low and low/moderate arable potential. This is because of the shallow soils and rock outcrops (refer to Section 6.3). According to the criteria in AGIS the land is not arable and more suitable for livestock grazing.
- The site visit found very little deep arable soils that is without rock outcrops.
- No land can be regarded as high potential for cropping and which should be protected because it is *highly sensitive* for farming purposes.

OHL

The footprint of the pylon is the only permanent feature that will lead to land loss.

- Line Option 1: The only sensitive portions are cultivated land and land under irrigation on the farm Roodepoortjie.
- Line Option 2: The route consists of mainly veld grazing and pastures.

8 IMPACT ASSESSMENT

8.1 LOSS OF HIGH POTENTIAL LAND

LINE CONNECTION

The footprint of the pylon is the only permanent feature that will lead to land loss.

- Line Option 1

  This route is approximately 14,6km and runs in a northerly direction. The only sensitive portions are cultivated land and land under irrigation, which is on the farm Roodepoortjie. There are two centre pivot irrigation machines and an orchard that will be impacted (see Figure 5).

  The placement according to the design is on the western side of the road; this is the side where the irrigated land is located.

  The impact is small and temporary and not significant on a local or regional scale.

- Line Option 2

  This route is approximately 2,4km and runs in a northerly direction. Pastures occur on the right-hand side of approximately half of the route. Although it is accepted that the land will be disturbed by the construction activity, experience elsewhere for similar situations find that the grass recovers within the following rainy reason.

  Livestock can utilise grazing under the line and even between the legs of the pylon.

  The impact is small and temporary and not significant on any scale.

PV SITE

No high potential land was found on the site.

- No impact.

8.2 LOSS OF AGRICULTURAL PRODUCTION

LINE CONNECTION

The footprint of the pylon is the only permanent feature that will lead to loss of production.

- Line Option 1

  This route is approximately 14,6km and runs in a northerly direction. The are two centre pivots on the farm Roodepoortjie irrigation machines and an orchard may be impacted (see Figure 5).

  Careful placement of the pylons can mitigate and reduce the impact. The impact on the pivots is only temporary, while that on the orchards may be permanent where trees will have to be removed to erect a pylon. If assumed that pylons are placed every 200 metres, then one or two pylons may be in the field.

  On the same assumptions as for Line Option 1, it is estimated that grazing for less than one LSU will permanently be lost.

  The impact is small and temporary and not significant on a local or regional scale.

  Mitigation for the potential loss in production on the irrigated land should be discussed with the farmer and the actual loss be compensated.

- Line Option 2

  The total area of the pylon is 240m^2 (assuming that 20m^2 is taken up by the legs of the pylon). This area makes no contribution to the grazing capacity of the affected farm. On the assumption that a 100m strip could be disturbed by construction, then a temporary loss of grazing land is approximately 3 LSU. Experience elsewhere for similar situations find that the grass recovers within following rainy reason.

  Livestock can utilise grazing under the lined and even between the legs of the pylon.

The impact is small and temporary and not significant on a local or regional scale.

PV SITE

There is no land cultivated on the property.

The site is used for animal grazing and can carry approximately 100 LSU. At a gross farm income (enterprise margin) of around R8 500 per LSU the financial impact is approximately R850 000. This is before overhead costs.

- The impact of the development is low but permanent.

8.3 LOSS OF AGRICULTURAL INFRASTRUCTURE

LINE CONNECTION

Fences are the only farming infrastructure that will be affected all the properties through which the line runs.

- The impact of the development is low and temporary.

Mitigation: fences should be repaired following construction. Inform and collaborate the construction process with the affected farmers.

The irrigated land, particularly where pylons are placed inside orchards can lead to permanent loss of income.

Mitigation for the potential loss in production on the irrigated land should be discussed with the farmer and the loss be compensated.

PV SITE

There is no farming infrastructure that will be lost.

- There is no impact.

8.4 LOSS OF SOIL DUE TO EROSION

LINE CONNECTION

The soil is well-drained with moderately developed structure. It is also on evenly sloped land where erosion is not expected.

- There is no impact.

PV SITE

The soil is well-drained with moderately developed structure. It is also on evenly sloped land where erosion is not expected.

Nevertheless, the PV projects creates areas that are cleared of vegetation, and that could be subject to erosion. Runoff from hard surfaces should be dealt with by a Stormwater Management Plan (SMP). This is an engineering function and is normally addressed as part of the project design.

Mitigation is achieved by allowing grass to re-establish after construction and by guidelines in the SMP.

- No impact is expected

9 CONCLUSIONS

FINDINGS AND ANALYSES

- There is no land that can be regarded as high potential cropping land that be protected because it is *highly sensitive* for farming purposes.
- Further, except for the irrigated land and permanent crops on Roodepoortjie there is no cultivated land along the OHL. The pylons should be placed in order to minimise the disturbed area that is under production.

IMPACT ASSESSMENT

- There will be no loss of high potential soil and only a small impact on cattle production.
- It appears that the land can carry approximately 100 LSU that will be lost due to the PV. The potential income is estimated at approximately R850 000. This is insignificant if measured against the benefit the region and country can reap from this project.
- The potential loss of irrigated land and permanent crops on Roodepoortjie is low if the pylons are placement in order to minimise the area under production.

IMPACT AND MITIGATION DURING CONSTRUCTION

- Security during construction: Mend fences when they are breached in order to protect livestock and game. This applies especially for farmers with rare and endangered game.
- Make the contact details of the main contractors available to surrounding landowners and attend to any problems expeditiously.
- Hazardous substances should be safely disposed of or stored to minimise any impact on animals and water resources.

IMPACT AND MITIGATION DURING OPERATIONAL PHASE

- Road reserves require normal maintenance. Mitigation is normally not required. However, alien vegetation should be controlled.
- Implement the Environmental Management Programme (EMPr) for the duration of the operations to eliminate potential impacts.

GENERAL CONCLUSIONS

- No key issues or triggers were identified.
- There is no high potential sensitive land on the PV Site.
- Except for the irrigated land and permanent crops on Roodepoortjie there is no cultivated land along the OHL. The pylons should be placed in order to minimise the disturbed area that is under production.
- Negative impacts on OHL Option 1 on Roodepoortjie can be mitigated,

10 Recommendation

The land on which the development is proposed is low potential cropping land that has a low sensitivity in in terms of Notice 320 of the National Environmental Management Act in May 2020 of the Department of Environmental Affairs. Potential negative impacts of the OPL pylon placement can be mitigated.

It is recommended that construction be approved.

11 ADDENDA

11.1 SOURCES OF INFORMATION

a) Criteria for high potential agricultural land in South Africa, Department of Agriculture, Directorate Land Use and Soil Management, 2002.

b) Grondklassifikasie Werkgroep, 1991. Grondklassifikasie, 'n Taksonomiese sisteem vir Suid Afrika, Departement van Landbou-ontwikkeling, Pretoria.

c) Department of Agriculture. Grazing capacity. Development of Agricultural Land Framework Bill , 2016

d) WRC, 2003 South African Atlas of Agrohydrology and Climatology, Water Research Commission

e) CROPWAT 8.0 has been developed by Joss Swennenhuis for the Water Resources Development and Management Service of FAO.

11.2 SACNASP CERTIFICATE

THE SOUTH AFRICAN COUNCIL
FOR
NATURAL SCIENTIFIC PROFESSIONS

herewith certifies that

Johan Andries Gouws
Registration number: 400140/06

has been registered as a

Professional 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)

Agricultural Science

11 July 2006		
Pretoria	President	Chief Executive Officer

11.3 CURRICULUM VITAE (CV)

Position Title and No.	Agriculture, Land use planning and wetland specialist. INDEX
Name of Expert:	Andries Gouws
Date of Birth	12/04/1955
Country of Citizenship /Residence	South Africa

Education

Name of institution: College/University or other	Degree/diploma/certificate or other specialized education	Date completed
University of Pretoria, South Africa	BSc. Agriculture	1979
University of Bloemfontein	BSc. Honours, Agriculture	1987
Potchefstroom Collage for Agriculture	Diploma: Stereoscopic aerial photo interpretation of natural resources for farm planning	1981
University of South Africa	Diploma: Financial management	1992
University of Trinity	PhD: Integrated agricultural development	2007

Employment record relevant to the assignment:

Period	Employing organization and your title/position. Contact info for references	Country	Summary of activities performed relevant to the Assignment
1993 - current	INDEX - Director and co-owner: Responsibility: Agriculture and land use planning. Contact: Eugene Gouws - Director +27 82 55 33 787	RSA	Provided specialist assessment services in agriculture and land use planning for various development projects.

Membership in Professional Associations and Publications:

Soil Science society of South Africa.

South African Council for Natural Scientific Professions – Registered Professional Scientist (Reg no: 400140/06)

Adequacy for the Assignment:

Detailed Tasks Assigned on Consultant's Team of Experts:	Reference to Prior Work/Assignments that Best Illustrates Capability to Handle the Assigned Tasks
Position: Agricultural Specialist	Agricultural Impact Assessment for the Proposed Mookodi-Mahikeng 400kv Line. 2018. Client: Nemai Consulting
	Agricultural Impact Assessment for the Proposed Foxwood Dam 2015 – 2016 Compiled the specialist report on Agricultural impact

	Client: Nemai Consulting, DWS
	Agricultural Impact Assessment for the Proposed Mokolo and Crocodile River (West) Water Augmentation Project (MCWAP) (2017 – 2019) Compiled the specialist report on Agricultural impact Client: Nemai Consulting, DWS
	MSOBO COAL – HARWAR; economic study for the farming enterprises Discussion of the natural resources that influences agricultural potential; Farming and the potential for different enterprises; Indicate the potential income from main enterprises and Indicate the financial impact of the development on the farmers. (2013/4) Client: Demacon
	Agricultural potential study of Portion 21 (Portion 1) of the farm Koppieskraal 1157-IR 2019. Client: Adv Johan du Plessis
	Agricultural Potential Assessment: Albany Wind Energy Facility & Grid Infrastructure Near Makhanda, Eastern Cape Province 2020 Client: CES Environmental and Social advisory Services
	Agricultural potential and impact assessment of Available Land At Mopeia, Mozambique 2016 Client: Barari Forest Management. Department: Research & Development Abu Dhabi

Expert's contact information: E-mail: index@iafrica.com

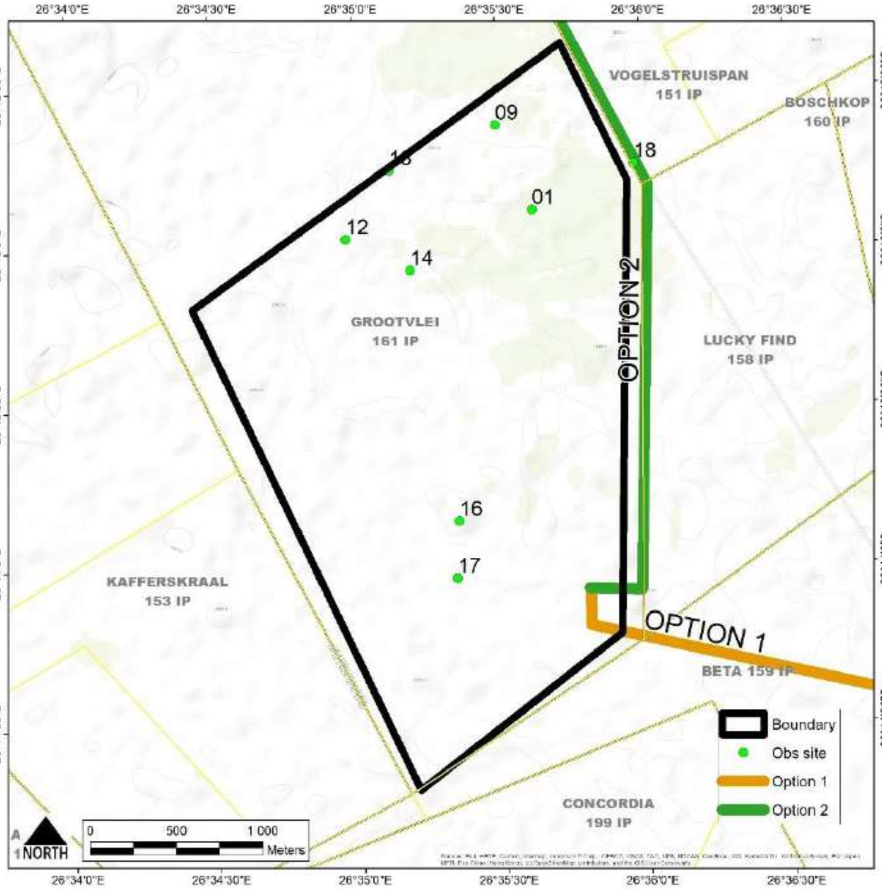
Phone: +27 (0) 82 807 6717

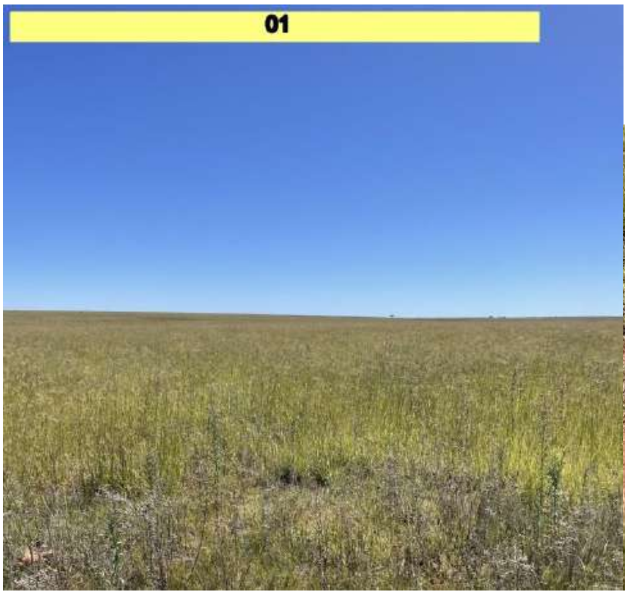
Certification:

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes my qualifications, my experience and myself.

Andries Gouws		March 2023
Name of Expert	Signature	Date

11.4 OBSERVATIONS



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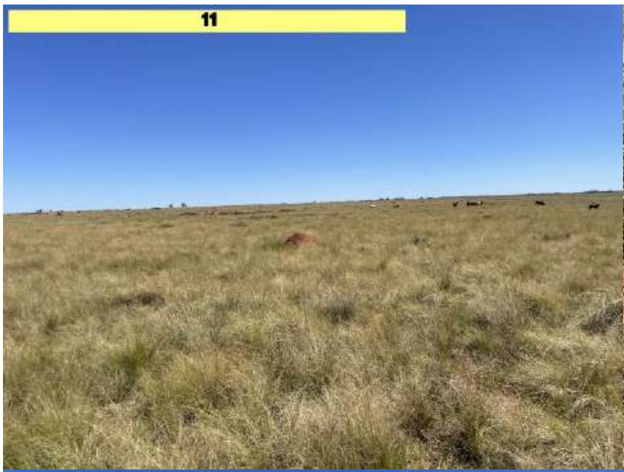
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APPENDIX D5: Heritage Impact Assessment

LTM GREEN ENERGIES (PTY) LTD

PROPOSED GROOTVLEI 600MW SOLAR PLANT, BATTERY ENERGY STORAGE SYSTEMS & GRID CONNECTION PROJECT, NEAR VENTERSDORP, JB MARKS LOCAL MUNICIPALITY, NORTH WEST PROVINCE

HERITAGE IMPACT ASSESSMENT

20 SEPTEMBER 2023

Submitted to : Nemai Green Consulting

Prepared by:

Jennifer Kitto

Nitai Consulting (PTY) Ltd

147 Bram Fischer Drive

Ferndale

2194

The heritage impact assessment report has been compiled considering the NEMA Appendix 6 requirements for specialist reports as indicated in the table below.

Requirements of Appendix 6 – GN R326 EIAs Regulations (2014, amended 2017)	**Relevant section in report**
1.(1) (a) (i) Details of the specialist who prepared the report	Section 1.1.3 of Report
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 1.1.3 and of Report and **Appendix 2**
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page iii of the report
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 1.1
(cA) An indication of the quality and age of base data used for the specialist report	N/A
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 6
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 7
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 5.2 and 5.4, Section 6
(g) An identification of any areas to be avoided, including buffers	Section 6, Section 12
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	**Appendix 1**
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Sections 6, 8
(k) Any mitigation measures for inclusion in the EMPr	Sections 11, 12
(l) Any conditions for inclusion in the environmental authorisation	N/A
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	N/A
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 12
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and	
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 11, 12
(o) A description of any consultation process that was undertaken during the course of carrying out the study	Not applicable. A public consultation process will be handled as part of the EIAs and EMPr process.

Requirements of Appendix 6 – GN R326 EIAs Regulations (2014, amended 2017)	Relevant section in report
(p) A summary and copies if any comments that were received during any consultation process	Not applicable. To date no comments have been raised regarding heritage resources that require input from a specialist.
(q) Any other information requested by the competent authority.	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 38(3) of the NHRA

Declaration of Independence

The report has been compiled by Nitai Consulting (Pty) Ltd, an appointed Heritage Specialist for Nemai Green for the Proposed Grootvlei 600MW Solar Plant, Battery Energy Storage Systems & Grid Connection Project, Ventersdorp, JB Marks Local Municipality, North West Province. The views contained in this report are purely objective and no other interests are displayed during the decision-making processes discussed in the Heritage Impact Assessment Process.

I, Jennifer Kitto, declare that –

General declaration:

- *I act as the independent heritage specialist for this project*
- *I will perform the work relating to the project 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 heritage impact assessments, including knowledge of the National Heritage Resources Act, No 25 of 1999 (NHRA), associated Regulations and any guidelines that have relevance to the proposed activity;*
- *I will comply with the NHRA, associated Regulations and all other applicable legislation, including the National Environmental Management Act, No 107 of 1998 (NEMA);*
- *I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;*
- *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;*
- *I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;*
- *I will provide the competent authority with access to all information at my disposal regarding the project, whether such information is favourable to the applicant or not*
- *All the particulars furnished by me in this form are true and correct;*
- *I will perform all other obligations as expected of a heritage specialist in terms of the NHRA and the constitutions of my affiliated professional bodies; and*
- *I realise that a false declaration is an offence in terms of regulation 71 of the NEMA Regulations and is punishable in terms of section 24F of the NEMA.*

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the NEMA Regulations;

HERITAGE CONSULTANT - Nitai Consulting (Pty) Ltd

PRINCIPAL HERITAGE PRACTITIONER – Jennifer Kitto

CONTACT PERSON - Jennifer Kitto

Tel - +27 (0) 633316606

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SIGNATURE - ______________________________

ACKNOWLEDGEMENT OF RECEIPT

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SIGNATURE - ______________________________

Executive Summary

LTM Green Energies (Pty) Ltd (the "Applicant") has proposed the development of Grootvlei 600MW Solar Plant, Battery Energy Storage Systems (BESS) and Grid Connection Project north west of Ventersdorp within the JB Marks Local Municipality in the North West Province (the "Project"). The electricity generated by the Project will be transmitted through either Option 4 which consists of 2 x 132kV powerlines, approximately 14km kilometres (km) in length, from the new facility 33kV substation to new 400/132kV Main Transmission Substation (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line; or Option 4 that comprises a single 2.8km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation.

In terms of the Grid Connection Capacity Assessment (GCCA) 2024, which is a report that presents the results of available generation connection capacity of all the transmission substations in all the supply areas in all the provinces of South Africa, the Project is located within the North West Supply Area. Based on the latest GCCA that was released by Eskom in March 2022, the GCCA confirms that the North West Supply Area currently has 4370MW generation connection capacity available. The Project Site is located approximately 14km from the Pluto – Watershed 275kV power line. The Applicant intends to bid for the current and future Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) bid windows and/or other renewable energy markets within SA

Methodology/ significance Assessment

The project area that will be impacted by the proposed Grootvlei Solar PV project contains some areas that are currently disturbed by cattle and game farming activities.

The impact significance of the project on graves and cemeteries is low as no definite grave sites were identified.

The impact significance of the proposed project on protected historical structures is low as two sites comprising historical structures (Groot 01 and Groot 04) were identified which are located within or adjacent to the general PV site area and/or powerline options.

The impact significance of the proposed project on archaeological resources is low as two sites containing a very low density scatter of stone tools (Groot 02, Groot 03) were identified within the general PV site area.

Mitigation Measures

The proposed Grootvlei Solar PV project could impact on heritage resources as four heritage resources were identified within or adjacent to the project footprint area: two historical structure sites (Groot

01, Groot 04) and two archaeological sites (Groot 02, Groot 03). However, the Alternative 2 layout has been adjusted to specifically avoid these heritage resources.

The recommendations below are provided to mitigate the potential impact of the proposed PV project on the identified heritage resources:

Historical Structures (Groot 01, Groot 04)

- A buffer of at least 20m (25m from the centre for the kraal) must be placed around both sites to ensure that during construction there is no indirect impact which could damage any structures
- The materials demarcating the buffer must be highly visible and made of durable material
- If any impact is anticipated, then a permit will be required for the alteration or destruction of any of the structures (from NW PHRA or SAHRA)

Archaeological material (Groot 02, Groot 03)

- A buffer of at least 30m must be placed around both sites to ensure that during construction there is no indirect impact which could damage any archaeological material
- The materials demarcating the buffer must be highly visible and made of durable material
- If any impact is anticipated, then a permit will be required for the destruction of the material (from SAHRA)

Palaeontological heritage

- A separate palaeontological study is being undertaken by a professional palaeontologist as the project area falls into an area where the underlying geology is mainly of Very High fossil sensitivity. The assessment would indicate if significant/sensitive fossils will be impacted by the proposed project and provide mitigation measures.

No fatal flaws were identified during this study, therefore, it is the considered opinion of the heritage specialist that the construction of the proposed Solar PV project within the footprint can proceed. There are no objections from a heritage perspective provided the recommendations and mitigation measures contained in this report and in the separate desktop palaeontological assessment are implemented. It should be noted that the original layout for the Grootvlei Solar PV footprint (Alternative 1) has been revised to exclude certain environmentally and heritage sensitive areas (Alternative 2). The Alternative 2 layout avoids the identified heritage resources that would be impacted by the Alternative 1 layout. Therefore, from a heritage perspective, Alternative 2 is the preferred layout. However, some of these heritage resources still could be subject to indirect impact, specifically during site clearance or construction activities, therefore the mitigation measures set out will still apply.

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List of Abbreviations

APHP	Association of Professional Heritage Practitioners
ASAPA	Association of Southern African Professional Archaeologists
BESS	Battery Energy Storage System
CRM	Cultural Resources Management
DALRRD	Department of Agriculture, Land Reform & Rural Development
DFFE	Department of Forestry, Fisheries and Environment
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EAP	Environmental Assessment Practitioner
EIA	Early Iron Age
EMPr	Environmental Management Programme
ESA	Early Stone Age
GIS	Geographic Information System
ha	Hectare
HIA	Heritage Impact Assessment
IAP	Interested and Affected Party
IAIAsa	International Association for Impact Assessment South Africa
km	Kilometre (1 000m)
LIA	Late Iron Age
kV	Kilo Volt
LSA	Later Stone Age
MSA	Middle Stone Age
MTS	Main Transmission Station
NEMA	National Environmental Management Act (No. 107 of 1998)
NHA	National Health Act, (No. 61 of 2003)
NHRA	National Heritage Resources Act (No 25 of 1999)
NHS	National Heritage Site
NW PHRA	North West Provincial Heritage Resources Authority
PHRA	Provincial Heritage Resources Authority
PV	Photo Voltaic
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SAHRA	South African Heritage Resources Agency

1 INTRODUCTION

LTM Green Energies (Pty) Ltd (the "Applicant") has proposed the development of Grootvlei 600MW Solar Plant, Battery Energy Storage Systems (BESS) and Grid Connection Project north west of Ventersdorp within the JB Marks Local Municipality in the North West Province (the "Project"). The electricity generated by the Project will be transmitted through either Option 4 which consists of 2 x 132kV powerlines, approximately 14km kilometres (km) in length, from the new facility 33kV substation to new 400/132kV Main Transmission Substation (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line; or Option 4 that comprises a single 2.8km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation.

In terms of the Grid Connection Capacity Assessment (GCCA) 2024, which is a report that presents the results of available generation connection capacity of all the transmission substations in all the supply areas in all the provinces of South Africa, the Project is located within the North West Supply Area. Based on the latest GCCA that was released by Eskom in March 2022, the GCCA confirms that the North West Supply Area currently has 4370MW generation connection capacity available. The Project Site is located approximately 14km from the Pluto – Watershed 275kV power line. The Applicant intends to bid for the current and future Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) bid windows and/or other renewable energy markets within SA.

1.1 Scope & Terms of Reference for the HIA report

1.1.1 Summary of Key Issues & Triggers Identified During Scoping

In terms of the NHRA, the following proposed activities trigger the need for a Heritage Impact Assessment (HIA):

- Potential occurrence of heritage resources, graves and structures older than 60 years within the Project's footprint.
- Proposed development that is more than 5000m^2
- Proposed linear development that is longer than 300m
- Proposed development where an impact assessment is triggered in terms of NEMA.

1.1.2 Approach

- Undertake a Heritage Impact Assessment in accordance with the NHRA.
- Identify and map all heritage resources in the area affected, as defined in Section 2 of the NHRA, including archaeological sites on or near (within 100m of) the proposed developments.
- Assess the significance of such resources in terms of the heritage assessment criteria as set out in the regulations.
- Assess the impacts of the Project on such heritage resources.

- Prepare a heritage sensitivity map (GIS-based), based on the findings of the study.
- Identify heritage resources to be monitored.
- Comply with specific requirements and guidelines of NW PHRA and SAHRA.

1.1.3 Nominated Specialist Details

Organisation:	Nitai Consulting
Name:	Jennifer Kitto
Qualifications:	BA Archaeology and Social Anthropology; BA (Hons) Social Anthropology
No. of years' experience:	24
Affiliation (if applicable):	Association of Southern African Professional Archaeologists (ASAPA) - Technical member No.444 International Association for Impact Assessment (IAIAsa) – Member No. 7151

1.2 Project Description

LTM Green Energies (Pty) Ltd (the "Applicant") has proposed the development of Grootvlei 600MW Solar Plant, Battery Energy Storage Systems (BESS) and Grid Connection Project north west of Ventersdorp within the JB Marks Local Municipality in the North West Province (the "Project"). The electricity generated by the Project will be transmitted through either Option 4 which consists of 2 x 132kV powerlines, approximately 14km kilometres (km) in length, from the new facility 33kV substation to new 400/132kV Main Transmission Substation (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line; or Option 4 that comprises a single 2.8km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation.

2 Legislation

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by various pieces of legislation, including the National Heritage Resources Act, 25 of 1999 (NHRA) and associated Regulations, National Environmental Management Act, Act 107 of 1998 (NEMA) and associated Regulations and, as well as the National Health Act, Act No. 61 of 2003 (NHA), specific Regulations governing human remains.

2.1 National Heritage Resources Act, No 25 of 1999 (NHRA)

The NHRA is the defines cultural heritage resources (section 3), provides protection to specific types of heritage resources (sections 34, 35, 36) and also requires an impact assessment of such resources for specific development activities (section 38(1)). Section 38(8) further allows for cooperation and integration of the management of such impact assessment between the national or provincial heritage authority (SAHRA or a PHRA) and the national environmental authority (DEFF).

In terms of section 38(1)(a) of the NHRA, the specific types of development activity that may require a Heritage Impact Assessment (HIA) include: the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length. As the proposed Solar PV project footprint is larger than 5000m^2, and includes two powerline options that are both longer than 300m, this study falls under s38(8) and requires comment from the relevant heritage resources authority. (South African Heritage Resources Authority-SAHRA and/or the Free State Provincial Heritage Authority).

Sections 34-36 of the NHRA further stipulate the protections afforded to specific types of heritage resources, *i.e*. structures older than 60 years (s34); archaeological, palaeontological, meteorites (s35); graves and burial grounds (s36), as well as the mitigation process to be followed if these resources need to be disturbed. The construction of the solar PV project and powerline may result in impacts to any of these types of heritage resources.

2.2 National Environmental Management Act, Act 107 of 1998 (NEMA)

NEMA states that an integrated Environment Management Plan (EMP) should, (23 -2 (b)) "…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage". In addition, the NEMA and associated Regulations GNR 982 (Government Gazette 38282, 14 December 2014, amended 2017) state that, "the objective of an environmental impact assessment process is to, … identify the location of the development footprint within the preferred site … focussing on the geographical, physical, biological, social, economic, *cultural and heritage aspects* of the environment" (GNR 982, Appendix 3(2)(c), emphasis added).

The EIA Regulations, 2014 (as amended), published in GNR 982 of 2014 (Government Gazette 38282) promulgated under the (NEMA) contain specific requirements to be addressed in the different types or impact assessment reports (Regulations 19, 21 and 23) as well as requirements for Specialist Reports (Appendix 6).

2.3 The National Health Act, No. 61 of 2003 (NHA), Regulations 2013

In the case of graves and/or burial grounds that could be impacted by a proposed development, and which are identified through an impact assessment, specific Regulations relating to the Management of Human Remains (GNR 363 of 2013 in Government Gazette 36473) address the exhumation and reburial of human remains: Regulations 26, 27 and 28.

3 Assumptions and Constraints

This assessment assumes that all the information provided by the Client and the Environmental Assessment Practitioner (EAP) regarding the project footprint (Including the powerline) is correct and current.

The project area traverses various properties separated by fences, and access was sometimes restricted by locked gates or extremely long and dense grass and other vegetation in some areas.

The large area of the PV Site project footprint and powerline options meant that it was not feasible to undertake a pedestrian survey of the whole area and the fieldwork therefore, comprised a combination of vehicle and pedestrian investigation. The extremely dense and long vegetation in several areas meant that archaeological and heritage visibility was low in those areas. Therefore, there is a possibility that some heritage resources were not identified, specifically, informal graves or burial sites.

4 Project Description

4.1 Location

The Project is located approximately 20km to the northwest of Ventersdorp central business district (CBD) and falls within Ward 34 of the JB Marks Local Municipality, in the North West Province. The site can be accessed via the N14 (main access) and the R53 (gravel road). The property earmarked for the Solar Project covers a combined area of approximately 655 hectares (ha).

The location details of the affected properties are provided below (Alternative 1 and Alternative 2 layouts).

- Solar Plant: Portion number 0 of the farm Grootvlei 161 IP
- New Main Transmission Substation: Portion number 1 of the Farm Houtkop 152
- Powerline Route Option 4: Portion number 1, Portion number 9, Portion number 11, Portion number 12 of the Farm Houtkop 152; Portion number 3, Portion number 4. Portion number 7 of the Farm Vogelstruispan 151; Portion number 0 of the Farm Lucky Find 158; and Portion number 0 of the farm Grootvlei 161 IP.
- Powerline Route Option 4: Portion number 0 of the farm Grootvlei 161, Portion RE of the Farm Beta 159 IP, Portion 0 of the Farm Boschkop.
-

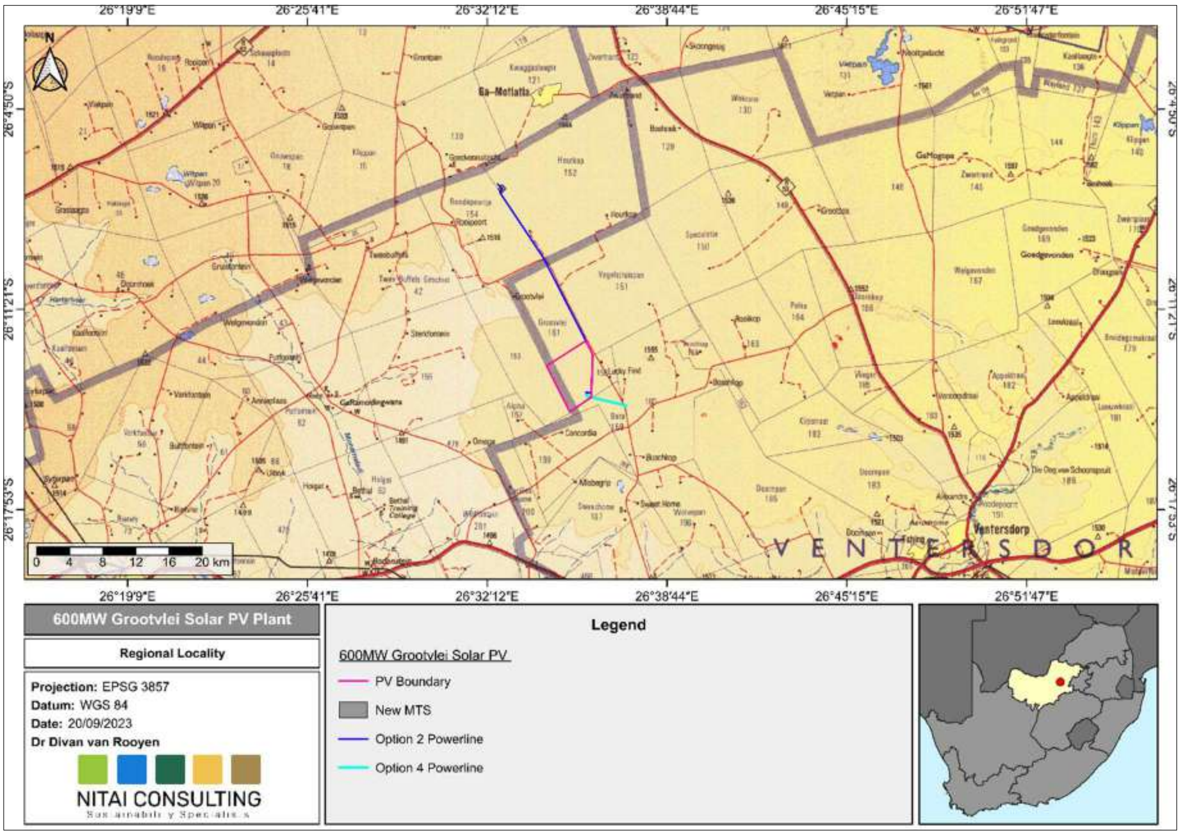

Figure 1: Grootvlei 600MW Solar PV Regional Locality northwest of Ventersdorp (Nitai 2023)

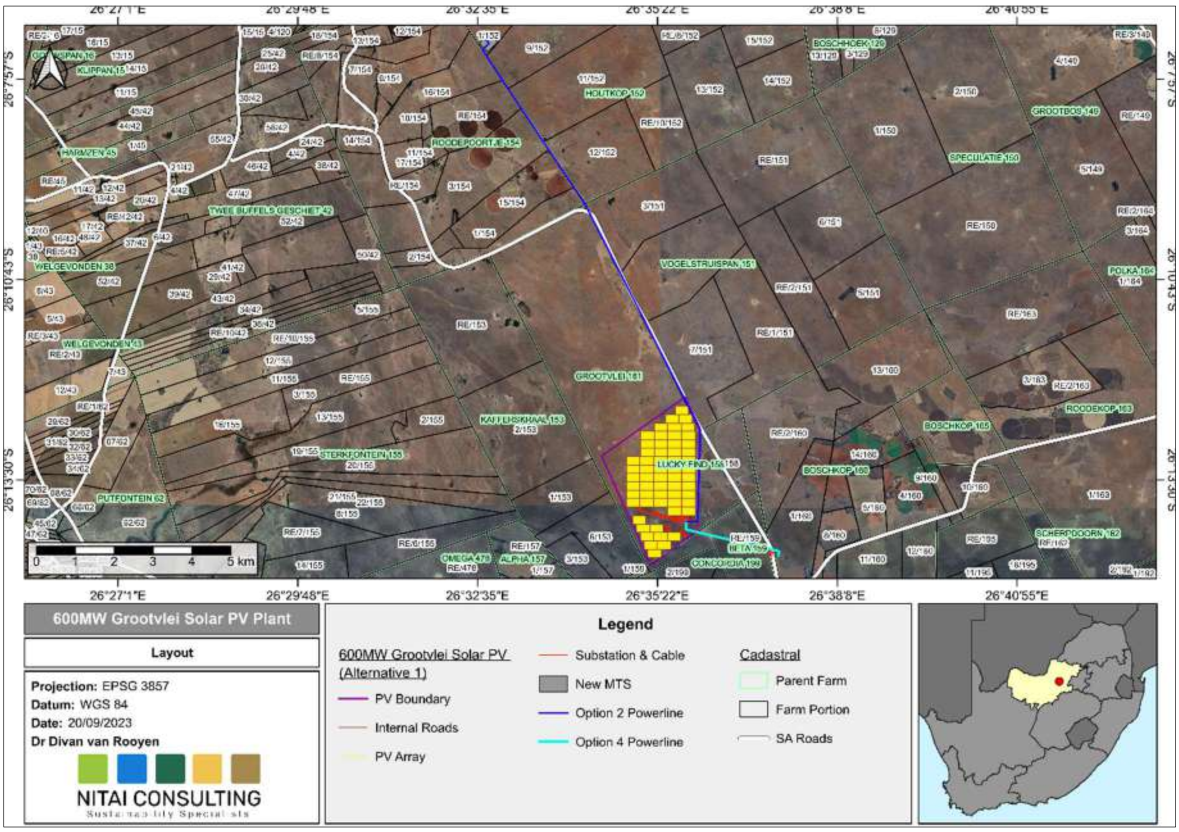

Figure 2: Grootvlei 600 MW Solar PV Project layout, Alternative 1 (Nitai 2023)

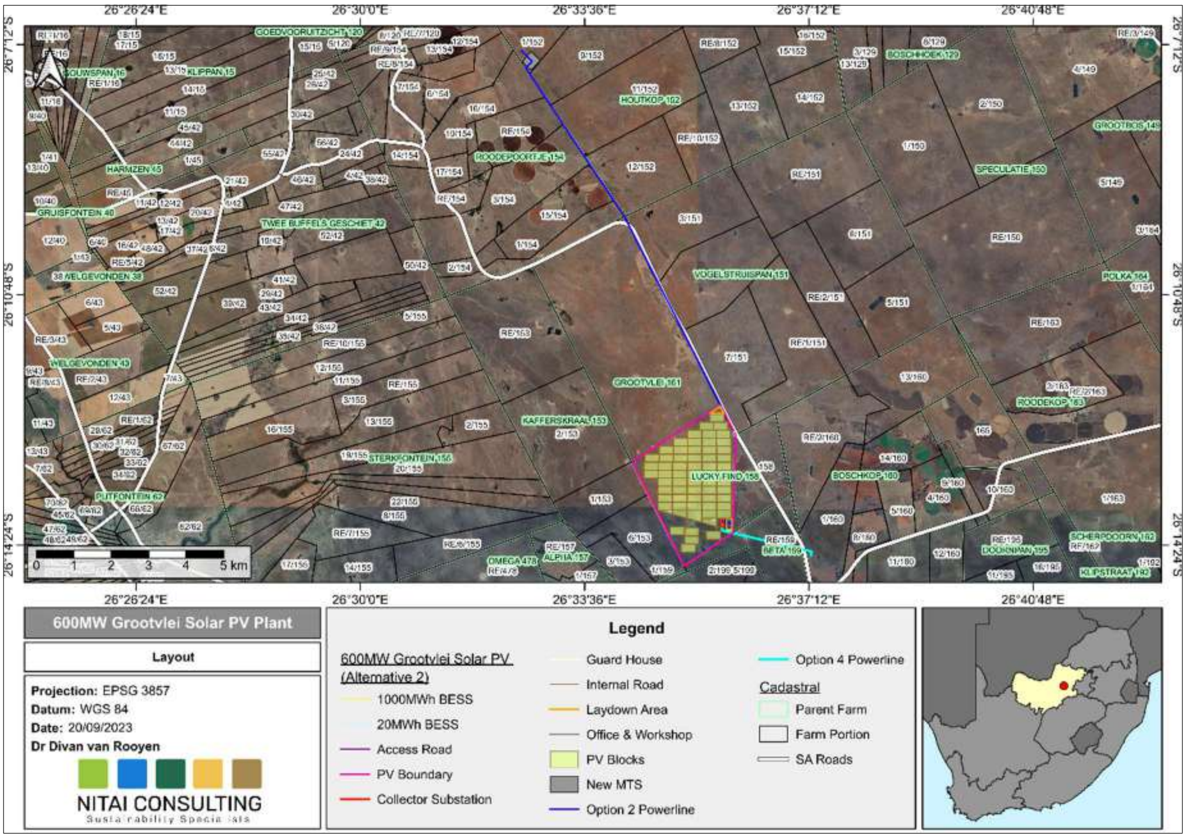

Figure 3: Grootvlei 600 MW Solar PV Project layout, Preferred Alternative 2 (Nitai 2023)

4.2 Project Technical Details

4.2.1 Solar Technology

Solar energy facilities operate by converting solar energy into a useful form (i.e. electricity). The use of solar energy for electricity generation is a non-consumptive use of a natural resource and consumes no fuel for continuing operation. Solar power produces an insignificant quantity of greenhouse gases over its lifecycle as compared to conventional coal-fired power stations. The operational phase of a solar facility does not produce carbon dioxide, sulphur dioxide, mercury, particulates, or any other type of air pollution, as fossil fuel power generation technologies do.

4.2.2 CSP Technology Overview

Concentrating Solar Plant (CSP) plants concentrate beams of light from the sun to heat a fluid and produce steam. The steam rotates a turbine connected to a generator, producing electricity to run a traditional power plant. There are four types of CSP technologies: parabolic troughs, power towers, dish/engine systems, and linear Fresnel reflectors. The parabolic trough system was the first CSP technology, thus it is the most developed and most replicated system.

4.2.2.1 Parabolic Trough Technology

Parabolic trough technology uses parabolic reflectors to concentrate the sun's rays into a receiver pipe along the reflector's focal line. The receiver heats a liquid which generates steam for power. This collector system rotates with the sun's movement to optimize solar energy generation. Refer to **Figure 4** for an example of parabolic trough panels.

Figure 4: Parabolic Trough Technology (www.e-education.psu.edu)

4.2.2.2 Power Tower Systems

Power tower system use flat mirrors to reflect the sun's rays onto a water-filled boiler atop a central tower (refer to **Figure 5**). The liquid is heated to a very high temperature and runs the turbine to create electricity.

Figure 5: Power Tower Technology (Planta Solar 10, Spain)

4.2.2.3 Dish/engine Systems

The dish/engine system is a concentrating solar power (CSP) technology that produces relatively small amounts of electricity compared to other CSP technologies typically in the range of 3 to 25 kilowatts. Dish/engine systems use parabolic reflectors to direct the sun's rays at a receiver placed at the reflector's focal point (refer to **Figure 6**). The liquid in the receiver is heated and runs a Stirling engine to create power.

Figure 6: Dish/Engine Technology www.e-education.psu.edu

4.2.2.4 Linear Fresnel Reflector Technology

Linear Fresnel Reflector technology works much like the parabolic trough system, except that it uses flat mirrors that reflect the sun onto water-filled pipes that generate steam (refer to **Figure 7**). This is a significant cost advantage because flat mirrors are much less expensive to produce than parabolic mirrors. Current advances in CSP allow these technologies to produce electricity several hours after sunset and on days with low intensity of solar radiation through heat accumulators and hybrid configurations.

Figure 7: Linear Fresnel Reflector Technology (social.csptoday.com)

4.3 Overview of Technical Details:

The technical details of the proposed Grootvlei 600MW Solar PV Plant are captured in **Table 1** below.

Table 1: Technical details of the proposed PV Plant

No.	Component	Description / Dimensions
1.	Height of PV panels	± 2.5m
2.	Area of PV Array	± 490 ha
3.	Number of inverters required	Approximately 240 x 2.5MW inverters
4.	Area occupied by inverter / transformer stations / substations	• Area occupied by inverter stations =0.35ha • Area occupied by Operation and Maintenance infrastructure = ± 0.1 ha • Area occupied by facility (step-up/Collector) substation = 0.2 ha • Area occupied by the onsite substations = 0.1 ha
5.	Capacity of on-site substation	Up to a maximum of 600 MW, 6.6kV/275kV
6.	Area occupied by buildings and BESS	• Area occupied by Operation & Maintenance infrastructure =± 0.1 ha • Area occupied by BESS = 0.35 ha
7.	Area occupied by both permanent and construction laydown areas	• Construction areas = 0.25 ha • Operation & Maintenance infrastructure = ± 0.1 ha • Total combined = ± 0.35 ha
8.	Area occupied by buildings	1.5 ha
9.	Length of internal roads	± 15km
10.	Width of internal roads	• Internal roads will have a 5m road width. • Access road will have a 14m reserve and road width of 8m.
11.	Proximity to grid connection	Grid Connection: • Route 1 which consists of 2 x 132kV powerlines, approximately 14km kilometres (km) in length, from the new facility 33kV substation to new 400/132kV Main Transmission Substation (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line; and • Route 2 that comprises of 2.8km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation.
12.	Height of fencing	Up to 3m
13.	Type of fencing	Type will vary around the site, welded mesh, palisade and electric fencing

4.4 Project Layout

The layout of the Solar Plant is shown in **Figure 3** (Alternative 1) and **Figure 3** (Alternative 2), above. The desirability of the earmarked site for the development of the proposed Solar Plant is due to the following key characteristics:

- Solar Irradiation: The feasibility of a solar facility is dependent on the direct solar irradiation levels.
- Topography: The suitability of the surface area is an important characteristic for the construction and operation of solar facilities. Most of the site has a low gradient slope and is suitable for this development.
- Grid capacity and connection: In terms of the Grid Connection Capacity Assessment (GCCA) 2024, which is a report presents the results of available generation connection capacity of all the transmission substations in all the supply areas in all the provinces of South Africa, the Project is located within the North West Supply Area. Based on the latest GCCA that was released by Eskom in March 2022, the GCCA confirms that the North West Supply Area currently has 4370MW generation connection capacity available. The Project Site is located approximately 14km from the LILO of the Pluto – Watershed 275kV power line and 2.8km from the Makokskraal Substation.
- Extent of site: The overall extent of the site is sufficient for the installation of the Solar Plant.
- Site access: The site can be accessed via an unnamed gravel road off the N14 and/or the R53

4.4.1 PV Technology Overview (Preferred)

PV technology produces direct current (DC) which is then converted to alternating current (AC) via power electronic inverters. The main technology categories are crystalline modules (mono or poly), thin film, and concentrated photovoltaics (CPV). **Figure 8** below, provides an overview of a typical Solar PV Power Plant.

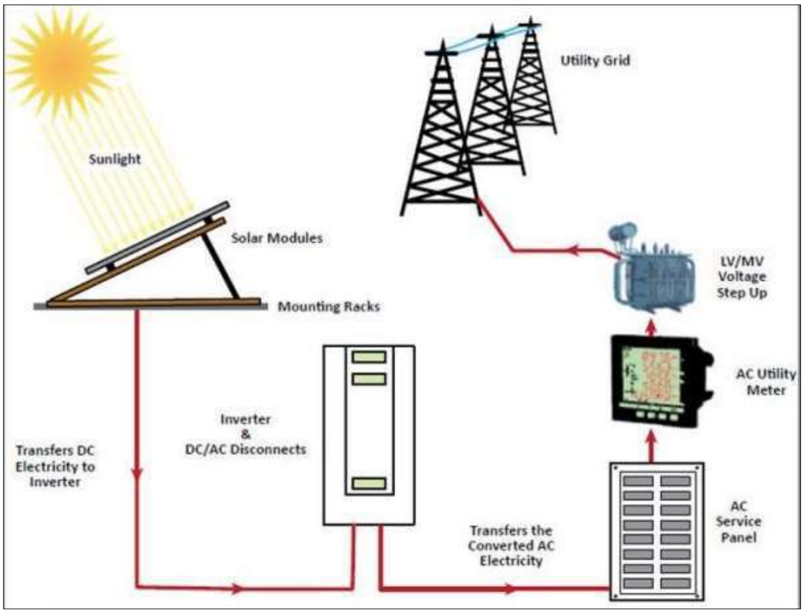

Figure 8: Overview of Solar PV Power Plant (International Finance Corporation, 2015. Utility-Scale Solar Photovoltaic Power Plan.)

5 Status Quo Analysis

5.1 General Existing Condition of Receiving Environment

The Project is located approximately 20km to the north west of Ventersdorp's CBD. The areas affected by the proposed Project footprint are rural in nature. The Project's PV Site is vacant and was historically used for agricultural purposes. The Project's power line connection to the Eskom grid is located 2km from the Project area. Grazing is the dominant land use in the Project area. The terrain topography is mostly flat and covered with mixed grassland and other vegetation that varies from relatively short to long and dense. There are several natural outcrops of dolomite and chert and many piles of rocks from field clearing occur.

Figure 9: View over the northeast section of the footprint area, showing the mainly grassland cover

Figure 10: View showing one of the many stone piles scattered over the project footprint

Figure 11: View showing dolomite rock outcrop visible in the southeast section of the project footprint

Figure 12: View of water hole located inside the southern boundary of the project footprint

Figure 13: View of vlei/wetland around the waterhole in the southern section of the project footprint

Figure 14: View of the grass cover and several rock piles in the central section of the project footprint, looking east

Figure 15: View of the long and dense vegetation section around the northeast section of the project footprint

Figure 16: View from existing substation looking west over the route for the shorter powerline option (Alternative 1)

Figure 17: View from the road looking north over the route for the shorter powerline option (Alternative 1)

Figure 18: View over the northern section of the longer powerline route option (Alternative 2)

Figure 19: View looking south along the west-central section of the road reserve, longer powerline route option (Alternative 2)

Figure 20: View looking south along the southwest section of the road reserve, longer powerline route Option 2 (Alternative 2 layout)

5.2 <u>Cultural-Heritage Receiving Environment</u>

5.2.1 DFFE Environmental Screening Tool

The DFFE Environmental Screening Tool was accessed for information on the cultural-heritage sensitivity of the general region. Note that only the PV area and the proposed longer powerline (Option 2) are shown due to certain technical limitations within the DFFE Screening Tool. As the two alternative layouts are situated within the same general site footprint, these are also not shown.

This tool indicated that the Archaeological and Cultural Heritage Sensitivity of the general region is rated as Low (**Figure 21**). However, the Palaeontological Sensitivity of the underlying geology in this area is indicated as High (**Figure 22**).

Figure 21: Archaeological Cultural Sensitivity map indicating that the project footprint is located within a region of low heritage sensitivity (DFFE Screening Tool).

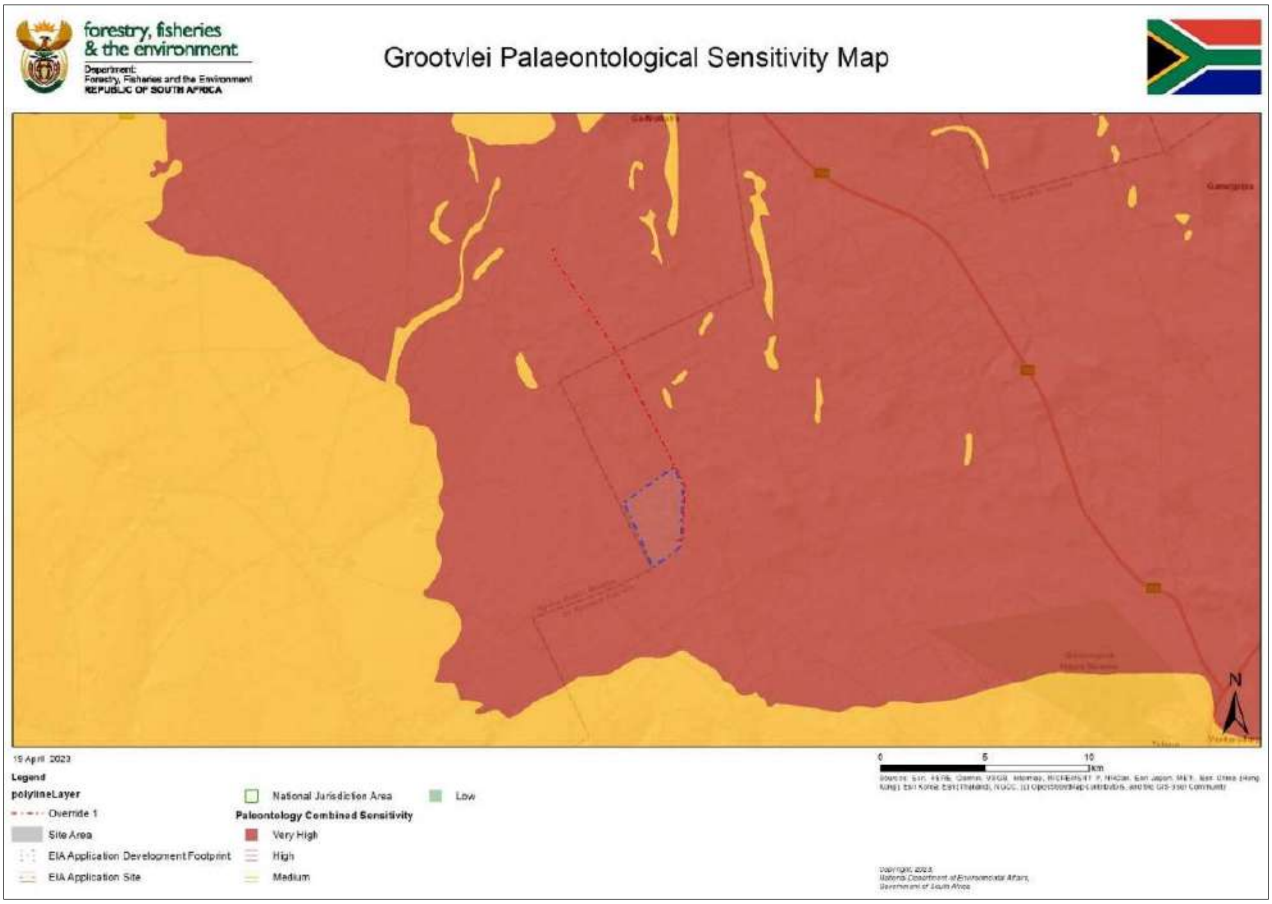

Figure 22: Palaeontological Sensitivity map indicating that the project footprint is located within a region of High sensitivity (DFFE Screening Tool).

5.2.2 Historical Background of Surrounding Region (archaeological and historical literature survey)

The archaeological history of the area can broadly be divided into a Stone Age, Iron Age and Historic or Colonial Period. An archaeological and historical overview of the general region is presented below.

The Stone Age

The Earlier Stone Age (ESA) is the oldest period of South Africa's archaeological history and comprises two technological phases. The earliest of these is known as Oldowan and is characterised by simple flakes and hammer stones. It dates to approximately 2 million years ago. The second technological phase is the Acheulian which includes more deliberately formed stone artefacts such as the cleaver and bifacial hand axe. The Acheulian dates to approximately 1.5 million years ago. No significant ESA sites are known from the area.

The Middle Stone Age (MSA) dates from around 250 000 to 40 000 years ago and is associated with flakes, points and blades manufactured by what is called the "prepared core" technique. This period is also associated with modern humans and the development of complex cognition (Wadley, 2013). No significant MSA sites are known in the region.

The Later Stone Age (LSA) is the third archaeological period is characterised by very small stone tools known as microliths, as well many rock art sites (paintings and engravings). LSA stone artefacts are more specialised, in that specific tools were created for specific purposes (Mitchell 2002) for example, scrapers and segments, and are sometimes made from bone. The LSA is further defined by evidence of ritual practices and complex societies (Deacon & Deacon 1999). This period is associated with hunter-gatherers (San) as well as early pastoralists (Khoekhoe) and lasted until the arrival of Iron Age and European communities (continuing in some areas for quite a long period). No significant sites from the LSA are known in the vicinity, however, two LSA sites have been recorded on the farm north-east of Ventersdorp (Birkholtz, 2008).

Rock engravings are known from the wider vicinity of the study area (Bergh, 1999; Lewis-Williams and Blundell 1998). The closest rock art site in the general area is Bosworth Farm located north-west of Klerksdorp. This is an extensive rock engraving site with over 400 San and Khoe herder rock engravings. The site is characterised by many depictions of human figures as well as animals (such as a charging rhinoceros, the large elephant, and ostrich dancing), and many geometric motifs. There are also many stone artefacts dating from over 1 million years ago (https://nasmus.co.za/rock-art/). The site is protected as a declared Provincial Heritage Site (SAHRIS database).

The Iron Age

The Iron Age period (AD 1600 – AD 1840) is associated with pre-colonial farming communities and includes both agricultural and pastoralist farming activities, metal working, cultural customs such as lobola and stone-walled settlements known as the 'Central Cattle Pattern' (Huffman, 2007).

The Early Iron Age (EIA) dates from roughly AD 200 - 900. The only well-known EIA sites in the greater North West province are Kruger Cave near Rustenburg and Broederstroom near Hartebeespoort Dam. Both sites date to approximately 460 AD (Mason 1974). No EIA sites are known within the region closer to the project area.

A Middle Iron Age (MIA) period has been defined by Huffman (2007) as occurring from AD 900 – 1300, however, no EIA sites are known within the region closer to the project area.

The Late Iron Age (LIA) period dates from around 1450 AD – 1650 AD and is distinguished by different ceramic styles (called facies) associated with specific settlement patterns (some characterised by stone walling). These ceramic styles have been defined by Tom Huffman for the regions within South Africa (2007). Four of these ceramic styles are known from the greater region around Ventersburg/Klerksdorp/Lichtenburg. The Ntsuanatsatsi facies of the Blackburn Branch of the Urewe Ceramic Tradition represents the earliest known period within this region (1450 AD – 1650 AD). The Ntsuanatsatsi facies of the Blackburn Branch of the Urewe Ceramic Tradition represents the earliest known Iron Age period within the surroundings of the study area. The decoration on the ceramics from this facies is characterised by a broad band of stamping in the neck, stamped. The decoration on these ceramics is defined by a broad band of stamping in the neck, stamped arcades on the shoulder and appliqué (Huffman, 2007). Huffman (2007) suggests that the Ntsuanatsatsi facies can be directly linked to the early Bafokeng, who were the first Mbo Nguni group to move from the area of present-day KwaZulu-Natal into the interior.

The second ceramic style from this region is known as the Olifantspoort facies of the Moloko Branch of the Urewe Ceramic Tradition. This facies is dated to between AD 1500 and AD 1700. The key features of the decoration defining this style include multiple bands of fine stamping or narrow incision separated by colour (Huffman, 2007). The type site for this facies is located on the farm Olifantspoort 328 JQ, which is situated closer to Rustenburg.

The Uitkomst facies of the Blackburn Branch of the Urewe Ceramic Tradition is the third style identified from the general region. This facies is dated to between AD 1650 and AD 1820. The decoration on these ceramics is defined by stamped arcades, appliqué of parallel incisions, stamping and cord impressions and is described by Huffman (2007) as a combination of both Ntsuanatsatsi (Nguni) and Olifantspoort (Sotho) styles. The type-site is Uitkomst Cave, situated in the Cradle of Humankind.

A fourth style called the Buispoort facies of the Moloko branch of the Urewe Ceramic is the latest phase (1700 AD – 1840 AD) occurring within the general region. The key features of decoration include rim notching, broadly incised chevrons and white bands, and the use of red ochre (Huffman, 2007). The Buispoort facies is associated with LIA so-called mega-sites such as Buffelshoek, Kaditshwene, Molokwane and Olifantspoort (Huffman, 2007). Various well-known sites from the end of the LIA period are located in the greater North-West Province, most of which are situated in the Zeerust-Marico area (Buispoort and Braklaagte, the Makgame megasite, and Kaditshwene). These sites date to between the 15th and 19th centuries and record the arrival and development of the early Moloto Sotho-Tswana speakers (Fourie 2016).

A study by Küsel (2011) notes that there are no known Iron Age sites in the immediate vicinity of Ventersdorp. However, Iron Age sites are known to occur in the Potchefstroom, Klerksdorp and Hartbeesfontein areas (Küsel 2011).

Historical/Colonial Period

Around 1836 the first Voortrekker parties started crossing the Vaal River and between 1839 – 1840, the first farms were established by the Voortrekkers in the general region of the study area. The district of Potchefstroom was established in 1839 (Bergh, 1999), and the project area fell into this district.

The town of Ventersdorp originated from the establishment of a parish of the Dutch Reformed Church on the farm Roodepoort in 1866. The town was established in 1887 and was named after the owner of the farm Roodepoort, Johannes Venter (Erasmus, 2014).

The South African War (1899 – 1902) was a war for independence of the Boer Republics of the Transvaal and Free State from Great Britain, but the victims and participants of the war were not restricted to only British or Boer citizens. On 11 June 1900 the town of Ventersdorp was occupied by the British Army. Subsequently, lines of blockhouses were built between Ventersdorp and the surrounding towns to restrict the movement of the Boer forces. Although there is evidence that troops of both the British and the Boer forces were present throughout the general region (van den Bergh, 2009), no information on battles or skirmishes from within the study area was found.

In 1924, the District of Ventersdorp was established separate from the District of Potchefstroom (Bergh 1999).

The region around Ventersdorp and Lichtenburg was mined for diamonds between 1920 to 1945. Alluvial diamonds were found on various farms in the Ventersdorp district in the period after c. 1920. Between 1925 and 1945 a large section of the black residents of the Ventersdorp district worked on the diamond mines. (Breutz, 1954; cited by Birkholtz 2021). In December 1924, a diamond of 3 carats was discovered near Lichtenburg and initial prospecting in 1925 produced a large enough number of diamonds for the area to be proclaimed as a “public diggings” in February 1926. By 1945 a total of 104 diggings were proclaimed on 13 farms in the area (Fourie 2016).

The more recent history of the town of Ventersdorp includes an association with JB Marks, who was born there in 1903 and Eugene Terreblanche who was also born there in 1941. These two figures represent two opposite ends of the political spectrum. JB Marks is associated with the trade union movement, the South African Communist Party (he was elected chairman in 1962) and the ANC (he was the President of the Transvaal branch in 1950) (Verwey 1995). Terreblanche was one of the founders of the Afrikaner Weerstandsbeweging (AWB) which was violently opposed to the establishment of the first democratic government in South Africa. On 9 August 1991 there was a violent confrontation at Ventersdorp between AWB supporters and police guarding a National Party meeting addressed by President FW De Klerk. Three AWB members died and 58 people were injured. Five months later he and nine other AWB members were arrested on charges of public violence resulting from this incident (https://www.sahistory.org.za/people/eugene-ney-terreblanche).

5.2.3 Cartographic findings

An assessment of available historical topographical maps was undertaken to establish a historic layering for the study area. Overlays of the maps were made on Google Earth. These historic maps are valuable resources in identifying possible heritage sites and features located within the study area. It should be noted that the earliest edition of the map sheets for this area dates to the 1960s. As the first edition of this sheet dates to 1966, it was not considered necessary to examine the later edition map sheets. Any heritage resources that are 57 years or older would be depicted on the 1966 edition sheet.

The topographical maps were obtained from the Department of Agriculture, Land Reform and Rural Development (DALRRD) in Cape Town.

The following 1:50 000 map sheet was assessed for the Grootvlei 600MW Solar PV footprint: 2626BA Zwartrand Edition 1 1966. The map was surveyed in 1972 and drawn in 1974 by the Director-General Surveys of South Africa from aerial photographs taken in 1966.

As can be seen from **Figure 23** and **Figure 24**, below, the 1966 edition map depicts one heritage feature (Kraal) located within the Grootvlei 600MW project footprint, while three heritage features are depicted adjacent to the powerline options (structures with or without kraals). Note: as there is a negligible difference in the general site footprint between the Alternative 1 and Alternative 2 layouts, I have included both footprint outlines in the figures below.

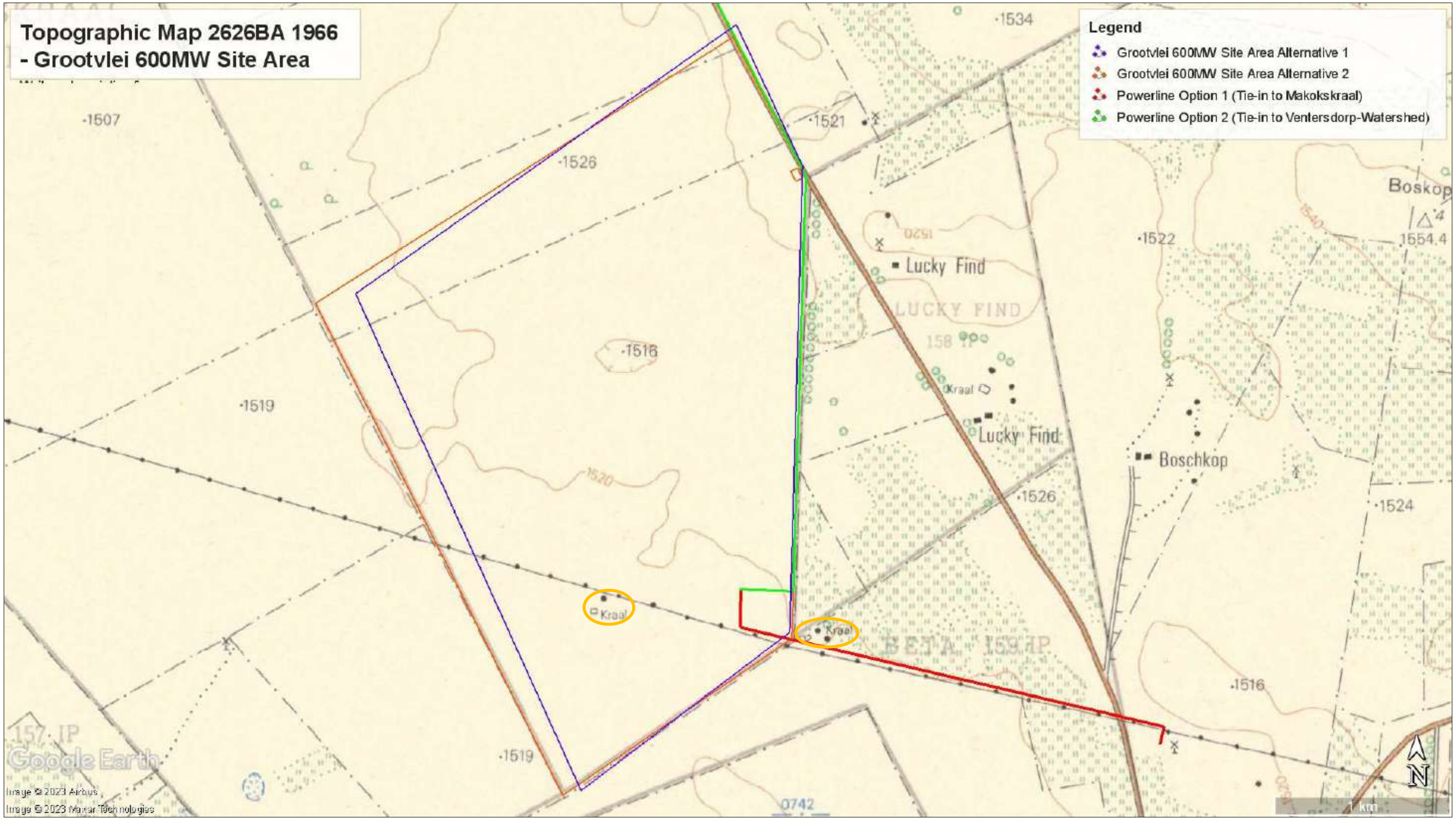

Figure 23: Enlarged view of Ed 1 topographic map sheets 2626BA 1966, depicting one heritage feature (Kraal) within the Solar PV footprint and one)Krall and structures) close to the two powerlines (yellow circles)

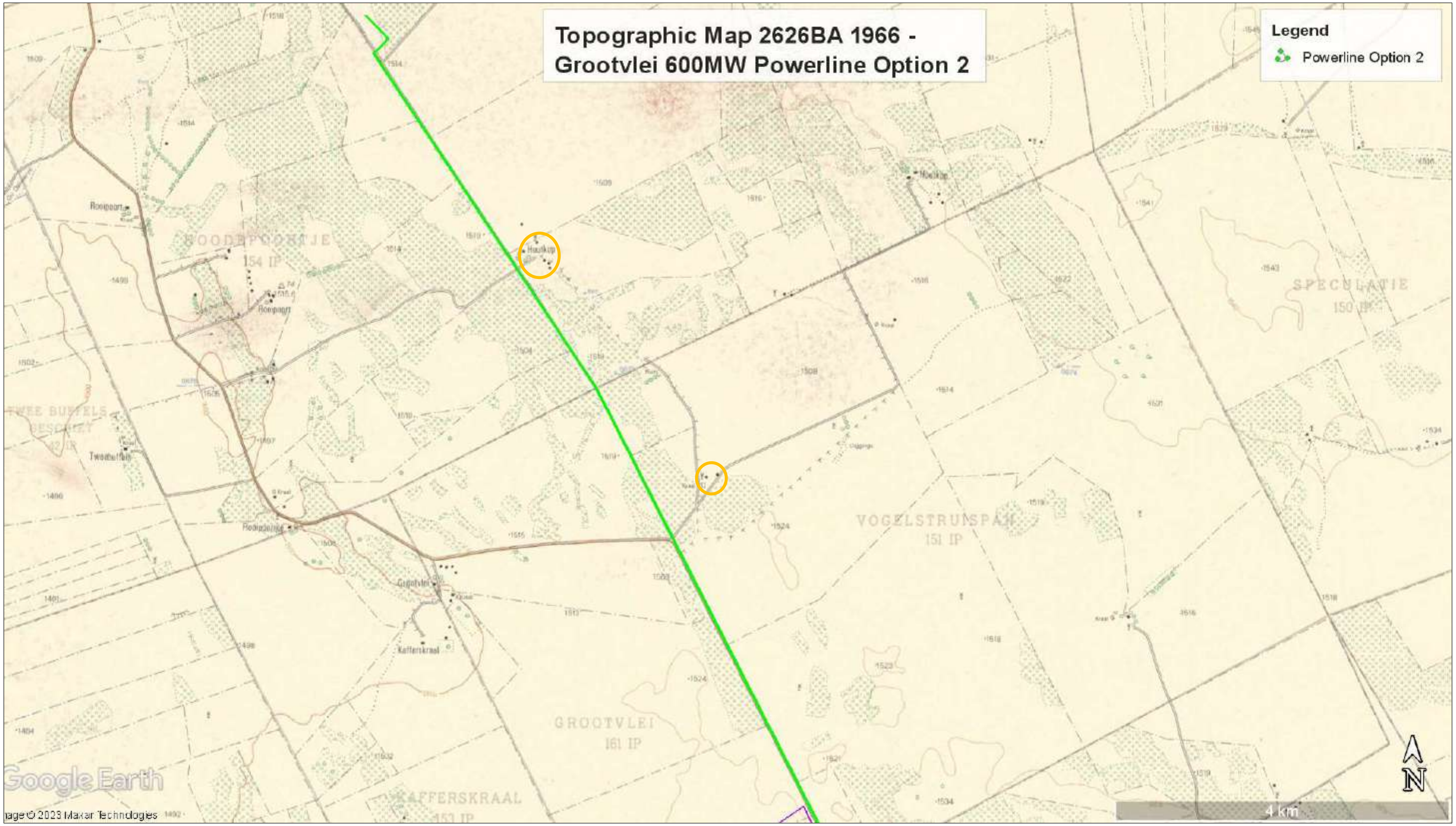

Figure 24: Enlarged view of Ed 1 topographic map sheets 2626BA 1966, depicting two farmsteads (yellow circles) adjacent to the powerline route Option 2 (green line)

5.3 Previous HIA reports in the area

A search on the South African Heritage Resources Information System (SAHRIS) has identified several Heritage Impact Assessments conducted in and around the study area. The project area of one of these reports covered the farms Houtkop and Kwaggaslaagte, which are located immediately north of the current project area (Mlilo 2017). Several remains of historical house foundations were recorded, including one traditional grave and a formal village cemetery. The project area for another of these reports covered several farms located immediately south of the current project area (Coetzee 2020).

Mlilo, T. 2017. *Phase 1 Archaeological Impact Assessment for the proposed Section 102 EMP Amendment for Mivami Agri- Mining Pty Ltd to include the Remaining Extent of Kwaggaslaagte 121 IP into the Prospecting Right for Dunbar 119 IP, and portion 9 of Houtkop 152 IP, in Ditsobotla Local Municipality of Ngaka Modiri Molema District Municipality, North West Province*. The proposed development consists of prospecting for diamonds and manganese and is located on the farm Kwaggaslaagte121 IP (Ga Motlatla Village). Twenty six (26) remains of historical house foundations were recorded adjacent to the prospecting area including one traditional grave. A formal village cemetery (with historical graves) was also recorded.

Coetzee,T. 2020. *Phase 1 Archaeological Impact Assessment & Desktop Study for Rivanet Mining & Exploration on Several Portions of the Farms Wolvenfontein 74 IQ, Syferfontein 81 IQ, Modderfontein 187 IP, Roodepoort 191 IP, Oatlands 79 IQ, Uitkyk 184 IP, Palmietfontein 189 IP, Koppieskraal 500 IP, Makokskraal 203 IP, Sweethome 197 IP and Doornpan 193 IP near Ventersdorp, North*. The farms Palmietfontein 189 IP, Koppieskraal 500 IP, Makokskraal 203 IP, Sweethome 197 IP and Doornpan 193 IP are located a short distance south to southeast of the current project area. However, only Palmietfontein 189 IP was subject to a field survey, while the other farms were assessed at a desktop level. Therefore, the only confirmed heritage resources were noted on Palmietfontein 189IP and included: 29 historical structure sites, which varied in terms of preservation; 4 cemeteries (containing between 25 to 45 graves each) and six modern buildings and structures.

Coetzee, F. 2022*. Cultural Heritage Impact Assessment: Phase 1 Investigation for the Proposed Construction of Several Layer, Rearing Houses and Broilers with Associated Activities and Supporting Infrastructure on Portion 2 of the Farm Rietfontein 210 IP, Portion 1 of the Farm Oatlands 79 IP and Portion 1 of the Farm Ventersdraai 183 IP, JB Marks Local Municipality, Dr Kenneth Kaunda District Municipality, North West Province*. Isolated finds comprising debitage and some broken formal Middle Stone Age tools were recorded, as well as two extant historical structures and two historical structure (foundation) remains.

Birkholtz, PD. 2008. *Phase 1 Heritage Impact Assessment Proposed Etruscan Diamonds (Pty) Ltd Development Situated On The Remaining Extent Of The Farm Nooitgedacht 131 Ip, Zwartrand 145 Ip And Hartbeeslaagte 146 Ip, Magisterial District Of Ventersdorp, North West Province.* A study for the proposed development of the Etruscan Diamonds mining extension on the remaining extent of the farms

Nooitgedacht 131 IP, Swartrand 145 IP and Hartbeeslaagte 146 IP. Eight sites were located, including two historic farm dwellings, four cemetery sites and two Later Stone Age sites

5.4 Palaeontological sensitivity

Note that this section was compiled by the author and not by a palaeontological specialist. A basic palaeontological sensitivity was determined using the SAHRIS database South African Fossil Sensitivity Map (http://www.sahra.org.za/sahris/map/palaeo). This map indicates that the project footprint falls within an area where the underlying geology has Very High fossil sensitivity (red) (see **Figure 25** below). Therefore, a separate palaeontological study is being undertaken by a professional palaeontologist.

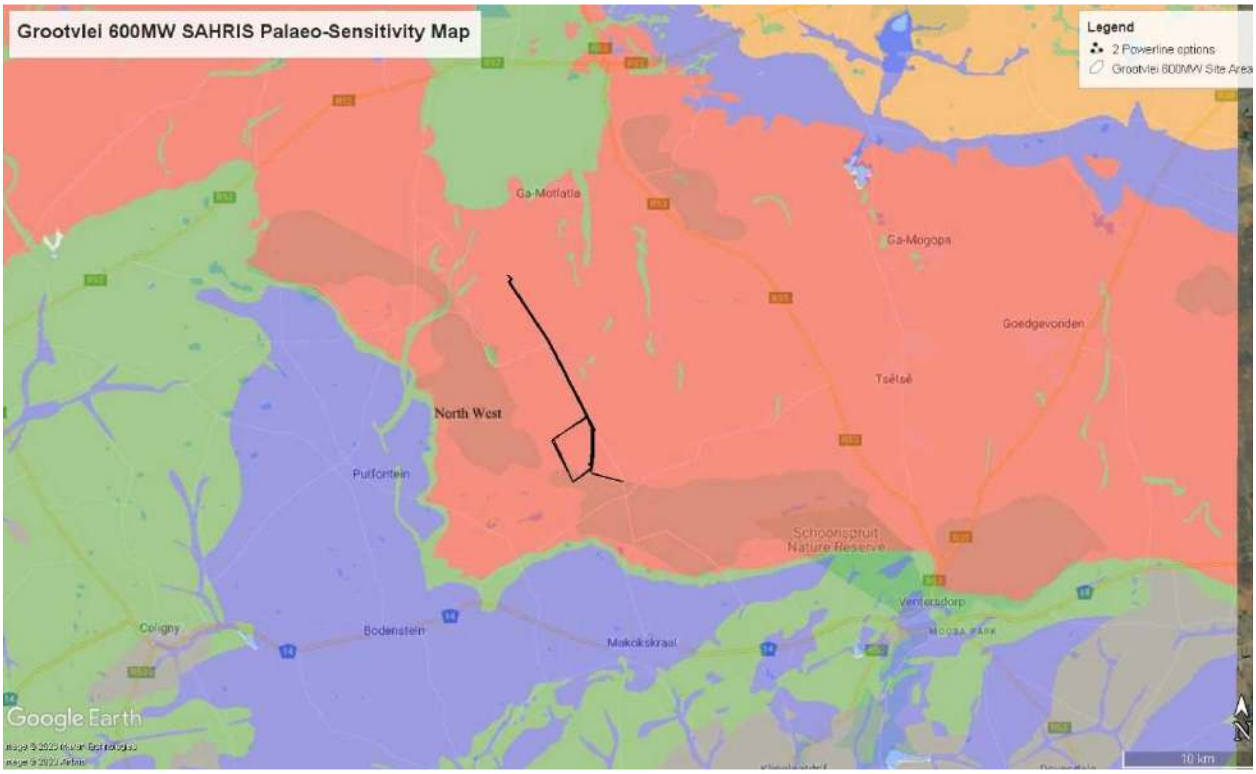

Figure 25: SAHRIS Palaeo sensitivity map overlain on the Grootvlei 600MW Solar PV project footprint (black polygon). The underlying geology is shown as of Very High fossil sensitivity (red).

Table 2: SAHRIS Fossil Map Palaeontological Sensitivity Ratings and Required Actions

Colour	Sensitivity	Required Action
RED	VERY HIGH	Field assessment and protocol for finds is required.
ORANGE/ YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely to be requested.
GREEN	MODERATE	Desktop study is required.

BLUE	LOW	No palaeontological studies are required however a protocol for finds is required.
GREY	INSIGNIFICANT /ZERO	No palaeontological studies are required.
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information becomes known, SAHRA will continue to populate the map.

5.5 Findings of the Historical Desktop Study

The general overview from the historical desktop study has shown that various archaeological and historical resources can be expected to occur in the project area. Furthermore, the examination of the earliest edition (1966) of the 1:50 000 topographical map, produced by overlying the map with satellite Imagery (Google Earth) has shown that four heritage features dating to c1966 are depicted either within or adjacent to the Solar project footprint and two powerline options.

The Site Survey fieldwork provided confirmation of the occurrence of heritage resources within and adjacent to the project area footprint.

6 SITE SURVEY/FIELDWORK RESULTS

The survey of the Grootvlei 600MW Solar project footprint took place over two separate days (22 March and 24 April 2023) by the author (heritage specialist) as part of a specialist team and the landowner accompanied us. A vehicle was used to access the project footprint area and the survey was conducted by both vehicle and on foot (at selected areas). The survey covered as much of the project footprint area as was feasibly accessible, given the long grass and dense vegetation covering several areas.

The author used a Global Positioning System (GPS) application to navigate access roads in the study area and for recording the tracklog of the survey and waypoints of the identified heritage resources. A Sony digital camera was used for photographic recording of identified heritage resources and general images of the project study area.

The survey aimed to find and identify archaeological and other heritage resources such as burial grounds and graves (BGG), archaeological material or sites, historic built environment and landscape features of cultural heritage significance. The inspection of the area that was surveyed identified five visible heritage resources within or close to the project footprint PV site area, shown in relation to both the Alternative 1 and Alternative 2 layouts (**Figure 39, Figure 40, Figure 41**, **Figure 42**).

Identified Heritage Sites

Site Name	Groot 01
GPS Coordinates	26°14'13.55"S; 26°36'4.54"E
Site Description	The site comprises three historical structures: a house, outbuilding and a kraal Estimated extent (from satellite images) = 1.71ha
Approximate Age	More than 60 years old. Structures and kraal are depicted at this location on the 1st edition topographic map of 1966.
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	The site comprises three historical structures: a house, outbuilding and a kraal. The structures are situated just outside the Solar Site Area (Alternative 1 and Alternative 2) on the farm Re/Beta 159 and could not be accessed due to a fence with no gate. The site is situated roughly 44m east of the Alternative 2 layout and 63m east of Alternative 1 layout. It is also situated roughly 26m north-east of the Powerline Option 4 route.
Site Density	3 structures
Uniqueness	Low
Heritage Significance	GP.C/IIIC - Low
Mitigation	The structures should be avoided and demarcated with a 20m buffer. If any alteration, damage or destruction is anticipated, a permit would be required from the NW PHRA. This would require Phase 2 mitigation, e.g. by photographic recording.

Figure 26: View of the three historical structures located at Groot 01. It was not possible to obtain a closer view due to fence and no gate.

Figure 27: Zoomed in view of the historical house and the stone kraal. The kraal is partially collapsed.

Site Name	Groot 02
GPS Coordinates	26°14'24.24"S; 26°35'35.13"E
Site Description	A single (possible) stone tool fragment was found at this location.
Approximate Age	Possible Middle Stone Age
NHRA, No. 25	Section 35
Field Grading and Ratings	
Site context and description	A single possible stone tool (fragment) was found at this location. The tool was found in a dolomite and chert outcrop area which is located just outside the solar panel area (Alternative 1) in the southern section of the Grootvlei Site Area. It is situated roughly 27m east of the closest solar panel block. Another find spot for stone tools was identified a short distance away (Groot 03) so these two sites may be associated.
Site Density	This was an isolated find.
Uniqueness	Low
Heritage Significance	GP.C/ IIIC – Low
Mitigation	As the site is likely to be associated with Site Groot 03, and as all archaeological material is protected by s35 of the NHRA, the site should be demarcated and avoided with a 30m buffer (together with Groot -03).

Figure 28: View of the stone tool fragment at Groot 02

Site Name	Groot 03
GPS Coordinates	26°14'23.64"S; 26°35'39.37"E
Site Description	The site comprises a find spot for several stone tools. Estimated extent 10m x 5m.
Approximate Age	Middle Stone Age
NHRA, No. 25	Section 35
Field Grading and Ratings	
Site context and description	The site comprises a find spot for four stone tools. Two were definite flakes and two were possible chunks/debitage. The tools were found in a rocky outcrop area which is located just outside the solar panel area (Alternative 1) in the southern section of the Grootvlei Site Area. It is situated roughly 80.60m south of the closest solar panel block. A single stone tool fragment (Groot 02) was identified a short distance away (± 119m) so these two sites may be associated.
Site Density	Very low
Uniqueness	Low
Heritage Significance	GP.C/ IIIC – Low
Mitigation	All archaeological material is protected by sec 35. The site should be demarcated and avoided with a 30m buffer (together with Groot -02). If any impact is anticipated a permit for destruction will be required.

Figure 29: View of stone tool ventral surface

Figure 30: view of stone tool, dorsal surface showing bulb of percussion (red arrow)

Figure 31: View of stone tool ventral surface

Figure 32: view of stone tool, dorsal surface showing bulb of percussion

Site Name	Groot 04
GPS Coordinates	26°14'7.99"S; 26°35'17.71"E
Site Description	The site comprises a large historical stone kraal with an associated long trough. Estimated extent (from satellite images) = 1.15ha
Approximate Age	More than 60 years old. A kraal is depicted at this location on the topographic map first edition of 1966
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	The site comprises an historical kraal constructed of stone and cement with an associated long trough. Two heaps of demolished building material (including historical bricks) were also noted to the south of the kraal. The site is located within the southern section of the Solar Site Area, a short distance away from the solar panel area for both Alternative 1 and Alternative 2 layouts. The kraal is situated slightly closer to the solar panel area for Alternative 2 layout (roughly between 6-14.52m north).
Site Density	2 historical structures and associated building rubble.
Uniqueness	Low
Heritage Significance	GP.C/ IIIC – Low
Mitigation	The structures should be avoided and demarcated with a 25m buffer (from the centre of the kraal). If any impact resulting in alteration, damage or destruction is anticipated, a permit would be required from the NW PHRA. This could require Phase 2 mitigation, e.g. by photographic recording.

Figure 33: View of historical stone kraal at Groot 04, showing entrance

Figure 34: View of historical stone kraal, showing cattle race at one corner

Figure 35: Closer view of the existing cattle race

Figure 36: View of the of the long trough associated with the kraal

Figure 37: Close-up view of interior of the trough showing plaster and paint

Site Name	Groot 05
GPS Coordinates	26°14'32.14"S; 26°37'12.90"E
Site Description	The site is a small building associated with the electrical substation existing at this location.
Approximate Age	Less than 60 years old. No structure is depicted at this location on the topographic maps until 2006.
NHRA, No. 25	N/A
Field Grading and Ratings	
Site context and description	The site is a small building associated with the electrical substation existing at this location
Site Density	N/A
Uniqueness	Low
Heritage Significance	N/A / NCW
Mitigation	No mitigation is required.

Figure 38: Building at Eskom substation

Figure 39: Grootvlei 600MW site Area and Powerline Options, showing identified heritage resources (Alternative 1 Layout)

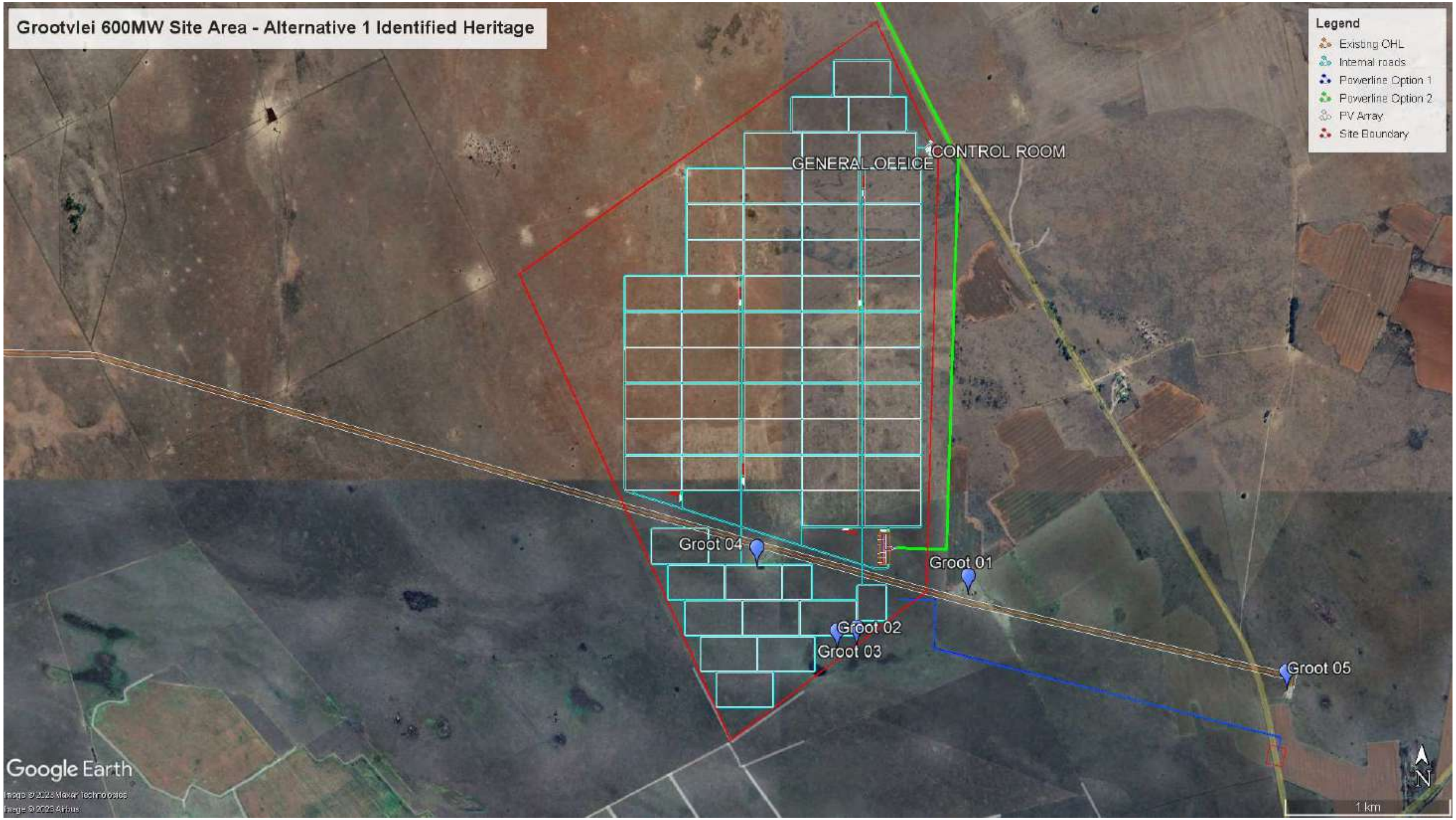

Figure 40: Enlarged view of Grootvlei 600MW Site Area and Powerline Options, showing identified heritage resources (enlarged Alternative 1 layout)

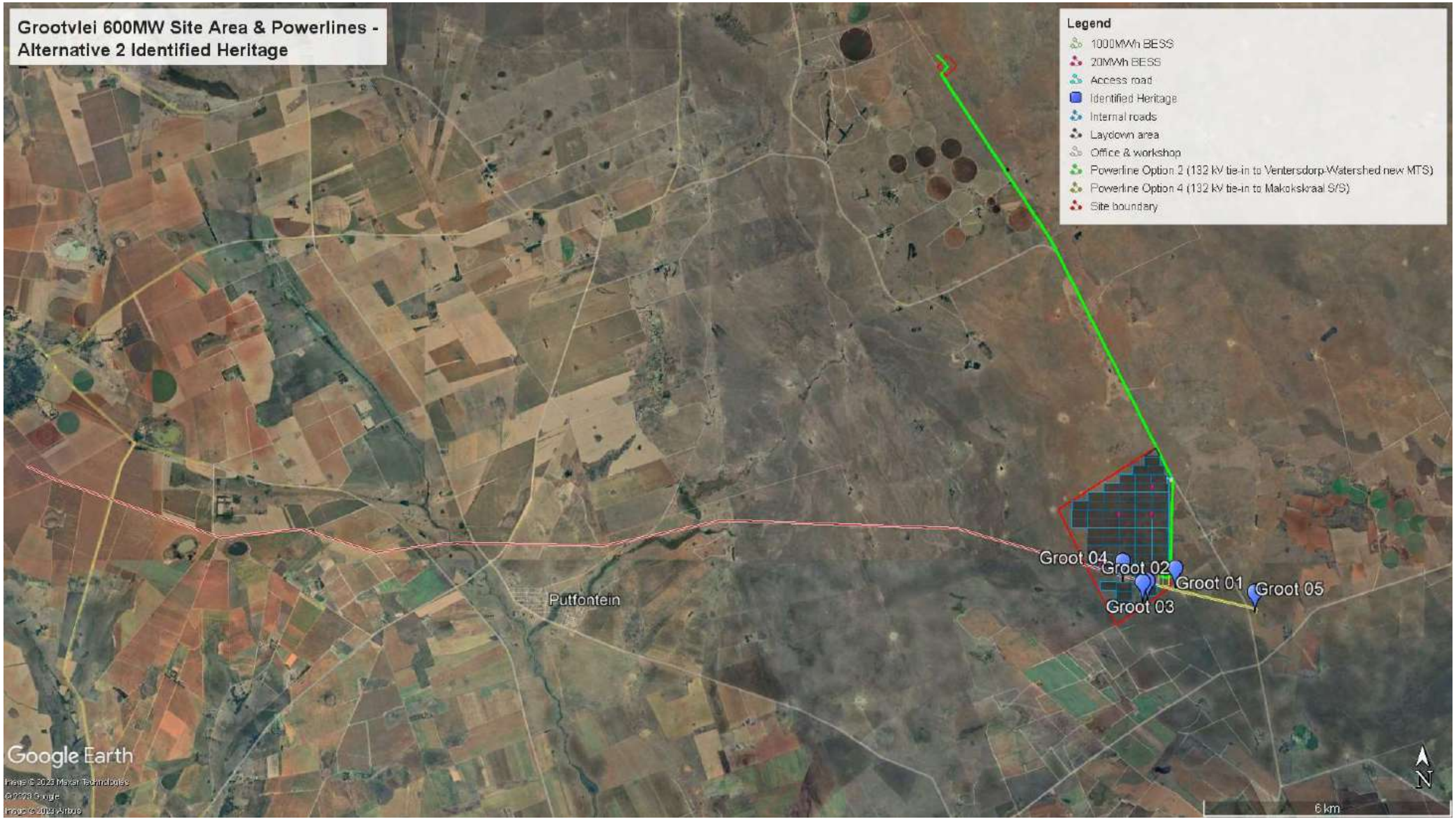

Figure 41: Grootvlei 600MW site Area and Powerline Options, showing identified heritage resources (Alternative 2 Layout)

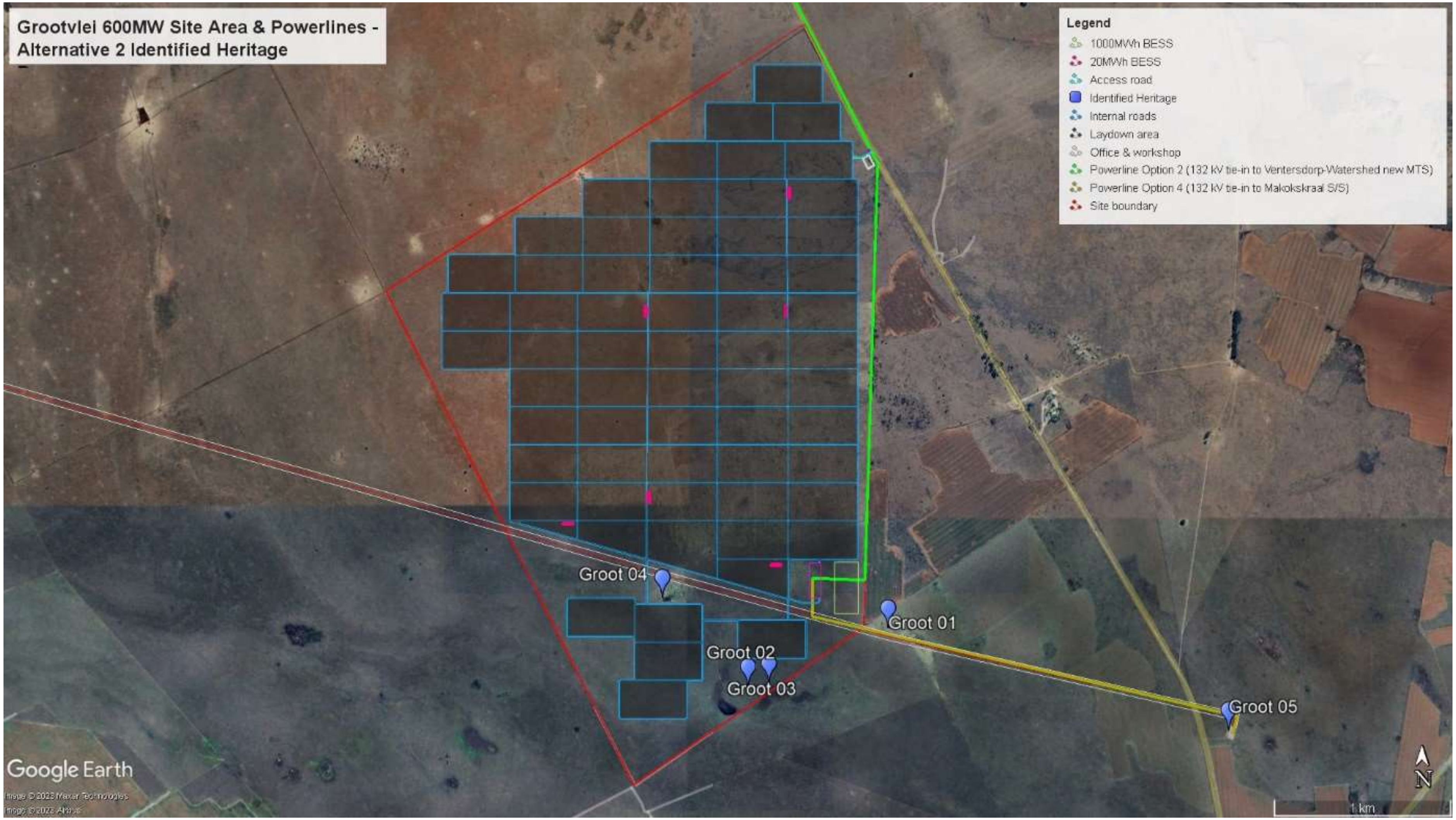

Figure 42: Grootvlei 600MW site Area and Powerline Options, showing identified heritage resources (enlarged Alternative 2 Layout)

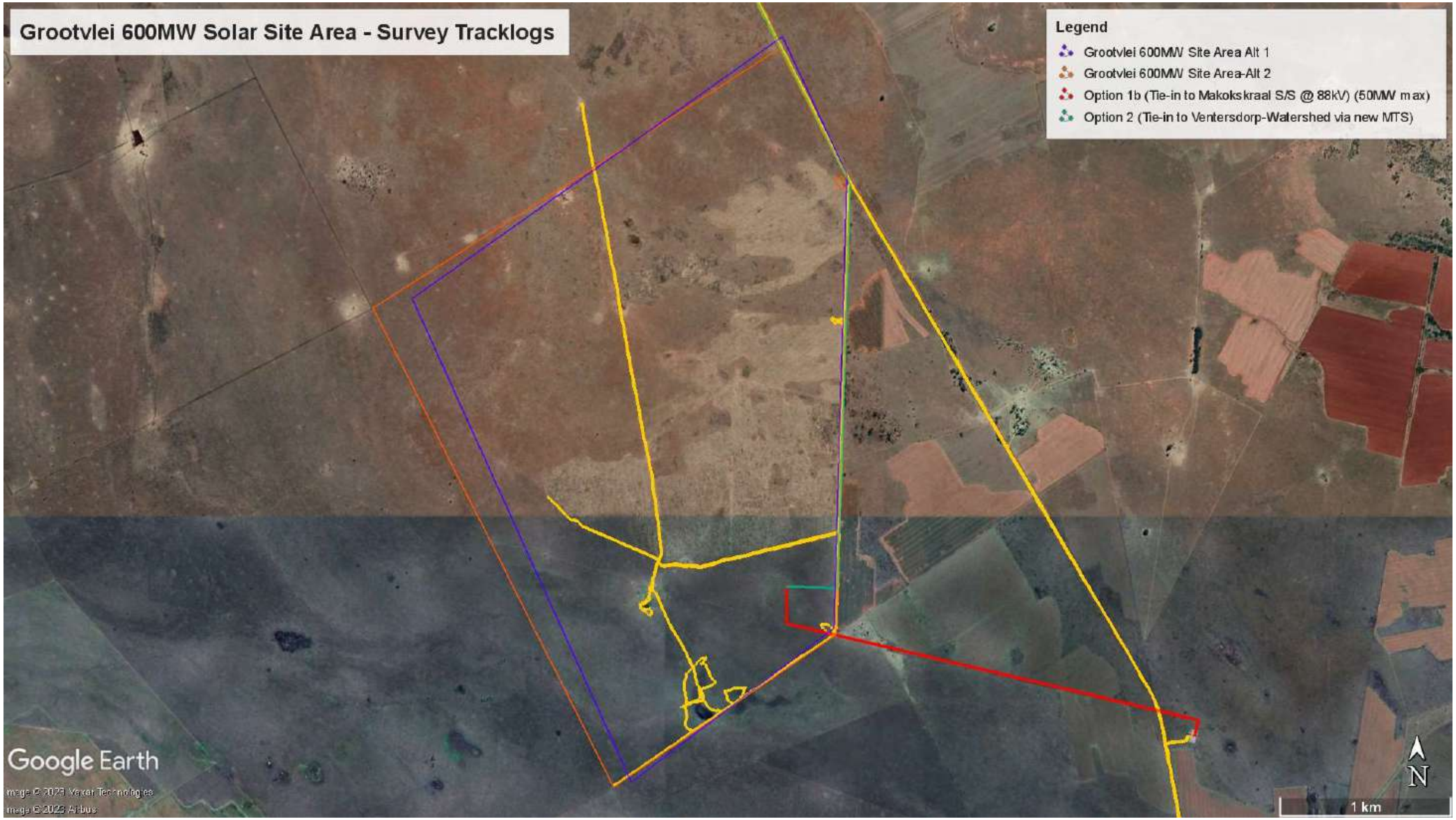

Figure 43: Site Survey Tracklog overlaid on the Grootvlei 600MW Solar site area.

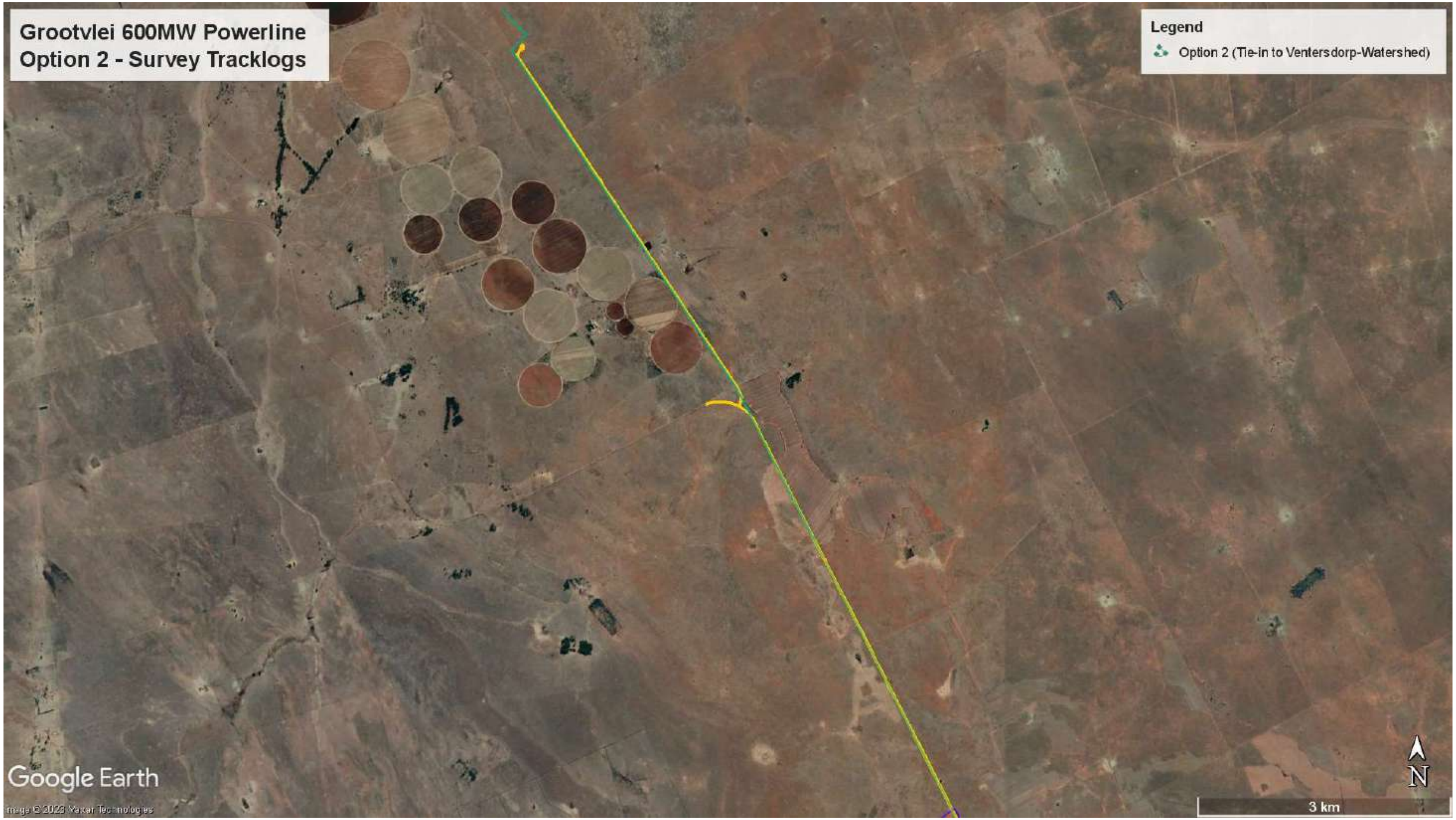

Figure 44: Site Survey Tracklog overlaid on the Grootvlei 600MW Powerline Option 2 Route

7 SITE SENSITIVITY VERIFICATION

The Historical Desktop study showed that four heritage features dating to c1966 are depicted either within or adjacent to the Solar project PV Site area footprint and two powerline options. The results from the fieldwork survey identified five visible heritage resources within or close to the project footprint which included two sites comprising historical structures and two archaeological sites comprising a very low density scatter of stone tools. This confirmed the sensitivity from the initial Site screening results that the Archaeological Cultural Heritage sensitivity is low for both the Alternative 1 and Alternative 2 layouts.

The palaeontological sensitivity verification will be discussed in the separate palaeontological report.

8 SIGNIFICANCE ASSESSMENT

Methodology for Assessing Heritage Site Significance

The applicable maps, tables and figures are included, as stipulated in NHRA and NEMA. The HIA process consists of three steps:

Literature Review

The desktop literature review provided information on the Heritage Background of the general region and project area. This included investigating published sources as well as past HIA studies conducted for the project area and surrounding region. An examination of historical 1:50 000 topographical maps and/or archival maps (if available) was also undertaken. The relevant early editions of the 2727CD topographical map sheets were obtained from the Department of Rural Development & Land Reform, Cape Town.

Literature resources accessed are listed in Table 3.

Table 3: Literature sources accessed

Source	Information
Background Information Document – Nemai Green	Project location and description details
Published sources and Past HIAs	Historical and archaeological background on Carletonville and surrounding region
Directorate: National Geo-spatial Information of the Department of Rural Development & Land Reform, Cape Town	Historical topographic maps, 1:50 000 2626BA Zwartrand Edition 1 1966

Field Survey

A physical Site Inspection or Field Survey was conducted, predominantly by vehicle with selected areas traversed on foot, through the project area by an experienced heritage specialist. This focussed on identifying and documenting heritage resources situated within and immediately adjacent to the proposed project area footprint, such as graves, historical structures or remains and archaeological sites or material.

HIA Report

The final step involved the recording and documentation of the identified heritage resources, the assessment of such resources in terms of heritage significance and impact assessment criteria, producing a heritage sensitivity map and compiling the heritage impact assessment report with constructive recommendations for mitigation, if required.

Impacts on these sites by the development will be evaluated as follows:

Site Significance

Site significance classification standards use is based on the heritage classification of s3 in the NHRA and developed for implementation keeping in mind the grading system approved by SAHRA for archaeological impact assessments. The update classification and rating system as developed by Heritage Western Cape (2021) is implemented in this report.

Site significance classification standards prescribed by the Heritage Western Cape Guideline (2016), were used for the purpose of this report (**Table 4** and **Table 5**).

Table 4: Rating system for archaeological resources

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Langebaanweg (West Coast Fossil Park), Cradle of Humankind	May be declared as a National Heritage Site managed by SAHRA. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Highest Significance
II	Heritage resources with special qualities which make them significant, but do not fulfil the criteria for Grade I status. Current examples: Blombos, Paternoster Midden.	May be declared as a Provincial Heritage Site managed by Provincial Heritage Authority. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Exceptionally High Significance
III	Heritage resources that contribute to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the Act but that does		

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
	not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. Current examples: Varschedrift; Peers Cave; Brobartia Road Midden at Bettys Bay	Resource must be retained. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	High Significance
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree.	Resource must be retained where possible where not possible it must be fully investigated and/or mitigated.	Medium Significance
IIIC	Such a resource is of contributing significance.	Resource must be satisfactorily studied before impact. If the recording already done (such as in an HIA or permit application) is not sufficient, further recording or even mitigation may be required.	Low Significance
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant or the consultant and approved by the authority.	No research potential or other cultural significance

Table 5: Rating system for built environment resources

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Robben Island	May be declared as a National Heritage Site managed by SAHRA.	Highest Significance
II	Heritage resources with special qualities which make them significant in the context of a province or region, but do not fulfil the criteria for Grade I status.	May be declared as a Provincial Heritage Site managed by Provincial Heritage Authority.	Exceptionally High Significance

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
	Current examples: St George's Cathedral, Community House		
II	Such a resource contributes to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the Act but that does not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. These are heritage resources which are significant in the context of an area.	This grading is applied to buildings and sites that have sufficient intrinsic significance to be regarded as local heritage resources; and are significant enough to warrant that any alteration, both internal and external, is regulated. Such buildings and sites may be representative, being excellent examples of their kind, or may be rare. In either case, they should receive maximum protection at local level.	High Significance
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree. These are heritage resources which are significant in the context of a townscape, neighbourhood, settlement or community.	Like Grade IIIA buildings and sites, such buildings and sites may be representative, being excellent examples of their kind, or may be rare, but less so than Grade IIIA examples. They would receive less stringent protection than Grade IIIA buildings and sites at local level.	Medium Significance
IIIC	Such a resource is of contributing significance to the environs These are heritage resources which are significant in the context of a streetscape or direct neighbourhood.	This grading is applied to buildings and/or sites whose significance is contextual, i.e., in large part due to its contribution to the character or significance of the environs. These buildings and sites should, as a consequence, only be regulated if the significance of the	Low Significance

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
		environs is sufficient to warrant protective measures, regardless of whether the site falls within a Conservation or Heritage Area. Internal alterations should not necessarily be regulated.	
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant and approved by the authority. Section 34 can even be lifted by the PHRA for structures in this category if they are older than 60 years.	Not Conservation worthy – no research potential or other cultural significance

Table 6: Site significance classification standards as prescribed by SAHRA.

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
National Significance (NS)	Grade 1	Very High - of National Significance	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	Very High – of Provincial Significance	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High Significance	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High Significance	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)		High / Medium Significance	Mitigation before destruction
Generally Protected B (GP.B)		Medium Significance	Recording before destruction
Generally Protected C (GP.A)		Low Significance	Destruction

9 Identification of Impacts

9.1 Impacts and Mitigation Framework

All impacts are analysed in the section to follow with regard to their nature, extent, magnitude, duration, probability and significance.

ISO 14001-2004 defines impacts as "any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects".

When considering an assessment of the impacts and their mitigation, the following definitions as per Table 7 apply.

Table 7: Impact and Mitigation Quantification Framework

Nature	The project could have a positive, negative or neutral impact on the environment.
Extent	**Local** – extend to the site and its immediate surroundings. **Regional** – impact on the region but within the province. **National** – impact on an interprovincial scale. **International** – impact outside of South Africa.
Magnitude	Degree to which impact may cause irreplaceable loss of resources: **Low** – natural and socio-economic functions and processes are not affected or minimally affected. **Medium** – affected environment is notably altered; natural and socio-economic functions and processes continue albeit in a modified way. **High** – natural or socio-economic functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.
Duration	**Short term** – 0-5 years. **Medium term** – 5-11 years. **Long term** – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention. **Permanent** – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.
Probability	**Almost certain** – the event is expected to occur in most circumstances. **Likely** – the event will probably occur in most circumstances. **Moderate** – the event should occur at some time. **Unlikely** – the event could occur at some time. **Rare/Remote** – the event may occur only in exceptional circumstances.
Significance	Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows- **0** – Impact will not affect the environment. No mitigation necessary. **1** – No impact after mitigation. **2** – Residual impact after mitigation. **3** – Impact cannot be mitigated.

Mitigation	Information on the impacts together with literature from socio-economic science journals, case studies and field work will be used to provide mitigation recommendations to ensure that any negative impacts are decreased and positive benefits are enhanced.
Monitoring	Monitoring usually involves developing and implementing a monitoring programme to identify deviations from the proposed action and to manage any negative impacts. The recommended mitigation measures will also include monitoring measures.

Table 8: Impact Methodology Table

Nature				
Negative	Neutral	Positive		
-1	0	+1		
Extent				
Local	Regional	National	International	
1	2	3	4	
Magnitude				
Low	Medium	High		
1	2	3		
Duration				
Short Term (0-5yrs)	Medium Term (5-11yrs)	Long Term	Permanent	
1	2	3	4	
Probability				
Rare/Remote	Unlikely	Moderate	Likely	Almost Certain
1	2	3	4	5
Significance				
No Impact/None	No Impact After Mitigation/Low	Residual Impact After Mitigation/Medium	Impact Cannot be Mitigated/High	
0	1	2	3	

9.2 Identification of Activities and Aspects

An "Activity" is defined as a distinct process or risks undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or pieces of infrastructure that are possessed by an organisation (International Organization for Standardization, 2011).

An aspect is defined as elements of an organisation's activities or products or services that can interact with the environment.

In order to capture the impacts associated with the proposed infrastructure, an activity – aspect – impact table was created refer to 9 below.

Table 9: Activity, Aspects and Impacts of the Project

Activity	Aspect	Potential Impact – Positive	Potential Impact – Negative
Site clearance/ construction camp			Damage to existing historical structures or unidentified graves
Construction		Positive - if historical structures are reused	Damage to existing historical structures
Operation		Positive – if historical structures are reused	Damage to existing historical structures

9.3 Impact and Mitigation Assessment

The project area that will be impacted by the proposed Grootvlei Solar PV project contains some areas that are currently disturbed by grazing activities as well as past agricultural activity including extensive field clearance.

The impact significance of the project on graves and cemeteries is low as no definite grave sites were identified.

The impact significance of the proposed project on protected historical structures is medium as two sites comprising historical structures were identified within the general site footprint: a small historical farmstead (Groot-01), and a site comprising an historical stone kraal with associated large trough (Groot -04). Since both of these sites are depicted on the 1966 topographic map it is very likely that these structure remains older than 60 years of age and therefore the sites are protected by s34 of the NHRA.

The impact significance of the project on archaeological sites or material is low as two sites containing stone tools were identified (Groot 02, Groot 03) but these are of low significance as isolated finds or extremely low density scatters.

9.4 Impacts During the Planning, Construction and Operation Phases

As a result of the analysis above,**Error! Reference source not found.** the following impact/mitigation tables have been generated.

Table 10: Heritage Resources – Historical Structure remains Mitigation Table

Environmental Feature	Heritage resources – historical structure remains (Groot 01, Groot 04)
Project life-cycle	Planning, Construction and Operation
Potential Impact	Proposed Management Objectives / Mitigation Measures
Possible damage to or destruction of historical structure remains	• A buffer of at least 20m (25m from the centre for the kraal) must be placed around both sites to ensure that during construction there is no indirect impact which could damage any structures

	• The materials demarcating the buffer must be highly visible and made of durable material • If any impact is anticipated, then a permit will be required for the alteration or destruction of any of the structures (from NW PHRA or SAHRA)					
Possible damage to or destruction of unidentified historical structure remains	• If any changes are made to the final design footprint prior to construction, monitoring of the site clearance activities must be undertaken by a heritage specialist to identify any additional historical structure remains					
Alternative 1	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Medium	Permanent	Moderate	2
After Mitigation	Positive	Local	Low	Long- term	Unlikely	1
Significance of Impact and Preferred Alternatives	The location of Groot 04 is within the PV area of the project footprint (Alternative 1) and the Option 4 powerline lies just on the 20m buffer for Groot 01. The structures at both sites are protected under s34 of the NHRA.					
Alternative 2	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Medium	Permanent	Moderate	2
After Mitigation	Positive	Local	Low	Long- term	Unlikely	1
Significance of Impact and Preferred Alternatives	The location of Groot 04 is just outside (14m north) of an internal road of the project layout (Alternative 2) but would be within a 25m buffer taken from the centre of the kraal. The Option 4 powerline lies close to the 20m buffer for Groot 01. The structures at both sites are protected under s34 of the NHRA.					

Table 11: Heritage Resources – Archaeological Material Mitigation Table

Environmental Feature	Heritage resources – archaeological material (Groot 02, Groot 03)					
Project life-cycle	Planning, Construction and Operation					
Potential Impact	Proposed Management Objectives / Mitigation Measures					
Possible damage to or destruction of historical structure remains	• A buffer of at least 30m must be placed around both sites to ensure that during construction there is no indirect impact which could damage any archaeological material • The materials demarcating the 30m buffer must be highly visible and made of durable material • If any impact is anticipated, then a permit will be required for the destruction of the material (from SAHRA)					
Possible damage to or destruction of unidentified archaeological material	• If any changes are made to the final design footprint prior to construction, monitoring of the site clearance activities must be undertaken by an archaeologist to identify any additional archaeological material					
Alternative 1	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Medium	Permanent	Moderate	2

After Mitigation	Negative	Local	Low	Long- term	Unlikely	1
Significance of Impact and Preferred Alternatives	The location of these two sites is just outside (23m east) of the PV area of the project footprint (Alternative 1). The material is protected under s35 of the NHRA. If any impact is anticipated, then a permit will be required to destroy the material.					
Alternative 2	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Medium	Permanent	Unlikely	1
After Mitigation	Negative	Local	Low	Long- term	Unlikely	1
Significance of Impact and Preferred Alternatives	The location of these two sites is well outside (140-159m south) of the PV area of the project footprint (Alternative 2). The material is protected under s35 of the NHRA. If any impact is anticipated, then a permit will be required to destroy the material.					

9.5 Cumulative impacts

The project area and surrounding region has been affected by impacts of activities occurring in the past, current activities and proposed future developments. These will be discussed below.

Past impacts: The past HIA reports recovered from the SAHRIS database indicated that the Grootvlei Solar PV project footprint and surrounding region has been affected by several development and other activities that would have disturbed the heritage resources which occur in the area. These include: agricultural activities within the project area including a proposed poultry farm and several prospecting or mining rights application for various farms situated immediately north and west of the project area.

Current impacts: the immediate area of the Grootvlei Solar PV footprint is affected by cattle and game farming activities.

The baseline impacts for the project area are considered low for Heritage resources, and additional project impacts (if no mitigation measures are implemented) will not increase the significance of the existing baseline impacts, where the cumulative unmitigated impact will probably be of a low-moderate significance. The impact is going to happen and will be long-term in nature, therefore the impact risk class will be Low to Moderate. However, with the implementation of the recommended management and mitigation measures this risk class can be minimized to a Low rating.

10 ALTERNATIVES

10.1 Introduction

Alternatives are the different ways in which the Project can be executed to ultimately achieve its objectives. Examples could include carrying out a different type of action, choosing an alternative location or adopting a different technology or design for a project.

10.2 Site Alternatives

No site alternatives are proposed for this Project. Favourable location factors for the PV Site include suitable solar irradiation levels, short distance to grid connection point, flat topography, suitable site access and availability of land.

10.3 Layout / Design Alternatives

In terms of the impact on the identified heritage resources, the original layout for the Grootvlei Solar PV footprint (Alternative 1) has been revised to exclude certain environmentally sensitive areas (Alternative 2). The Alternative 2 layout avoids the identified heritage resources that would be directly impacted by the Alternative 1 layout. Therefore, from a heritage perspective, Alternative 2 is the preferred layout. However, some of these heritage resources still could be subject to indirect impact, specifically during site clearance or construction activities, therefore the mitigation measures set out above and below will still apply.

10.4 No-Go Option

As standard practice and to satisfy regulatory requirements, the option of not proceeding with the Project is included in the evaluation of the alternatives.

The no-go alternative can be regarded as the baseline scenario against which the impacts of the Project are evaluated. This implies that the current status and conditions associated with the proposed Project footprint will be used as the benchmark against which to assess the possible changes (impacts) associated with the Project.

In contrast, should the proposed Project not go ahead, any potentially significant environmental issues would be irrelevant, and the status quo of the local receiving environment would not be affected by the project-related activities. The objectives of the Project, including the benefits (such as the exploitation of SA's renewable energy resources, potential economic development and related job creation, and increased security of electricity supply), will not materialise.

The no-go alternative will be assessed during the EIA Phase, taking into consideration the findings of the specialist studies and the outcomes of public participation (amongst others).

11 STATEMENT OF IMPACT SIGNIFICANCE

The project area that will be impacted by the proposed Grootvlei Solar PV project contains some areas that are currently disturbed by cattle and game farming activities.

The impact significance of the project on graves and cemeteries is low as no definite grave sites were identified.

The impact significance of the proposed project on protected historical structures is medium as two sites comprising historical structures were identified within the general site footprint: a small historical farmstead (Groot 01), and a site comprising an historical stone kraal with associated large trough (Groot 04). Since both of these sites are depicted on the 1966 topographic map it is very likely that these structure remains older than 60 years of age and therefore the sites are protected by s34 of the NHRA.

The impact significance of the project on archaeological sites or material is low as two sites containing stone tools were identified (Groot 02, Groot 03) but these are of low significance as isolated finds or extremely low density scatters.

12 HERITAGE MANAGEMENT GUIDELINES

12.1 General Management Guidelines

The following General Heritage Management Guidelines are recommended:

1. It is advisable that an information section on cultural resources be included in the SHEQ training given to contractors involved in surface earthmoving activities. These sections must include basic information on:
   a. Heritage;
   b. Graves;
   c. Archaeological finds; and
   d. Historical Structures.
2. This module must be tailor made to include all possible finds that could be expected in that area of construction. Possible finds include:
   a. Open air Stone tool scatters, disturbed during vegetation clearing.
   b. Unidentified informal graves
   c. Palaeontological deposits.

3. In the event that a possible find is discovered during construction, all activities must be halted in the area of the discovery and a qualified archaeologist contacted.
4. The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures.
5. If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA.
6. After mitigation, an application must be lodged with SAHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed.
7. If during the initial survey sites of cultural significance are discovered, it will be necessary to develop a management plan for the preservation, documentation or destruction of such a site. Such a program must include an archaeological/palaeontological monitoring programme, timeframe and agreed upon schedule of actions between the company and the archaeologist.
8. In the event that human remains are uncovered, or previously unknown graves are discovered, a qualified archaeologist needs to be contacted and an evaluation of the finds made.
9. If the remains are to be exhumed and relocated, the relocation procedures as accepted by SAHRA need to be followed. This includes an extensive social consultation process.

13 Recommendations and Conclusion

The proposed Grootvlei Solar PV project could impact on heritage resources as four heritage resources were identified within or adjacent to the project footprint area: two historical structure sites (Groot 01, Groot 04) and two archaeological sites (Groot 02, Groot 03). However, the Alternative 2 layout has been adjusted to specifically avoid these heritage resources.

The recommendations below are provided to mitigate the potential impact of the proposed PV project on the four identified heritage resources:

Historical Structures (Groot 01, Groot 04)

- A buffer of at least 20m (25m from the centre for the kraal) must be placed around both sites to ensure that during construction there is no indirect impact which could damage any structures
- The materials demarcating the buffer must be highly visible and made of durable material
- If any impact is anticipated, then a permit will be required for the alteration or destruction of any of the structures (from NW PHRA or SAHRA)

Archaeological material (Groot 02, Groot 03)

- A buffer of at least 30m must be placed around both sites to ensure that during construction there is no indirect impact which could damage any archaeological material

- The materials demarcating the buffer must be highly visible and made of durable material
- If any impact is anticipated, then a permit will be required for the destruction of the material (from SAHRA)

Palaeontological heritage

- A separate palaeontological study is being undertaken by a professional palaeontologist as the project area falls into an area where the underlying geology is mainly of Very High fossil sensitivity. The assessment would indicate if significant/sensitive fossils will be impacted by the proposed project and provide mitigation measures.

No fatal flaws were identified during this study, therefore, it is the considered opinion of the heritage specialist that the construction of the proposed Solar PV project within the footprint can proceed. There are no objections from a heritage perspective provided the recommendations and mitigation measures contained in this report and in the separate desktop palaeontological assessment are implemented. It should be noted that the original layout for the Grootvlei Solar PV footprint (Alternative 1) has been revised to exclude certain environmentally sensitive areas (Alternative 2). The Alternative 2 layout avoids the identified heritage resources that would be impacted by the Alternative 1 layout. Therefore, from a heritage perspective, Alternative 2 is the preferred layout. However, some of these heritage resources still could be subject to indirect impact, specifically during site clearance or construction activities, therefore the mitigation measures set out above will still apply.

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IP, Koppieskraal 500 IP, Makokskraal 203 IP, Sweethome 197 IP and Doornpan 193 IP near Ventersdorp, North West Province

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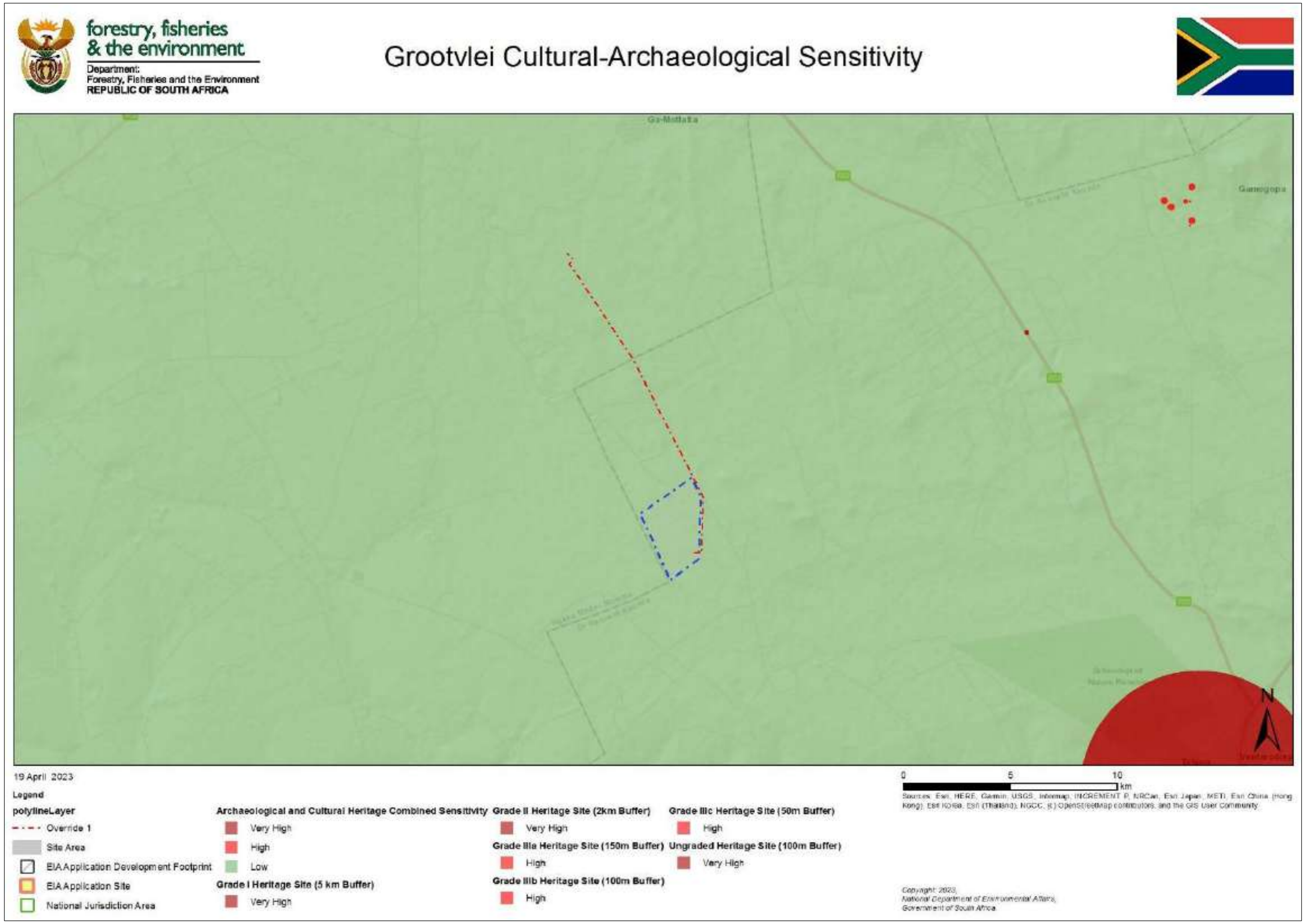
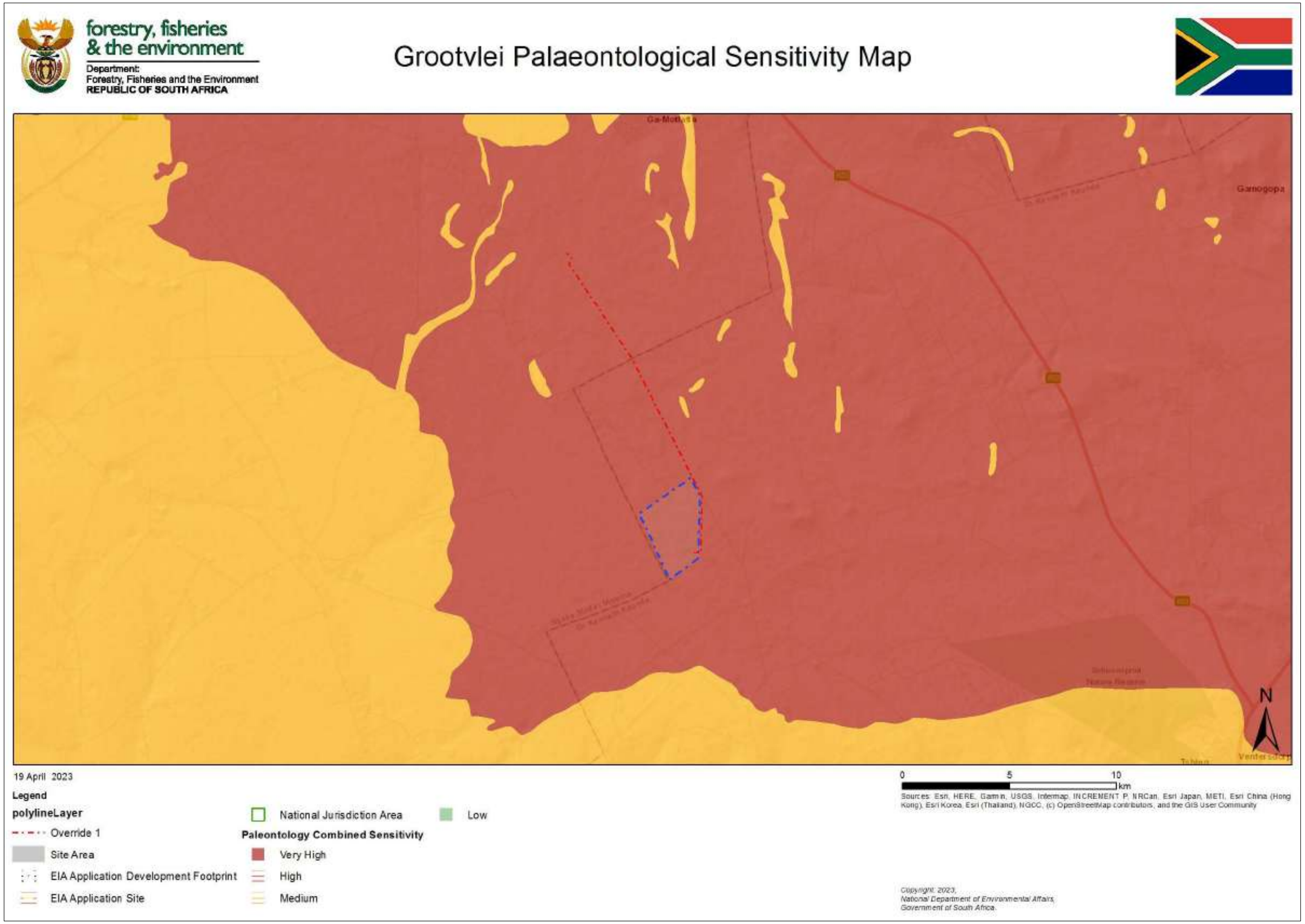
https://www.sahistory.org.za/people/eugene-ney-terreblanche

Appendix 1: Heritage Sensitivity Map/s

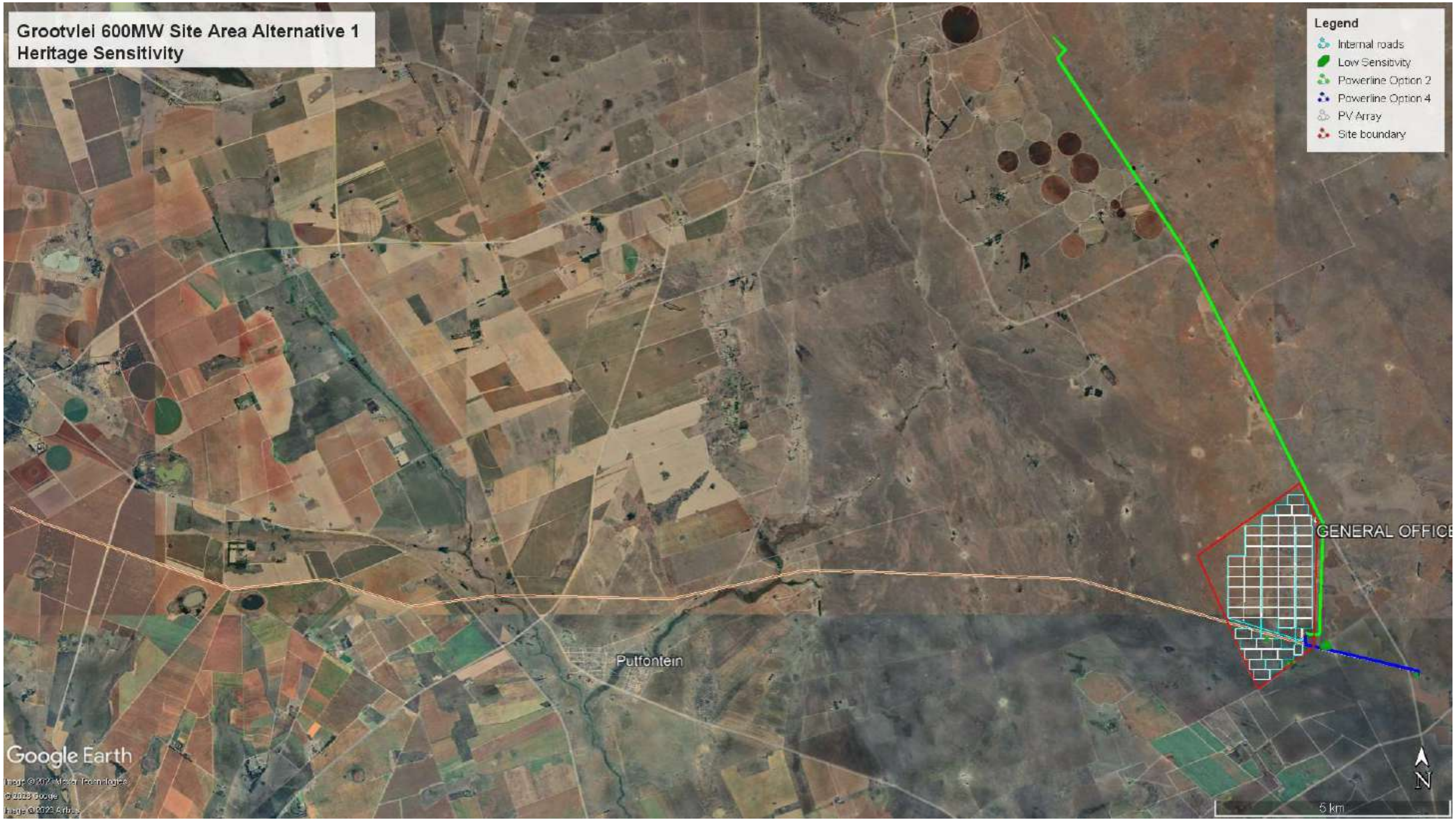
1. Cultural Heritage Sensitivity map from DFFE screening tool

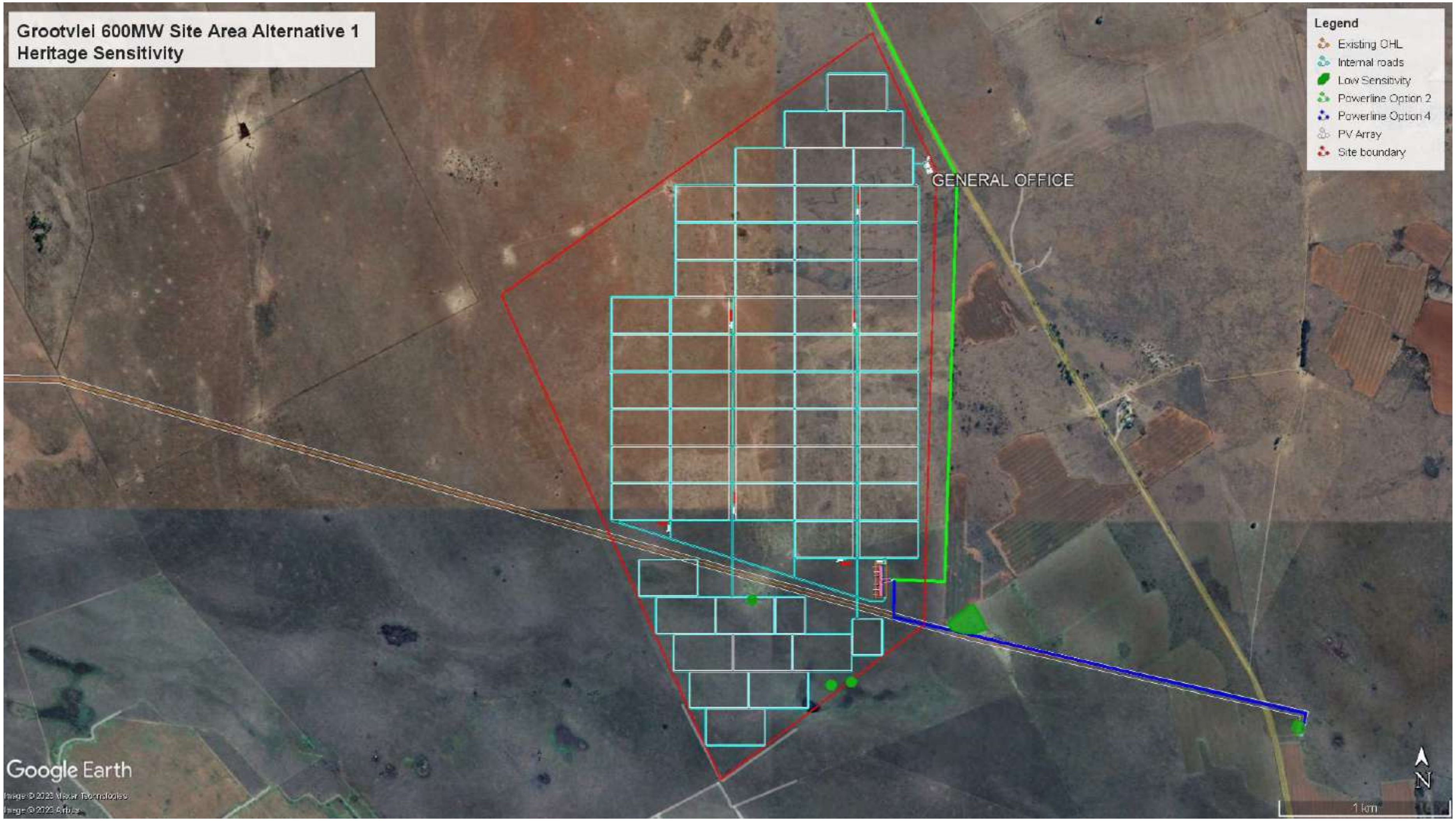


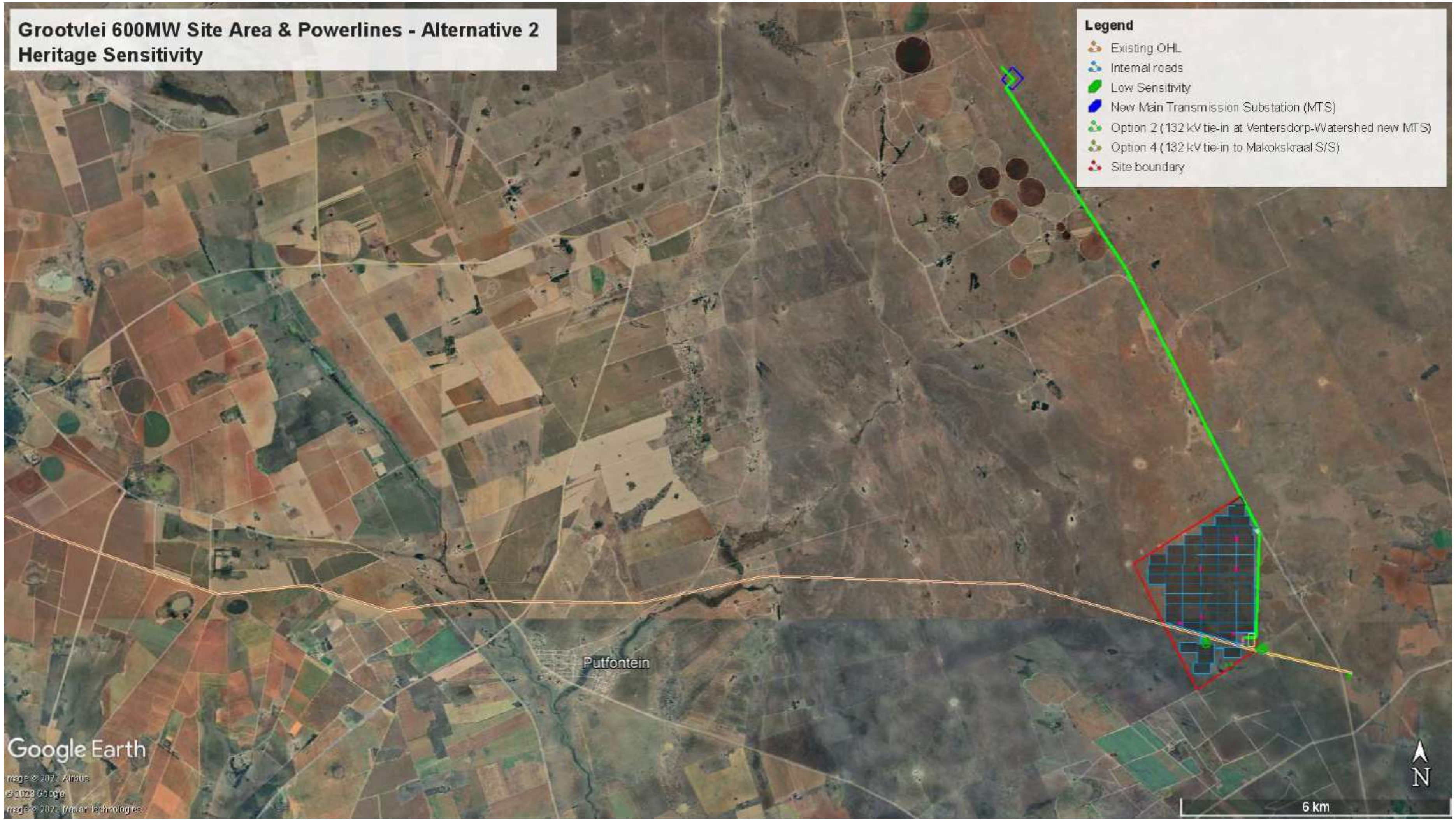
2. Palaeontological Sensitivity map from DFFE screening tool

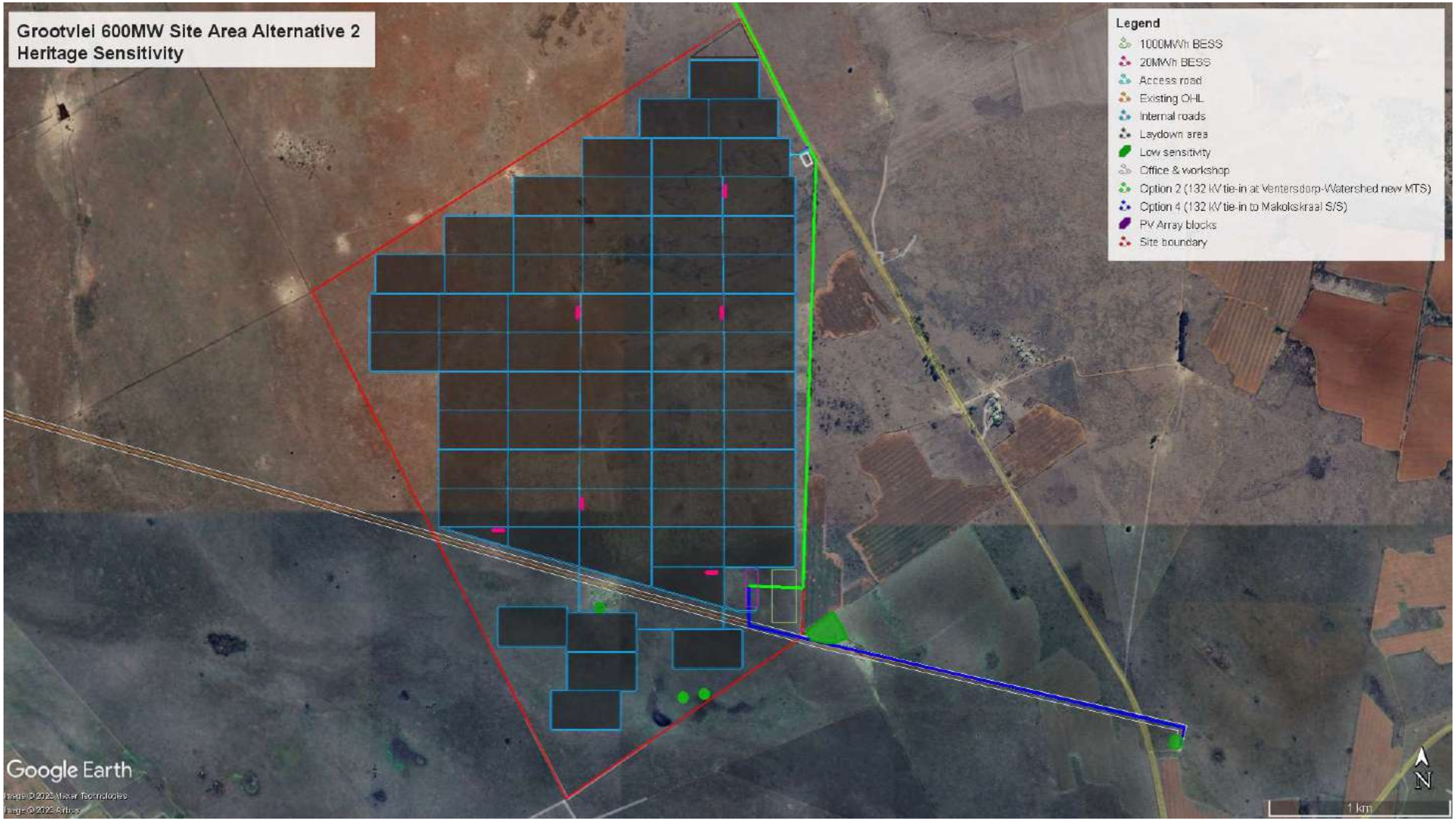


3. Heritage Sensitivity Maps based on the Site Inspection / Field survey




Grootvlei 600MW Site Area Alternative 1
Heritage Sensitivity
Legend
Existing OHL
Internal roads
Low Sensitivity
Powerline Option 2
Powerline Option 4
PV Array
Site boundary
GENERAL OFFICE
Google Earth
1 km
N


Grootvlei 600MW Site Area & Powerlines - Alternative 2
Heritage Sensitivity
Legend
Existing OHL
Internal roads
Low Sensitivity
New Main Transmission Substation (MTS)
Option 2 (132 kV tie-in at Ventersdorp-Watershed new MTS)
Option 4 (132 kV tie-in to Makokskraal S/S)
Site boundary
Putfontein
Google Earth
6 km
N


Grootvlei 600MW Site Area Alternative 2
Heritage Sensitivity
Legend
1000MWh BESS
20MWh BESS
Access road
Existing OHL
Internal roads
Laydown area
Low sensitivity
Office & workshop
Option 2 (132 kV tie-in at Ventersdorp-Watershed new MTS)
Option 4 (132 kV tie-in to Makokskraal S/S)
PV Array blocks
Site boundary
Google Earth
N
1 km

APPENDIX 2: CURRICULUM VITAE OF HERITAGE SPECIALIST

1 Personal Particulars

Profession:	Heritage Specialist
Date of Birth:	11 September 1966
Name of Firm:	Nitai Consulting
Name of Staff:	Jennifer Kitto
Nationality:	RSA
Membership of Professional Societies	Association of Southern African Professional Archaeologists (444); International Association for Impact Assessment South Africa (7151)

2 Education:

BA Hons Social Anthropology, WITS, South Africa, 1994

BA. Archaeology and Social Anthropology, WITS, South Africa, 1993

Higher National Diploma, Practical Archaeology, Dorset Institute for Higher Education (now Bournemouth University), UK, 1989

3 Employment Record:

2022 – Present Heritage Specialist, Nitai Consulting

Conduct Heritage Impact Assessments;

2012 – 2021 Heritage Specialist, PGS Heritage (Pty) Ltd

Conduct Heritage Impact Assessments

Compile Desktop Historical Research

Compile Heritage Audit and Management Plans

Compile and submit permit applications to National and Provincial Heritage Authorities for Section 34 building alterations and demolitions (under National Heritage Resources Act, 25 of 1999)

Compile and submit permit applications to Provincial and Municipal Health Authorities for Section 36 relocations of graves and burial grounds (under National Heritage Resources Act, 25 of 1999 and National Health Act, No 61 of 2003)

2008 – 2011 *Cultural Heritage Officer (National), Burial Grounds and Graves Unit: South African Heritage Resources Agency (SAHRA)*

Review and assessing permit applications for relocation of historical graves and burial grounds

1998 – 2008 *Cultural Heritage Officer (Provincial), Provincial Office – Gauteng: SAHRA*

Review and comment on heritage and archaeological impact reports

Research for the nomination and grading process for related to the declaration of specific heritage resources as National Heritage Sites

Monitoring of certain archaeological and built environment National Heritage Sites (e.g. The Cradle of Humankind World Heritage Site)

4 Selected Consultancies

4.1 GDID East Corridor, OHS Implementation, Tambo Memorial Regional Hospital (as sub-contractor to PGS Heritage (Pty) Ltd

2022 Independent Heritage Specialist. Compile Historical Archival Report of Tambo Hospital Boksburg, Gauteng for PGS Heritage (Pty) Ltd, Finalise HIA Report and submit HIA report to Gauteng Provincial Heritage Resources Authority

4.2 GDID East Corridor, OHS Implementation, Tembisa Regional Hospital (as sub-contractor to PGS Heritage (Pty) Ltd

2022 Independent Heritage Specialist. Compile Historical Archival Report of Tembisa Hospital, Ekurhuleni, Gauteng for PGS Heritage (Pty) Ltd, Finalise HIA Report and submit HIA report to Gauteng Provincial Heritage Resources Authority.

4.3 Kroonstad Cluster Solar PV Facilities

2022/2023 Heritage Specialist, Development of three Solar PV facilities west of Kroonstad, Free State Province, South Africa, Undertake Heritage Impact Assessment of all heritage resources associated with the three solar PV facilities

4.4 Rustenburg Solar PV Facilities

2022/2023 Heritage Specialist, Development of three Solar PV facilities near Rasimone, Rustenburg, North West Province, South Africa, Undertake Heritage Impact Assessment of all heritage resources associated with the three solar PV facilities

4.5 Seelo Solar PV Cluster

2022/2023 Heritage Specialist, Development of three Solar PV facilities near Carletonville, North West Province, South Africa, Undertake Heritage Impact Assessment all heritage resources associated with the three solar PV facilities

4.6 Decommissioning of Komati Power Station

2023, Heritage Specialist, Proposed Decommissioning of the Komati Power Station, Middelburg, Mpumalanga, Undertake Heritage Impact Assessment of all heritage structures within the power station

4.7 Carbon Capture Utilisation & Storage Pilot Project

2023 Heritage Specialist, Proposed pilot project for the capture and storage of CO_2, in Mpumalanga, comprising a 3D seismic survey and test drilling for the purpose of geological characterisation of the project area. Undertake Heritage Impact Assessment all heritage resources associated with the CCUS Pilot Project.

5 Languages:

English - excellent speaking, reading, and writing
Afrikaans –fair speaking, reading and writing

APPENDIX D6: Paleontological Impact Assessment

PALAEONTOLOGICAL IMPACT ASSESSMENT

PROPOSED GROOTVLEI 600MW SOLAR PLANT, BATTERY ENERGY STORAGE SYSTEMS PROJECT

NEAR VENTERSDORP, JB MARKS LOCAL MUNICIPALITY, NORTH WEST PROVINCE

2023

COMPILED for: Nemai GREEN

Declaration of Independence

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological 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 favorable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, 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 will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- 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;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realize that a false declaration is an offense in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations.

PALAEONTOLOGICAL CONSULTANT: Banzai Environmental (Pty) Ltd

CONTACT PERSON: Elize Butler

Tel: +27 844478759

Email: info@banzai-group.com

SIGNATURE: Butler.

The Palaeontological impact assessment report has been compiled considering the National Environmental Management Act 1998 (NEMA) and Environmental Impact Regulations 2014 as amended, requirements for specialist reports, Appendix 6, as indicated in the table below.

Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
1.(1) (a) (i) Details of the specialist who prepared the report	Page ii and Section 2 of Report – Contact details and company and Appendix 1	-
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 2 – refer to **Appendix 1**	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report	-
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 4 – Objective	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 5 – Geological and Palaeontological history	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 10	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1;9 & 11	-
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 7 Approach and Methodology	-
(f) details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associated	Section 1; & 11	-

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
structures and infrastructure, inclusive of a site plan identifying site alternatives;		
(g) An identification of any areas to be avoided, including buffers	Section 1 & 11	-
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5 – Geological and Palaeontological history	-
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 7.1 – Assumptions and Limitation	-
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 1 and 11	-
(k) Any mitigation measures for inclusion in the EMPr	Section 12	-
(l) Any conditions for inclusion in the environmental authorisation	Section 12	-
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 12	-
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 & 11	-
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and		-
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 1 and 11	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public consultation process was

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**The relevant section in the report**	**Comment where not applicable.**
		handled as part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) process.
(p) A summary and copies of any comments that were received during any consultation process	N/A	Not applicable. To date, no comments regarding heritage resources that require input from a specialist have been raised.
(q) Any other information requested by the competent authority.	N/A	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines	

EXECUTIVE SUMMARY

Banzai Environmental was appointed by Nemai Green Environmental Solutions and Sustainable Future to conduct the Palaeontological Impact Assessment (PIA) to assess the proposed Grootvlei 600 MW Solar Plant, and Battery Energy Storage Systems (BESS) Project west of Ventersdorp, in the North West Province. In accordance with the National Environmental Management Act No 107 of 1998 (NEMA) and to comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), this PIA is necessary to confirm if fossil material could potentially be present in the planned development area, to evaluate the potential impact of the proposed development on the Palaeontological Heritage and to mitigate possible damage to fossil resources.

The proposed Grootvlei Solar Plant PV Facility is entirely underlain by the Precambrian dolomites and associated marine sedimentary rocks of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup). According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) is Very High (Almond *et al*, 2013; SAHRIS website), while the Palaeotechnical report of the Northwest (Groenewald et al., 2014) allocated a High Sensitivity to the Malmani Subgroup. Two Layout alternatives have been considered for the grid connection of this Project. As the geology of the alternatives are the same there is no preference between the alternatives from a Palaeontological point of view.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 31 May 2023. Outcrops of weathered stromatolites were discovered on the development. Stromatolites may be better preserved elsewhere in the area and thus mitigation is not suggested.

Based on the site investigation it is concluded that fossil heritage of scientific and conservational interest in the development footprint is rare. This is in contrast with the High Sensitivity allocated to the development area by the SAHRIS Palaeosensitivity Map and DFFE Screening Tool. A medium Palaeontological Significance has been allocated for the construction phase of the PV development pre-mitigation and a low significance post mitigation. The construction phase will be the only development phase impacting Palaeontological Heritage and no significant impacts are expected to impact the Operational and Decommissioning phases. As the No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The Cumulative impacts of the development is considered to be medium pre- mitigation and Low post mitigation and falls within the acceptable limits for the project. It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources. It is consequently recommended that

no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

If well-preserved fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the Chance Find Protocol must be implemented by the ECO/site manager in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the ECO/site manager must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation (recording and collection) can be carry out by a paleontologist.

Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies suggested by SAHRA.

Impact Summary

Environmental parameter	**Issues**	**Rating prior to mitigation**	**Average**	**Rating post mitigation**	**Average**
Planning Phase Alternative 1 Grootvlei Solar Plant PV Facility	No Impact	0	No Impact	0	No Impact
Construction Stage Alternative 1 Grootvlei Solar Plant PV Facility Loss of fossil heritage	Destroy or permanently seal-in fossils at or below the surface that are then no longer available for scientific study	45	Negative Medium impact	16	Negative Low impact
Operational Phase Alternative 1 Grootvlei Solar Plant PV Facility	No Impact	0	No Impact	0	No Impact
Decommissioning Phase Alternative 1 Grootvlei Solar Plant 1 PV Facility	No Impact	0	No Impact	0	No Impact
Planning Phase Alternative 2 Grootvlei Solar Plant PV Facility	No Impact	0	No Impact	0	No Impact
Construction Stage Alternative 2 Grootvlei Solar Plant PV Facility Loss of fossil heritage	Destroy or permanently seal-in fossils at or below the surface that are then no longer available for scientific study	45	Negative Medium impact	16	Negative Low impact

Operational Phase Alternative 21 Grootvlei Solar Plant PV Facility	No Impact	0	No Impact	0	No Impact
Decommissioning Phase Alternative 2 Grootvlei Solar Plant 1 PV Facility	No Impact	0	No Impact	0	No Impact

It is therefore considered that the proposed Grootvlei Solar Plant PV Facility is deemed appropriate and will not lead to detrimental impacts on the palaeontological reserves of the area. Thus, the construction of the development may be authorised in its whole extent.

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1 INTRODUCTION

Electricity generation sources need to be diversified to ensure security of supply and reduction in the carbon footprint created by the current heavy reliance of South Africa (SA) on coal to produce electricity. LTM Green Energies (Pty) Ltd (the "Applicant") has proposed the development of Grootvlei 600MW Solar Plant, Battery Energy Storage Systems (BESS) and Grid Connection Project north west of Ventersdorp within the JB Marks Local Municipality in the North West Province (the "Project").

The Applicant intends to bid for the current and future Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) bid windows and/or other renewable energy markets within SA (Figure 1-3).

1.1 Technical details

The Project consists of the following systems, sub-systems or components (amongst others):

- 600MW PV solar panels or modules (arranged in arrays);
- Mounting structures to support the PV panels;
- DC-AC current inverters stations, transformers, and internal electrical reticulation (underground cabling);
- Grid Connection: Option 1 which consists of 2 x 132kV powerlines, approximately 14km kilometers (km) in length, from the new facility 33kV substation to new 400/132kV Main Transmission Substation (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line and Option 2 that comprises of 2.8km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation.
- New 400/132kV Main Transmission Substation
- On site switching station/substation;
- Administration Buildings (Offices);
- Workshop areas for maintenance and storage;
- Temporary laydown areas;
- Internal access roads and perimeter fencing of the footprint area;
- Lithium-ion battery energy storage system (BESS);
- Security Infrastructure; and
- Site access from unnamed gravel road via the N14 and/or R53.

An overview of the project life-cycle, as well as the resources required to execute the Project, is provided in the Scoping Report.

The alternatives under consideration for the Project include design/layout alternatives, technology alternatives and the no-go option. The EIA phase will include a detailed comparative analysis of the Project's feasible alternatives that emanate from the Scoping exercise, which will include environmental (with specialist input) and technical evaluations.

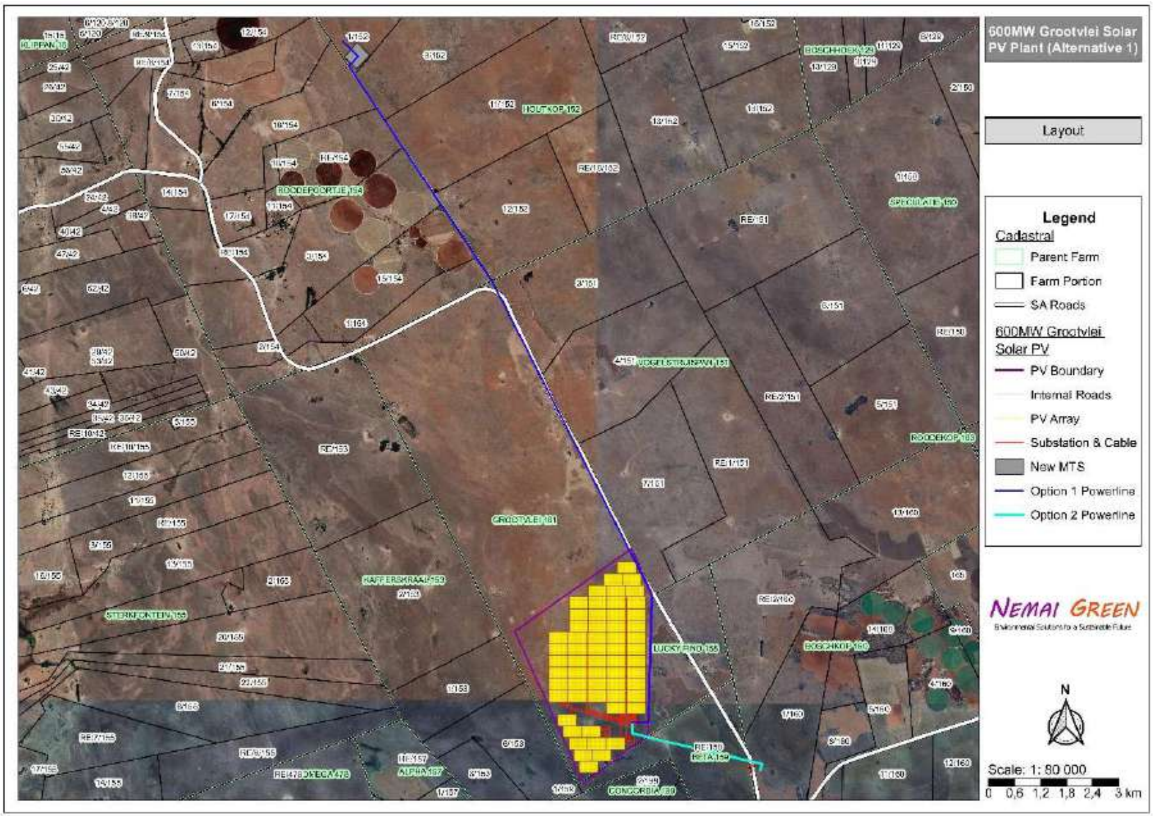

Figure 1: *Regional locality of Alternative 1 of the proposed Grootvlei 600MW Solar Plant Project, BESS & Grid Connection Project in North West Province.*

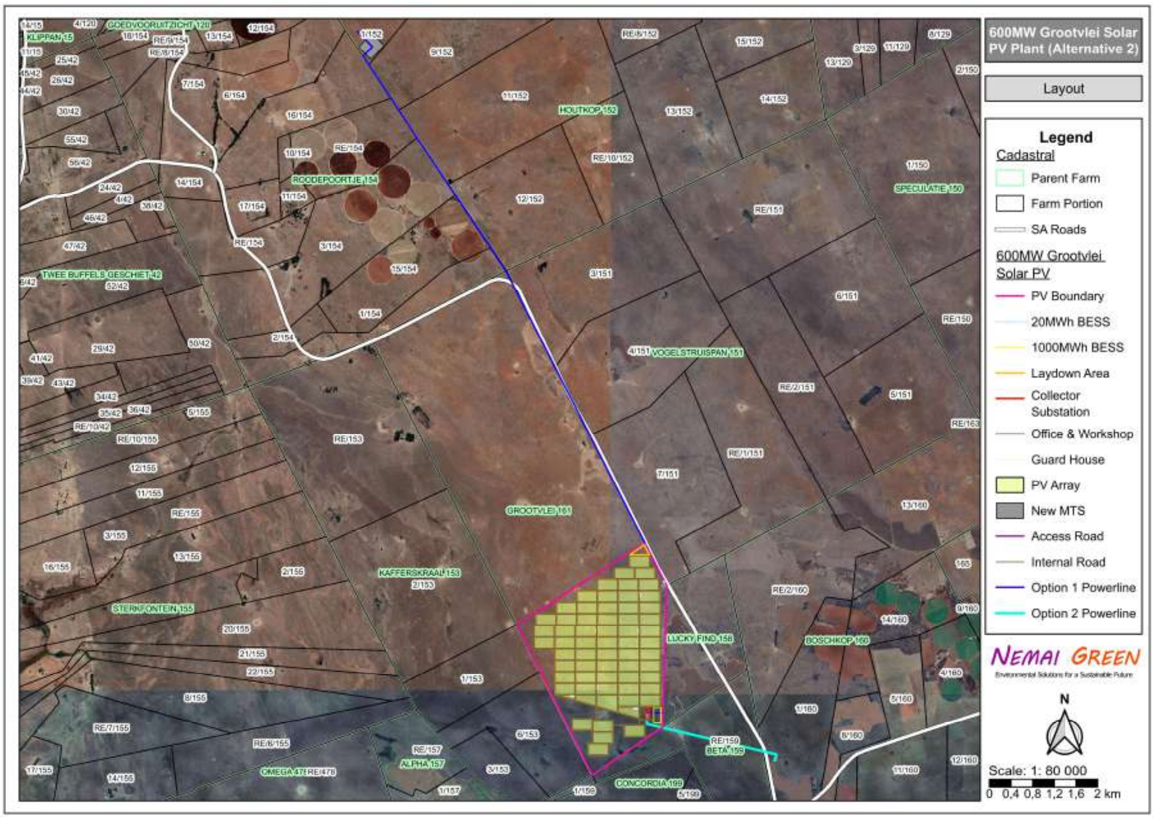

Figure 2: *Regional locality of Alternative 2 of the proposed Grootvlei 600MW Solar Plant Project, BESS & Grid Connection Project in North West Province.*

***Figure 3**: Locality map of the proposed* Grootvlei 600MW Solar Plant Project in North West Province.

Table 2: Location of the proposed Project.	
Solar Plant	
Portion number 0 of the farm Grootvlei 161 IP	T0IP00000000016100000
New Main Transmission Substation	
Portion number 1 of the Farm Houtkop 152	T0IP00000000015200001
Powerline Route Option 1	
Portion number 1 of the Farm Houtkop 152	T0IP00000000015200001
Portion number 9 of the Farm Houtkop 152	T0IP00000000015200009
Portion number 11 of the Farm Houtkop 152	T0IP00000000015200011
Portion number 12 of the Farm Houtkop 152	T0IP00000000015200012
Portion number 3 of the Farm Vogelstruispan 151	T0IP00000000015100003
Portion number 4 of the Farm Vogelstruispan 151	T0IP00000000015100004
Portion number 7 of the Farm Vogelstruispan 151	T0IP00000000015100007
Portion number 0 of the Farm Lucky Find 158	T0IP00000000015800000
Portion number 0 of the farm Grootvlei 161 IP	T0IP00000000016100000
Powerline Route Option 2	
Portion number 0 of the farm Grootvlei 161 IP	T0IP00000000016100000
Portion RE of the Farm Beta 159 IP	T0IP00000000015900000
Portion 0 of the Farm Boschkop	T0IP00000000016090000

Table 3: Technical details of the proposed Solar Plant

No.	**Component**	**Description / Dimensions**
1.	Height of PV panels	± 2.5m
2.	Area of PV Array	± 490 ha
3.	Number of inverters required	Approximately 240x 2.5MW inverters
4.	Area occupied by inverter / transformer stations / substations	• Area occupied by inverter stations =0.35ha • Area occupied by Operation and Maintenance infrastructure = ± 0.1 ha • Area occupied by facility (step-up/Collector) substation = 0.2 ha • Area occupied by the onsite substations = 0.1 ha
5.	Capacity of on-site substation	Up to a maximum of 600 MW, 6.6kV/275kV

6.	Area occupied by buildings and BESS	• Area occupied by Operation & Maintenance infrastructure =± 0.1 ha • Area occupied by BESS = 0.35 ha
7.	Area occupied by both permanent and construction laydown areas	• Construction areas = 0.25 ha • Operation & Maintenance infrastructure = ± 0.1 ha • Total combined = ± 0.35 ha
8.	Area occupied by buildings	1.5 ha
9.	Length of internal roads	± 15km
10.	Width of internal roads	• Internal roads will have a 5m road width. • Access road will have a 14m reserve and road width of 8m.
11.	Proximity to grid connection	Grid Connection: Option 1 which consists of 2 x 132kV powerlines, approximately 14km kilometres (km) in length, from the new facility 33kV substation to new 400/132kV Main Transmission Substation (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line; or Option 2 that comprises of 2.8km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation.
12.	Height of fencing	Up to 3m
13.	Type of fencing	Type will vary around the site, welded mesh, palisade and electric fencing

1.2 Alternatives

Alternatives are the different ways in which the Project can be executed to ultimately achieve its objectives. Examples could include carrying out a different type of action, choosing an alternative location or adopting a different technology or design for a project.

The sub-sections to follow discuss the Project's alternatives considered during the Scoping process. The EIA process will provide a detailed comparative analysis of feasible alternatives from environmental (including specialist input) and technical perspectives.

By conducting the comparative analysis, the BPEO can be selected with technical and environmental justification. Münster (2005) defines BPEO as the alternative that "*provides the* *most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term*".

1.2.1 Site alternatives

No site alternatives are proposed for this Project. Favourable location factors for the PV Site include suitable solar irradiation levels, short distance to grid connection point, flat topography, suitable site access and availability of land.

1.2.2 Layout / Design Alternatives

It is anticipated that the space available at the Project Site will be adequate to position the facility and its associated infrastructure to avoid areas of sensitive environmental features, which will be determined in the EIA Phase through the specialist studies. The extent of the site allows for the identification of layout/design alternatives to manage impacts to environmental sensitivity.

1.2.3 Technology Alternatives

Solar PV Technology

Solar PV technology consists of either monofacial or bifacial solar panels used on either a fixed mounting system or tracking mounting system.

Solar CSP Technology

Four types of CSP technologies will be considered: parabolic troughs, power towers, dish/engine systems, and linear Fresnel reflectors. The parabolic trough system was the first CSP technology, thus it is the most developed and most replicated system.

Solar PV Technology is considered as the preferred technology.

1.2.4 BESS Technology

The BESS can be broken into solid state and flow battery systems. The EIA Report will evaluate the advantages and disadvantages associated with the types of BESS.

1.2.5 No-go Option

As standard practice and to satisfy regulatory requirements, the option of not proceeding with the Project is included in the evaluation of the alternatives. The no-go alternative can be regarded as the baseline scenario against which the impacts of the Project are evaluated. This implies that the current status and conditions associated with the proposed Project footprint will be used as the benchmark against which to assess the possible changes (impacts) associated with the Project. In contrast, should the proposed Project not go ahead, any potentially significant environmental issues would be irrelevant, and the status quo of the local receiving environment would not be affected by the project-related activities. The objectives of the Project, including the benefits (such as the exploitation of SA's renewable energy resources, potential economic development and related job creation, and increased security of electricity supply), will not materialise. The no-go alternative will be assessed during the EIA Phase, taking into consideration the findings of the specialist studies and the outcomes of public participation (amongst others).

1.2.6 Terms of Reference and scope of work

A site sensitivity verification report is required to be undertaken to comply with "Part A - General Protocol for the Site Sensitivity Verification and Minimum Report Content Requirements where a Specialist Assessment is required but no specific Environmental Theme Protocol has been prescribed" (GG 43110 / GNR 320, 20 March 2020).

A site-specific field survey of the development footprint for the project was conducted in May 2023 to verify the site sensitivity assigned to the Kroonstad South Cluster and to validate the sensitivity and land use as prescribed by the DFFE Screening Tool (see Appendix 2). The Screening Tool indicates that the proposed development has a Very High Palaeontological Sensitivity. This provisional assessment is contested here due to the fact that no fossils were recovered in the palaeontological site investigation. It is concluded that the study area generally has a low palaeontological sensitivity. If Palaeontological Heritage is uncovered during surface clearing and excavations, the Chance find Protocol attached should be implemented immediately. These recommendations should be incorporated into the EMPr and fully implemented during the construction phase of the development. The construction of the development may thus be permitted in its whole extent, and no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This study has been conducted by Mrs Elize Butler. She has conducted approximately 400 palaeontological impact assessments for developments in the Free State, KwaZulu-Natal, Eastern, Central, and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga. She has an MSc (*cum laude*) in Zoology (specializing in Palaeontology) from the University of the Free State, South Africa and has been working in Palaeontology for more than twenty-eight years. She has experience in locating, collecting, and curating fossils. She has been a member of the

Palaeontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

3. LEGISLATION

National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include "all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens".

The identification, evaluation and assessment of any cultural heritage site, artefact or finds in the South African context is required and governed by the following legislation:

- National Environmental Management Act (NEMA) Act 107 of 1998
- National Heritage Resources Act (NHRA) Act 25 of 1999
- Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
- Notice 648 of the Government Gazette 45421- general requirements for undertaking an initial site sensitivity verification where no specific assessment protocol has been identified.

The next section in each Act is directly applicable to the identification, assessment, and evaluation of cultural heritage resources.

GNR 982 (Government Gazette 38282, 14 December 2014) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998

- Basic Assessment Report (BAR) – Regulations 19 and 23
- Environmental Impacts Assessment (EIA) – Regulation 23
- Environmental Scoping Report (ESR) – Regulation 21
- Environmental Management Programme (EMPr) – Regulations 19 and 23

National Heritage Resources Act (NHRA) Act 25 of 1999

- Protection of Heritage Resources – Sections 34 to 36
- Heritage Resources Management – Section 38

MPRDA Regulations of 2014

Environmental reports to be compiled for application of mining right – Regulation 48

- Contents of scoping report – Regulation 49
- Contents of environmental impact assessment report – Regulation 50
- Environmental management programme – Regulation 51
- Environmental management plan – Regulation 52

The NEMA (No 107 of 1998) states that an integrated EMP should (23:2 (b)) "*…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage*".

In agreement with legislative requirements, EIA rating standards as well as SAHRA policies the following comprehensive and legally compatible PIA report have been compiled.

Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources and may not be unearthed, broken moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

This Palaeontological Impact assessment forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to Section 38 (1), an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length.
- the construction of a bridge or similar structure exceeding 50 m in length.
- any development or other activity which will change the character of a site—
  - (Exceeding 5 000 m^2 in extent; or
  - involving three or more existing erven or subdivisions thereof; or
  - involving three or more erven or divisions thereof which have been consolidated within the past five years; or
  - the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 m^2 in extent.
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

4. OBJECTIVE

The objective of a Palaeontological Impact Assessment (PIA) is to determine the impact of the development on potential palaeontological material at the site.

According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the aims of the PIA are: 1) to identify the palaeontological status of the exposed as well as rock formations just below the surface in the development footprint 2) to estimate the palaeontological importance of the formations 3) to determine the impact on fossil heritage; and 4) to recommend how the developer ought to protect or mitigate damage to fossil heritage.

The terms of reference of a PIA are as follows:

General Requirements:

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended;

- Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements;
- Submit a comprehensive overview of all appropriate legislation, guidelines;
- Description of the proposed project and provide information regarding the developer and consultant who commissioned the study;
- Description and location of the proposed development and provide geological and topographical maps;
- Provide palaeontological and geological history of the affected area;
- Identification of sensitive areas to be avoided (providing shapefiles/kmls) in the proposed development;
- Evaluation of the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
    a. Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.
    b. Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity.
    c. Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.
- Fair assessment of alternatives (infrastructure alternatives have been provided);
- Recommend mitigation measures to minimise the impact of the proposed development; and
- Implications of specialist findings for the proposed development (such as permits, licenses etc).

5. GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The geology of the proposed Grootvlei Solar Plant PV Project near Ventersburg in North Westis depicted on the 1: 250 000 West-Rand 2626 (1986) Geological Map (Council for Geosciences, Pretoria). This study area is underlain by the Precambrian dolomites and associated marine sedimentary rocks of the Monte Christo Formation of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) (Figure 4, Table 4). The PalaeoMap of the South African Heritage Resources Information System (Almond *et al*, 2013; SAHRIS website; Figure 5) as well as the the DFFE Screening tool (Figure 6) indicates that the Palaeontological Sensitivity of the proposed development is Very High while the Palaeotechnical Report of the North West Province (Groenewald et al, 2014) indicates that the Palaeontological Sensitivity is High (Table 5). Updated geology (Council of Geosciences, Pretoria) is depicted in Figure 7 and indicates that the Grootvlei

Solar Power Plant is underlain by the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup).

The Malmani Subgroup is divided into five formations (Figure 7) that are classified by the amount of chert, stromatolitic morphology, erosion surfaces and intercalated shales in them. The Malmani Subgroup overlies the Black Reef Formation. The oldest Formation in the Malmani Subgroup is the Oaktree Formation that consists of stromatolitic dolomites, carbonaceous shales, and locally developed quartzites. This formation overlies the (Monte Christo Formation that comprises of stromatolitic and oolitic platform dolomites as well as erosive breccia. The Lyttleton Formation overlies the Monte Christo Formation and consists of stromatolitic dolomites as well as shale quartzites. The Eccles Formation follows and comprises of erosional breccias while the youngest Formation is the Frisco Formation that mostly comprises of stromatolitic dolomites.

The Malmani Subgroup carbonates of the Transvaal Basin (Figure 7) comprise of an assortment of stromatolites (microbial laminates), ranging from supratidal mats to intertidal columns and large subtidal domes (Eriksson *et al.* 2006). Stromatolites are layered mounds, columns and sheet-like sedimentary rocks (Figure 6). These structures were originally formed by the growth of layer upon layer of cyanobacteria, a single-celled photosynthesizing microbe. Cyanobacteria are prokaryotic cells (simplest form of modern carbon-bases life). Stromatolites are first found in Precambrian rocks and are known as the earliest known fossils. These algae photosynthesised in the low oxygen atmosphere and deposited layer upon layer of calcium sulphate, magnesium sulphate and calcium carbonate as well as other compounds to form these domes. Researchers have examined and classified the stromatolite structures but seldomly find preserved algal cells. The oxygen atmosphere that we depend on today was generated by numerous cyanobacteria photosynthesizing during the Archaean and Proterozoic Era.

Stromatolites and oolites from the Transvaal Supergroup have been described by various authors (Eriksson and Altermann, 1998). Detailed descriptions of South African Archaean stromatolites are available in the literature (Altermann, 2001; Buick, 2001; and Schopf, 2006). The Malmani stromatolites literature includes articles by Truswell and Eriksson (1972, 1973, 1975), Eriksson and MacGregor (1981), Eriksson and Altermann (1998), Sumner (2000), Schopf (2006).

The Malmani Subgroup succession is about 2 km-thick and consists of a series of formations of oolitic and stromatolitic carbonates (limestones and dolomites), black carbonaceous shales and minor secondary cherts. The Malmani Dolomites also consist of historic lime mines, and palaeocave fossil deposits. Dolomite (limestone rock) forms in warm, shallow seas from slow gathering remainders of marine microorganisms and fine-grained sediment. Dolomites of the

Malmani Subgroup has a higher magnesium content than other limestones. These materials contain high levels of calcium carbonate and are often referred to as *carbonates*.

Currently very few palaeontologists study stromatolites but geologists find the stromatolites interesting because they reveal the change from a reducing environment (that is an oxygen-poor) to an oxidizing environment (oxygen--rich). This transition is known as the Great Oxygen Event (Eroglu et al., 2017).

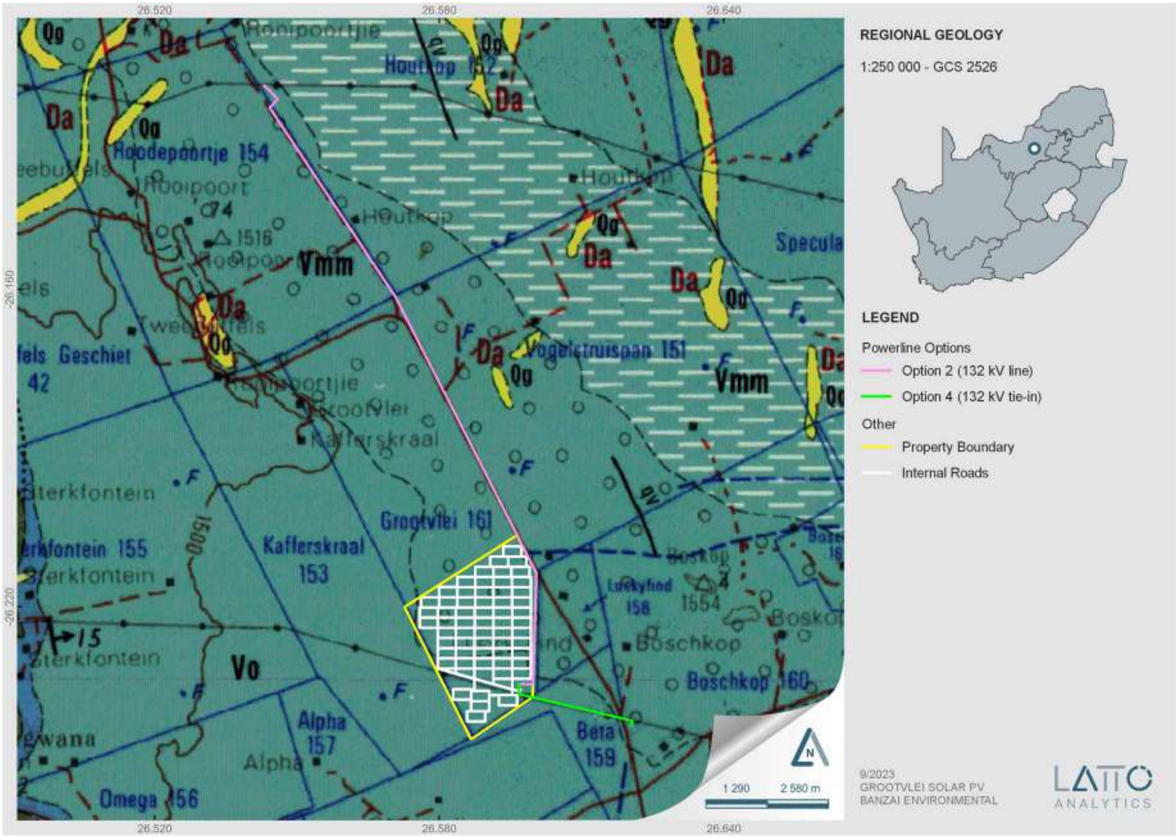

***Figure 4**: Extract of the 1:250 000* West Rand 2626 (1986) *Geological Map (Council for Geosciences, Pretoria) indicating the Grootvlei PV Project in North West Province. The proposed development is entirely underlain by the Monte Christo Formation (Vmd), of the Malmani Subgroup, Chuniespoort Group, Transvaal Supergroup.*

Table 4: Legend to the West Rand 2626 (1986) Geological Map (Council for Geosciences, Pretoria). Relevant sediments are indicated in a red square.

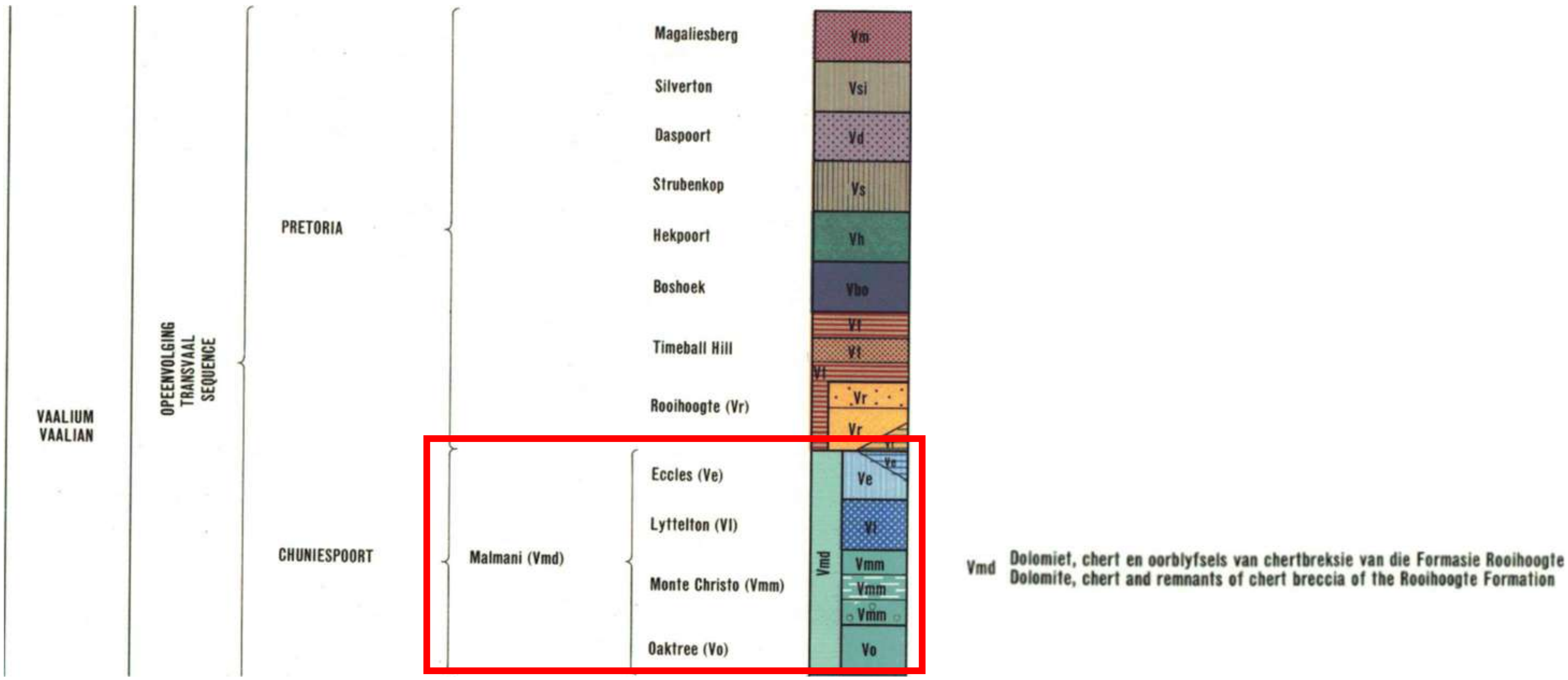

Table 5: Extract of the Palaeotechnical Report of the North West Province (Groenewald, et al., 2014)

CHUNIESPOORT			Penge (Vp; Vla; Qd; Vda; Vk; Vpe)		Banded ironstone	Stromatolites
	Malmani (Vm; Vma)		Mma; Vmm; Vmo; Vmo1; Vmo2; Vmf; Vme; Ve; Ve1; Vml; Va1; Va2; Va3; Vmd; Vm; Vc; Vb; Vf; Vfr; Vfr1; Vfr2; Ve; Vl; Vmo1; Vmo2; Vmo3; Vo; Voa		Stromatolitic carbonates (limestones / dolomites), minor secondary cherts, mudrocks including carbonaceous shales	Range of shallow marine to intertidal stromatolites (domes, columns etc), organic-walled microfossils

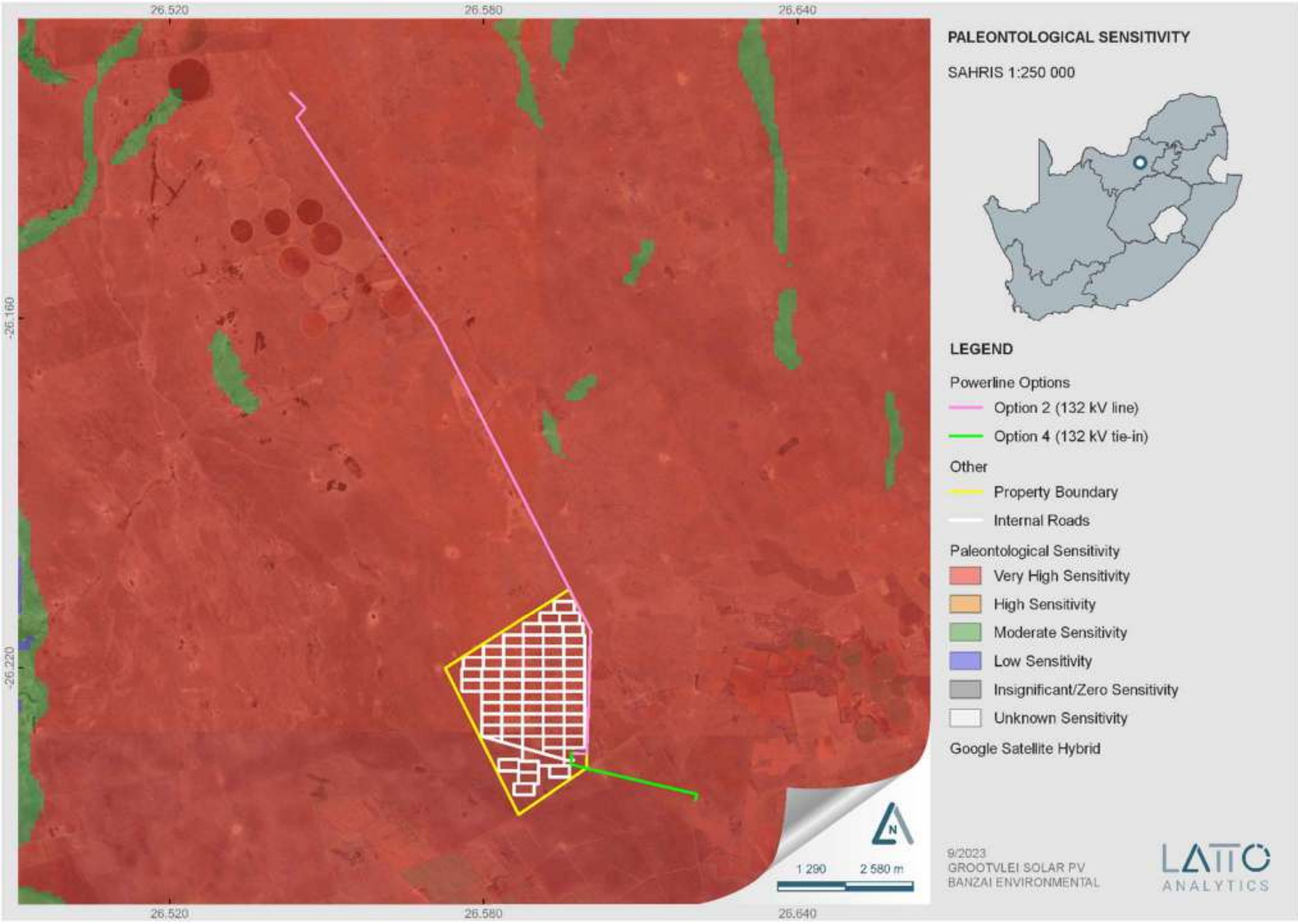

***Figure 5**: Extract of the 1 in 250 000 SAHRIS PalaeoMap (Council of Geosciences) indicating the proposed Grootvlei Solar Project in the North West Province.*

Table 6: Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website.		
Colour	**Sensitivity**	**Required Action**
RED	**VERY HIGH**	**Field assessment and protocol for finds is required**
ORANGE/YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study; a field assessment is likely
GREEN	MODERATE	Desktop study is required
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	No palaeontological studies are required

WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

According to the SAHRIS Palaeosensitivity map (Figure 5) the proposed development is underlain by sediments with a Very High (red) Palaeontological Significance.

Figure 6*: Palaeontological Sensitivity of the* Grootvlei PV Project *by the National Environmental Web-bases Screening Tool indicates a Very High Palaeontological Sensitivity.*

Figure 7: *Updated Geology (Council of Geosciences, Pretoria) of the study area indicates that the development is underlain by the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup).*

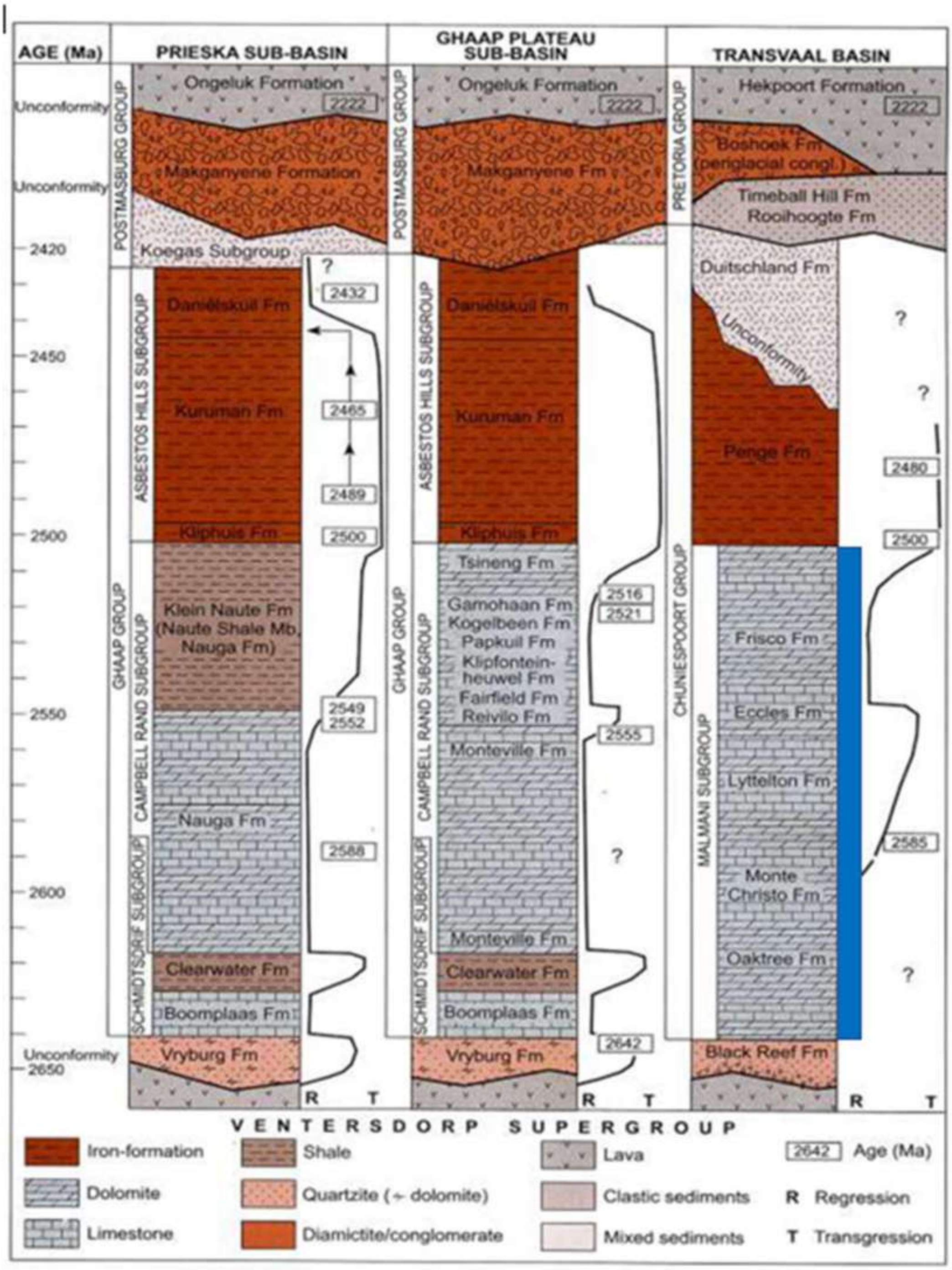

Figure 8: *Stratigraphy of the Transvaal Supergroup of the Transvaal Basin. The proposed development is indicated in blue (Eriksson,* et al. *2006).*

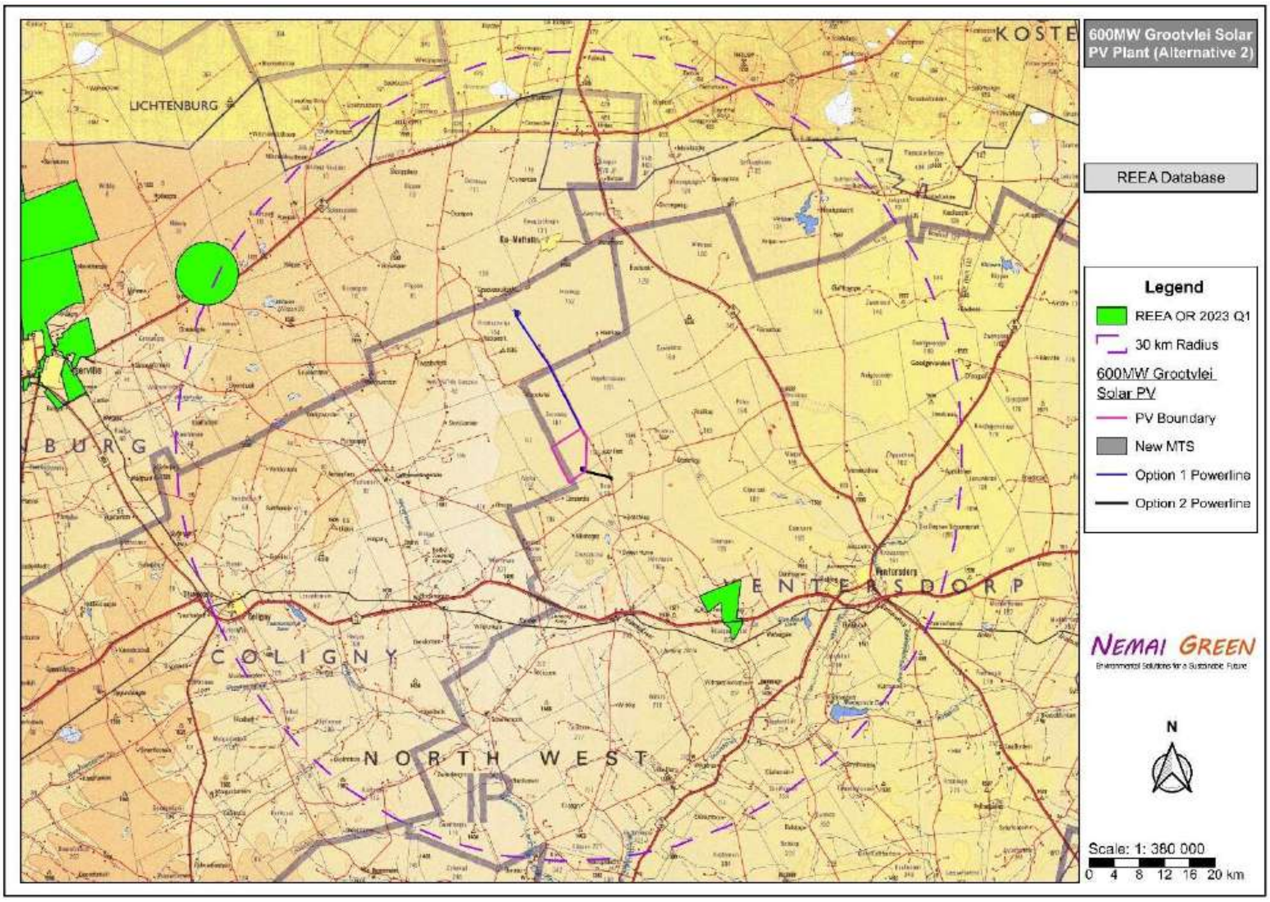

Figure 9:*Renewable energy applications in relation to the Project (within a 30km radius)*

Only one Solar Facility has been identified to the north-west of the proposed development. This development will have a Very High Palaeontological Sensitivity (Figure 4). However, it is important to note that the quality of preservation of different sites will most probably vary and it is thus difficult to allocate a Cumulative Sensitivity to the projects. If all the mitigation measures are carried out, a conservative estimate of the Cumulative impacts on fossil Heritage will vary between Low and Medium.

6. GEOGRAPHICAL LOCATION OF THE SITE

The Project is located approximately 20km to the north west of Ventersdorp central business district (CBD) and falls within Ward 34 of the JB Marks Local Municipality, in the North West Province. The site can be accessed via the N14 (main access) and the R53 (gravel road). The property earmarked for the Solar Project covers a combined area of approximately 655 hectares (ha) (Figure 1-2).

7. METHODS

The aim of a desktop study is to evaluate the possible risk to palaeontological heritage in the proposed development. This includes all trace fossils as well as all fossils in the proposed footprint. All possible information is consulted to compile a desktop study, and this includes the following: all Palaeontological Impact Assessment reports in the same area; aerial photos and Google Earth images, topographical as well as geological maps.

7.1 Assumptions and Limitations

The focal point of geological maps is the geology of the area and the sheet explanations of the Geological Maps were not meant to focus on palaeontological heritage. Many inaccessible regions of South Africa have never been reviewed by palaeontologists and data is generally based on aerial photographs alone. Locality and geological information of museums and universities databases have not been kept up to date or data collected in the past have not always been accurately documented.

Comparable Assemblage Zones in other areas is also used to provide information on the existence of fossils in an area which has not documented in the past. When using similar Assemblage Zones and geological formations for Desktop studies it is generally assumed that exposed fossil heritage is present within the footprint. A field-assessment will thus improve the accuracy of the desktop assessment.

8. ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984);
- A Google Earth map with polygons of the proposed development was obtained from Nemai Green;
- 1:250 000 West-Rand 2626 (1986) Geological Map (Council for Geosciences, Pretoria);
- Updated geological shape files (Council for Geosciences, Pretoria);
- Palaeosensitivity map on SAHRIS (South African Heritage Resources Information System) website;
- National Environmental Web-based Screening Tool;
- Published geological and palaeontological literature as well as
- Relevant PIAs in the area;
- A comprehensive site-specific field survey of the development footprint for the project was conducted on foot and motor vehicle in May 2023.

9. SITE VISIT

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 31 May 2023. Outcrops of weathered stromatolites were identified during the site visit piled to create clearance for agriculture activities.

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Figure 10*: Example of well-preserved Archaean Stromatolites.*

Figure 11: *General view of the proposed development indicates a low topography with grassveld vegetation.*

***Figure 12**:Dolomite outcrop on the surface of the development.*

Figure 13:*General view over the Powerline footprint indicating no outcrops.*

Figure 14. *Outcrops of weathered stromatolites were identified during the site visit piled to create clearance for agriculture activities.*

10. ASSESSMENT METHODOLOGT

10.1 Method of Environmental Assessment

The environmental assessment aims to identify the various possible environmental impacts that could results from the proposed activity. Different impacts need to be evaluated in terms of its significance and in doing so highlight the most critical issues to be addressed.

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e., site, local, national, or global whereas intensity is defined by the severity of the impact e.g., the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table below.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

10.2 Impact Rating System

Impact assessment must take account of the nature, scale, and duration of impacts on the environment whether such impacts are positive or negative. Each impact is also assessed according to the project phases:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact, the following criteria is used:

Table 7: The rating system

NATURE		
The Nature of the Impact is the possible destruction of fossil heritage		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur

		in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible, and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.

3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects
SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (**Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity = X.** The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".

74 to 96	Positive very high impact	The anticipated impact will have highly significant positive

Table 8: Impacts on PL Alternative 1							
Impacts	Extent	Duration	Magnitude	Reversibility	Irreplaceable loss	Cumulative effect	Impact
Pre-mitigation	1	4	3	4	4	2	45
Post mitigation	1	4	1	4	4	2	15

Table 9: Impacts on PL (Alternative 2)							
Impacts	Extent	Duration	Magnitude	Reversibility	Irreplaceable loss	Cumulative effect	Impact
Pre-mitigation	1	4	3	4	4	2	45
Post mitigation	1	4	1	4	4	2	15

Table 10: Impacts on Grootvlei PV							
Impacts	Extent	Duration	Magnitude	Reversibility	Irreplaceable loss	Cumulative effect	Impact
Pre-mitigation	1	4	3	4	4	2	45
Post mitigation	1	4	1	4	4	2	15

Impact Summary

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Planning Phase Alternative 1 Grootvlei Solar Plant PV Facility	No Impact	0	No Impact	0	No Impact
Construction Stage Alternative 1 Grootvlei Solar Plant PV Facility Loss of fossil heritage	Destroy or permanently seal-in fossils at or below the surface that are then no longer available for scientific study	45	Negative Medium impact	16	Negative Low impact
Operational Phase Alternative 1 Grootvlei Solar Plant PV Facility	No Impact	0	No Impact	0	No Impact
Decommissioning Phase Alternative 1 Grootvlei Solar Plant 1 PV Facility	No Impact	0	No Impact	0	No Impact
Planning Phase Alternative 2 Grootvlei Solar Plant PV Facility	No Impact	0	No Impact	0	No Impact
Construction Stage Alternative 2 Grootvlei Solar Plant PV Facility Loss of fossil heritage	Destroy or permanently seal-in fossils at or below the surface that are then no longer available for scientific study	45	Negative Medium impact	16	Negative Low impact
Operational Phase Alternative 21 Grootvlei Solar Plant PV Facility	No Impact	0	No Impact	0	No Impact
Decommissioning Phase	No Impact	0	No Impact	0	No Impact

Alternative 2 Grootvlei Solar Plant 1 PV Facility					

11. FINDINGS AND RECOMMENDATIONS

The proposed Grootvlei Solar Plant PV Facility is entirely underlain by the Precambrian dolomites and associated marine sedimentary rocks of the Malmani Subgroup (Monte Christo Formation, Chuniespoort Group, Transvaal Supergroup). According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) is Very High (Almond *et al*, 2013; SAHRIS website), while the Palaeotechnical report of the Northwest (Groenewald et al., 2014) allocated a High Sensitivity to the Malmani Subgroup. Two Layout alternatives have been considered for the grid connection of this Project. As the geology of the alternatives are the same there is no preference between the alternatives from a Palaeontological point of view.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 31 May 2023. Outcrops of weathered stromatolites were discovered on the development. Stromatolites may be better preserved elsewhere in the area and thus mitigation is not suggested.

Based on the site investigation it is concluded that fossil heritage of scientific and conservational interest in the development footprint is rare. This is in contrast with the High Sensitivity allocated to the development area by the SAHRIS Palaeosensitivity Map and DFFE Screening Tool. A medium Palaeontological Significance has been allocated for the construction phase of the PV development pre-mitigation and a low significance post mitigation. The construction phase will be the only development phase impacting Palaeontological Heritage and no significant impacts are expected to impact the Operational and Decommissioning phases. As the No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The Cumulative impacts of the development near Ventersburg is considered to be medium pre- mitigation and Low post mitigation and falls within the acceptable limits for the project. It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources. It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

If fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the Chance Find Protocol must be implemented by the ECO/site manager in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the ECO/site manager must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation (recording and collection) can be carry out by a paleontologist.

Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies suggested by SAHRA.

12. CHANCE FINDS PROTOCOL

The following procedure will only be followed if fossils are uncovered during the excavation phase of the development.

Legislation

Cultural Heritage in South Africa (includes all heritage resources) is protected by the National Heritage Resources Act (Act No 25 of 1999) (NHRA). According to Section 3 of the Act, all Heritage resources include "all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens".

Palaeontological heritage is unique and non-renewable and is protected by the NHRA and are the property of the State. It is thus the responsibility of the State to manage and conserve fossils on behalf of the citizens of South Africa. Palaeontological resources may not be excavated, broken, moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

A fossil is the naturally preserved remains (or traces thereof) of plants or animals embedded in rock. These organisms lived millions of years ago. Fossils are extremely rare and irreplaceable. By studying fossils, it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

This informational document is intended for workmen and foremen on construction sites. It describes the actions to be taken when mining or construction activities accidentally uncovers fossil material.

It is the responsibility of the Environmental Site Officer (ESO) or site manager of the project to train the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. In the absence of the ESO, a member of the staff must be appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

Chance Find Procedure

- If a chance find is made the person responsible for the find must immediately stop working and all work that could impact that finding must cease in the immediate vicinity of the find.
- The person who made the find must immediately report the find to his/her direct supervisor which in turn must report the find to his/her manager and the ESO or site manager. The ESO or site manager

must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa.

- Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.
- A preliminary report must be submitted to the Heritage Agency within 24 hours of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.
- Upon receipt of the preliminary report, the Heritage Agency will inform the ESO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.
- The site must be secured to protect it from any further damage. No attempt should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- If the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO. Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once the Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.

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APPENDIX 1

CURRICULUM VITAE

PROFESSION:	Palaeontologist
YEARS' EXPERIENCE:	30 years in Palaeontology
EDUCATION:	B.Sc Botany and Zoology, 1988
	University of the Orange Free State
	B. Sc (Hons) Zoology, 1991
	University of the Orange Free State
	Management Course, 1991
	University of the Orange Free State
	M. Sc. *Cum laude* (Zoology), 2009
	University of the Free State

Dissertation title: The postcranial skeleton of the Early Triassic non-mammalian Cynodont *Galesaurus planiceps*: implications for biology and lifestyle

MEMBERSHIP

Palaeontological Society of South Africa (PSSA) 2006-currently

EMPLOYMENT HISTORY

Part-time Laboratory assistant	Department of Zoology & Entomology University of the Free State Zoology 1989-1992
Part-time laboratory assistant	Department of Virology
	University of the Free State Zoology 1992
Research Assistant	National Museum, Bloemfontein 1993 – 1997
Principal Research Assistant	National Museum, Bloemfontein
and Collection Manager	1998–2022

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APPENDIX 2

PALAEONTOLOGICAL SITE VERIVICATION REPORT

Grootvlei 600 MW Solar Plant, Battery Energy Storage Systems (BESS) and Grid Connection Project north west of Ventersdorp, in the North West Province

CONTENTS

1. INTRODUCTION

LTM Green Energies (Pty) Ltd (the "Applicant") has proposed the development of Grootvlei 600MW Solar Plant, Battery Energy Storage Systems (BESS) and Grid Connection Project north west of Ventersdorp within the JB Marks Local Municipality in the North West Province (the "Project").

The Applicant intends to bid for the current and future Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) bid windows and/or other renewable energy markets within SA (Figure S1-2).

Table S1: Details of properties	
Solar Plant	
Portion number 0 of the farm Grootvlei 161 IP	T0IP00000000016100000
New Main Transmission Substation	
Portion number 1 of the Farm Houtkop 152	T0IP00000000015200001
Powerline Route Option 1	
Portion number 1 of the Farm Houtkop 152	T0IP00000000015200001
Portion number 9 of the Farm Houtkop 152	T0IP00000000015200009
Portion number 11 of the Farm Houtkop 152	T0IP00000000015200011
Portion number 12 of the Farm Houtkop 152	T0IP00000000015200012
Portion number 3 of the Farm Vogelstruispan 151	T0IP00000000015100003
Portion number 4 of the Farm Vogelstruispan 151	T0IP00000000015100004
Portion number 7 of the Farm Vogelstruispan 151	T0IP00000000015100007
Portion number 0 of the Farm Lucky Find 158	T0IP00000000015800000
Portion number 0 of the farm Grootvlei 161 IP	T0IP00000000016100000
Powerline Route Option 2	

Portion number 0 of the farm Grootvlei 161 IP	T0IP00000000016100000
Portion RE of the Farm Beta 159 IP	T0IP00000000015900000
Portion 0 of the Farm Boschkop	T0IP00000000016090000

Technical details

The Project consists of the following systems, sub-systems or components (amongst others):

- 600MW PV solar panels or modules (arranged in arrays);
- Mounting structures to support the PV panels;
- DC-AC current inverters stations, transformers, and internal electrical reticulation (underground cabling);
- Grid Connection: Option 1 which consists of 2 x 132kV powerlines, approximately 14km kilometers (km) in length, from the new facility 33kV substation to new 400/132kV Main Transmission Substation (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line or Option 2 that comprises of 2.8km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation.
- New 400/132kV Main Transmission Substation
- On site switching station/substation;
- Administration Buildings (Offices);
- Workshop areas for maintenance and storage;
- Temporary laydown areas;
- Internal access roads and perimeter fencing of the footprint area;
- Lithium-ion battery energy storage system (BESS);
- Security Infrastructure; and
- Site access from unnamed gravel road via the N14 and/or R53.

An overview of the project life-cycle, as well as the resources required to execute the Project, is provided in the Scoping Report.

The alternatives under consideration for the Project include design/layout alternatives, technology alternatives and the no-go option. The EIA phase will include a detailed comparative analysis of the Project's feasible alternatives that emanate from the Scoping exercise, which will include environmental (with specialist input) and technical evaluations.

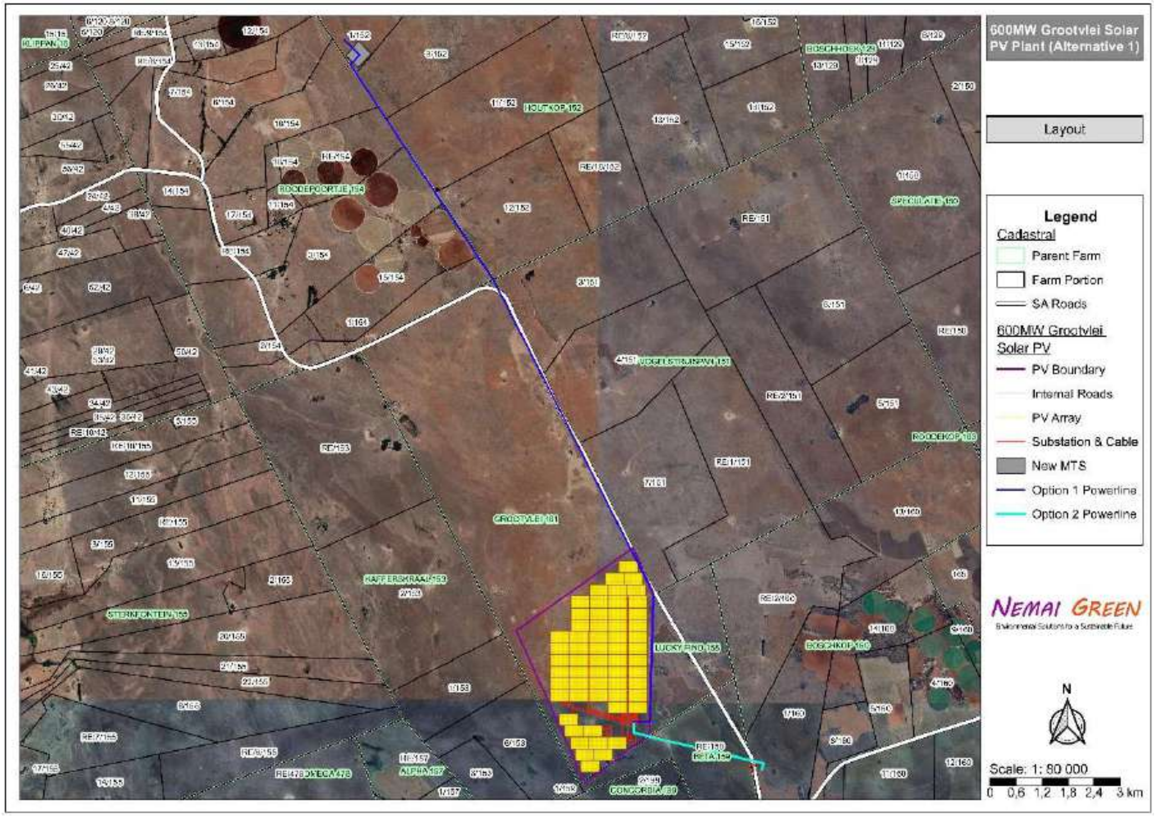


Figure S1: Regional locality of Alternative 1 of the proposed Grootvlei 600MW Solar Plant Project, BESS & Grid Connection Project in North West Province.

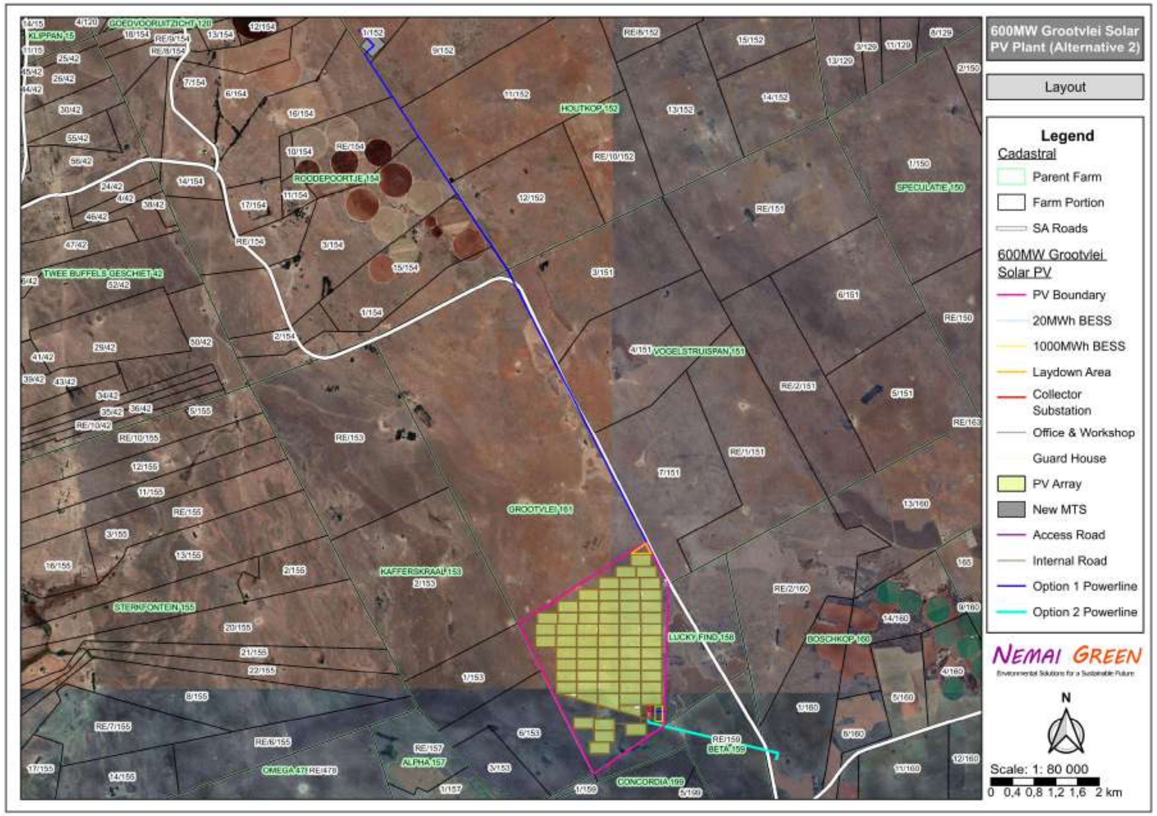


Figure S2: Regional locality of Alternative 2 of the proposed Grootvlei 600MW Solar Plant Project, BESS & Grid Connection Project in North West Province.

In terms of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations [4 December 2014, Government Notice (GN) R982, R983, R984 and R985, as amended), various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require environmental authorisation (EA) from the Competent Authority (CA), namely the Department of Small Business Development, Tourism and Environmental Affairs (DESTEA), prior to the commencement thereof.

In accordance with GN 320 of 20 March 2020 and GN 1150 of 30 October 2020[1] (i.e., "the Protocols") of the NEMA EIA Regulations of 2014 (as amended), prior to commencing with a specialist assessment, a site sensitivity verification must be undertaken to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (i.e., Screening Tool). Elize Butler as Palaeontology Specialist have been commissioned to verify the sensitivity of the Bultfontein Solar PV Cluster and associated infrastructure site under these specialist protocols.

3. SITE SENSITIVITY VERIFICATION METHODOLOGY

The Palaeontology Sensitivity Verification was undertaken by the following methodology:

- The site sensitivity is established through the National Environmental Web-Based Screening Tool
- The Site is mapped on the relevant Geological Map to determine the underlying geology of the development
- Then the site is mapped on the South African Heritage Resources Information System (SAHRIS) PalaeoMap, and the Sensitivity of the proposed development established.
- Other information is obtained by using satellite imagery and
- Palaeontological Impact Assessments and Desktop Assessments of projects in the same area are studied.
- A comprehensive site-specific field survey of the development footprint for the combined projects was conducted on foot and motor vehicle by Banzai Environmental in May 2023.

4. OUTCOME OF SITE SENSITIVITY VERIFICATION

Grootvlei Solar Plant PV Project near Ventersburg in North Westis depicted on the 1: 250 000 West-Rand 2626 (1986) Geological Map (Council for Geosciences, Pretoria). This study area is underlain by the Precambrian dolomites and associated marine sedimentary rocks of the Monte Christo Formation of the

[1] GN 320 (20 March 2020): Procedures for The Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation

Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) (Figure S3, Table S2). The PalaeoMap of the South African Heritage Resources Information System (Almond *et al*, 2013; SAHRIS website; Figure S4) as well as the the DFFE Screening tool (Figure S5) indicates that the Palaeontological Sensitivity of the proposed development is Very High (Table 5). Updated geology (Council of Geosciences, Pretoria) is depicted in Figure 6 and indicates that the Grootvlei Solar Power Plant is underlain by the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup).

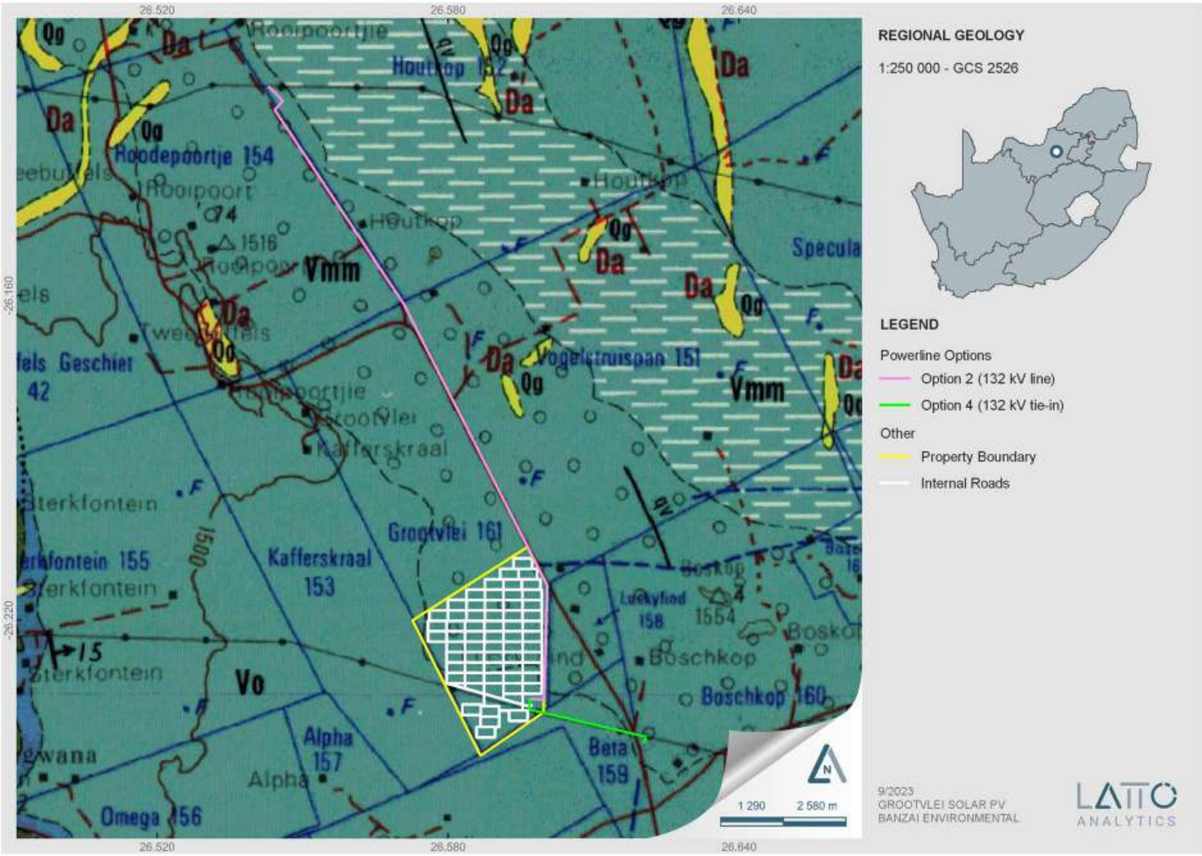
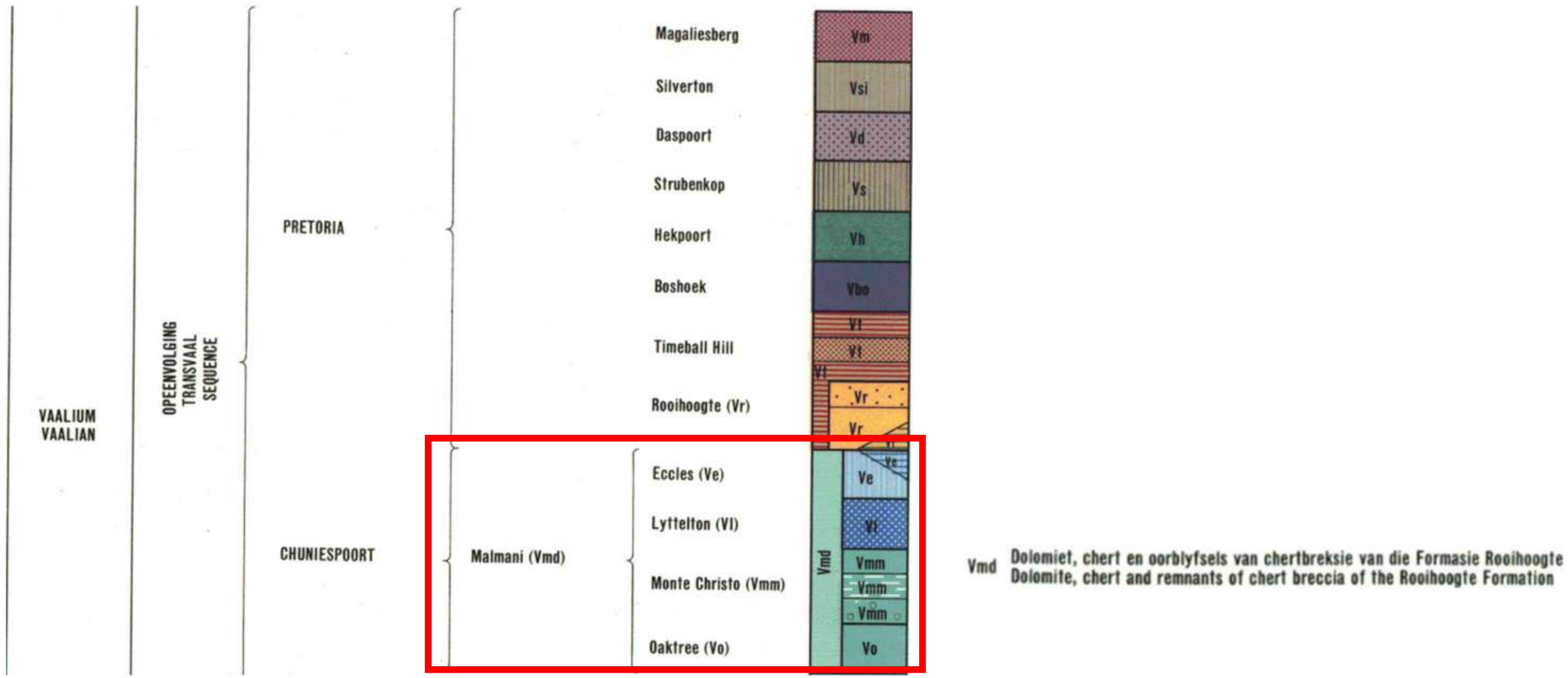


Figure S3: Extract of the 1: 250 000 Kroonstad 2726 (2000) Geological Map (Council of Geoscience, Pretoria) indicating that the Oslaagte Solar 2 PV development and associated infrastructure is underlain by the Adelaide Subgroup (Balfour Group, Karoo Supergroup with a very small portion of Dolerite in the south).

Table S2: Legend to the Kroonstad 2726 (2000) Geological Map (Council for Geosciences, Pretoria).

Relevant sediments are indicated in a red square



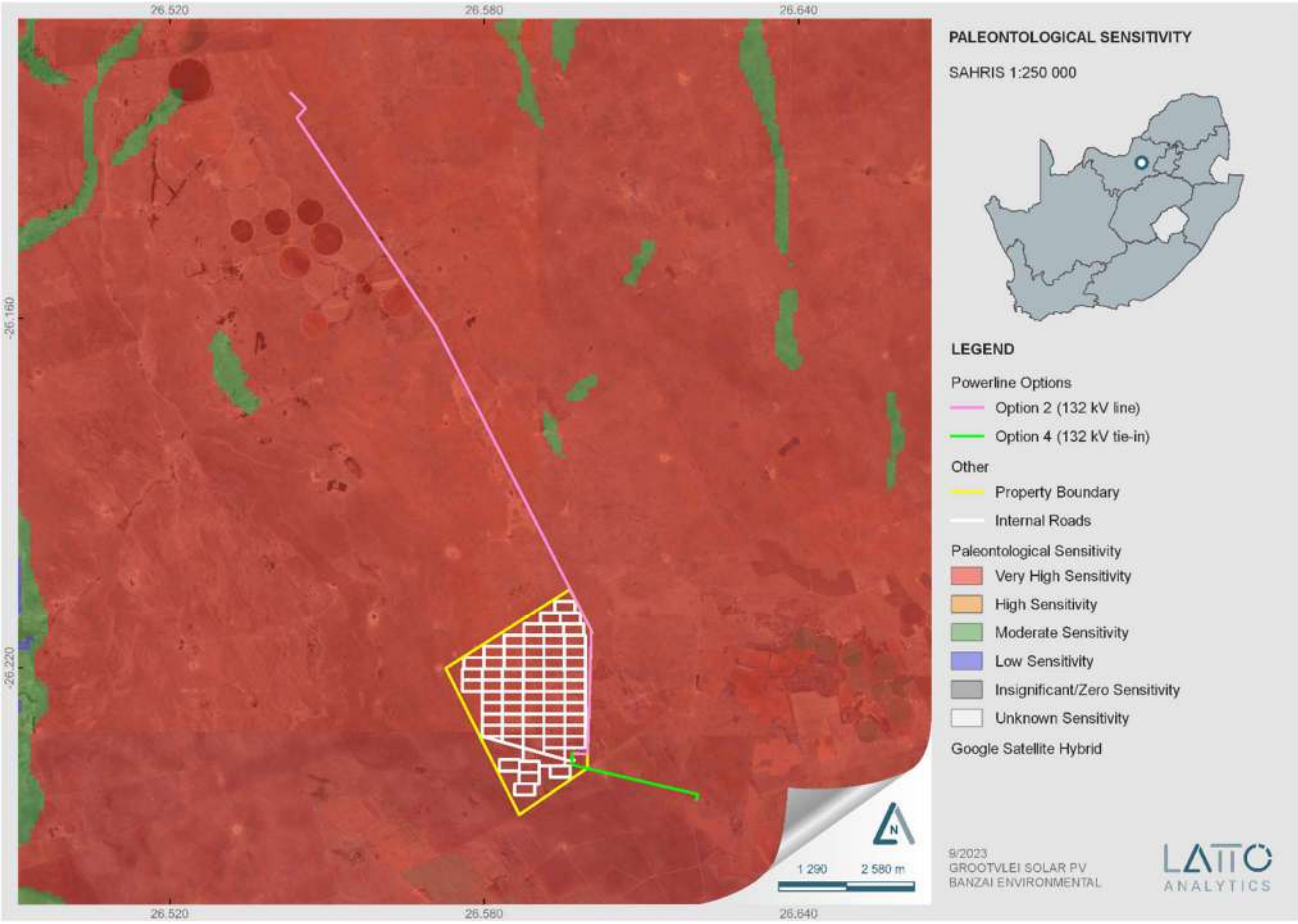


Figure S4: Extract of the 1 in 250 000 SAHRIS PalaeoMap (Council of Geosciences) indicating the proposed Grootvlei Solar Project in the North West Province.

Table S3: Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website).		
Colour	**Sensitivity**	**Required Action**
RED	**VERY HIGH**	**field assessment and protocol for finds is required**
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study; a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

The PalaeoMap of the South African Heritage Resources Information System (Figure S4, Table S3) indicates that the Palaeontological Sensitivity of the Grootvlei Solar Plant PV development is Very High (red), (Almond and Pether, 2009; Almond *et al*., 2013).

Figure S5: Palaeontological Sensitivity of the Oslaagte Solar PV 2 facility by the National Environmental Web-bases Screening Tool indicates a Very High Palaeontological Sensitivity.

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the development is Very High (dark red).

5. CONCLUSION

The Site Sensitivities of the proposed Grootvlei PV Project has been verified and it was found that:

The SAHRIS Palaeosensitivity map indicates that the Palaeontological Sensitivity of the development is Very High.

And

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the development is Very High.

These maps indicate that the proposed Grootvlei PV Project development is highly Sensitive from a Palaeontological point of view. A site investigation in May 2023 did not detect any fossiliferous outcrops. This classification (National Environmental Web-bases Screening Tool and SAHRIS) is thus contested here based on actual conditions recorded on the ground during the site visit in May 2023.

APPENDIX D7: Visual Impact Assessment

SPECIALIST ASSESSMENT

ENVIRONMENTAL VISUAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED GROOTVLEI 600 MW SOLAR PROJECT, NEAR VENTERSDORP, NORTHWEST PROVINCE, SOUTH AFRICA.

ENVASS
GROUP OF COMPANIES

PREPARED FOR:	**GIBB ENVIRONMENTAL**
PREPARED BY:	**ENVIRONMENTAL ASSURANCE (PTY) LTD.**
SUBMITTED TO:	**UMESHREE NAICKER**
MONTH:	**MAY 2023**
REVISION DATE:	**SEPTEMBER 2023**
REPORT NUMBER:	**SPS-VIA-132-23_24**
VERSION:	**0.1**

DOCUMENT CONTROL

Document Title	Environmental Visual Impact Assessment Report for the Proposed Grootvlei 600 MW Solar Facility Project near Ventersdorp, North-west Province, South Africa.
Report Number	SPS-VIA-132-23_24
Version	0.1
Date	May 2023
Revision date	September 2023
Submitted to	Client: GIBB Environmental Contact Person: Umeshree Naicker Position: Environmental Consultant
Distribution	1 x GIBB Environmental 1 x Environmental Assurance (Pty) Ltd

QUALITY CONTROL

	Originated By:	Internal Reviewer:	Technical Reviewer:
Name	Andre Buys	Richard Viljoen	Carl Schoeman
Designation	Environmental Specialist Pr.Sci. Nat - 119183	Environmental Consultant	Environmental Specialist Pr.Sci.Nat - 114848
Signature			
Date	30-05-2023	01-06-2023	01-06-2023
Final submission date	28 September 2023		

DISCLAIMER

DECLARATION OF INDEPENDENCE

I, **Andre Buys**, in my capacity as a specialist consultant, hereby declare that I: -

- Act as an independent consultant;
- Do not have any financial interest in the undertaking of this project, other than remuneration for the work performed in terms of the National Environmental Management Act 107 of 1998;
- Have and will not have vested interest in the proposed and/or existing activity nor will I engage myself in any conflicting interest associated with this project;
- I undertake to disclose and provide to the competent authority any material or information at my disposal regarding this project as required in terms of National Environmental Management Act 107 of 1998;
- Based on the information provided to me by the client and in addition to information obtained during the course of this study, I have presented the results and conclusion with regard to this project to the best of my professional ability;
- I reserve the right to modify aspects pertaining to this study should additional information become available through ongoing research and further work on this field;
- I undertake to have my work peer reviewed on a regular basis by a competent specialist in the field of study; and
- I am duly qualified and experienced to undertake the work at hand.

Andre Buys (Environmental Consultant)

Environmental Consultant	Relevant expertise
Andre Buys	Has completed a B.Sc. in Geography and Geology, followed by a B.Sc. (Hons) Geography and Geology. He has comprehensive experience and knowledge on compliance monitoring, geohydrological studies, project management and specialist reporting. As an environmental consultant, Andre has provided several environmental monitoring assessments, audits and specialist input services.

EXECUTIVE SUMMARY

This report has been prepared by Environmental Assurance (Pty) Ltd. (hereafter referred to as "ENVASS") as an independent environmental consultancy was appointed by GIBB Environmental to undertake a visual impact assessment for the proposed Grootvlei 600 MW Solar Plant, Battery Energy Storage Systems (BESS) and Grid connection project northwest of Ventersdorp, Northwest Province, South Africa (referred to as the "Project"). The assessment is required as part of an application for Environmental Authorisation (EA) in terms of the National Environmental Management Act (Act 107 of 1998), for the approval of the proposed project. The scope of the assessment focussed on the current visual baseline conditions of the study area and the possibility of the proposed project having a visual impact.

RESULTS AND IMPACT STATEMENT

From the results obtained in this study, it is expected that the construction of the proposed project will contribute to localised visual impacts, however, the visual impacts are expected to be **moderate to low** if proactively managed. Mitigation measures are recommended under Section 9 to reduce potential visual impacts. **Both the alternatives were assessed and had the same findings.**

The assessment found that the proposed project itself will have the greatest potential visual impact among those activities assessed. Secondary visual impacts are expected to include dust generation during construction, solar glint and glare, and night-time illumination. Several mitigation measures have been identified to address the anticipated impacts.

The Project could potentially have a moderate visual impact on surrounding land users located near the proposed solar facility and associated infrastructure. This impact may be mitigated to low. The visual impact on the users of roads and the local residents and homesteads within the region (i.e., beyond the 5km radius) is expected to be low for the proposed solar energy facility, both before and after the implementation of mitigation measures. The potential visual impact of construction activities on sensitive visual receptors located near to the proposed solar energy facility is likely to be of moderate significance and may be mitigated to low. The potential visual impact associated with lighting at the facility at night and daytime glare is expected to be of moderate significance and may be mitigated to low.

The anticipated visual impacts are expected to be of low significance with the implementation of appropriate mitigation, and the project development is not considered to be fatally flawed from a visual perspective.

SPECIALIST'S RECOMMENDATION

Considering the project assessment, it is the specialist's reasoned opinion that the proposed project be allowed, provided that the findings within this report are considered along with the recommendations made towards the management of the proposed project. All mitigation measures recommended herein should be considered and included in the Environmental Management Programme (EMPr) relevant to the proposed project. It is of the specialists' opinion that both Layouts can be used, as the same visual impact will be of result.

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ACRONYMS

ACRONYM	EXPANSION
BESS	Battery Energy Storage System
DEM	Digital Elevation Model (*also* DTM or "Digital Terrain Model")
DFFE	Department of Forestry, Fisheries and Environment
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
ENVASS	Environmental Assurance (Pty) Ltd.
EMPr	Environmental Management Programme
ESA	Ecological Support Area
GIS	Geographic Information System
GPS	Global Positioning System
IDW	Inverse Distance Weighting
km	Kilometres
LiDAR	Light Detection and Ranging
NEMA	National Environmental Management Act
PV	Photovoltaic
SLR	Single Lens Reflex
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment
VP	Viewpoint
VT	Vegetation Type

GLOSSARY

TERM	DEFINITION
Cumulative impact	Cumulative impacts can result from individually minor but collectively significant activities taking place over a period.
Critical viewpoints	Important points from where viewers will be able to view the proposed or actual development and from where the development impact may be significant.
Environmental Impact Assessment	A public process that is used to identify, predict, or cause the least damage to the environment at a cost acceptable to society, in the long term as well as in the short term.
Field of view	The field of view is the angular extent of the observable world that is seen at any given moment. Humans have an almost 180º forward-facing field of view. Note that human stereoscopic (binocular) vision only covers 140º of the field of view in humans; the remaining peripheral 40º have no binocular vision due to the lack of overlap of the images of the eyes. The lower the focal length of a lens (see below), the wider the field of view.
Focal length	The focal length of a lens is a measure of how strongly the lens converges (focuses) or diverges (defocuses) light. Focal length refers to the “strength” of a lens, in other words how many times the lens magnifies an image (brings it closer) or widens an image (makes it look further away). The standard lens on most Single-Lens Reflex (SLR) cameras have a focal length of 50 mm. Using a 50 mm lens as a start, a 200 mm lens will magnify an image four times (i.e,. 4 x magnification). The focal length of an average human eye is 22 mm.
Impact (Visual)	A description of the effect of an aspect of the development on a specified component of the visual, aesthetic, or scenic environment within a defined time and space.
Land cover	The surface cover of the land usually expressed in terms of vegetation cover or the lack of it. Related to but not the same as Land use.
Land use	What land is used for based on broad categories of functional land cover, such as urban and industrial use and the different types of agriculture and forestry.
Landform	The shape and form of the land surface which has resulted from combinations of geology, geomorphology, slope, elevation, and physical processes.
Landscape	An area, as perceived by people, the character of which is the result of the action and interaction, of natural and/ or human factors.
Landscape character	These are distinct types of landscape that are relatively homogeneous in character. They are generic in nature in that they may occur in different areas in different parts of the country, but wherever they occur, they share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement pattern, and perceptual and aesthetic attributes.
Landscape quality	A measure of the physical state of the landscape. It may include the extent to which typical landscape character is represented in individual areas, the intactness of the landscape and the condition of individual elements.
Landscape value	The relative value that is attached to different landscapes by society. A landscape may be valued by different stakeholders for a variety of reasons.

TERM	DEFINITION
Mitigation	Any action taken or not taken in order to avoid, minimise, rectify, reduce, eliminate, or compensate for actual or potential adverse visual impacts.
Scenic value	Degree of visual quality resulting from the level of variety, harmony and contrast among the basic visual elements.
Sense of place	The character of a place, whether natural, rural or urban. It is allocated to a place or area through cognitive experience by the user.
Viewshed	The theoretical area within which an observer is likely to see a specific structure or area in the landscape. It is generated from a digital terrain model (DTM) made up of 3D contour lines of the landform. Intervening objects, structures or vegetation will modify the view shed at ground level.
Visual absorption capacity (VAC)	The ability of elements of the landscape to “absorb” or mitigate the visibility of an element in the landscape. Visual absorption capacity is based on factors such as vegetation height (the greater the height of vegetation, the higher the absorption capacity), structures (the larger and higher the intervening structures, the higher the absorption capacity) and topographical variation (rolling topography presents opportunities to hide an element in the landscape and therefore increases the absorption capacity).
Visual character	The overall impression of a landscape created by the order of the patterns composing it; the visual elements of these patterns are the form, line, colour and texture of the landscape’s components. Their interrelationships are described in terms of dominance, scale, diversity and continuity. This characteristic is also associated with land use.
Visual exposure	Visual exposure is based on distance from the project to selected viewpoints. Visual exposure or visual impact tends to diminish exponentially with distance.
Visual quality	Subjective evaluation of the visible components of the environment by viewers.
Visually sensitive	Areas in the landscape from where the visual impact is readily or excessively encountered.

1. INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

Environmental Assurance (Pty) Ltd (ENVASS), as an independent environmental consultancy, was appointed by GIBB Environmental to undertake a visual impact assessment for the proposed development of the proposed Grootvlei 600 MW Solar Plant, Battery Energy Storage Systems (BESS) and Grid connection project northwest of Ventersdorp, in the Northwest Province, South Africa (referred to as the "Project") (refer to Figure 1). This document reports on the visual impact assessment conducted and outlines findings and recommendations made towards the Environmental Impact Assessment (EIA) process undertaken for the proposed project. The proposed facility will be constructed on the Portion 0 of the farm Grootvlei 161 IP. Additionally, the main transmission sub-station will be constructed on Portion 1 of the farm Houtkop 152. Two powerline route options forms part of the assessment. The Farm Portions relevant to the study is depicted in Table 1 below.

Table 1: Farm portion detail

FARM DETAILS
Portion number 0 of the farm Grootvlei 161 IP
Portion number 1 of the Farm Houtkop 152
Portion number 1 of the Farm Houtkop 152
Portion number 9 of the Farm Houtkop 152
Portion number 11 of the Farm Houtkop 152
Portion number 12 of the Farm Houtkop 152
Portion number 3 of the Farm Vogelstruispan151
Portion number 4 of the Farm Vogelstruispan151
Portion number 7 of the Farm Vogelstruispan151
Portion number 0 of the Farm Lucky Find 158
Portion number 0 of the farm Grootvlei 161 IP
Portion number 0 of the farm Grootvlei 161 IP
Portion RE of the Farm Beta 159 IP
Portion 0 of the Farm Boschkop

*** Retrieved from Scoping report – NEMAI Consulting*

The electricity generated by the Project will be transmitted through either Option 1, which consists of 2 x 132kV powerlines, approximately 14km kilometres (km) in length, from the new facility 33kV substation to new 400/132kV Main Transmission Substation (MTS) to Loop In- Loop Out (LILO) of the Pluto – Watershed 275kV power line or Option 2 that comprises of 2.8km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation.

1.2 LOCALITY

The Project is located approximately 20 km to the northwest of Ventersdorp's central business district (CBD) and falls within Ward 34 of the JB Marks Local Municipality (JB MLM), in the North West Province. The property earmarked for the Project

PV site covers (excluding powerline and access roads) a combined area of approximately 655 hectare (ha). The proposed project area is in close proximity to major roads such as the N14 and R53 as well as surrounding gravel roads. The surrounding area can be characterized by agricultural activities. According to the SA Renewable Energy EIA Application (REEA) Database, one (1) renewable energy application have been made for properties located near Ventersdorp. The proposed site ranges from approximately 1511 to 1523 metres above mean sea level (mamsl), predominantly flat, with a general decrease in slope towards the south and southwestern boundaries. The elevation gain/loss: 77.6 meters, - 77.6 meters. The maximum slope is 7,9 %, -8,4 % with an average slope of 0.7%; -0,7%.

The vegetation in the area consists mainly of grasses, shrubs, and trees, as the study area is surrounded by agricultural activities whilst the majority of the study area is currently utilized for grazing of livestock and game. The surrounding area includes several reserves and game farms, which are home to a variety of wildlife species. Overall, the landscape and terrain around study area typical of the Highveld region of South Africa, consisting of dominant Carletonville Dolomite Grassland type vegetation, with wide open spaces and a mix of fallow land and old fields (grass), natural grassland, open woodland, commercial annual crops (rain-fed / dry land) and village scattered (bare and low veg).

1.3 ACTIVITY DESCRIPTION

The proposed project consists of the following systems, sub-systems or components (amongst others):

- 600MW PV solar panels or modules (arranged in arrays);
- Mounting structures to support the PV panels;
- DC-AC current inverters stations, transformers, and internal electrical reticulation (underground cabling);
- Grid Connection: Option 1 which consists of 2 x 132kV powerlines, approximately 14km kilometres (km) in length, from the new facility 33kV substation to new 400/132kV Main Transmission Substation (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line or Option 2 that comprises of 2.8km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation.
- New 400/132kV Main Transmission Substation
- On site switching station/substation;
- Administration Buildings (Offices);
- Workshop areas for maintenance and storage;
- Temporary laydown areas;
- Internal access roads and perimeter fencing of the footprint area;
- Lithium-ion battery energy storage system (BESS);
- Security Infrastructure; and
- Site access from unnamed gravel road via the N14 and/or R53.

The project can be separated into three (3) phases namely the construction, operational and decommissioning phases. Per phase the following activities can conceivably occur and not limited.

- **Construction phase -** During the implementation of the Project, the following construction activities will be undertaken:
  - Pegging the footprint of the development;
  - Establishing access roads;
  - Preparing the site (fencing, clearing, levelling and grading, etc.);
  - Establishing the site office;
  - Establishing laydown areas and storage facilities;
  - Transporting equipment to site;
  - Undertaking civil, mechanical and electrical work; and
  - Reinstating and rehabilitating working areas outside of permanent development footprint.

- **Operational phase -** Once the solar park is up and running the facility will be largely self- sufficient. Operational activities associated with the maintenance and control of the Solar PV Plant will include the following (amongst others):
  - Testing and commissioning the facility's components;
  - Cleaning of PV modules;
  - Controlling vegetation;
  - Managing stormwater and waste;
  - Conducting preventative and corrective maintenance; and
  - Monitoring of the facility's performance.

- **Decommissioning -** PV panels are guaranteed to produce at least 80% of their rated power for 20 to 30 years. In practice, PV panels will perform satisfactorily well beyond this timeframe. At the end of the 20–30-year lifespan, two scenarios exist for the PV panels:
  - The old, redundant panels can be disposed of (at a registered disposal facility designated for this purpose); or
  - The panels can be recycled, by either using their components to fix or make new panels, or be donated for use elsewhere (e.g., for the electrification of rural schools and clinics).

Table 2: Technical details of the proposed PV Plant (Nemai Consulting CC Scope Report)

No.	Component	Description / Dimensions
1.	Height of PV panels	± 2.5m
2.	Area of PV Array	± 490 ha
3.	Number of inverters required	Approximately 240x 2.5MW inverters
4.	Area occupied by inverter / transformer stations / substations	Area occupied by inverter stations =0.35ha. Area occupied by Operation and Maintenanceinfrastructure = ± 0.1 ha. Area occupied by facility (step-up/Collector)substation = 0.2 ha. Area occupied by the onsite substations. = 0.1 ha
5.	Capacity of on-site substation	Up to a maximum of 600 MW, 6.6kV/275kV
6.	Area occupied by buildingsand BESS	Area occupied by Operation & Maintenanceinfrastructure =± 1 ha Area occupied by BESS = 0.35 ha
7.	Area occupied by both permanent and construction laydown areas	Construction areas = 0.25 ha Operation & Maintenance infrastructure = ± 0.1 ha Total combined = ± 0.35 ha
8.	Area occupied by buildings	1.5 ha
9.	Length of internal roads	± 15km
10.	Width of internal roads	Internal roads will have a 5m road width. Access road will have a 14m reserve and road width of8m.
11.	Proximity to grid connection	Grid Connection: Option 1 which consists of 2 x 132kV powerlines, approximately1 4km kilometers (km) in length, from the new facility 33kV substation to new 400/132kV Main Transmission Substation (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line; or Option 2 that comprises of 2.8km 132 kV line from the newfacility 33kV substation facility 33kV substation to the Makokskraal Substation.
12.	Height of fencing	Up to 3m
13.	Type of fencing	Type will vary around the site, welded mesh, palisade andelectric fencing

Figure 3 below is a representation of the study area, including the proposed infrastructure layout. A set of two alternatives is evident in terms of the layouts. The two alternatives will be assessed and the deemed most effective site with the least impact will be recommended.

The main difference between the two Alternatives (Revisions based on specialists' studies) is the boundary where Alternative two as well as the grid expands slightly to the west.

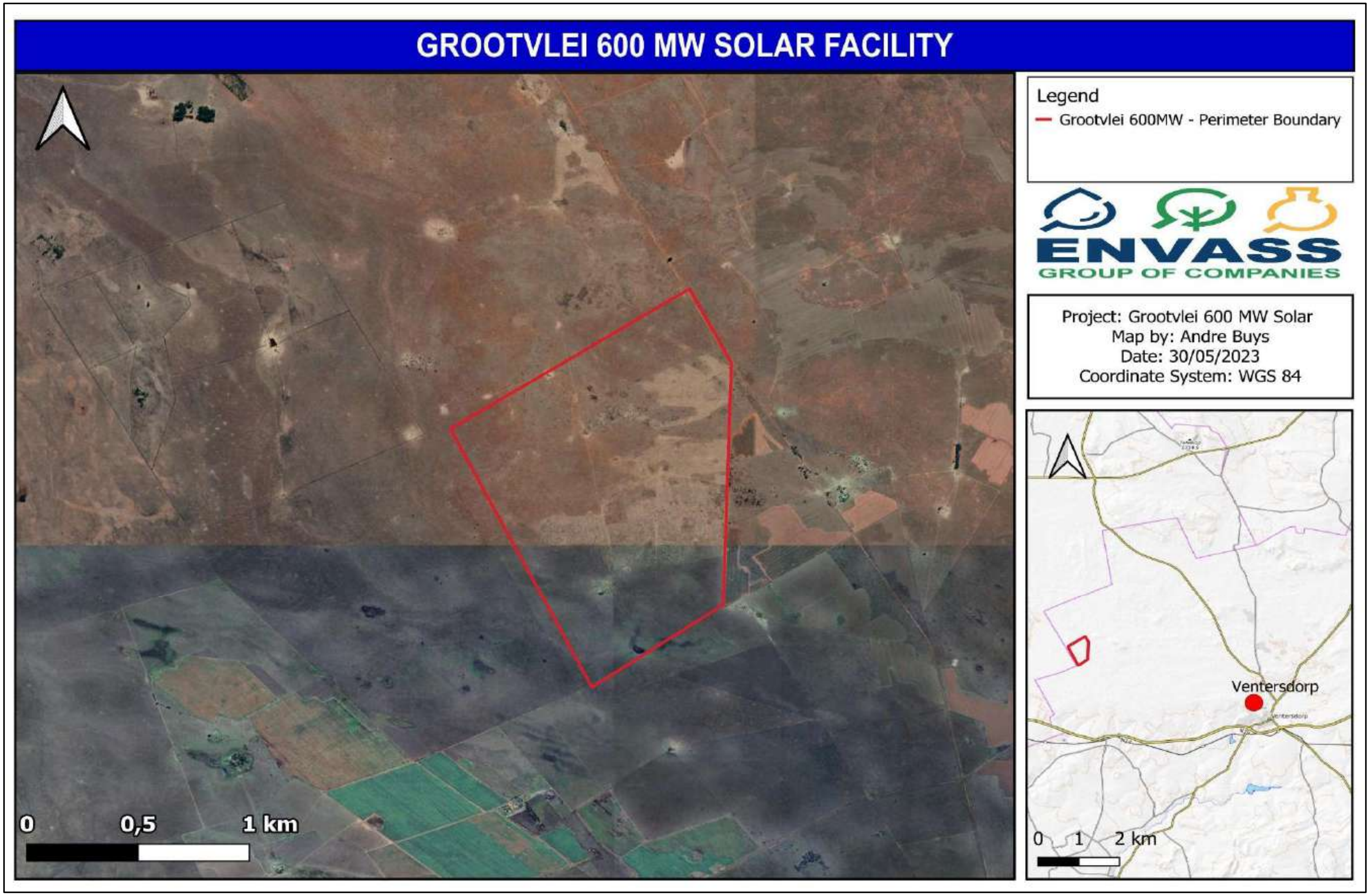

Figure 1: Project locality map

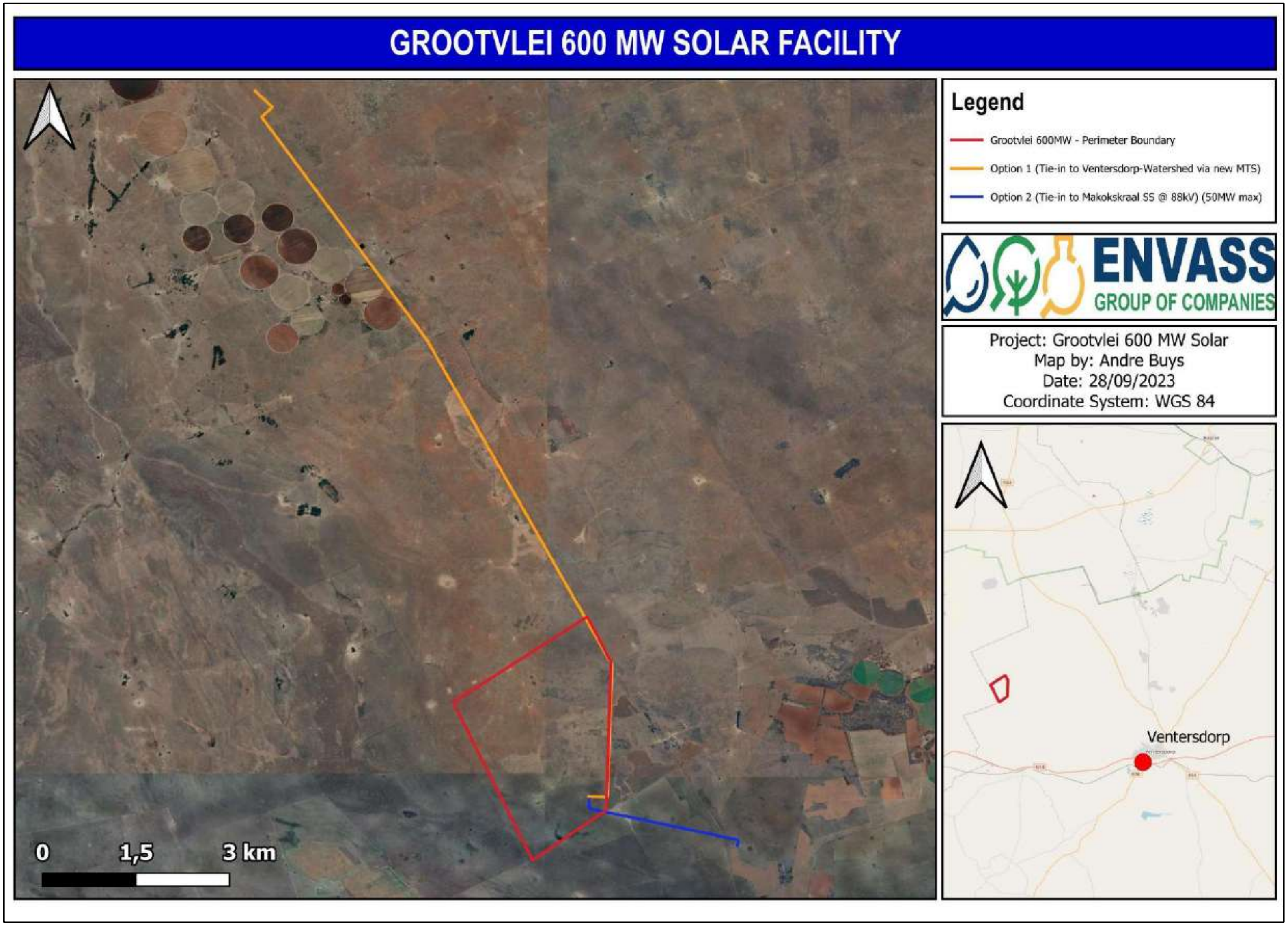

Figure 2: Powerline (Grid) Options

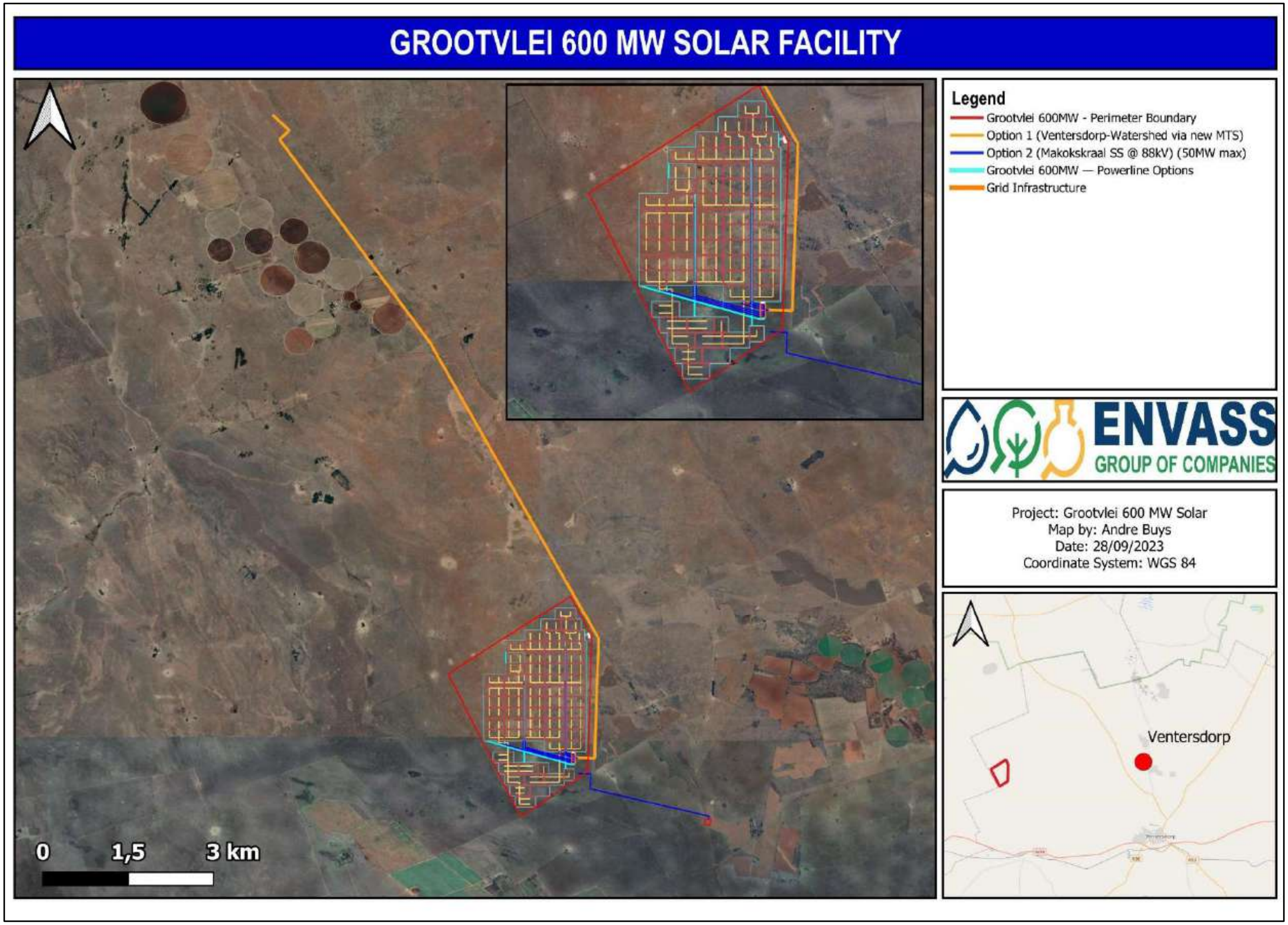

Figure 3: Infrastructure Layout – Alternative 1

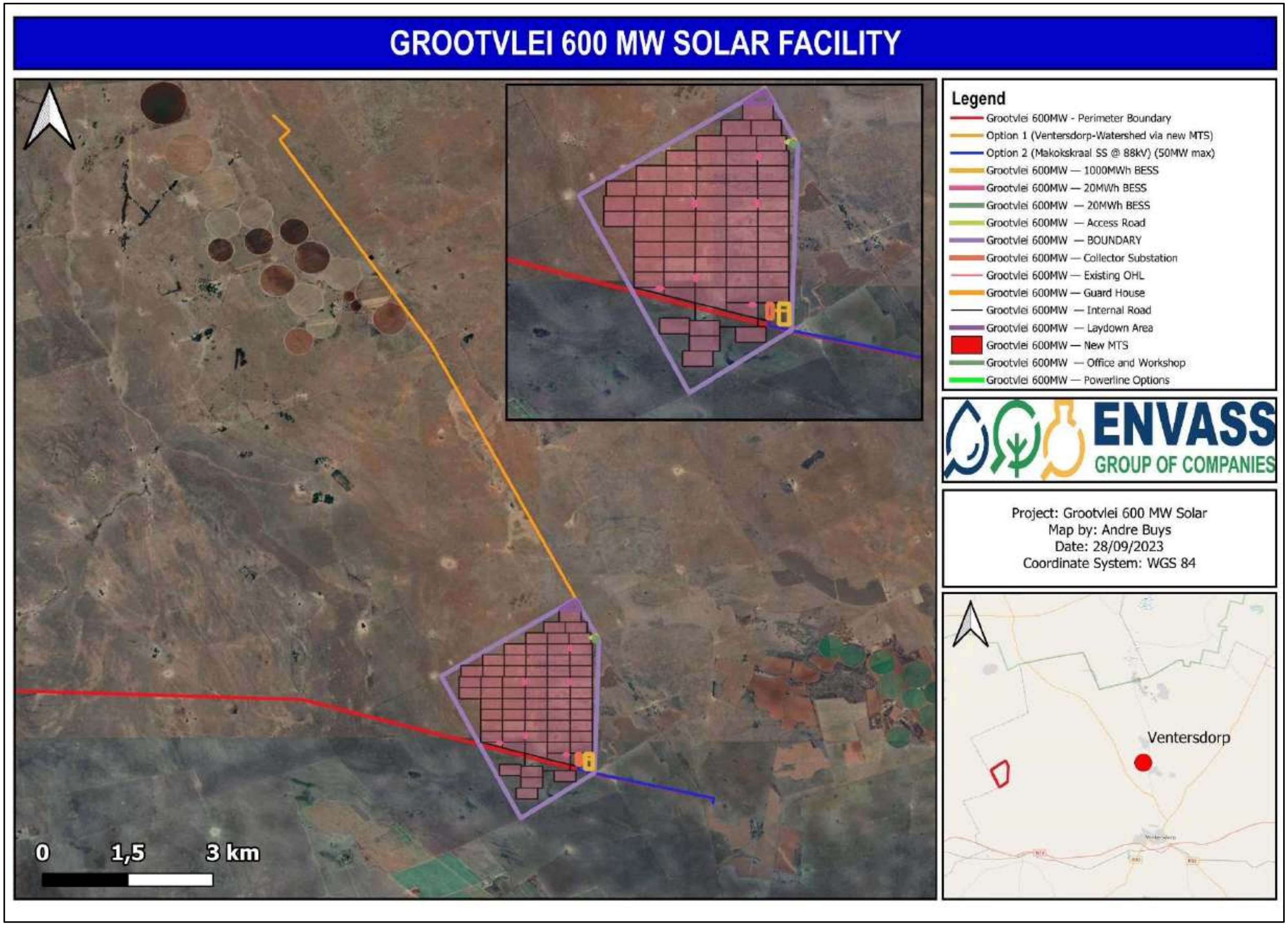

Figure 4: Infrastructure Layout – Alternative 2

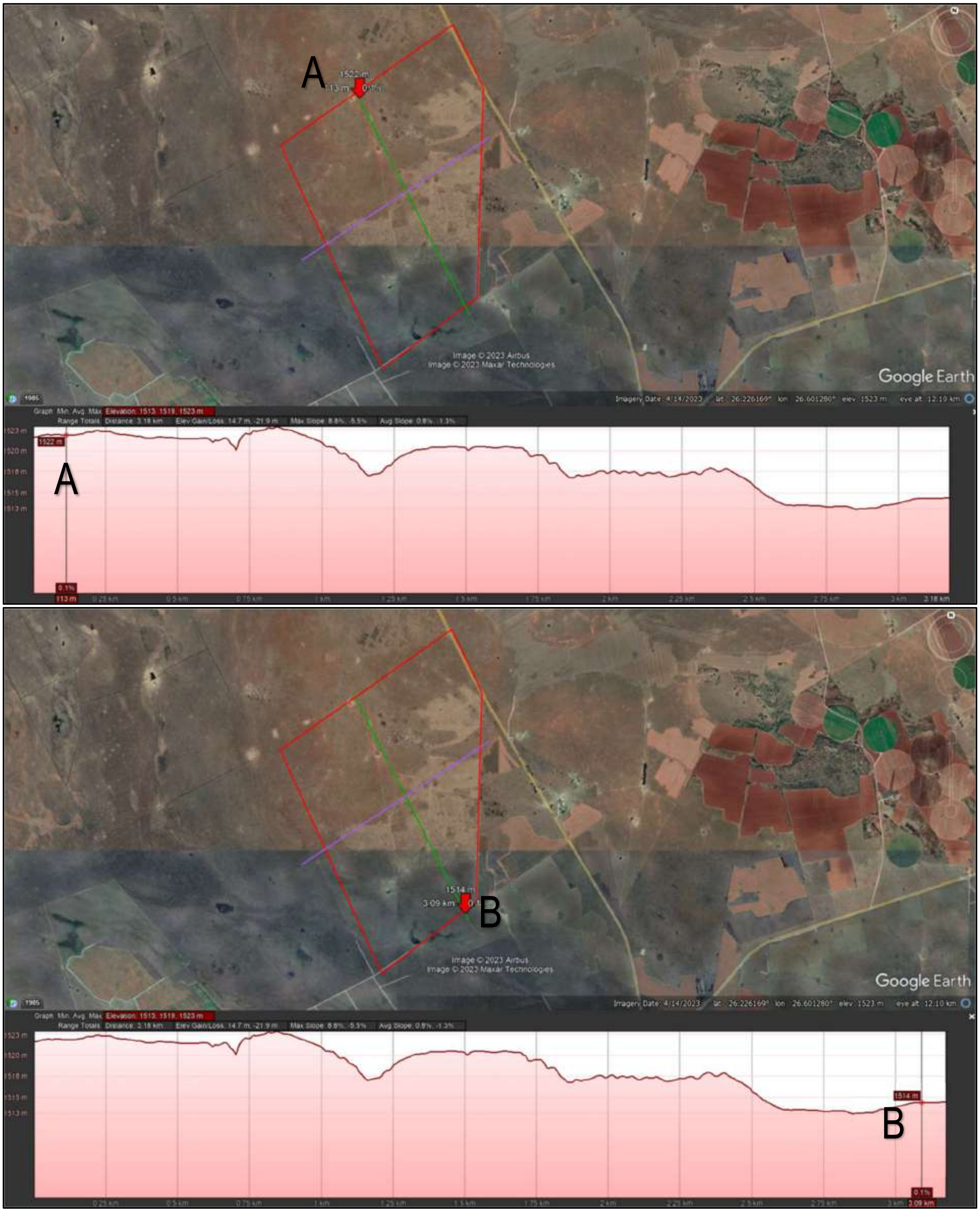

Figure 5: Elevation Profile (maximum elevation at point A and minimum at point B)

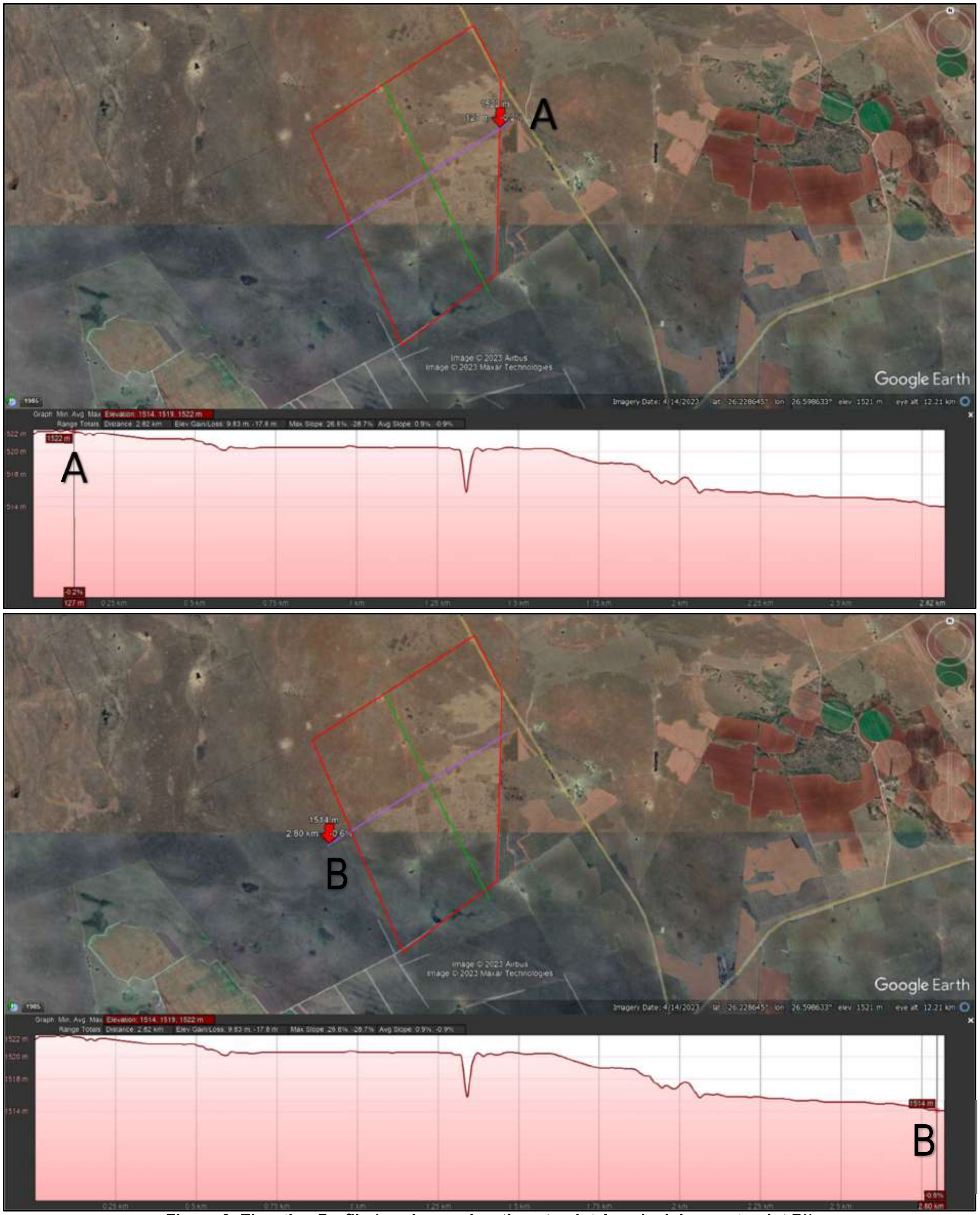

Figure 6: Elevation Profile (maximum elevation at point A and minimum at point B))

1.4 DELINEATION OF THE VISUAL STUDY AREA

The study area for the VIA comprises of the spatial extent of the project footprint and related activities, as well as an associated buffer area. For the purposes of this VIA, the study area was defined as a ten (10) km radius around the physical footprint of all surface components of the project. The distance of ten (10) km was selected based on the location of sensitive receptors, topography, and the elevation of the proposed area. For the purposes of this VIA, the term 'site' refers to the area that will be physically affected by the proposed activities. Similarly, the term 'study area' refers to the area that will potentially be visually affected by the project and represents the ten (10) km radius buffer around the visible components of the proposed infrastructure.

2. LEGISLATIVE CONTEXT AND REFERENCES

Section 28 of the National Environmental Management Act (NEMA, Act 107 of 1998) places a duty of care on any person causing, has caused or may cause significant pollution or degradation of the environment to take reasonable measures to prevent such pollution or degradation from occurring, continuing, or, insofar as such harm to the environment is authorised by law or cannot be reasonably avoided or stopped and rectify such pollution of the environment. The measures required in terms of subsection (1) may include measures to:

- Investigate, assess, and evaluate the impact on the environment.
- Inform and educate employees on the environmental risk of their work and the way tasks must be performed in order to avoid causing significant pollution or degradation of the environment.
- Cease, modify or control any activity or processes causing pollution or degradation.
- Contain or prevent the movement of pollutants or the cause of degradation.
- Eliminate any source of the pollution or degradation; or
- Remedy the effects of pollution or degradation.

In addition to this, the Protected Areas Act (57 of 2003) Section 17 is intended to protect natural landscapes and the National Heritage Resources Act (25 of 1999) provides legislated protection for listed proclaimed sites such as urban conservation areas, natural reserves and proclaimed scenic routes. This legislation is applicable to the study and will be used in the determination of the possible visual impact of the proposed development.

Requirements of Appendix 6 of the NEMA: EIA Regulations (2014, as amended). The following is an extract of the requirements:

Specialist reports

1. (1) A specialist report prepared in terms of these Regulations must contain—

(a) details of—

(i) the specialist who prepared the report; and

(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;

(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;

(c) an indication of the scope of, and the purpose for which, the report was prepared;

(cA) an indication of the quality and age of base data used for the specialist report;

(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;

(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;

(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;

(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;

(g) an identification of any areas to be avoided, including buffers;

(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;

(i) a description of any assumptions made and any uncertainties or gaps in knowledge;

(j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;

(k) any mitigation measures for inclusion in the EMPr;

(l) any conditions for inclusion in the environmental authorisation;

(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;

(n) a reasoned opinion—

(i) whether the proposed activity, activities or portions thereof should be authorised;

(iA) regarding the acceptability of the proposed activity or activities; and

(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;

(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;

(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and

(q) any other information requested by the competent authority.

(2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.

3. PURPOSE AND SCOPE

3.1 PURPOSE

The purpose of this assessment is to determine the visual impact of the proposed activity. The visual impact assessment will describe the existing visual characteristics of the proposed site and surrounding environment to establish the baseline characteristics of the receiving environment. If it is found that the possibility exists for visual impacts to pose a problem, recommendations will be made as to prevent and/or mitigate the possible impacts. This will be done to prevent disturbances to the receiving environment. This report also aims to give effect to the requirements and legislation as promulgated in South Africa. Please refer to Section 2 for detailed legislative requirements for the study. Key aspects for the purpose of this document are to:

- Description of the existing visual characteristics of the proposed site and its surroundings.
- Determining areas from which the proposed development will be visible.
- Visual Impact Assessment (VIA) in order to assess the significance of the visual impacts determined to be caused by the proposed development; and
- Recommendation of possible mitigation measures.

3.2 SCOPE

The scope includes the visual impact assessment of the proposed project (refer to Figure 3). This document reports on the visual impact assessment conducted, and outlines findings made supported by recommendations to the authorisation of the proposed project. The Project is located approximately 20km to the northwest of Ventersdorp central business district (CBD) and falls within Ward 34 of the JB Marks Local Municipality, in the North West Province. The site can be accessed via the N14 (main access) and the R53 (gravel road).

4. METHODOLOGY AND UNDERTAKING

4.1 SITE ESTABLISHMENT

An initial desktop site assessment was conducted to determine suitable locations regarding the visual impact assessment. The result of the desktop study is the identification of areas or activities, which could possibly contribute to the deterioration of the visual characteristics of the area.

Site baseline characterisation (and subsequent fieldwork) occurred on the 29th of May 2023 for the visual assessment. The site baseline characterisation was conducted to undertake the visual assessment of the current characteristics of the receiving environment. The field survey included photographic evidence at the various viewpoints, which were used as a basis for determining the potential visual ability and visual impacts of the proposed development. Various viewpoints were identified based on the sensitivity and visual impact of the area.

The VIA was conducted following the methodology:

- Site visit and orientation.

- Describing the landscape character or visual baseline based on:
    - Photographs of the project site and larger study area were taken during a field visit conducted on the 29th of May 2023.
- A review of available aerial photography and topographical maps, in relation to:
    - Natural elements; and
    - Human-made elements.
- Determining the area/s where the project will be visible from.
- Determining the visual resource value of the landscape in terms of:
    - The topographical character of the site and its surroundings and potential occurrence of landform features of interest;
    - The presence of water bodies within the study area;
    - The general nature and level of disturbance of existing vegetation cover within the study area; and
    - The nature and level of human disturbance and transformation evident.
- Determine the visual absorption capacity of the receiving visual landscape.
- Determining the receptor sensitivity to the proposed project.
- Determine the magnitude of the impact, by considering the proposed project in terms of aspects of VIA, namely:
    - Visibility.
    - Visual intrusion; and
    - Visual exposure.
- Assessing the impact significance by relating the magnitude of the visual impact to its:
    - Duration.
    - Severity; and
    - Geographical extent.
- To recommend mitigation measures to reduce the potential visual impacts of the project.

4.2 ASSUMPTIONS AND LIMITATIONS

The following is relevant to the field of VIA and the findings of this study:

- Determining the value, quality and significance of a visual resource or the significance of the visual impact that any activity may have on it, in absolute terms, is not achievable. Visual perception is by nature a subjective experience, as it is influenced largely by personal opinions and world views. For instance, what one viewer may experience as an intrusion in the landscape, another may regard as positive. Such differences in perception are greatly influenced by culture, education, and socio-economic background. A degree of subjectivity is therefore bound to influence the rating of visual impacts. It is therefore impossible to conduct a visual assessment without relying to some extent on the opinion of an experienced consultant, which is inherently subjective. The subjective opinion of the visual consultant is however unlikely to materially influence the findings and recommendations of this study, as a wide body of scientific knowledge exists in the industry of VIA, on which findings are based.

- A once-off field survey was sufficient to characterise the baseline visual characteristics of the site.
- The primary objective of this study was to assess the visual environment.
- The fieldwork relevant to this study was a once-off assessment that was conducted.
- A preliminary layout was available. Detailed dimensions, such as the vertical offset of proposed surface infrastructure above ground level, were however not available and were assigned based on experience from similar infrastructure in previous projects.
- All viewsheds were based on terrain level. As such these viewsheds do not incorporate distractive views in the form of vegetation or land use (infrastructure, buildings, etc.).
- This study did not include an illumination or social assessment.
- The assessment of impacts and recommendation of mitigation measures was informed by the site-specific aspects identified and based on the assessor's working knowledge and experience with similar activities.

4.3 BASELINE VISUAL ENVIRONMENT

The visual baseline assessment was informed by a field visit, assessment of on-site photographs and Google Earth imagery. To determine the visual resource value of the study area, specific attention was given to the following aspects:

- The nature of existing vegetation cover, in terms of its overall appearance, density and height, and level of disturbance.
- The general topographical character of the study area, including prominent or appealing landforms, and their spatial orientation in terms of the project sites.
- The nature and level of human transformation or disturbance of the study area.
- The location, physical extent, and appearance of water bodies within the study area if present; and
- The perceived level of compatibility of existing land uses in terms of the study area and each other.

4.4 DESCRIPTION OF AFFECTED AREA AND ENVIRONMENT

This section provides a brief overview of the visual baseline environment and context in which the proposed project will take place.

The Project is located approximately 20km to the northwest of Ventersdorp's CBD. The areas affected by the proposed Project footprint are rural in nature. The Project's PV Site is vacant and was historically used for agricultural purposes. The Project's power line connection to the Eskom grid is located 2km from the Project area. Grazing is the dominant land use in the Project area. The proposed project is accessed via an unnamed gravel road off the N14 and/or R53.

According to the SA REEA Database, there were one (1) renewable energy applications that have been made for properties located in a thirty (30) km radius of the study area.

Table 3: Desktop study attributes and descriptions relevant to the study area.

Hydrological Setting (DWS, 2012)	
Water Management Area (WMA)	Midvaal Water Management Area
Sub-WMA	Taaiboschspruit Sub-Catchment Area
Quaternary Catchment Area	C24F
Sub-Quaternary Reach (SQR)	C24F – 01159 PES: Class C (Moderately modified)
Ecoregion (Kleynhans *et al.*, 2005) (bold indicates most dominate attributes)	
ATTRIBUTES	**Highveld (11)**
Terrain Morphology: Broad division (dominant types in bold) (Primary)	**Plains; Low Relief;** **Plains; Moderate Relief;** Lowlands; Hills and Mountains; Moderate and High Relief; Open Hills; Lowlands; Mountains; Moderate to high Relief Closed Hills. Mountains; Moderate and High Relief
Vegetation types (dominant types in bold) (Primary)	Mixed Bushveld (limited); Rocky Highveld Grassland; **Dry Sandy Highveld Grassland;** Dry Clay Highveld Grassland; **Moist Cool Highveld Grassland;** Moist Cold Highveld Grassland; North Eastern Mountain Grassland; Moist Sandy Highveld Grassland; Wet Cold Highveld Grassland (limited); Moist Clay Highveld Grassland; Patches Afromontane Forest (very limited) Carletonville Dolomite Grassland. It has a complex mosaic pattern of grasses as *Aristida congesta, Brachiaria, Eragrostis chloromelas and Alloteropsis semialata* (Mucina and Rutherford, 2006).
Altitude (m a.m.s.l) (secondary)	1100-2100, 2100-2300 (very limited)
MAP (mm) (modifying)	400 – 1000
Coefficient of Variation (% of annual precipitation)	< 20 to 35
Rainfall concentration index	45 - 65
Rainfall seasonality	Early to late summer
Mean annual temp. (°C)	12 - 20
Mean daily max. temp. (°C): February	20 - 32
Mean daily max. temp. (°C): July	14 - 22
Mean daily min. temp. (°C): February	10 - 18
Mean daily min temp. (°C): July	-2 - 4
Median annual simulated runoff (mm) for quaternary catchment	5 - >250
Landcover within the study area (DEA, 2020)	
Landcover Category (DEA, 2020)	

Desktop Delineation	Site Conditions
Grassland	The onsite conditions for the most part mimic the presumed desktop landcover classes.
Natural Grassland	
National Wetland Map Version 5 (NWM5), National Freshwater Ecosystem Priority Areas (NFEPA's) (Driver *et al.*, 2011) and Strategic Water Source Areas (SWSA) (Le Maitre *et al.*, 2017)	
NWM5	No wetlands occur within the project area.
Fish sanctuary	The project area does not fall within a catchment that has been flagged as a fish sanctuary.
NFEPA Rivers	No rivers fall within the study area.
NFEPA Wetlands	The project area does not consist of artificial wetlands. A wetland is found in close proximity of the southern border.
WetVeg	The project area falls over one (WetVeg) unit namely the Dry Highveld Grassland Group 5.
SWSA	The project area does not fall within a SWSA.
Geology and Soils (Council for Geosciences 2008; Schultze *et al.*, 1992; MacFarlane & Bredin, 2016)	
Geology and Soil	The Project Area for the Solar site and powerline options are underlain by the Transvaal Rooiberg Griqualand West. The soils are mostly from the Dolerite and chert of the Malmani Subgroup, which supports mostly shallow Mispah and Glenrosa soil forms.
Conservation Attributes (SANBI, 2018; SANBI, 2006-18; DFFE, 2021)	
CBA	• CBAs are areas that are important for conserving biodiversity. • A portion of the study area occurs within a CBA at a desktop level. The Project Area crosses covers an area that is CBA 2.
ESA	ESAs are areas that are important to ensure the long-term persistence of species or functioning of other important ecosystems. • A portion of the study area occurs within an ESA1 and ESA2.
Threatened Ecosystems	The project area does fall within a threatened ecosystem, which is the Carletonville Dolomite Grassland listed as Vulnerable (VU).
Protected Areas	These are areas that are considered protected and imperative for conservation purposes: The project area does not fall within a protected area. According to the South Africa Protected Areas Database (SAPAD_OR_2021_Q4), the nearest formally protected area to the Project Area is ±6km and ±13km from the Project site respectively i.e. Klipstraat Private Nature Reserve and Witkrans Private Nature Reserve, Powerline Option 2 is 4km from Klipstraat Private Nature Reserve while powerline Option 1 and the new 400/132kV MTS is 14 km from Witkrans Private Nature Reserve
Vegetation Types	The primary or reference vegetation unit of the study area is the Carletonville Dolomite Grassland. It falls within the Grassland Biome and the Highveld Ecoregion and Dry Highveld Grassland Bioregion. This vegetation unit is classified as 'Poorly Protected' (Skowno *et al*, 2019), however of low concern. During the infield assessment, the general vegetation structure was observed to be minimally transformed by linear activities and agricultural activities.
Key: CBA – Critical Biodiversity Area EI: Ecological Importance	

ES: Ecological Sensitivity
ESA – Ecological Support Area
m a m s l: Metres Above Mean Sea Level
NFEPA: National Freshwater Ecosystem Priority Area
NWM5: National Wetland Map Version 5;
PA – Protected Areas
PES: Present Ecological State
REC: Recommended Ecological Class
SWSA: Strategic Water Source Area

Refer to Section 5.1 for figures that illustrate various views from and of the site from different angles. These provide a visual indication of the current state and possible areas of importance for the determination of the possible impact.

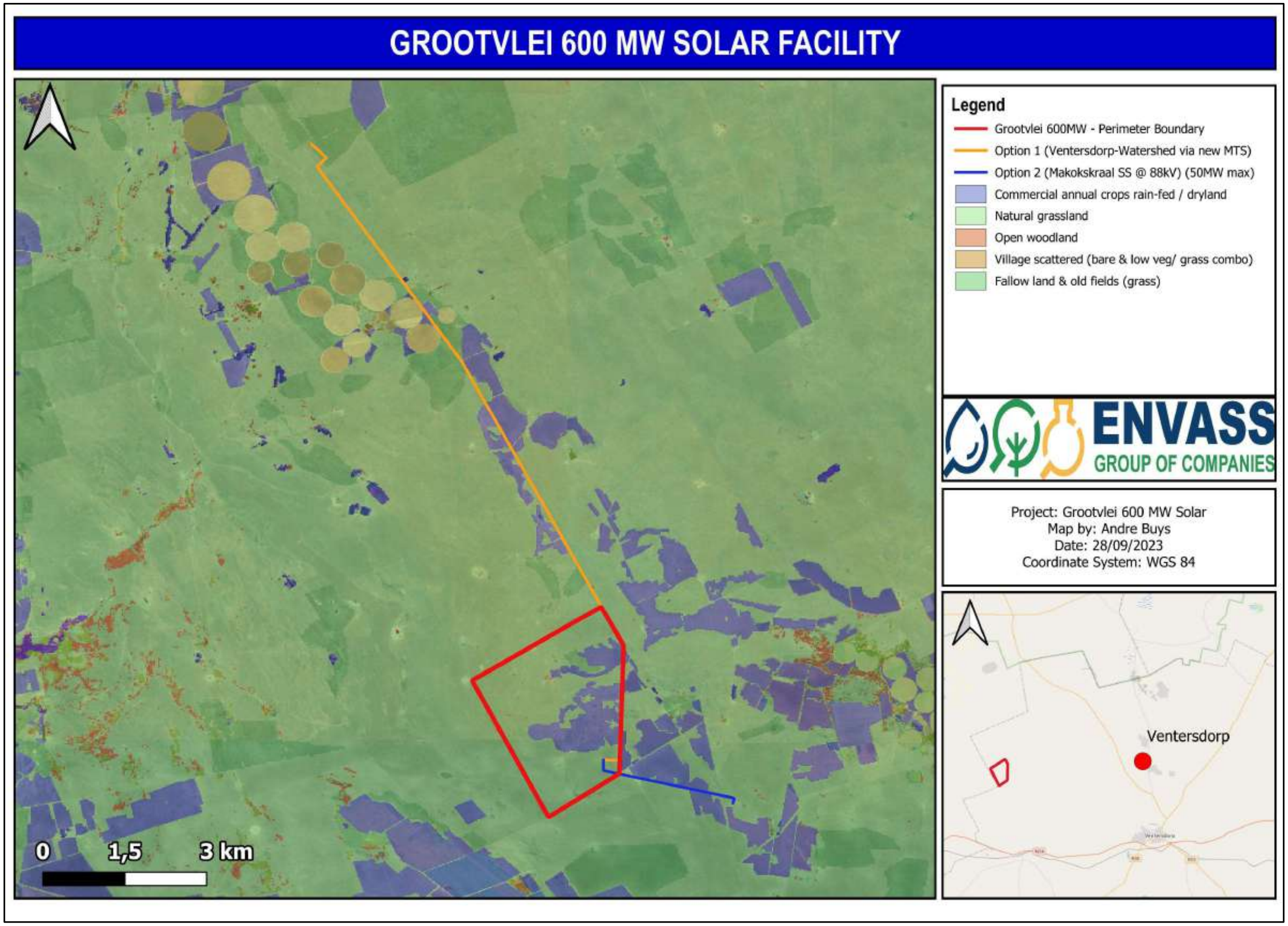

Figure 7: Proposed Grootvlei Solar Landcover

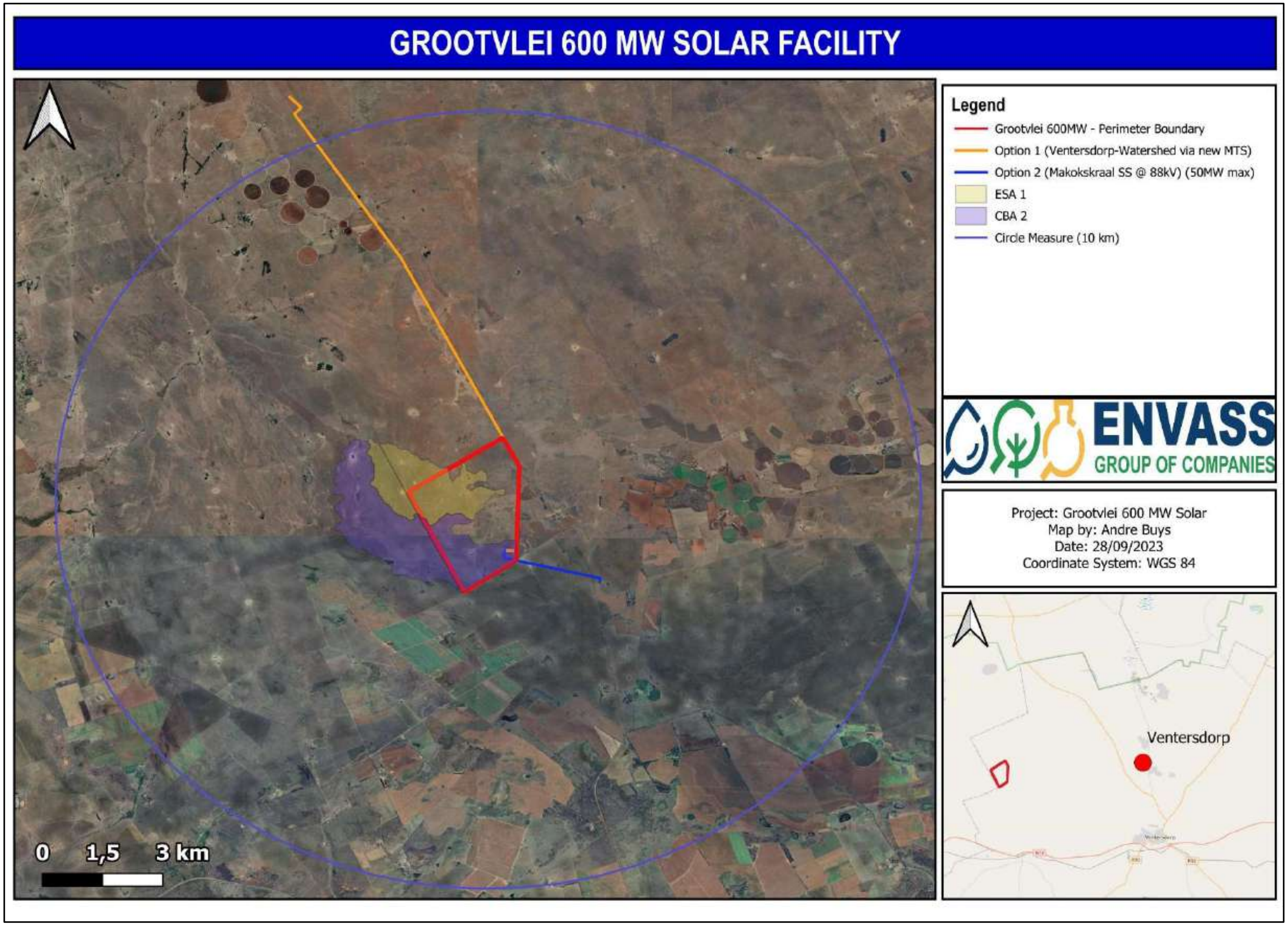

Figure 8: Proposed Grootvlei Solar CBA and ESA

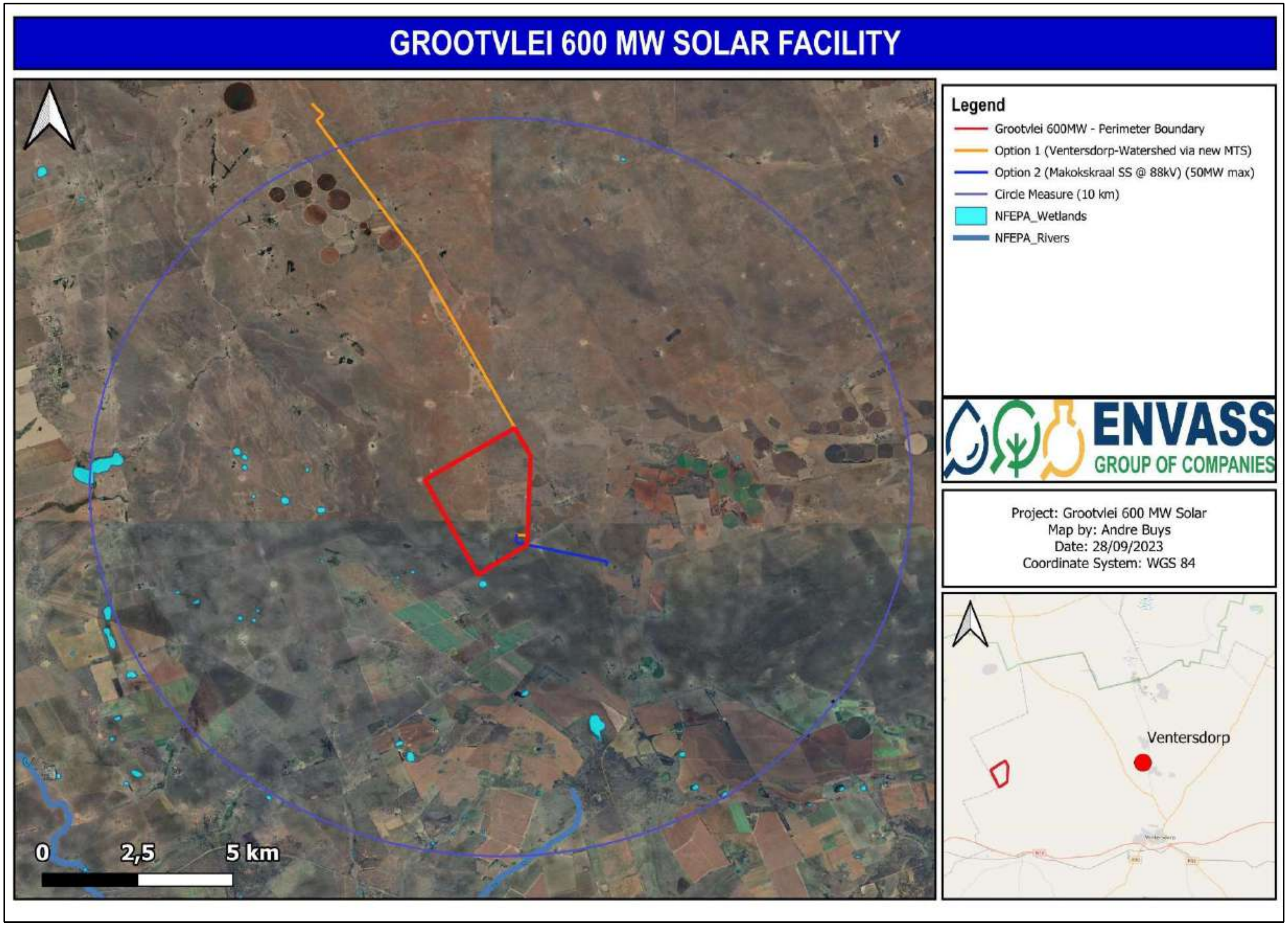

Figure 9: Proposed Grootvlei Solar Watercourses

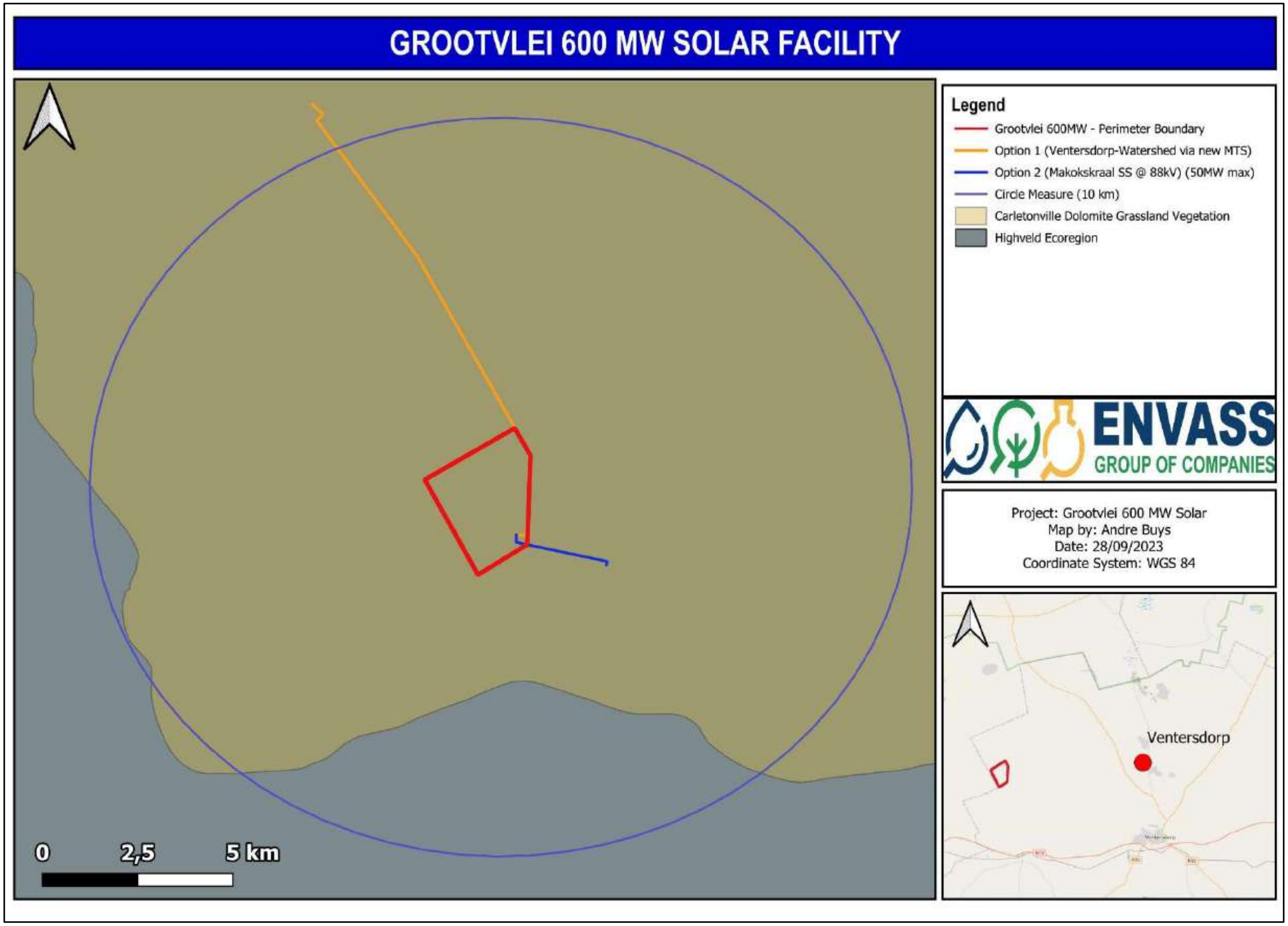

Figure 10: Proposed Grootvlei Solar Ecoregion and Vegetation Cover

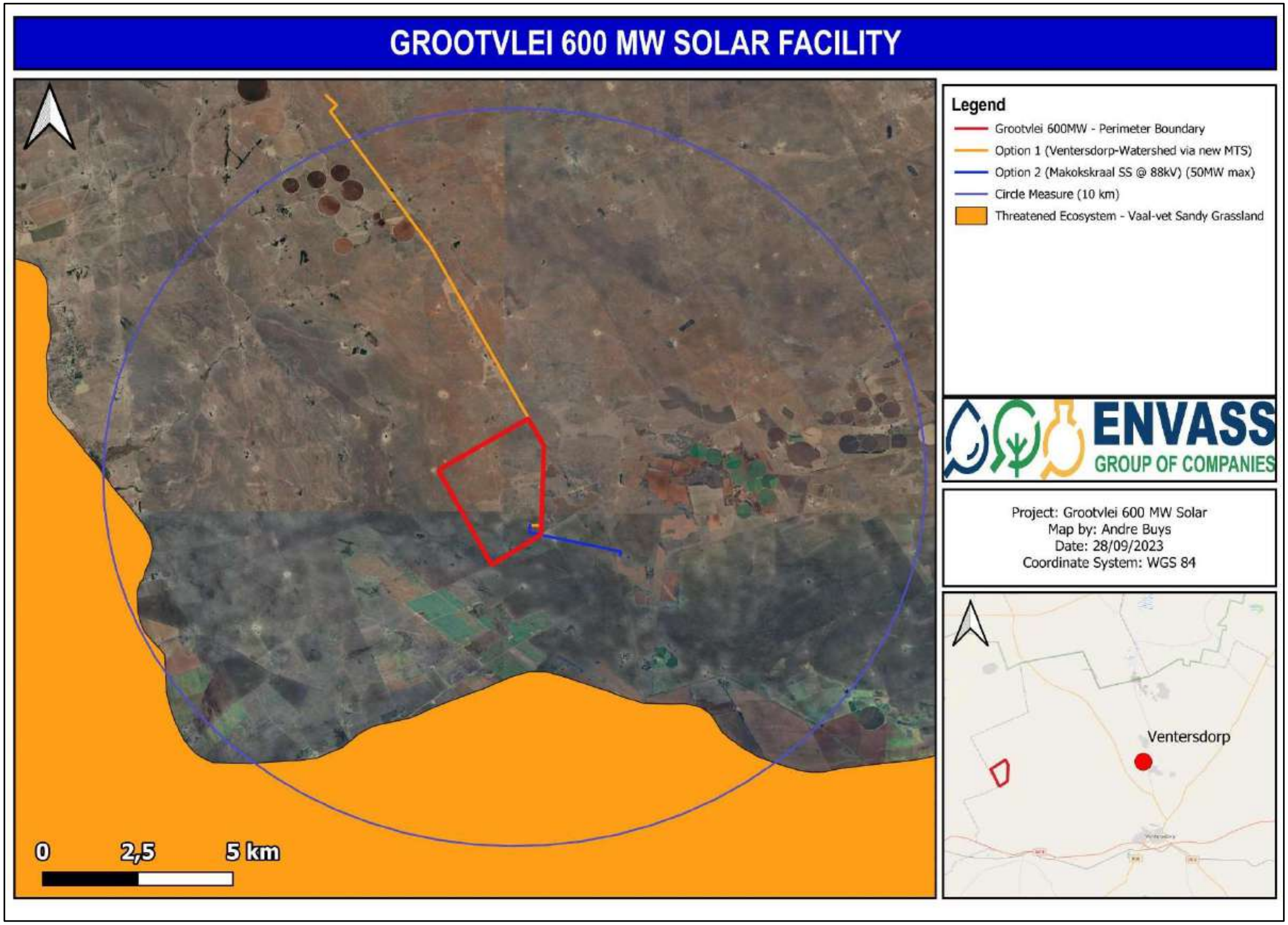

Figure 11: Proposed Grootvlei Solar Threatened Ecosystems

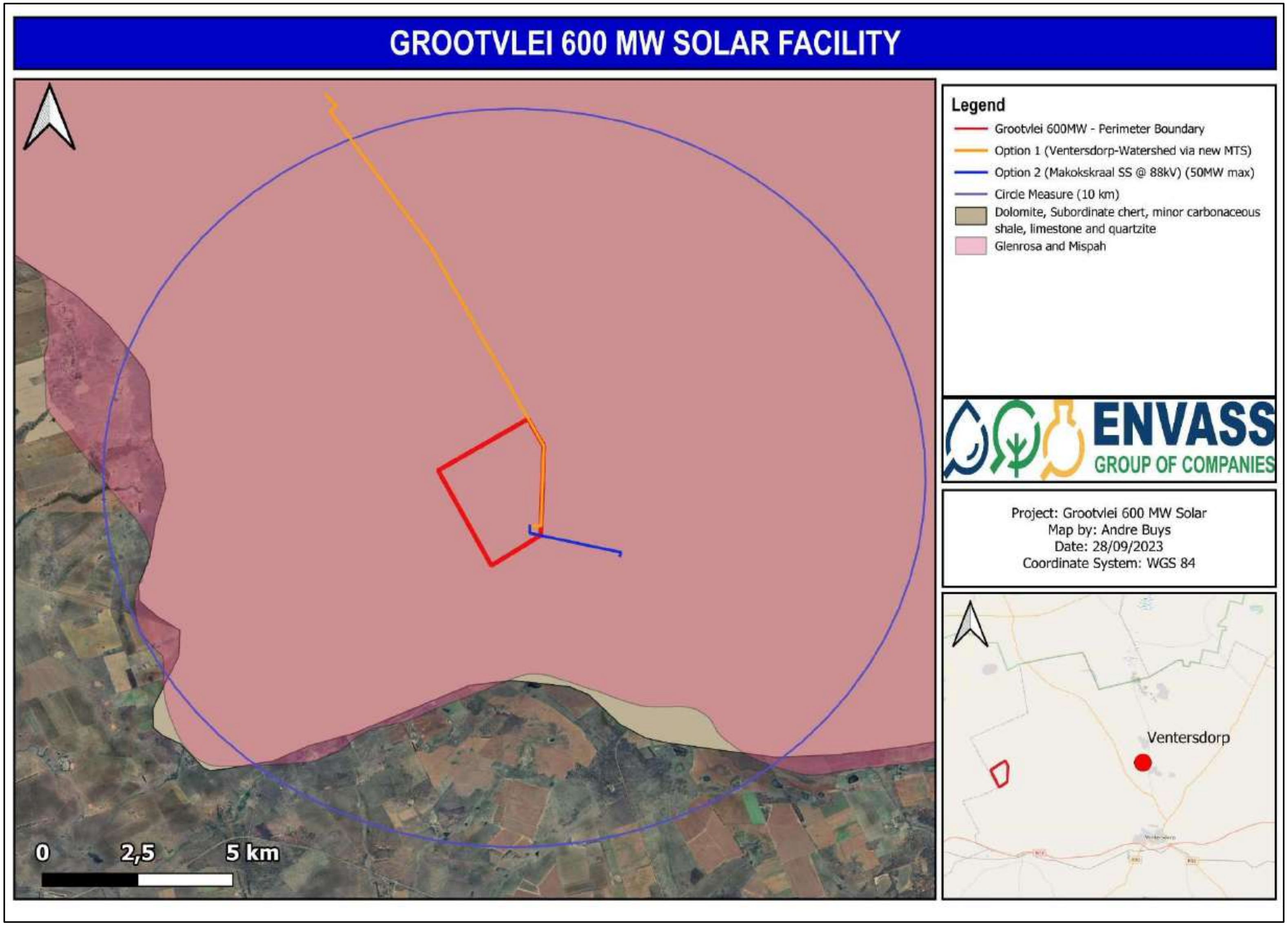

Figure 12: Proposed Grootvlei Solar Geology

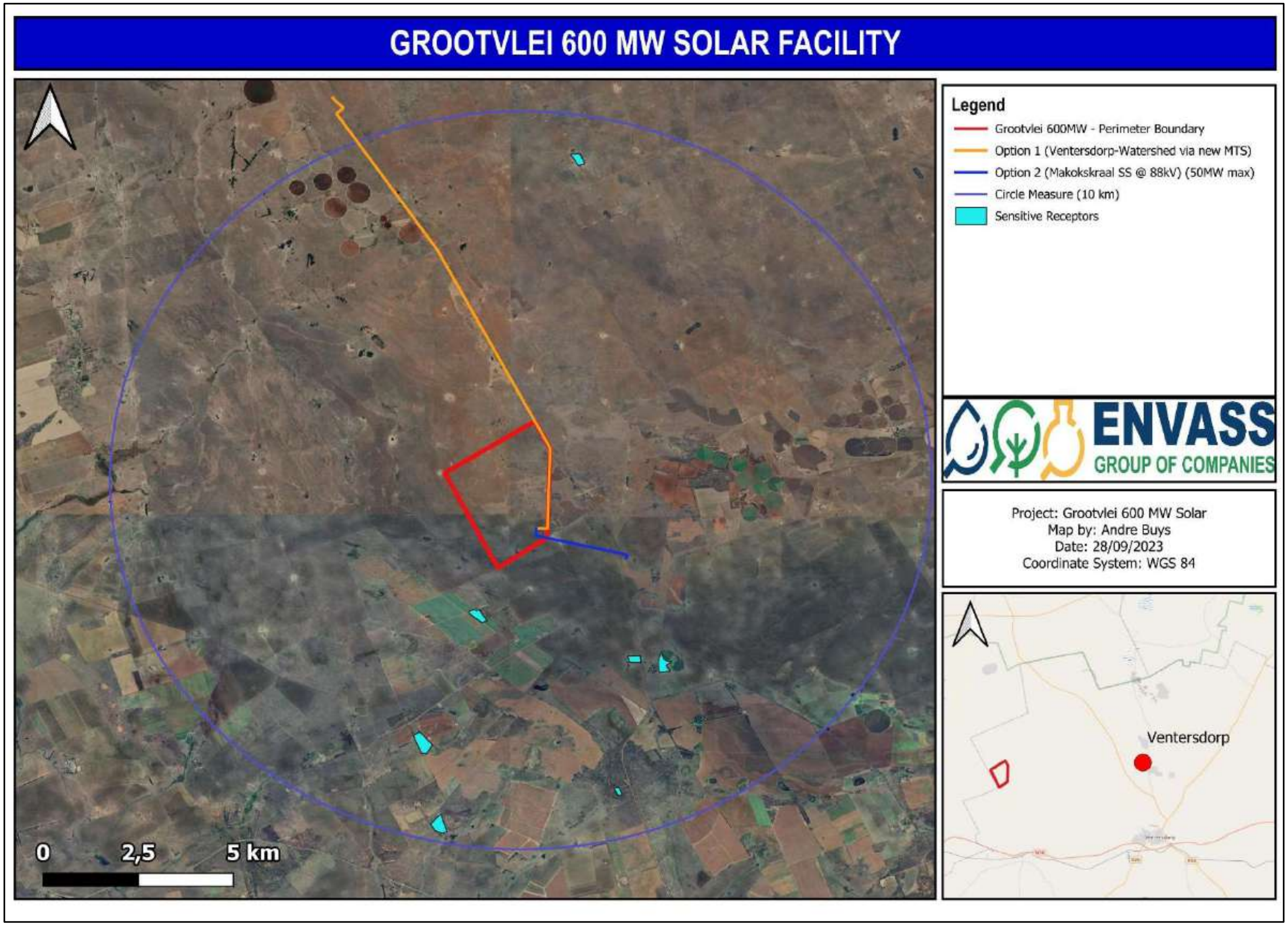

Figure 13: Sensitive Receptors - Desktop

4.5 SENSE OF PLACE

The below information was obtained from the Department of Arts and Culture – JB Marks Ventersdorp (http://www.dac.gov.za/content/reburial-jb-marks-ventersdorp-22-mar). Sense of place is a unique collection of qualities and characteristics that include visual, cultural, social, and environmental. Sense of place is what makes one city or town different from another and what makes our physical surroundings unique. The proposed site is located near a small town Ventersdorp.

Ventersdorp is a small city, in Dr Kenneth Kaunda District Municipality, North-west province of South Africa. The sense of place of Ventersdorp is shaped by its history, location, culture, and natural surroundings.

History:

The town started a Dutch Reformed Church that was established in 1866. It was named on Mr Johannes Venter, who owned the farm Roodepoort as well as the property the church was constructed on. The area is familiar with a vast majority of Agricultural activities in and around the town dating back a few hundred years.

Location:

Ventersdorp is located approximately 50 km east of Coligny as well as 40 km north Of Potchefstroom. Krugersdorp is located 100 km east of Ventersdorp. Ventersdorp falls within Ward 34 of the JB Marks Local Municipality (JB MLM), in the North West Province. The area is surrounded by fertile farmland, grazing fields and rolling hills. Additionally, Klerkskraal dam is located 25 km east of Ventersdorp, which is a favourable fishing and camping destination. One of the largest economic hubs of South-Africa is just over 100 kilometres away known as Johannesburg. Tranquillity and serenity, peace and quiet, fresh open fields and Game reserves bring an immediate calm and languor to the predominantly outdoor experience that is this part of area in the North West province.

Culture:

The Ventersdorp community is a predominantly Setswana and Afrikaans speaking town, with a rich cultural heritage. Though the town has several charming historical buildings and a few Boer War monument sites, Ventersdorp is best known for a cold mineral spring, or 'eye, the source of South Africa's first bottled mineral water 'Schoonspruit', which means 'Clean Spring' and for the iconic image of the town – the long row of grain silos that is the first thing to greet one on the road into Ventersdorp.

Attractions in and around Schoonspruit include several dams which offer excellent fishing and watersports, namely the Rietspruit Dam and Resort, the Elandskuil Dam and the Klerkskraal Dam, making Ventersdorp a well-appointed destination for anglers.

In summary, the sense of place of Ventersdorp is shaped by its rich history, location in the heart of various surrounding farmers and farming communities in the North-west province, cultural heritage, and natural surroundings. The town offers visitors a chance to experience the beauty of the South African countryside, as well as a glimpse into its past, as well as enjoying the best of some of the tourist attractions South Africa can offer.

5. VISUAL CHARACTERISATION

5.1 VIEWPOINTS

Since topography and visual landscape modification has already occurred as a result of various activities in the area, the viewshed is only a theoretical study. For this VIA to be more accurate, viewpoints have been identified and a visual inspection was conducted from these points to identify the current state of the environment and to provide information that can assist in determining the severity of the visual impact of the proposed activity. As indicated in Figure 13, thirteen (13) viewpoints were identified from where characterisation were conducted, and corresponding visual influence and characteristics have been defined.

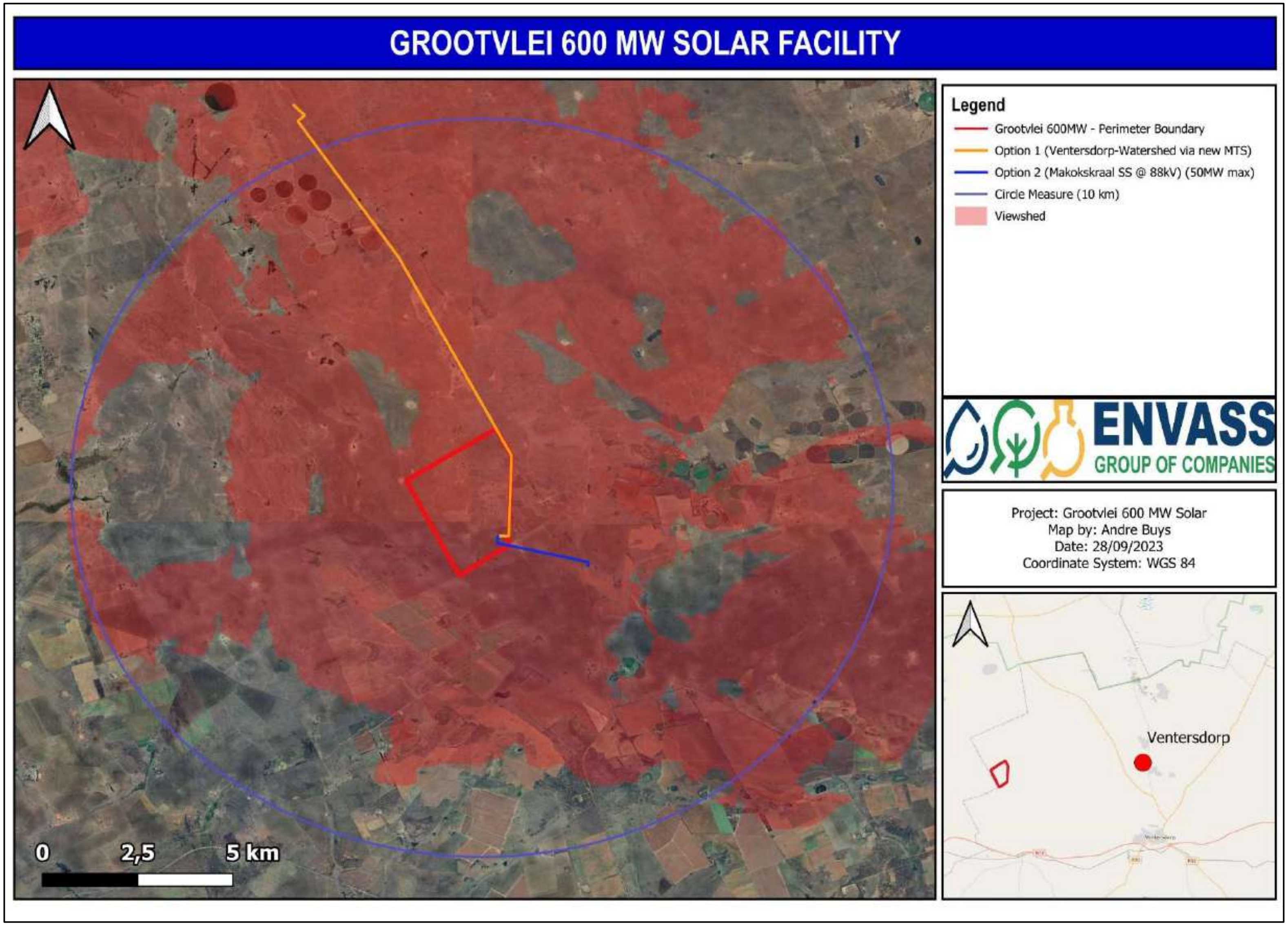

Figure 14: Viewpoints of the proposed Grootvlei Solar Facility

5.1.1 Viewpoint 1 (VP1):

Viewpoint 1 is located along the Gravel Road towards the southern border of the Alternative 1 layout area. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation, as far as can be observed. Slight high trees and plantations can be seen in the distance. The study area is located to the North-west. In addition, powerlines arere visible along the gravel road in a north to south direction.

Figure 15: View 1 (North)

Figure 16: View 2 (East)

Figure 17: View 3 (South)

Figure 18: View 4 (West)

5.1.2 Viewpoint 2 (VP2):

Viewpoint 2 is located along the Gravel Road towards the southern border of the Alternative 1 layout area. The viewpoint is slightly North of VP01. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation, as far as can be observed. Slight high trees and plantations can be seen in the distance. The study area is located to the North-west. In addition, powerlines arere visible along the gravel road in a north to south direction.

Figure 19: View 1 (North)

Figure 20: View 2 (East)

Figure 21: View 3 (South)

Figure 22: View 4 (West)

5.1.3 Viewpoint 3 (VP3):

Viewpoint 3 is located along the Gravel Road towards the southern border of the Alternative 1 layout area. The viewpoint is further north of Viewpoint 1 and 2. Directly to the east, an existing sub-station is evident. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation, as far as can be observed. Slight high trees and plantations can be seen in the distance. The study area is located to the North-west.

Figure 23: View 1 (North)

Figure 24: View 2 (East)

Figure 25: View 3 (South)

Figure 26: View 4 (West)

5.1.4 Viewpoint 4 (VP4):

Viewpoint 4 is located on the Gravel Road which passes the study area on the right. It is situated at North of the northern boundary corner of the study area. View 3 (South) have been taken towards the proposed project area. The area comprises predominately grassland vegetation, as far as can be observed. From the viewpoint, the visual character comprises of a predominantly flat terrain. In addition, powerlines and tall trees are visible in the distance.

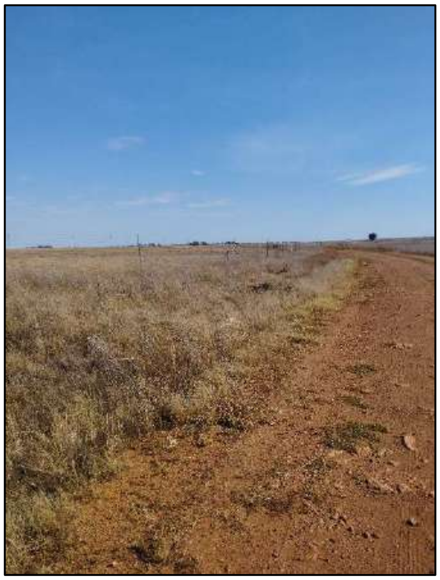

Figure 27: View 1 (North)

Figure 28: View 2 (East)

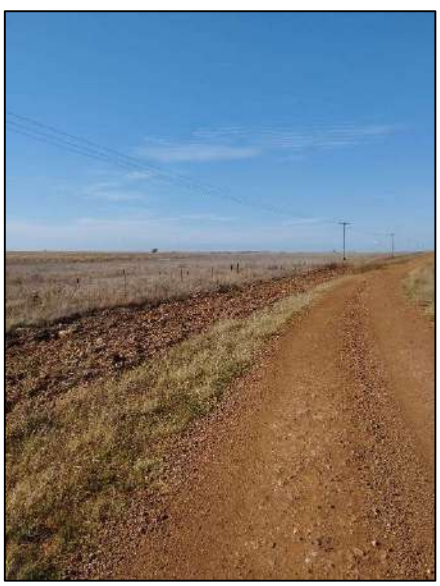

Figure 29: View 3 (South)

Figure 30: View 4 (West)

5.1.5 Viewpoint 5 (VP5):

Viewpoint 5 is located on the Gravel Road which passes the study area on the right. It is situated at North of the northern boundary corner of the study area, further north of Viewpoint 4. View 3 (South) have been taken towards the proposed project area. The area comprises predominately grassland vegetation, as far as can be observed. From the viewpoint, the visual character comprises of a predominantly flat terrain. In addition, tall trees are visible in the distance.

Figure 31: View 1 (North)

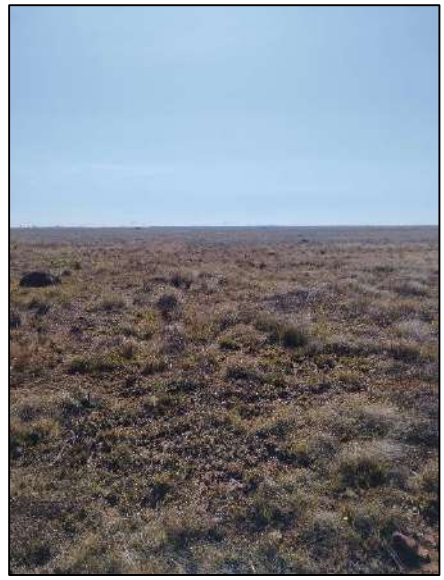

Figure 32: View 2 (East)

Figure 33: View 3 (South)

Figure 34: View 4 (West)

5.1.6 Viewpoint 6 (VP6):

Viewpoint 6 is located to the south-western point of the study area. View 1 (North) have been taken towards the proposed project area. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately of natural grassland and old fallow lands. In addition, scattered trees of various heights are visible in the distance. The area can be seen to be used for grazing.

Figure 35: View 1 (North)

Figure 36: View 2 (East)

Figure 37: View 3 (South)

Figure 38: View 4 (West)

5.1.7 Viewpoint 7 (VP7):

Viewpoint 7 is located to the north-western boundary of the project area. View 2 (East) and 3 (South) have been taken towards the proposed project area. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately of natural grassland and is currently utilized as grazing fields.

Figure 39: View 1 (North)

Figure 40: View 2 (East)

Figure 41: View 3 (South)

Figure 42: View 4 (West)

5.1.8 Viewpoint 8 (VP8):

Viewpoint 8 is north of the northern boundary. View 3 (South) have been taken towards the proposed project area. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately of natural grassland and old fallow lands. In addition, trees of various heights is visible in the distance.

Figure 43: View 1 (North)

Figure 44: View 2 (East)

Figure 45: View 3 (South)

Figure 46: View 4 (West)

5.1.9 Viewpoint 9 (VP9):

Viewpoint 9 is located directly east of the eastern boundary towards the north of the study area. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation which a high coverage of grass and shrubs. View 2 (East) have been taken towards the proposed study area.

Figure 47: View 1 (North)

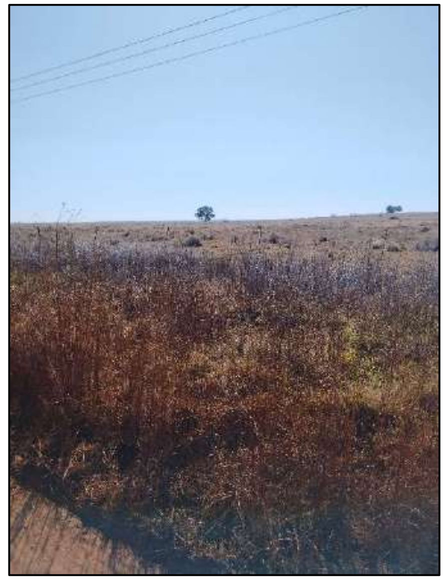

Figure 48: View 2 (East)

Figure 49: View 3 (South)

Figure 50: View 4 (West)

5.1.10 Viewpoint 10 (VP10):

Viewpoint 10 is located directly south of the southern boundary towards the middle of the study area. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation. View 1 (North) have been taken towards the proposed study area. In addition, crops were evident to the east.

Figure 51: View 1 (North)

Figure 52: View 2 (East)

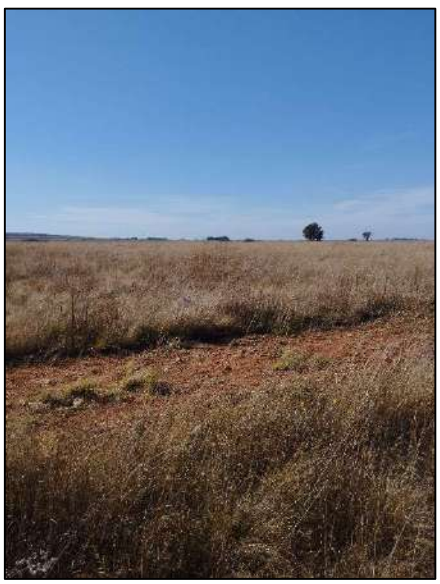

Figure 53: View 3 (South)

Figure 54: View 4 (West)

5.1.11 Viewpoint 11 (VP11):

Viewpoint 11 is located directly to the centre of the study area. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation which a high coverage of grass plains. All viewpoints reflect the proposed study area.

Figure 55: View 1 (North)

Figure 56: View 2 (East)

Figure 57: View 3 (South)

Figure 58: View 4 (West)

5.1.12 Viewpoint 12 (VP12):

Viewpoint 12 is located directly east of the eastern boundary towards the middle of the study area. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation, which a high coverage of grass plains. View 4 (West) have been taken towards the proposed study area. Hight trees towards the South were evident, and the area is currently utilized for grazing purposes.

Figure 59: View 1 (North)

Figure 60: View 2 (East)

Figure 61: View 3 (South)

Figure 62: View 4 (West)

5.1.13 Viewpoint 13 (VP13):

Viewpoint 13 is located directly west of the western boundary towards the middle of the study area. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation. View 2 (East) have been taken towards the proposed study area. In addition, shrubs and trees of various heights are visible in the distance.

Figure 63: View 1 (North)

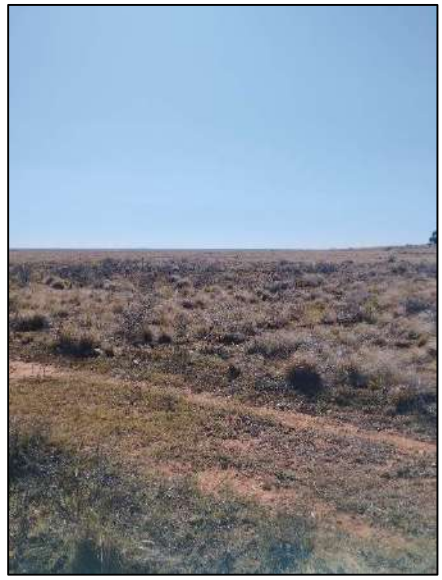

Figure 64: View 2 (East)

Figure 65: View 3 (South)

Figure 66: View 4 (West)

5.2 VISUAL RESOURCE VALUE OF THE STUDY AREA

The visual resource value refers to the visual quality of an environment and how the environment appeal to our senses. According to Crawford (1994), landscape quality increases when:

- Prominent topographical features and rugged horizon lines exist.
- Water bodies such as streams or dams are present.
- Untransformed indigenous vegetation cover dominates.
- Limited presence of human activity, or land uses that are not visually intrusive or dominant prevail.

The criteria incorporated for the visual resource assessment is highlighted in the Table 3 below. The landscape is rated either high, moderate or low depending on factors such as sense of place, current views and aesthetic appeal.

Table 4: Visual Resource Value Criteria

Visual Resource Value	Criteria
High (3)	Pristine or near-pristine condition/little to no visible human intervention visible/ characterised by highly scenic or attractive natural features, or cultural heritage sites with high historical or social value and visual appeal/characterised by highly scenic or attractive features/areas that exhibit a strong positive character with valued features that combine to give the experience of unity, richness and harmony. These are landscapes that may be considered to be of particular importance to conserve and which may be sensitive to change.
Moderate (2)	Partially transformed or disturbed landscape/human intervention visible but does not dominate view, or that is characterised by elements that have some socio-cultural or historic interest but that is not considered visually unique/scenic appeal of landscape partially compromised/noticeable presence of incongruous elements/areas that exhibit positive character, but which may have evidence of degradation/erosion of some features resulting in areas of more mixed character. These landscapes are less important to conserve but may include certain areas or features worthy of conservation.
Low (1)	Extensively transformed or disturbed landscape/human intervention is of visually intrusive nature and dominates available views/scenic appeal of landscape greatly compromised/visual prominence of widely disparate or incongruous land uses and activities/areas generally negative in character with few, if any, valued features. Scope for positive enhancement frequently occurs.

- **Topography –** From north to south the elevation increased from 1514 m to 1523 m above sea level over a distance of approximately 3,00 km. From west to east the elevation drops very similarly from 1514 m to 1523 m above sea level over a distance of approximately 3,20 km. The topography or terrain morphology of the region is broadly described as plains with low relief. The main topographical character can be described as a flat plain, therefore, the topography is considered to have a **moderate** value.

- **Hydrology –** There are no visually prominent water drainage courses within the proposed project area. From a wetland perspective, there is no (0) NFEPA wetlands (artificial). Therefore, the aesthetic value of the hydrology is **low**.
- **Vegetation cover –** The landscape is primarily characterized by grassy plains and old cultivated fields. The vegetation in the area consists mainly of grasses, shrubs, and trees. The visual resource value of the proposed site's vegetation cover is rated **moderate**.
- **Land use –** The main land use is agriculture and livestock grazing, while land use activities within the broader area are predominantly described as agricultural and formal residential areas. The visual resource value of the study area is therefore considered to be **moderate**.

A resource value is subjectively applied, based on the specialist's expertise and experience in assessing visual impacts. A value is applied to the visual resources with each resource able to receive a maximum score of three (3) and counted to reach a final score out of twelve (12). The **total** is counted, and final score rated as:

- Low, equal to 4 – 6.
- Moderate, equal to 7 – 9, and
- High, equal to 10 - 12.

The values applied to the study area is detailed in Table 4 below.

Table 5: Visual resource value determination

VISUAL BASELINE ATTRIBUTES	TOPOGRAPHY	HYDROLOGY	VEGETATION	LAND USES
Visual resource value score	2	1	2	2
			Total	**7**

Based on the above score ranges, the overall visual resource value of the study area is rated as **low** (7).

5.3 VISUAL ABSORPTION CAPACITY

According to Oberholzer (2008), Visual Absorption Capacity (VAC) can be defined as an '*estimation of the capacity of the landscape to absorb development without creating a significant change in visual character or producing a reduction in scenic quality*'. VAC was determined by considering the nature and occurrence of vegetation cover, topographical characteristics, and human structures. A further major factor is the degree of visual contrast between the proposed new project and the existing elements in the landscape.

5.3.1 Visual Absorption Capacity Weighting Factor

To account for the fact that visual impacts are expected to be more intrusive in landscapes with a lower VAC than in those with a higher VAC (regardless of the visual quality of the landscape), a weighting factor is incorporated into the impact magnitude determination, as indicated in Table 5.

Table 6: Visual absorption capacity weighting factor

VISUAL RESOURCE VALUE OF RECEIVING LANDSCAPE	LOW VAC	MODERATE VAC	HIGH VAC
High resource value	High (1.2)	High (1.2)	Moderate (1.0)
Moderate resource value	High (1.2)	Moderate (1.0)	Low (0.8)
Low resource value	Moderate (1.0)	Low (0.8)	Low (0.8)

The majority of vegetation cover is predominately dominated by grasses, shrubs and scattered trees, while the topographical characteristics (flat to gentle), which can conceivably result in a **low** VAC. The visual resource value of the study area has been determined to be **low** and the VAC of the study area has been rated as **low**. Therefore, a **moderate** (1.0) weighting factor in terms of VAC is applied during the impact assessment.

5.4 VISUAL RECEPTOR SENSITIVITY AND INCIDENCES

Receptor sensitivity refers to the degree to which an activity will impact the receptors and depends on how many persons see the project, how frequently they are exposed to it and their perceptions regarding aesthetics. Receptors of the proposed project can be broadly categorised into two (2) main groups, namely:

- People who live or work in the area, and who will be frequently exposed to the project components (resident receptors); and
- People who travel through the area and are only temporarily exposed to the project components (transient receptors).

Resident receptors located outside the proposed site include:

- Resident receptors would include the employees of the agricultural activities, residents and the local farming communities that are present outside the proposed project area.

Transient receptors located outside the proposed site include:

- The R53 (gravel road) and N14 public road, is the only roads located near the proposed site. The roads situated near the proposed site are predominately used for access to the surrounding areas, tourism attractions, residential areas, and agricultural activities. The proposed project area may potentially be visible from the tar road, while the visibility may be reduced due to vegetation obstructing the view from the roads at certain points. The visual receptor sensitivity and incidence can be classified as high, moderate or low, as indicated in Table 7.

Table 7: Visual receptor and sensitivity criteria

NUMBER OF PEOPLE THAT WILL SEE THE PROJECT (INCIDENCE FACTOR)	
High	Towns and cities, along major national roads (e.g., thousands of people).
Moderate	Villages, typically less than 1 000 people.
Low	Less than 100 people (e.g., a few households).
RECEPTOR PERCEIVED LANDSCAPE VALUE (SENSITIVITY FACTOR)	
High	People attach a high value to aesthetics, such as in or around a game reserve or conservation area, and the project is perceived to impact significantly on this value of the landscape.
Moderate	People attach a moderate value to aesthetics, such as smaller towns, where natural character is still plentiful and in close range of residency.
Low	People attach a low value to aesthetics, when compared to employment opportunities, for instance. Environments have already been transformed, such as cities and towns.

The following ratings have therefore been applied to the identified visual receptor groups:

- **Resident Receptors:** Resident receptors comprise a high number of people (incidence factor) living around the proposed project area:
    - People living and working in the surrounding areas will rate a moderate value (sensitivity factor) to the project; and

- **Transient Receptors:** People travelling through and near the proposed site will be moderate as the proposed site is located in close proximity of frequently travelled roads, constituting a moderate number of people (incidence factor). It is expected that travellers will attach a moderate degree of value to the current setting and visual character of the proposed site (sensitivity factor) due to the activities already established in the area. Hence, this receptor group has also been given a moderate sensitivity rating.

To determine the magnitude of a visual impact, a weighting factor that accounts for receptor sensitivity is determined (Table 7), based on the number of people that are likely to be exposed to a visual impact (incidence factor) and their expected perception of the value of the visual landscape and project impact (sensitivity factor).

Table 8: Weighting factor for receptor sensitivity criteria

RECEPTOR SENSITIVITY	HIGH INCIDENCE	MODERATE INCIDENCE	LOW INCIDENCE
High Sensitivity	High (1.2)	High (1.2)	Moderate (1.0)
Moderate Sensitivity	High (1.2)	Moderate (1.0)	Low (0.8)
Low Sensitivity	Moderate (1.0)	Low (0.8)	Low (0.8)

Based on the receptor sensitivity assessment and the above criteria, a **moderate** weighting factor (1.0) in terms of this aspect is applied during the impact magnitude determination.

6. BASELINE VISUAL ASSESSMENT

6.1 IMPACT IDENTIFICATION

Solar PV facilities are considered long-term in nature and long-term structures will be constructed. The primary visual impacts associated with a change from the current state of the site (fallow lands, cultivated fields and grassland vegetation) to a solar PV facility will have the greatest visual impact due to the visibility of the site from sensitive receptors. The visual impacts will be assessed based on a synthesis of criteria (nature of impact, extent, duration, probability, intensity, status, degree of confidence, level of significance and significance after mitigation) as defined by the NEMA Environmental Impact Assessment (EIA) regulations (2014, as amended). The nature of the visual impacts will be the visual effect that the activity would have on the receiving environment. These visual impacts would be:

- The construction and operation of the proposed PV facility and its associated infrastructure may have a visual impact on the study area, especially within (but not restricted to) a 1 - 5km radius of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility.

- Visibility from sensitive receptors. The proposed development will be visible from receptors outside the proposed project area. These include:
  - Site personnel at the operation;
  - People travelling to work and commercial activities in the surrounding areas;
  - People travelling on the surrounding access routes to their place of residence;
  - Surrounding farming communities; and
  - Surrounding residential areas.

6.2 IMPACT MAGNITUDE CRITERIA

The magnitude of a visual impact is determined by considering the visual resource value and VAC of the landscape within which the project will take place, the receptors potentially affected by it, together with the level of visibility of the project components, their degree of visual intrusion and the potential visual exposure of receptors to the project, as further elaborated on in the sections below:

6.2.1 Theoretical Visibility

Theoretical visibility was determined by conducting a Viewshed analysis and using Geographic Information System software with three-dimensional topographical modelling capabilities:

- The Digital Elevation Model (DEM) for the Viewshed analysis was acquired; and
- A 10 km area surrounding the site was used due the topography of the area.

The Viewshed was modelled on the above-mentioned DEM and the layout plan supplied by GIBB Environmental (Nemai Consulting scoping report), using Esri ArcGIS for Desktop software, 3D Analyst Extension. A viewshed was modelled to account for the PV facility and its associated infrastructure, that will be constructed.

Table 9: Rating of level of visibility

LEVEL OF THEORETICAL VISIBILITY OF PROJECT ELEMENTS	VISIBILITY RATING
More than half of the study area	High
Between a quarter and half of the study area	Moderate
Less than a quarter of the total project study area	Low

When considering the viewshed analysis, the visibility rating is **high.**

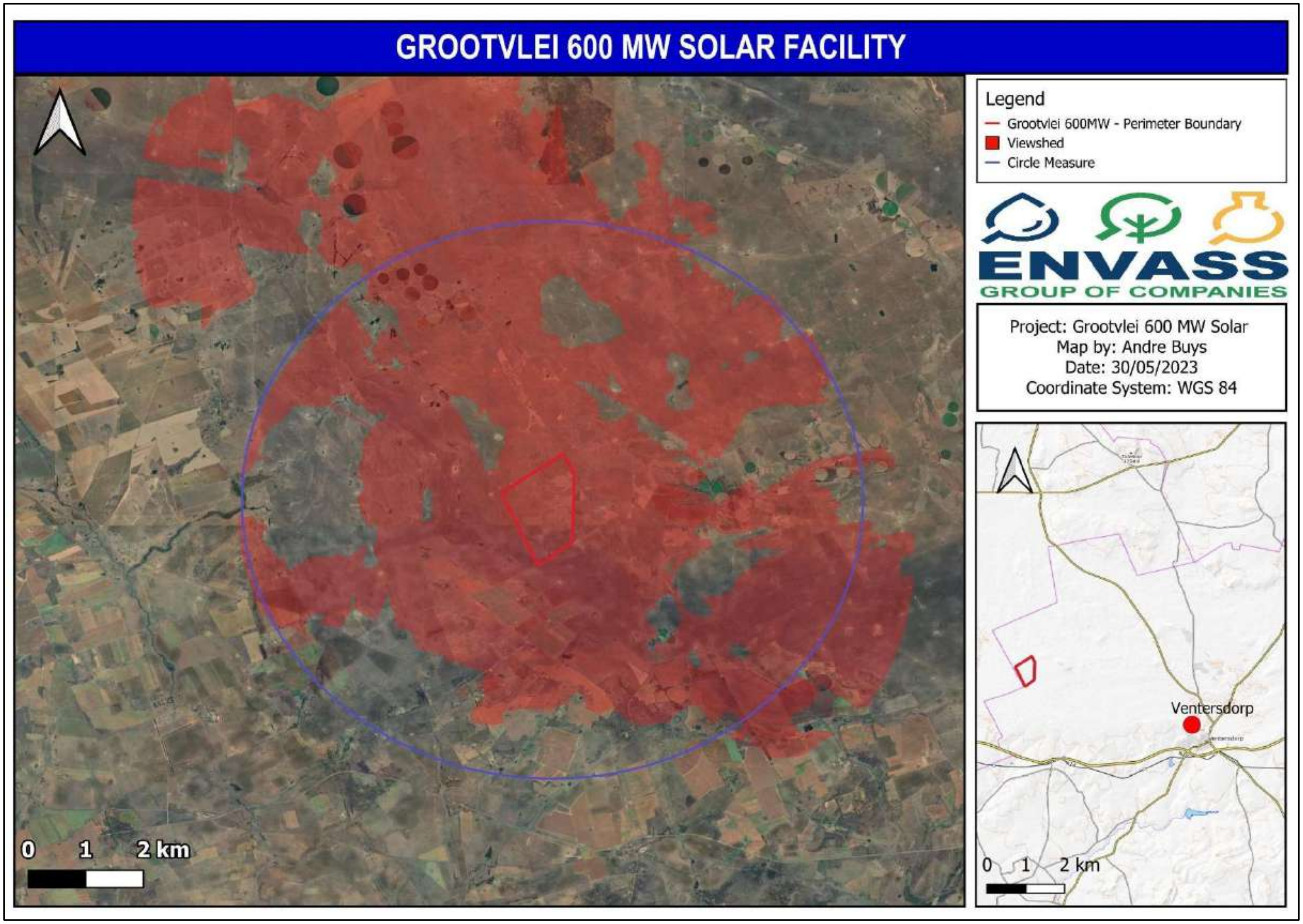

Figure 67: Viewshed analysis for the proposed Grootvlei Solar (10 km Radius)

6.3 VISUAL INTRUSION

Visual intrusion deals with how well the project components fit into the ecological and cultural aesthetic of the landscape. An object will have a greater negative impact on scenes considered to have a high visual quality than on scenes of low quality.

Given that the study area has a **low** VAC (due to vegetation and the flat to gentle landscape) and **low** visual resource value, the proposed project will have a **moderate** (without mitigation measures) visual intrusion on surrounding sensitive receptors. Ensuring that vegetation is retained on the periphery of these areas, and wherever possible, lights be directed downwards as to avoid illuminating the sky and limit the reflection from the solar panels, the visual impact on the surrounding environment will be **moderate** depending on the proximity to the sensitive receptors.

The altered visual environment during the construction and operational phases will lead to **moderate** (without mitigation measures) levels of visual intrusion, with **moderate** levels of compatibility with the surrounding land uses as well as moderate visual contrast. The level of visual intrusion because of the proposed project, with specific mention of vegetation clearing, removal of topsoil and solar PV infrastructure, is considered to be **moderate** (without mitigation measures) during the construction and operational phases, in line with the **low** VAC. The perceived visual impacts associated with the construction and operational phases are **moderately** (without mitigation measures) intrusive to the receiving environment.

6.4 VISUAL EXPOSURE

The visual impact of a development diminishes at an exponential rate as the distance between the observer and the object increases. The impact at 1 000 m would be 25% of the impact as viewed from 500 m. At 2 000 m, it would be 10 % of the impact at 500 m. The inverse relationship of distance and visual impact has been an important component in visual analysis literature (Hull and Bishop, 1998).

For the purposes of this assessment, close-range views (equating to a high level of visual exposure) are views over a distance of 500 m or less, medium-range views (equating to a moderate level of visual exposure) are views of 500 m to 2 km, and long-range views are over distances greater than 2 km (low levels of visual exposure). Limited sensitive receptors are located within 2 km of the site and are limited to people working in the area, residents and the number of farms surrounding the site.

For the purposes of this assessment, visual exposure in terms of all identified impacts has therefore been rated as **moderate** as the majority of the high sensitivity, sensitive receptors, are located more than 5 km from the project site.

6.5 IMPACT MAGNITUDE METHODOLOGY

The expected impact magnitude of the proposed project was rated, based on the above assessment of the visual resource value of the site, as well as level of visibility, visual intrusion, visual exposure and receptor sensitivity as visual impact criteria. The process is summarised below:

- *Magnitude = [(Visual quality of the site x VAC factor) x (Visibility + Visual Intrusion + Visual Exposure)] x Receptor sensitivity factor.*

Table 10: Magnitude Criteria

MAGNITUDE SCORE	MAGNITUDE RATING
20.1≤	High
13.1 - 20.0	Moderate
6.1 - 13.0	Low
≤6.0	Negligible

6.5.1 Impact Magnitude Determination

Based on the visual resource, VAC, receptor sensitivity and impact assessment criteria assessed in the preceding sections, the magnitude of the various impacts identified was determined for each phase of the project.

Table 11: Construction Phase – Impact Magnitude (Without Mitigation)

VISUAL	STUDY AREA VISUAL RESOURCE VALUE	VAC WEIGHTING FACTOR	LEVEL OF VISIBILITY	VISUAL INTRUSION	VISUAL EXPOSURE	RECEPTOR SENSITIVITY FACTOR	IMPACT MAGNITUDE POINT SCORE (WITHOUT MITIGATION)
Site establishment • This will involve the vegetation clearance, stripping and stockpiling of soil in areas designated for surface infrastructure. Site Clearing of the project footprint: • Removal of vegetation leading to increased visual contrast and loss of VAC and increase visual intrusion on sensitive receptors. • Alteration of current landscape features impacting on landscape character and sense of place. Construction activities of infrastructure • Construction of the solar PV facility and associated infrastructure. Construction vehicle movement and increased human activity in and around project site. General and hazardous waste management Formation of dust plumes as a result of construction activities.	1	1.0	2	2	2	1.0	6.0 (Low)

VISUAL	STUDY AREA VISUAL RESOURCE VALUE	VAC WEIGHTING FACTOR	LEVEL OF VISIBILITY	VISUAL INTRUSION	VISUAL EXPOSURE	RECEPTOR SENSITIVITY FACTOR	IMPACT MAGNITUDE POINT SCORE (WITHOUT MITIGATION)
Use of security lighting. Topographical and vegetation alteration which will lead to increased visual intrusion and potential impact on sense of place.							
Where for: visual resource value, visibility, visual intrusion and visual exposure: high=3; moderate=2; low=1; VAC and receptor sensitivity: high = factor 1.2; moderate = factor 1; low = factor 0.8							

Table 12: Operational Phase – Impact Magnitude (Without Mitigation)

VISUAL	STUDY AREA VISUAL RESOURCE VALUE	VAC WEIGHTING FACTOR	LEVEL OF VISIBILITY	VISUAL INTRUSION	VISUAL EXPOSURE	RECEPTOR SENSITIVITY FACTOR	IMPACT MAGNITUDE POINT SCORE (WITHOUT MITIGATION)
Topographical alteration which will lead to increased visual intrusion and potential impact on sense of place. Solar PV facility and associated infrastructure being visible. Vehicles and increased human activity in and around the Solar PV facility. Solar glint and glare. Night-time illumination due to security lighting and lighting within the solar PV facility and associated infrastructure.	1	1.0	2	2	2	1.0	6.0 (Low)
Where for: visual resource value, visibility, visual intrusion and visual exposure: high=3; moderate=2; low=1; VAC and receptor sensitivity: high = factor 1.2; moderate = factor 1; low = factor 0.8							

Table 13: Decommission Phase – Impact Magnitude (Without Mitigation)

VISUAL	STUDY AREA VISUAL RESOURCE VALUE	VAC WEIGHTING FACTOR	LEVEL OF VISIBILITY	VISUAL INTRUSION	VISUAL EXPOSURE	RECEPTOR SENSITIVITY FACTOR	IMPACT MAGNITUDE POINT SCORE (WITHOUT MITIGATION)
Removal of all structures and recycling of the structure and cables. Removal of any foundations and filling of holes created and shaped to appear natural. Rehabilitation and restoration of the footprint.	1	0.8	2	2	2	1.0	6.0 (Low)
Where for: visual resource value, visibility, visual intrusion and visual exposure: high=3; moderate=2; low=1; VAC and receptor sensitivity: high = factor 1.2; moderate = factor 1; low = factor 0.8							

6.6 IMPACT ASSESSMENT RATING METHODOLOGY

The significance of the identified impacts will be determined using the approach outlined below (terminology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998). This approach incorporates two aspects for assessing the potential significance of impacts, namely occurrence and severity, which are further sub-divided as follows:

Table 14: Ranking scales for assessment of occurrence and severity of factors

INTENSITY (MAGNITUDE)		
The intensity of the impact is determined by examining whether the impact is destructive or benign, whether it has a significant, moderate or insignificant visual impact.		
Insignificant	0	The visual impact of the development will have no effect on the environment.
Minor	2	The visual impact of the development is minor and will not result in an impact on processes.
Low	4	The visual impact of the development is low and will cause a slight impact on processes.
Moderate	6	The visual impact of the development is moderate and will result in processes continuing but in a modified way.
High	8	The visual impact of the development is high, processes are altered to extent that they temporarily cease.
Very high	10	The visual impact of the development is very high and results in complete destruction of patterns and permanent cessation of processes.
DURATION		
The lifetime of the impact that is measured in relation to the lifetime of the proposed development.		
(T)emporary	1	The impact either will disappear with mitigation or will be mitigated through a natural process in a period shorter than that of the construction phase. (0-1.5 years).
(S)hort term	2	The impact will be relevant through to the end of a construction phase (2 – 5 years).
(M)edium term	3	The impact will last up to the end of the development phases, where after it will be entirely negated. (5 – 15 years).
(L)ong term	4	The impact will continue or last for the entire operational lifetime i.e. exceed 30 years of the development, but will be mitigated by direct human action or by natural processes thereafter. (>15 years).
(P)ermanent	5	This is the only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact is transient.
SPATIAL SCALE (EXTENT)		
Classified of the physical and spatial aspect of the impact		
(F)ootprint	0/1	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.
(S)ite	2	The impact could affect the whole, or a significant portion of the site.
(R)egional	3	The impact could affect the area including the neighbouring settlements, the transport routes and the adjoining towns.

(N)ational	4	The impact could have an effect that expands throughout the country (South Africa).
(I)nternational	5	Where the impact has international ramifications that extend beyond the boundaries of South Africa.
PROBABILITY		
This describes the likelihood of the impact occurring. The impact may occur for any length of time during the life cycle of the activity. The classes are rated as follows:		
(I)mprobable	0/1	The possibility of the Visual Impact occurring is none, due to the circumstances, design. The chance of this Visual Impact occurring is zero (0%)
(P)ossible	2	The possibility of the Visual Impact occurring is very low, due either to the circumstances or design. The chance of this Visual Impact occurring is defined as 25% or less
(L)ikely	3	There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chances of the Visual Impact occurring are defined as 50%
(H)ighly Likely	4	It is most likely that the Visual Impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chances of this impact occurring is defined as 75 %.
(D)efinite	5	The Visual impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined as 100 %.

Table 15 below provides the ranking and score, which is used to determine the significance (with equation 1 below) and ranking of the possible impact on the proposed site. The score is then compared to Table 14 where the range of significance rating, with and without mitigation, is provided.

Table 15: Assessment Criteria and Ranking Scale

PROBABILITY (P)		MAGNITUDE (M)	
Description Meaning	Score	Description Meaning	Score
Definite / don't know	5	Very High	10
Highly likely	4	High	8
Likely	3	Moderate	6
Possible	2	Low	4
Improbable	1	Minor	2
Never	0	Insignificant	0

DURATION (D)		SPATIAL SCALE (S)	
Description Meaning	Score	Description /Meaning	Score
Permanent	5	International	5
Long Term	4	National	4
Medium	3	Regional	3
Short term	2	Local/Site	2
Temporary	1	Footprint	1/0

Equation 1: Significance Rating

SP (Significant Points) = Consequence (Extent + Duration + Severity) x Likelihood (Probability)

Table 16: Significance Rating Scale without mitigation and with mitigation

SR < 30	**LOW (L)**	Visual Impact with have little real effect and should not have an influence on or require modification of the project design or alternative mitigation. No mitigation is required.
30 > SR < 60	**MEDIUM (M)**	Where Visual Impact could have an influence on the decision unless it is mitigated. An impact or benefit, which is sufficiently important to require management. Of moderate significance - could influence the decisions about the project if left unmanaged.
SR > 60	**HIGH (H)**	Impact is significant, mitigation is critical to reduce impact and visual exposure. Resulting impact could influence the decision depending on the possible mitigation. An impact, which could influence the decision about whether or not to proceed with the project.

6.7 POTENTIAL VISUAL IMPACT OF THE PROPOSED PROJECT

Using the above criteria, the results of the impact significance assessment before and after mitigation, for the Construction, Operational and Decommissioning Phases are presented below.

Table 17: Impact assessment before and after mitigation

Phase	Potential Visual Impacts	Visual Significance											
		Before Mitigation						After Mitigation					
		M	D	S	P	SP	RATING	M	D	S	P	SP	RATING
Construction	Site establishment • This will involve the vegetation clearance and stripping of soil in areas designated for surface infrastructure.	6	2	3	3	33	**Medium**	6	2	3	2	22	**Low**
	Site Clearing of the project footprint: • Removal of vegetation leading to increased visual contrast and loss of VAC and increase visual intrusion on sensitive receptors. • Alteration of current landscape features impacting on landscape character and sense of place.	6	2	3	4	44	**Medium**	6	2	3	2	22	**Low**
	Construction of Solar PV facility and associated infrastructure.	6	2	3	4	44	**Medium**	6	2	3	2	22	**Low**
	Construction vehicle movement and increased human activity in and around the proposed site.	6	2	3	2	22	**Low**	6	2	3	1	11	**Low**
	General and hazardous waste management.	2	2	2	2	12	**Low**	2	2	2	1	6	**Low**
	Formation of dust plumes as a result of construction activities.	4	2	3	2	18	**Low**	4	2	3	1	9	**Low**
	Use of security lighting.	4	2	2	2	16	**Low**	4	2	2	1	8	**Low**
	Topographical alteration which will lead to increased visual intrusion and potential impact on sense of place.	6	2	3	4	44	**Medium**	6	2	3	2	22	**Low**

Phase	Potential Visual Impacts	Visual Significance											
		Before Mitigation						After Mitigation					
		M	D	S	P	SP	RATING	M	D	S	P	SP	RATING
Operational	Topographical alteration which will lead to increased visual intrusion and potential impact on sense of place.	6	4	3	4	52	Medium	6	4	3	2	26	Low
	Increased vehicle and human activity in and around the Solar PV facility and associated infrastructure.	6	4	3	2	26	Low	6	4	3	1	13	Low
	Night-time illumination due to security lighting and lighting associated with the Solar PV facility and associated infrastructure.	6	4	2	3	36	Medium	6	4	2	2	24	Low
	Potential visual impact of solar glint and glare as a visual distraction.	6	4	3	3	39	Medium	6	4	3	2	26	Low

Phase	Potential Visual Impacts	Visual Significance											
		Before Mitigation						After Mitigation					
		M	D	S	P	SP	RATING	M	D	S	P	SP	RATING
Decommissioning	General decommissioning and closure activities leading to visual intrusion on sensitive receptors.	6	1	3	2	20	Low	6	1	2	2	14	Low
	Dismantling and removal Solar PV facility and associated infrastructure.	6	1	3	1	10	Low	6	1	2	1	7	Low
	Cleaning, landscaping, and replacement of soils over the disturbed area.	6	1	3	1	10	Low	6	1	2	1	7	Low
	Waste generation and disposal	4	1	2	2	14	Low	4	1	2	1	7	Low
	Ineffective rehabilitation leading to landscape scarring, permanent visual contrast and a permanent alteration of the landscape character and sense of place.	6	4	3	3	39	Medium	6	1	2	3	21	Low

7. RESULTS AND DISCUSSION

Results of the visual impact assessment indicated that from a visual perspective, the proposed project and related activities are the main project components that are expected to result in a visual impact. Receptors located within 2km of the proposed site will have the **moderate** (without mitigation) visual impact. Within a 5 km radius of the proposed project, residential areas and farming communities will have a **low** (without mitigation) visual impact. Beyond the 5 km study area, there are some areas where the development is discernible. However, the visual impacts are generally of **moderate to low** magnitude and impact. Local low and high-level vegetation will provide limited screening; however, the proposed solar PV facility and associated infrastructure can conceivably be visible to the sensitive receptors located near the proposed project boundary. The visual impacts associated with the Project and associated infrastructure will occur once construction has been completed and will be long term in nature.

In terms of the potential cumulative impacts, the proposed site is surrounded by various commercial and agricultural activities. In addition, according to the REEA Database, there are one (1) renewable energy applications have been made for properties located near the project site. Most of the proposed site currently grassland vegetation and the clearance and subsequent development of the site will result in the alteration of this space. Consequently, the development of this site will add cumulatively to the loss of sense of place. While the result in a change in the sense of place for those areas that look onto the project site, the magnitude of the impact is likely to be **low** as most of the sensitive receptors are located more than 5km from the project site.

Based on the results of the impact assessment, the majority of the potential visual impacts were considered to be **moderate** before mitigation and with the successful implementation this can be reduced to low. With regards to the proposed activities, due to the terrain of the proposed boundary, vegetation, VAC, and current land uses, the proposed activities are expected to result in a **moderate** visual impact on the receiving environment. The proposed activities will have a long-term temporal visual impact, due to the very nature of the Project and associated infrastructure. The activity will have a localised visual impact over a long-term duration. The activity will be able to continue with the implementation of appropriate mitigation strategies during the construction, operational and decommissioning phases.

Both the alternative options have been assessed, and a similar finding and recommendation is reasonable for both alternatives. This is due to the alternatives covering relatively similar area size as well as being at very similar locations.

8. FINDINGS

From the impact assessment results obtained, potential visual impacts may be present within the construction, operational and decommissioning phases. From the assessment, the proposed activities can conceivably have a **moderate** (without mitigation) visual impact on the surroundings and the natural and topographical environment.

Impacts are likely to be largely localised and within 5 km of the proposed project boundary, while significant visual impacts with regards to the proposed activities are expected at the sensitive receptors located within 2km of the proposed project boundary. It should be mentioned that an estimation of the impact distance is difficult to determine in terms of the visual impact assessment as it does not incorporate distractive views in the form of vegetation or land use (infrastructure, buildings, etc.), however, with successful mitigating implementation the significance can be reduced.

Cumulative impacts can result from individually minor but collectively significant actions taking place over a period. Cumulative visual impacts resulting from landscape modifications because of the proposed activities in conjunction with other commercial activities are likely to be of moderate significance, however, it can be reduced with the successful implementation of the proposed mitigation measures.

9. MITIGATION MEASURES

As there are certain visual impacts from the proposed solar development project, mitigation measures have been developed and are provided within this section.

Visual mitigation can be divided into two (2) options. Typically using a combination of the two (2) options is most effective. The first option is an attempt to "hide" the source of the visual impact from view, by placing visually appealing elements between the viewer and the source of the visual impact. The second option aims to minimise the severity of the visual impact itself. This can be achieved in numerous ways for example limiting heights or by blending the infrastructure to match the surrounding environment.

During the construction phase, the following mitigation measures should be implemented to minimise the visual impact.

- General site management:
    - Maintain the construction site in a neat and orderly condition at all times;
    - Plan the placement of lay-down areas and any potential temporary construction camps in order to minimise vegetation clearing;
    - Ensure that rubble, litter, and disused construction materials are managed and removed regularly; and
    - Ensure that all infrastructure and the site and general surroundings are maintained in a neat and appealing way.

- Height and Orientation:
    - The height and orientation of the solar panels should be considered during the design phase. Panels should be oriented to minimize glare and reflection, and their height should be kept as low as possible to reduce their visual impact.
- Infrastructure:
    - All constructed facilities and buildings should cause minimum visual disturbance by reducing the contrast and blending in with the surrounding vegetated natural area. This could be achieved by painting rooftops and walls of buildings in the hues and tones of the surrounding vegetation and/or by adding matt paints to highly reflective surfaces, as well as sharp protruding features on the structures. All of these solutions are subject to the technical design of individual buildings and facilities and should be pursued by the

technical design and/or construction team, taking into consideration added value from reduced visibility, engineering feasibility and cost.

- Dust Management:
  - Implement dust suppression using a water cart to minimise airborne dust;
  - Enforce a 50 km/h speed limit on-site for Light-Duty Vehicles and a 40 km/h speed limit for large construction vehicles and machinery.

During the operational phase the following mitigation measures should be implemented to minimise the visual impact.

- Light pollution management:
  - Plan the lighting requirements of the facilities to ensure that lighting meets the need to keep the site secure and safe, without resulting in excessive illumination.
  - Avoid up-lighting of structures by rather directing lighting downwards and focusing on the area to be illuminated.
  - Reduce the height and angle of illumination from which floodlights are fixed as much as possible while still maintaining the required levels of illumination.
  - Lighting should be shielded in areas where specific objects are to be illuminated.
  - Minimise the use of lighting, where possible.
  - Lighting should exclude the blue-rich wavelengths and be closer to the red-rich wavelength spectrum. Globes used in lighting outside areas should be warm white. This also applies to light spilling out from within buildings. A colour temperature of no more than 3000 Kelvins is recommended for lighting.
  - Light intensity of illuminating lights should be limited as far as possible, i.e., to limit lighting to areas required to serve operational functionality.
  - Illumination where not permanently required should be fitted with timers, motion-activated sensors or be dimmable to reduce total light emitted.

- Site management:
  - Shape any slopes and embankments to a maximum gradient of 1:4 and vegetate, to prevent erosion and improve their appearance.
  - Utilise vegetation screens where possible as visual screening devices around the proposed project, specifically buildings.
  - Eradicate invasive alien plant species.

During decommissioning and closure phase, the following mitigation measures should be implemented to minimise the visual impact.

- Eradicate invasive alien plant species;
- Remove all built infrastructure; and
- Re-shape all footprint areas to be as natural in appearance as possible and revegetate using locally occurring vegetation.

10. CONCLUSION AND RECOMMENDATIONS

The project site and surrounding area can be characterized by residential and agricultural activities. According to the REEA Database, one (1) renewable energy application have been made for properties located near the project site. The proposed site ranges from approximately 1511 to 1523 metres above mean sea level (mamsl),and is predominantly flat. The landscape is characterized a mix of natural grassland, open woodland, commercial annual crops (rain-fed / dry land) and Fallow land (old fields (bush), typically of the Highveld (11) region of South Africa. The surrounding areas comprises with a mix of residential activities and agricultural activities. The vegetation in the area consists mainly of grasses, shrubs, and scattered trees.

Several potential risks to the receiving aesthetic and visual environment as a result of the proposed activities have been identified, relating to impacts on the visual character and sense of place, visual intrusion and visual exposure and visibility. The significance of these impacts may be reduced should appropriate and effective mitigation measures be implemented. The proposed Project and associated infrastructure can conceivably have a **moderate impact** on the visual environment, while secondary impacts, such as dust emission, solar glint and glare and lighting at night, will also manifest as visual disturbances from project initiation. The study area comprises of residential activities, agricultural and commercial activities which have had a visual impact on the natural environment. Therefore, the proposed project has been predicted to have a **moderate** impact before mitigation on the visual environment. After appropriate and effective mitigation measures the impact is rated as **moderate to low**. **Both the alternative options have been assessed, and a similar finding and recommendation is reasonable for both Alternatives.**

The proposed activities should therefore have a **moderate to low** visual impact on the receiving environment and is thus not fatally flawed from a visual impact perspective. Considering the project, it is the specialist's opinion that the proposed activities be allowed, provided that the findings within this report are considered along with the recommendations made towards the management of the proposed activity. All recommendations should be included in the Environmental Management Programme (EMPr) relevant to the proposed project.

11. REFERENCES

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APPENDIX A – SPECIALISTS CURRICULUM VITAES

ENVIRONMENTAL ASSURANCE (PTY) LTD

ANDRE BUYS

ENVIRONMENTAL CONSULTANT / BUSINESS UNIT HEAD

394 Tram Street, New Muckleneuk, Pretoria, 0181

T: 012 460 9768 ; M : 083 555 4354; F : 012 460 3071 ; E mail : andre@envass.co.za

Date of Birth : 18 November 1991; Place of Birth : South Africa

Ethnic Group and Gender: White Male ; Disabilities : None

AREAS OF EXPERTISE

- Compliance Monitoring
- Specialist Report (Visual and Noise assessments)
- Project Management
- Potable, Ground and Surface Water Quality
- Scientific Report Writing
- Data Analysis & Interpretation
- Hydrogeology
- Soil classification
- Ambient Air and Particulate Matter Quality
- Noise Monitoring
- Geophysics
- GIS, Surfer, Wish, QGIS, ARC GIS and WRPLOT software
- Customer Relationships

CAREER HISTORY

Employer
Period
Position
Responsibilities

ENVIRONMENTAL ASSURANCE (PTY) LTD

Andre holds a B.Sc. in Environmental Sciences, followed by a B.Sc. (Hons) specializing in Geology, Geography and Hydrology. He has comprehensive experience and knowledge on compliance monitoring, project management and specialist reporting. As an environmental consultant, Andre has provided several environmental monitoring and geohydrological assessments and specialist input services.

BUSINESS UNIT HEAD / ENVIRONMENTAL SPECIALIST
Environmental Specialist, Environmental Control Officer and Auditor
June 2022 – Current

- Develop and maintain environmental compliance monitoring programmes in conjunction with site audits and assessments. Monitoring co-ordination and planning of all relevant projects. Maintaining data and results from monitoring programmes and databases. Determining financial provision of mine closures. Compile and overseeing reports on water-, soil-, air-quality and site findings, with interpretation of results and recommendations. Conduct and report on specialist assessments Maintain and build customer relationships with guidance on environmental matters and updates on environmental legislation. Market to potential clients with site specific marketing material. Additionally, conducting Geohydrological studies including Groundwater resource development, Geophysical surveys, Conceptual modelling, Pump tests, Borehole siting, Borehole logging, Groundwater remediation programmes and hydrocensus'.

EDUCATION AND QUALIFICATIONS

North-West University; Honours BSc. Hydrogeology and Hydrology - 2014
North-West University; Degree BSc. Environmental Science Geology and Geography – 2013

PROFESSIONAL STATUS

Registration
Membership

Registered as a Professional Natural Scientist (119183) with the South African Council of Natural Scientific Professions (SACNASP)

PROJECT EXPERIENCE

PROJECT DESCRIPTION	CLIENT
Environmental Compliance Monitoring	Assmang Dwarsrivier
	Tronox Namakwa Sands
	Tronox KZN
	Samancor Ferrometals
	CEMZA Cement
	Northam Platinum Zondereinde
	Northam Platinum Eland
	Northam Platinum Maroelabult
	Wescoal Mining Elandspruit
	Wescoal Mining Keaton
	Neosho Moabsvelden
	Wescoal Processing Plant
	Wescoal Khanyisa
	Exxaro Grootegeluk
	Exxaro Thabametsi
	Exxaro Grootegeluk Depot
	AECI Mining and Explosives
	Calodex Enstra Waste Disposal Facility
	Anglo American Whiskey Creek
	Keywest Shopping Centre
	Glencore Chrome Kroondal
	Glencore Chrome Rietvly
	Glencore Chrome Boshoek
	Kelvin Power Station
	Potchefstroom Dolomite Risk Project
Groundwater Resource Development and Geophysics	Ganyisa Groundwater Resource Development
	Moretele Groundwater Provision
	Polokwane Groundwater Resource Development
	Majakaneng Water Provision
	Steelpoort Pipeline Geophysical Investigation
	Swaziland Waste Disposal Site Investigation
Environmental Control Officer	Moretele Road Construction Phase 2
	Zululand Anthracite Colliery – Report Approval and Sign-off
Environmental Auditor	Makoya Blinkpan External EMPr Auditor
	Sephaku Cement External Water Use License Auditor
	Ocon Bricks External Water Use License Auditor
	Ocon Bricks External EMPr Auditor
Software Modelling and GIS	Ganyisa Groundwater Resource Development

	Moretele Groundwater Provision
	Polokwane Groundwater Resource Development
	Majakaneng Water Provision
	Steelpoort Pipeline Geophysical Investigation
	Swaziland Waste Disposal Site Investigation

CERTIFICATION

I, **ANDRE BUYS**

Declare that, to the best of my knowledge, all the information contained herein is true.

Signature:____________________

On the_________29______ day of _May____ 2023.

APPENDIX D8: Social Impact Assessment

PROPOSED GROOTVLEI 600MW SOLAR PLANT, BATTERY ENERGY STORAGE SYSTEMS & GRID CONNECTION PROJECT NORTHWEST OF VENTERSDORP, JB MARKS LOCAL MUNICIPALITY, NORTHWEST PROVINCE

Social Impact Assessment Report

May 2023

Prepared for: LTM Green Energies (Pty) Ltd

Title and Approval Page

Project Name:	Proposed Grootvlei 600MW Solar Plant, Battery Energy Storage Systems & Grid Connection Project Northwest of Ventersdorp, JB Marks Local Municipality, Northwest Province
Report Title:	Social Impact Assessment Report
Report Status:	Draft EIA

Client	LTM Green Energies (Pty) Ltd

Prepared By:	Nemai Consulting			
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Report Reference:				R-PRO-REP|20170216

Authorisation	Name	Signature	Date
Author:	Caroline Tanhuke		21 March 2023
Reviewer:	Ciaran Chidley		15 May 2023

Amendments Page

Date:	Nature of Amendment	Amendment Number:
15 May 2023	Draft for public review	0

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List of Abbreviations

AIDS	Acquired immunodeficiency syndrome
BESS	Battery Energy Storage System
CRR	Comments and Response Report
DEA	Department of Environmental Affairs
DFA	Development Facilitation Act (Act 67 of 1995)
DMRE	Department of Mineral Resources and Energy
DWAF	Department of Water Affairs and Forestry
DLM	Ditsobotla Local Municipality
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
GIS	Geographic Information System
HIV	Human Immunodeficiency Virus
IAP	Interested and Affected Party
ILO	International Labour Organisation
IRP	Integrated Resource Plan
ISO	International Organisation for Standardization
km	Kilometre (1 000m)
NDP	National Development Plan
NEMA	National Environmental Management Act (No. 107 of 1998)
JBLM	JB Marks Local Municipality
MW	Mega Watt (one million watts)
OHS	Occupational Health and Safety
PAJA	Promotion of Administrative Justice Act ((PAJA) Act 3 of 2000)
PV	Photovoltaic
SIA	Social Impact Assessment
STI/STD	Sexually Transmitted Infections / Sexually Transmitted Disease

1 INTRODUCTION

The team of Caroline Tanhuke and Ciaran Chidley of Nemai Consulting have been appointed to undertake the Social Impact Assessment (SIA) as part of the environmental authorisation process for the proposed 600MW Grootvlei Solar Photovoltaic Project.

This solar PV generator aims to provide 600MW of electricity to the electrical grid. The project is being prepared for submission to bid for the current and future Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) bid windows and/or other renewable energy markets within South Africa. The proposed project is located to the west of the town of Ventersdorp in the eastern North-West Province.

One of the specialist studies required by the Environmental Impact Assessment (EIA) is a Social Impact Assessment. This report fulfils the requirements of the Social Impact Assessment, and its recommendations will be included into the EIA.

1.1 Terms of Reference

The terms of reference for the study are as follows:

- Describe the social baseline conditions that may be affected by the project;
- Describe the approach proposed for assessing the potentially significant issues that should be addressed by the SIA during the EIA phase;
- Determine the specific local social impacts of the project;
- Identify the potential social issues associated with the project;
- Suggest suitable mitigation measures to address the identified impacts; and
- Make recommendations on preferred options from a social perspective.

1.2 Structure of the report

The remainder of the report is structured as follows:

Section 2: Project Description – This section provides an introduction and motivation to the project. It includes a description of the study area.

Section 3: Legislation – A description of the statutory and regulatory requirements that informed this report.

Section 4: Definition of the Study Area – Defines the studies areas for the SIA.

Section 5: Methodology – Outlines the methodology used to determine the social impacts of the proposed project.

Section 6: Status Quo Analysis – A desktop analysis of the baseline situation in the regional study area.

Section 7: Local Study Area Overview – Provides an analysis of the social aspects of the local study area. The section includes a discussion on the findings that resulted from community engagement, site visits and stakeholder participation.

Section 8: Identification of Impacts - Aspects and Impacts – The identification of the project activities and an investigation into what aspects of these activities will result in social impacts.

Section 9: Analysis of Alternatives – Decision making with regards the preferred project alternatives from a social perspective.

1.2 Specialists' Details

This report is written by Caroline Tanhuke and Ciaran Chidley. Ciaran Chidley obtained bachelor's degrees in civil engineering, economics and philosophy, and holds a Master of Business Administration. His experience over the past 26 years includes economic and social assessments for a wide variety of linear and site-based infrastructure and industrial projects. Caroline Tanhuke holds a B.A Environmental Management (Geography) Degree and has three years of experience. Her experience in assessing social impacts of infrastructure projects include renewable energy infrastructure, powerlines and pipelines. She has conducted social facilitation projects throughout South Africa.

1.3 Specialist Declaration

Nemai Consulting operates as an independent consultant conducting environmental impact assessments and associated specialists' studies. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget).

2 PROJECT DESCRIPTION

Electricity demand is increasing in South Africa, and to match that demand there is a need to supply a diversified power generation that includes renewable energy technologies. These technologies include solar, wind, small utility scale hydro, biomass, biogas and energy storage that the Department of Mineral Resources and Energy intends to develop and implement as identified in the approved Integrated Resource Plan (IRP) 2019.

To this end the proponent has proposed the subject of this report, a solar photovoltaic generation facility.

2.1 Project Locality

The Project is located approximately twenty kilometers to the northwest of Ventersdorp central business district (CBD) and falls within Ward 34 of the JB Marks Local Municipality (JBMLM), in the Northwest Province. Option 1 of the transmission line falls within Ward 17 of the Ditsobotla Local Municipality.

The project area is considered to have favorable solar irradiation levels of 263.37 ± 7.13 Wm^2 which makes it ideal to generate solar energy using PV Panels (World bank, 2019). The site is accessible off the N14, followed by the R53 to the site gate. The R53 is a gravel road.

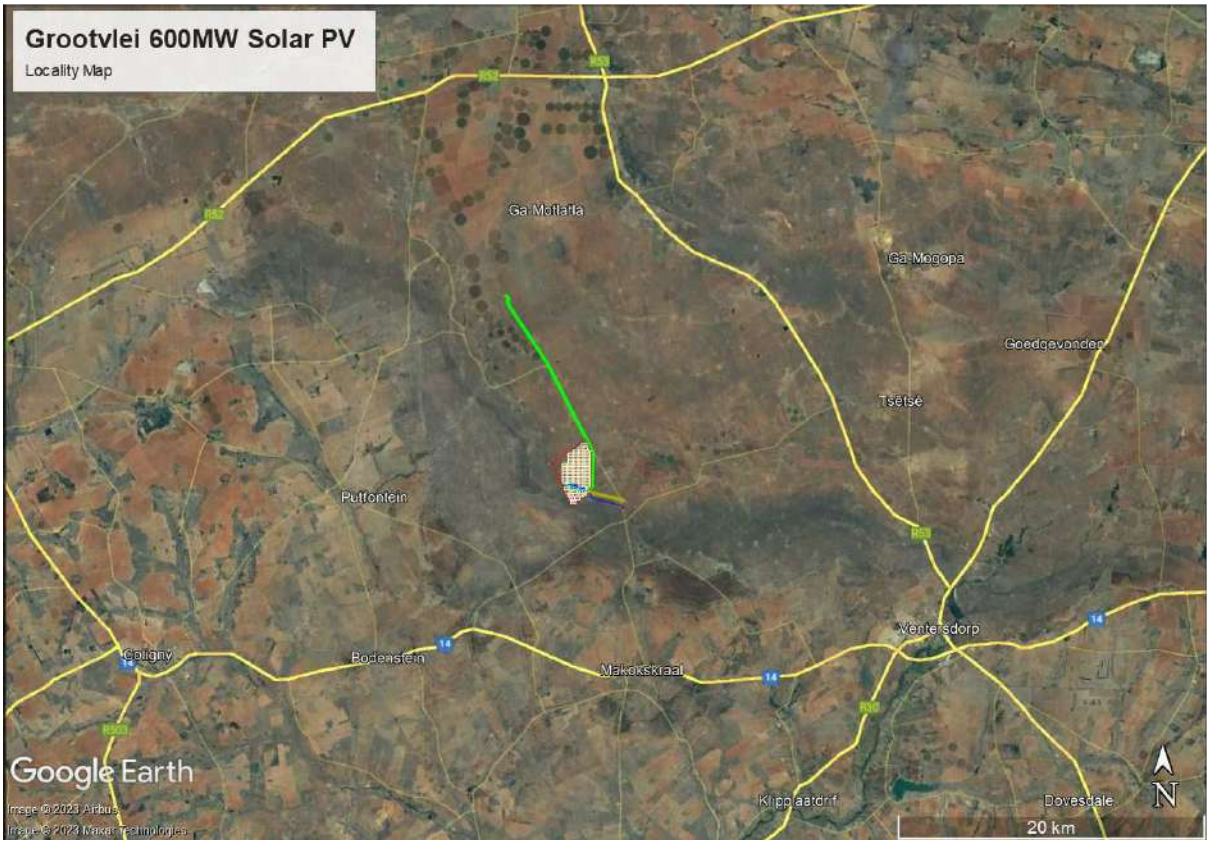


Figure 1: Grootvlei Solar Locality

The details of the affected properties are provided in **Table 2** below.

Table 1:Details of the affected properties

Farm Details	21-digit Surveyor General No.
Solar Plant	
Portion number 0 of the farm Grootvlei 161 IP	T0IP00000000016100000
New Main Transmission Substation	
Portion number 1 of the Farm Houtkop 152	T0IP00000000015200001
Powerline Route Option 1	
Portion number 1 of the Farm Houtkop 152	T0IP00000000015200001

Farm Details	21-digit Surveyor General No.
Portion number 9 of the Farm Houtkop 152	T0IP00000000015200009
Portion number 11 of the Farm Houtkop 152	T0IP00000000015200011
Portion number 12 of the Farm Houtkop 152	T0IP00000000015200012
Portion number 3 of the Farm Vogelstruispan 151	T0IP00000000015100003
Portion number 4 of the Farm Vogelstruispan 151	T0IP00000000015100004
Portion number 7 of the Farm Vogelstruispan 151	T0IP00000000015100007
Portion number 0 of the Farm Lucky Find 158	T0IP00000000015800000
Portion number 0 of the farm Grootvlei 161 IP	T0IP00000000016100000
Powerline Route Option 2	
Portion number 0 of the farm Grootvlei 161 IP	T0IP00000000016100000
Portion RE of the Farm Beta 159 IP	T0IP00000000015900000
Portion 0 of the Farm Boschkop	T0IP00000000016090000

2.2 Project Components

LTM Green Energies (Pty) Ltd has proposed the development of Grootvlei 600MW Solar Plant, Battery Energy Storage Systems (BESS) and Grid Connection in the Northwest of Ventersdorp. The property earmarked for the Solar Project covers a combined area of approximately 655 hectares (ha).

LTM Green Energies intends to bid for the current and future Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) bid windows and/or other renewable energy markets within south Africa, in compliance with the National Energy Act was promulgated in 2008 (Act 34 of 2008)

The solar energy functions by the conversion of solar energy into electricity. The generation of electricity using solar energy is a non-consumptive use of a natural resource that requires no fuel for continued operation. In comparison to typical coal-fired power plants, solar energy creates a negligible amount of greenhouse gases during its existence. And in the operational phase of solar power, it does not emit carbon dioxide, sulphur dioxide, or any other kind of air-pollution.

Photovoltaic technology produces direct current which is then converted to alternating current via power electronic inverters. Figure 2 below provides an overview of a typical Solar PV Power Plant project.

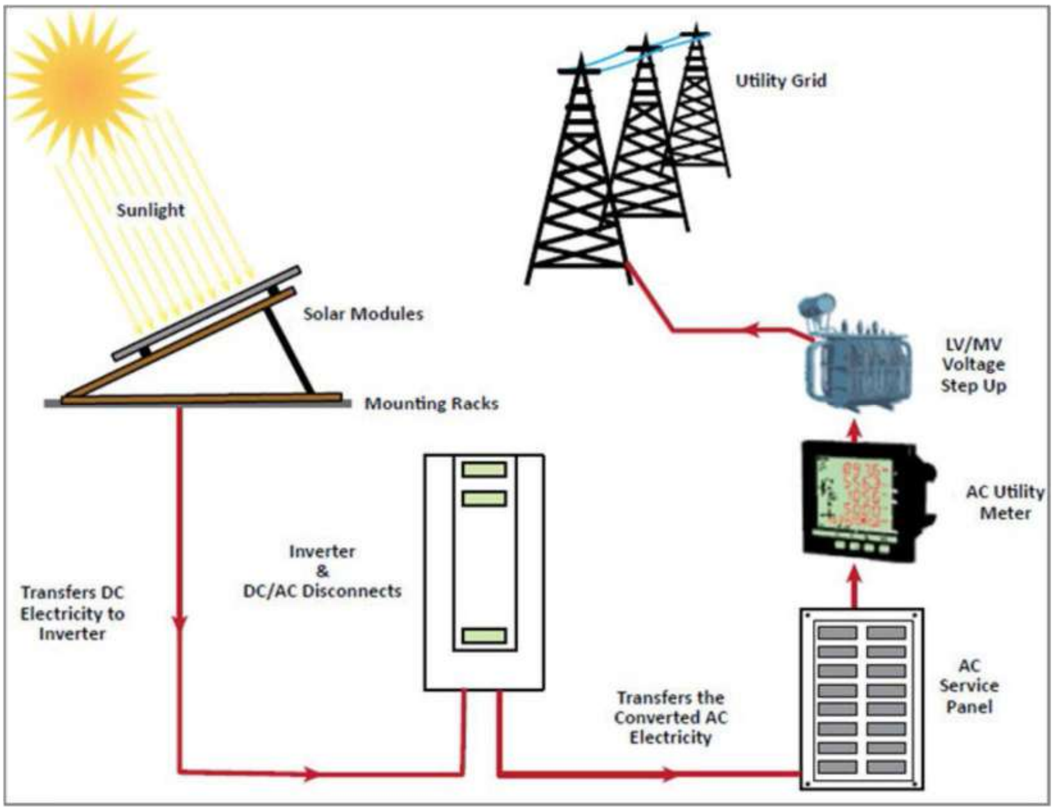


Figure 2:Overview of the solar power plant

(Source: International Finance Corporation, 2015. Utility-Scale Solar Photovoltaic Power Plants)

Energy is harvested from the solar modules, which are angled toward the sun using mounting racks. The energy harvested is in the form of direct electrical current, which is processed through the inverters to convert this electrical power into alternating electrical current which can be used by the national electrical system. The alternating current is transferred via the facility substation onto the national grid.

The proposed Grootvlei 600MW Solar Plant consists of the following systems; sub-systems or components (amongst others):

- 600MW PV solar panels or modules (arranged in arrays);
- Mounting structures to support the PV panels;
- DC-AC current inverters stations, transformers, and internal electrical reticulation (underground cabling);
- Grid Connection: Option 1 which consists of 2 x 132kV powerlines, approximately 14km kilometres (km) in length, from the new facility 33kV substation to new 400/132kV Main. Transmission Substation (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line or Option 2 that comprises of 2.8km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation.
- New 400/132kV Main Transmission Substation
- On site switching station/substation.
- Administration Buildings (Offices);
- Workshop areas for maintenance and storage.
- Temporary laydown areas.

- Internal access roads and perimeter fencing of the footprint area.
- Lithium-ion battery energy storage system (BESS);
- Security Infrastructure; and
- Site access from unnamed gravel road via the N14 and/or R53

The electricity generated by the proposed development will be transmitted through one of two options, described as follows:

- Option 1: Consists of 2 x 132kV powerlines, approximately 14km kilometres (km) in length, from the new facility 33kV substation to new 400/132kV Main Transmission Substation (MTS) to Loop In-Loop Out (LILO) of the Pluto – Watershed 275kV power line; or
- Option 2: Comprises of 2.8km 132 kV line from the new facility 33kV substation facility 33kV substation to the Makokskraal Substation.

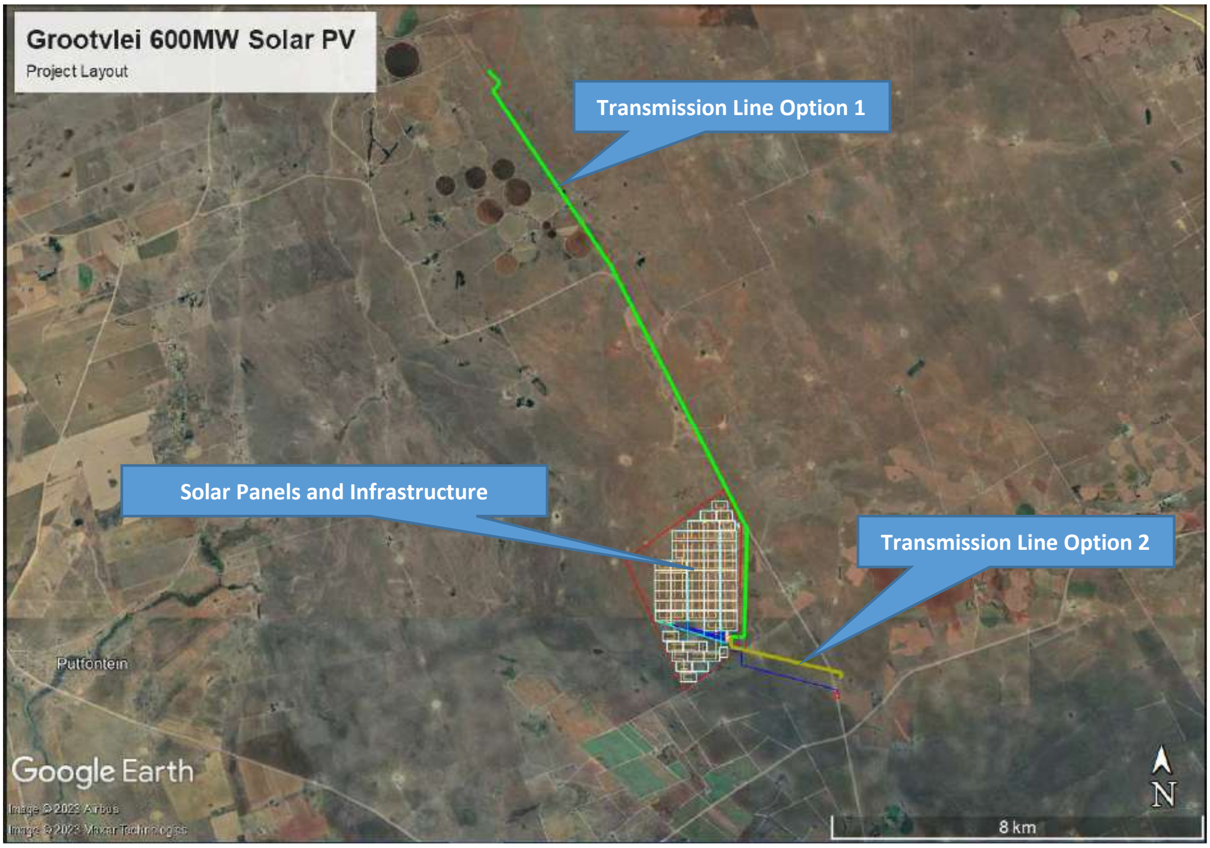


Figure 3: Grootvlei Solar Layout

The proposed Solar PV Projects have a design life of a minimum of 25 years. The extension of the life of the plant will be considered when assessing the plant's economic viability to remain operational after its end of life.

2.3 Social Stimulus

Solar PV creates several social impacts which are created at different stage of the value chain. The value chain can be conceptualised as being during the following events (IRENA and CEM, 2014):

- Project planning – consulting work conducted by specialists;
- Manufacturing – raw material sourcing and component manufacture and assembly. Component manufacturing covers the solar modules, transformers, inverters, electrical cabling, combiner boxes and module support structures;
- Installation – a labour intensive process involving civil engineering contractors, module installation and electrical engineering contractors;
- Grid Connection – carried out by specialised electrical engineering contractors. This work allows the solar park to contribute to the national grid, thereby contributing to stabilising supply of electricity;
- Operations and Maintenance – a long-term activity requiring regular plant monitoring, equipment inspections and repair services; and
- De-commissioning – plant at the ned of their lifespan require activities such as recycling the modules and disposal or reselling of components.

The potential for creating value within the regional study area and into the broader North West economy is depends on the level of development of the renewable energy sector. The major cost items for a solar park are the modules, the transformers, and the inverters – these will be imported items. The cabling and electrical systems can be manufactured in South Africa. The economic value created through installation and grid connection can be created within South Africa, with much of the labour and semi-skilled workers being available within the regional study area.

As South Africa's level of development in the renewable energy field increases, so the value captured within the country will increase all along the value chain.

2.3.1 Job Creation

The number of direct and indirect jobs created for the construction phase was estimated in 2007 as being 69.1 per MW installed, and 0.73 / MW installed during the operations and maintenance phase (IRENA and CEM, 2014). The definition of "jobs" in this case would be work opportunities of any duration above one month. For the proposed project, this yields total values of 22 803 during construction, and 241 during operations and maintenance. These jobs are not all created on the construction site, they are distributed throughout the value chains of these two phases, at different parts of the country where the value is being created.

The Independent Power Producers programme, managed by the Department of Energy has local content requirements and targets for the bid windows. Some of these targets are:

- Job creation for SA citizens – a minimum of 50% and a target of 80%; and
- Local content for SA manufactures – a minimum of 45% and a target of 65%, the minimum has been increased by 10% from bid window 2.

The proportion of employment from local communities for all renewable energy projects have been reported (Department of Energy, 2019). The Department of Energy reports that of the 33 019 job years created for the entire renewable energy procurement programme, 18 253 job years were attributable to people from the local community – this is a proportion of 55%. This proportion can be attributed to the proposed project. The Department of Energy also cites figures that 8% of employment was female and 41% was from the youth category (Department of Energy, 2019). These proportions can also be attributable to the project.

An estimate of the number of direct job years to be created by the proposed project can be derived from the Department of Energy Report using the figures to date for the Limpopo Province. A provincial breakdown is provided for 3 projects (all completed) which all use Solar PV technology. It was reported that 118MW of energy was generated, creating 1 240 job years to date (which included all the construction jobs) and estimated at 2 917 job years over the 20-year life of the projects (Department of Energy, 2019). Applying these proportions to the proposed project yields the total job years of 11 626, made up of 8 158 job years for operations and maintenance and a construction phase job phase year estimate of 3 468. No estimate has been made for the Battery Energy Storage portion of the project since no data is available to make an estimate.

The table below summarises the job creation estimates for the proposed project. Readers should bear in mind the various sources for this information, the assumptions made and the dates of the data – together these factors combine to set the degree of accuracy for these estimates at 20%.

Table 2: Job Creation Estimate

Description	Total No.	Local No.
Total Jobs Created (durations above one month)	41 898	23 044
Planning and Construction Phase	41 460	22 803
Operation and Maintenance Phase, 20 years	438	241

Table 3: Estimated Job Years Created

Description	Total No.	Local No.
Total Job Years Created	21 137	11 626
Planning and Construction Phase	6 305	3 468
Operation and Maintenance Phase, 20 years	14 832	8 158

2.3.2 Economic Value Creation

The contribution of the project to South Africa's Gross Domestic Product (GDP) can be estimated from published literature. A Department of Energy report using the figures for renewable project delivery to date for the Limpopo Province provides an indication. A provincial breakdown is provided for 3 projects (all completed) which all use Solar PV technology. It was reported that 118MW of energy was generated, creating R3.6 billion in GDP contribution (Department of Energy, 2019). Applying this proportion to the proposed project yields a total GDP contribution of R7.3 billion. This captured the total impact of the project on the nation's economy, both through direct and indirect spending.

The local content for Solar PV projects has varied over the four bid windows. Bid window 1 achieved 50% local content, bid window 2 achieved 52%, bid window 3 achieved 55% and bid window 4 achieved 75% (Department of Energy, 2019). This increasing trend demonstrates the possible impact that the proposed project could have on the South African value chain. To date, the average local content spend for PV projects in South Africa has been R46.5 billion versus a comparable total project value of R90.3 billion – a percentage of 51%.

If this value is applied to the proposed project value of R18.3 billion, a local value chain addition of R9.3 billion can be estimated. The proportion of value attributable to the regional study could not be estimated and figures from the literature are not available.

3 RELEVANT LEGISLATION, STANDARDS AND GUIDELINES

Legislation, policy, plans and strategy provide an important framework and governance of the SIA. This section provides a summary of the prevailing acts, policies, plans and strategy which were considered by this study.

3.1 The Constitution of South Africa (Act 7 of 1996)

The Constitution emphasizes human rights with the intention of establishing a society based on democratic values; social justice and fundamental human rights. Furthermore, The Constitution recognizes the general need to improve the quality of life of all citizens. These constitutional rights can be used to support reasonable environmental demands. Other fundamental rights in the Constitution which support environmental demands include:

- The right to life (Section 11).
- The right to human dignity (Section 10).
- The right to privacy (Section 14).
- Certain socio-economic rights.

Socio-economic rights relevant to environmental rights:

- The right of access to adequate housing (Section 26).
- The right of access to sufficient food and water (Section 27).
- The right of access to health care services (Section 27).
- The rights of children to basic nutrition and shelter, and to be protected from maltreatment; neglect; abuse or degradation (Section 28).

3.2 National Development Plan (2011)

The National Development Plan (NDP) of 2010 proposes to “invigorate and expand economic opportunity through infrastructure, more innovation, private investment and entrepreneurialism.

The Plan aims to ensure that all South Africans attain a decent standard of living through the elimination of poverty and reduction of inequality. The core elements of a decent standard of living identified in the Plan are:

- Housing, water, electricity and sanitation;
- Safe and reliable public transport;
- Quality education and skills development;
- Safety and security;
- Quality health care;
- Social protection;
- Employment;
- Recreation and leisure;
- Clean environment; and
- Adequate nutrition.

3.3 National Energy Act (Act 34 of 2008)

The National Energy Act was promulgated in 2008 (Act 34 of 2008); and one of the key objectives of the Act was to promote diversity in the supply of energy and its sources. The development of a National Integrated Energy Plan (IEP) was envisaged in the White Paper on the Energy Policy of the Republic of South Africa of 1998 and; in terms of the National Energy Act, 2008 (Act No. 34 of 2008), the Minister of Energy is mandated to develop and; on an annual basis; review and publish the IEP in the Government Gazette. The purpose of the IEP is to provide a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development.

The IEP notes that South Africa needs to grow its energy supply to support economic expansion and in so doing, alleviate supply constriction and supply-demand deficits. In addition, it is essential that all citizens are provided with clean and modern forms of energy at an affordable price. As part of the Integrated Energy Planning process; eight key objectives were identified; namely:

- Objective 1: Ensure security of supply.
- Objective 2: Minimize the cost of energy;
- Objective 3: Promote the creation of jobs and localization.
- Objective 4: Minimize negative environmental impacts from the energy sector.
- Objective 5: Promote the conservation of water.
- Objective 6: Diversify supply sources and primary sources of energy;
- Objective 7: Promote energy efficiency in the economy; and
- Objective 8: Increase access to modern energy.

3.4 National Environmental Management Act (Act 107 of 1998)

The National Environmental Management Act (NEMA) and the principles contained therein have a significant influence on the need to identify and assess social impacts. The NEMA principles are based on the basic rights as set out in Chapter 2 (Bill of Rights) of the Constitution as referred to above.

According to Barber (2007:16) the following NEMA principles have an important impact on social issues:

- Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably;
- Development must be socially, environmentally and economically sustainable;
- Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must consider the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option;
- Environmental justice must be pursued so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons;
- Equitable access to environmental resources, benefits and services to meet basic human needs and ensure human well-being must be pursued and special measures may be taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination;
- The participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured;
- Decisions must consider the interests, needs and values of all interested and affected parties, and this includes recognising all forms of knowledge, including traditional and ordinary knowledge;
- Community well-being and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means;
- The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in light of such consideration and assessment;
- The right of workers to refuse work that is harmful to human health or the environment and to be informed of dangers must be respected and protected;
- Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law;
- The environment is held in public trust for the people. The beneficial use of environmental resources must serve the public interest and the environment must be protected as the peoples' common heritage; and
- The vital role of women and youth in environmental management and development must be recognised and their full participation therein must be promoted.

3.5 Guideline for Involving Social Assessment Specialists in EIA Processes (Barbour, 2007)

These guidelines direct the role of social assessment specialists in the Environmental Impact Assessment (EIA) process within the South African context.

3.6 Social Impact Assessment: Guidance document (2015) (Vanclay, Esteves, Aucamp, & Franks, 2015)

This document encapsulates the core values of the international SIA community providing a set of principles to guide SIA practitioners in incorporating the social element into environmental impact assessments.

3.7 International Labour Organisation

A guide on gender issues in employment and labour market policies: working towards women's economic empowerment and gender equality.

"The objective of this resource guide is to strengthen the capacities of International Labour Organisation (ILO) constituents and development policy makers in the formulation of employment policies. There is a well-known proclivity among many policymakers and practitioners to treat employment as a "residual" of economic growth" (Otobe, 2014).

3.8 International Organisation for Standardization, ISO 14001:2004

The International Organisation for Standardization (ISO) is used for identifying impacts. The ISO 14001: 2004 – Environmental Management Systems definitions for aspect, activity and impact are used in keeping with best practice.

ISO 14001:2004 specifies requirements for an environmental management system to enable an organization to develop and implement a policy and objectives and information about significant environmental aspects. It applies to those environmental aspects that the organization identifies as those which it can control and those which it can influence.

4 DEFINITION OF THE STUDY AREA

A study area is defined by the International Finance Corporation (IFC) as "an area that is likely to experience impacts from, or exert influence over, the Project or activity being evaluated" (IFC World Bank, 2012). For the purposes of this study, a study area that conforms to existing administrative boundaries, has been identified.

Three study areas have been delineated for the purposes of analysing the project and its social impacts: a regional study area which comprises the affected local municipality; and a local study area which is the Ward in which the project is located, and a direct study area which is the site's close neighbours upon which the project will be located. For the purposes of the study, five kilometres from the site has been selected as the direct study area, using the centre of the solar park as the centre of the five-kilometre circle.

4.1 Regional Study Area

The regional study area is the JB Marks and the Ditsobotla Local Municipalities within the Northwest Province. The regional study will experience the highest effects of the stimulus created by the project, in terms of economic development, inwards migration of workers and multiplier effects in the economy due to the proximity of the project footprint. Figure 4 shows the regional study area of Grootvlei Solar PV project.

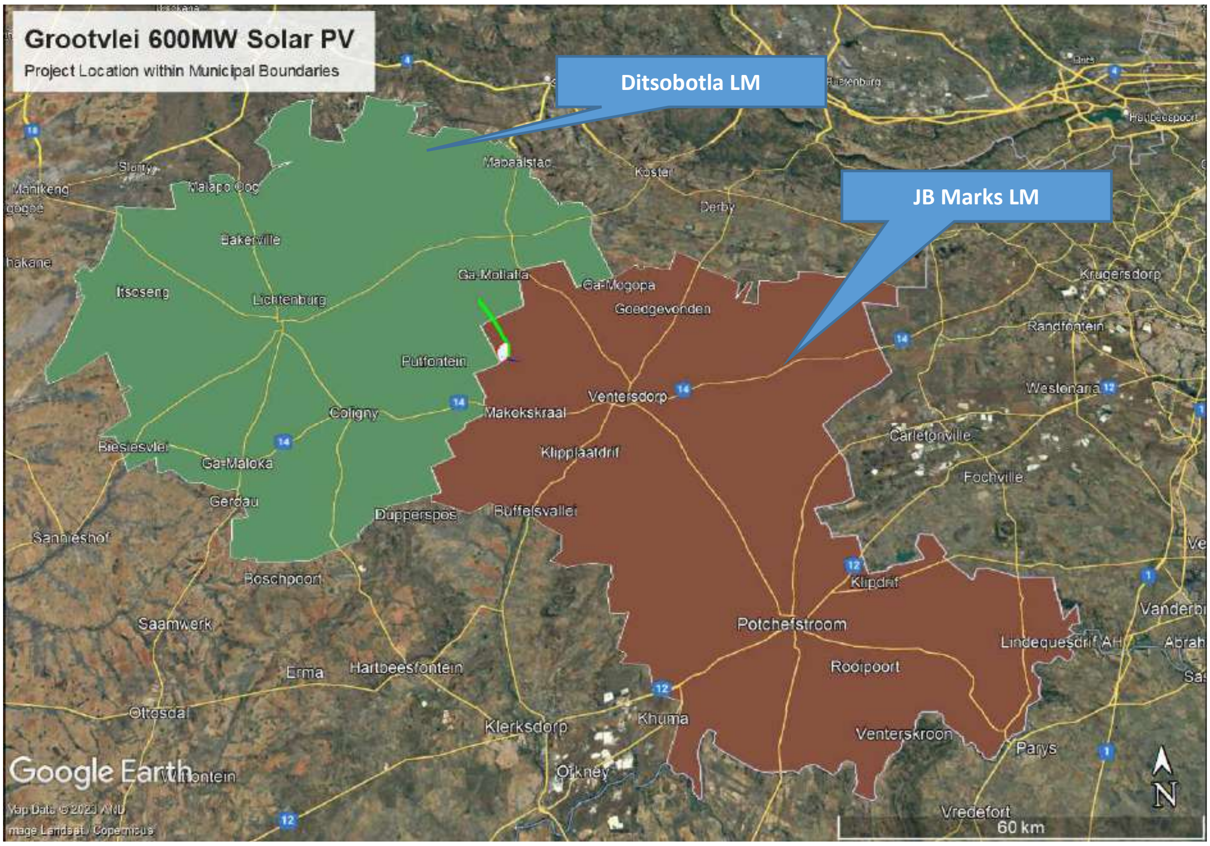


Figure 4: Grootvlei Solar in the Municipality Context

The location of the site is such that the labor sending area for the project are likely to Coligny, Lichtenburg, and Ga-Motlatla, both in Ditsobotla Local Municipality and Ventersdorp and Makokskraal in the JB Marks Local Municipality. The economic impacts will be felt in both local municipalities.

4.2 Local Study Area

The local study area is Ward 34 of the JB Marks Local Municipality and Ward 17 of the Ditsobolta Local Municipality, as shown in Figure 5 below.

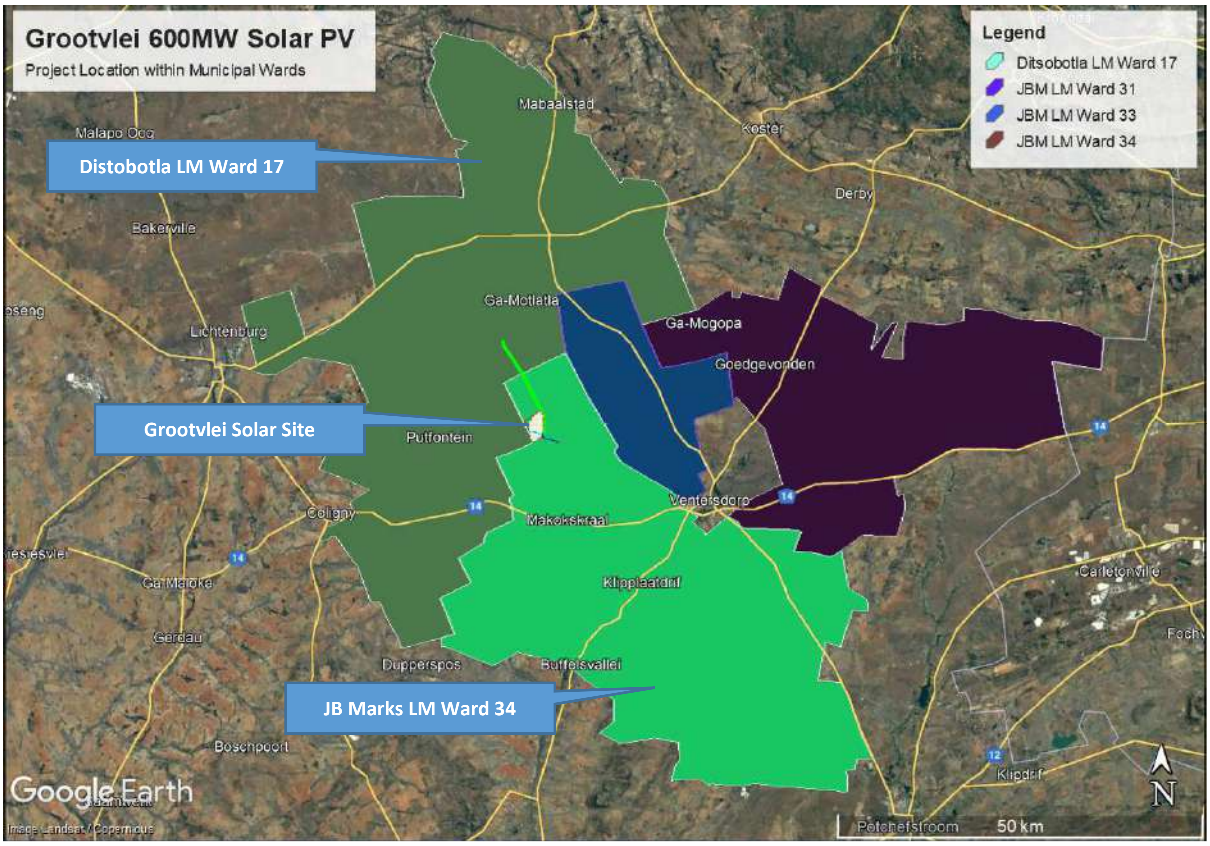


Figure 5: Grootvlei Solar PV in Ward 34

4.3 Direct Study Area

The direct study area is the area immediately adjacent to the project. This study area is shown in the Google Earth map below.

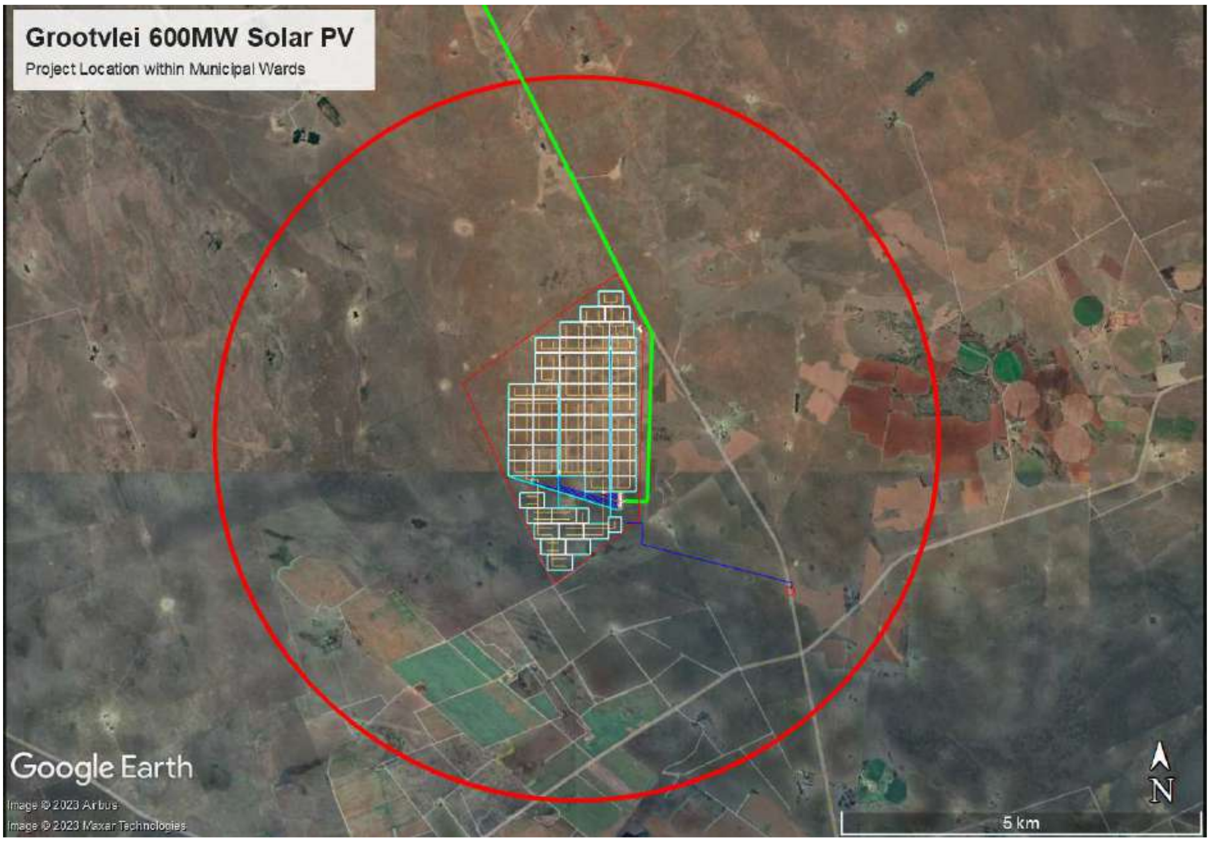


Figure 6: Grootvlei Solar Direct Study Area

The direct study area was used for the possible impactor assessment carried out using Google Earth and documented in Appendix One of this report. The radius of the direct study area was used as a guide when compiling social receptors, with local features being decisive as to whether they were selected as part of the analysis. This assessment provided information as to the possible social receptors for the project.

5 METHODOLOGY

The information presented in this report was obtained through the following data collection methods.

5.1 Sourcing of Information and Data Analysis

The Socio-Economic Impact Assessment sets out the socio-economic baseline of the study area; predicts social and economic impacts and makes recommendations for mitigation of negative social and economic impacts and measures which can be taken to enhance the positive social and economic impacts.

The baseline study is based on both primary and secondary data. Primary data was collected directly from engagements with community members, landowners and business owners. Secondary data was accessed through South African economic and social databases. Articles and internet searches were also used and are referenced in the text and in the reference sections of this report.

The profile of the baseline conditions includes describing the current status quo of the community; including information on several social and economic issues such as:

- Demographic data.
- Socio-economic factors such as income and population data.
- Access to services.
- Institutional environment.
- Social Organization (Institutional Context); and
- Statutory and Regulatory Environment.

5.2 Primary Data

5.2.1 Public Participation

The Public Participation Process granted Interested and Affected Persons an opportunity to comment on the project during the Scoping and EIA phase. Comments and responses used during this process have formed one of the bases of the analysis of the socio-economic impacts considered in this report.

Further primary data was collected for the purposes of the study; these were collected using the following approaches:

- Rapid Rural Assessment: A survey was conducted to capture visual observations on the social dynamics, community proceedings, community resources and infrastructure.
- Stakeholder Consultations: Consultations with the affected communities carried out by members of the project team along each project component to discuss the proposed project and to gather their concerns and feedback on the project; and
- Key Informant Interviews: Informal discussions with the IAP's to help inform the baseline were conducted during site visits and as well as during the scoping phase. These included community members and authority members.

5.3 Secondary Data

An assessment of the EIA and Scoping phase was conducted to provide an understanding of the project detail, location, and possible impacts.

The required information was collected using different sources, these included Statistics South Africa Census data as well as a review of relevant municipal, district and other literature. The discussion of the demographics and the development profile of the study area is carried out using Census 2011 data produced by Statistics South Africa. The Census 2011 data is the most comprehensive dataset available for the subject areas, and it is currently the best data at hand. Where possible, information from the Community Survey 2016 was included in the analysis. The ward and municipal data have been extracted using the project Geographic Information System, and the data for the affected areas will be presented in tables and figures throughout the report.

5.4 Geographic Information System

A Geographic Information System (GIS) was used to conduct an analysis of the area. The use of GIS brings together the demographic and socio-economic data to enable a thorough analysis of the project area.

5.5 Impact Assessment

The determined impacts are clustered around a common-issue and are assessed before and after mitigation. The identification of the socio-economic impacts associated with the project is issues-based, with the main headings referring to a common theme addressing several related impacts. Under each of these issues, the specific impacts and potential mitigation strategies are discussed for pre-construction, construction, operation and decommissioning phases.

5.6 Assumptions and Limitations

The following assumptions and limitations underlie this socio-economic impact assessment:

- The information obtained during the public participation phase provides a comprehensive account for the community structure and community concerns for the project.
- The study was done with the information and the time frames available to the specialist at the time of executing the study. The specialist took an evidence-based approach in the compilation of this report and did not intentionally exclude information which is relevant to the assessment; and
- No relocation of families will take place for this project.

6 STATUS QUO ANALYSIS

This section has been compiled from research of the regional study area Integrated Development Plan, Statistics South Africa and Wazi Map have also been used as a resource for the statistical information. The following section presents the socio-economic profile of the study areas.

6.1 Project Locality Context

The Northwest Province consists of four districts namely Bojanaia, Ngaka Modiri Molema, Dr Ruth Segomotsi Mompati and Dr Kenneth Kaunda District Municipalities. There are a total of eighteen local municipalities in these four districts. The province had a total population of 3 509 553 in 2011 and a total population of approximately 3 748 435 in the 2016 Community Survey. The most populated district is the Bojanala District Municipality and the most populated local municipality in Northwest province is the Mafikeng Municipality.

Dr Kenneth Kaunda District Municipality has the third largest population at approximately 695 933 people in 2011 (19.8% of the Northwest province population), and 742 821 in 2016 (19.8%). The Dr Kenneth Kaunda District is made up of three Local Municipalities namely City of Matlosana, Maquassi Hills and Ventersdorp/Tlokwe. The latter was amalgamated into JB Marks Municipality. The municipality is the largest in the district and covers almost half of the Dr Kenneth Kaunda District's geographic area, some 6 398 square kilometers. The municipality was formed by combining the populations of 56 702 from the Ventersdorp Local Municipality with the 162 7621 people from the Tlokwe Local Municipality, to form a single municipality (NW IDP, 2020).

Ngaka Modiri Molema District Municipality has the second largest population at approximately 842 699 people in 2011 (23% of the Northwest province population), and 889 108 in 2016 (24%). The Ngaka Modiri Molema District is made up of five local municipalities namely the Ratlou, Tswaing, Mafikeng, Ditsobotla, and Ramotshere Moiloa Local Municipalities (NW IDP, 2020).

6.2 JB Marks Local Municipality

The JB Marks Local Municipality is rural and agricultural area, with large urban nodes. The large urban nodes within the municipality are Potchefstroom and Ventersdorp. Smaller nodes include Goedgevonden, Makokskraal, Klippatdrif, Buffelsvlei, Dovesdale, Niemeer, and Klipdrft.

Two national roads traverse municipality: the N12 route to the south of the municipality that connects Johannesburg and Cape Town via the city of Kimberley; and the N14 which connects Johannesburg with the western half of South Africa. The main railway route from Gauteng to the northern and western cape runs through Potchefstroom. (NW IDP, 2020).

6.3 Ditsobotla Local Municipality

The Ditsobotla Local Municipality is a predominantly rural and agricultural area. The largest twon in the municipality is Lichtenburg, which is the main economic service area for the agricultural activities in the municipality. Smaller nodes in the municipality, and in close proximity to the project area are: Coligny, Bodenstein and Putfontein.

The N14 traverses the municipality as it continues towards the west coast of South Africa. (NW IDP, 2020).

6.4 Demographics

The population of the JB Marks Local Municipality has increased from 219 463 to 243 527 between 2011 and 2016, with an annual growth rate of 2.2%. The population of the Ditsobotla Local Municipality has increased from 166 951 to 181 8651 between 2011 and 2016, with an annual growth rate of 1.8%.

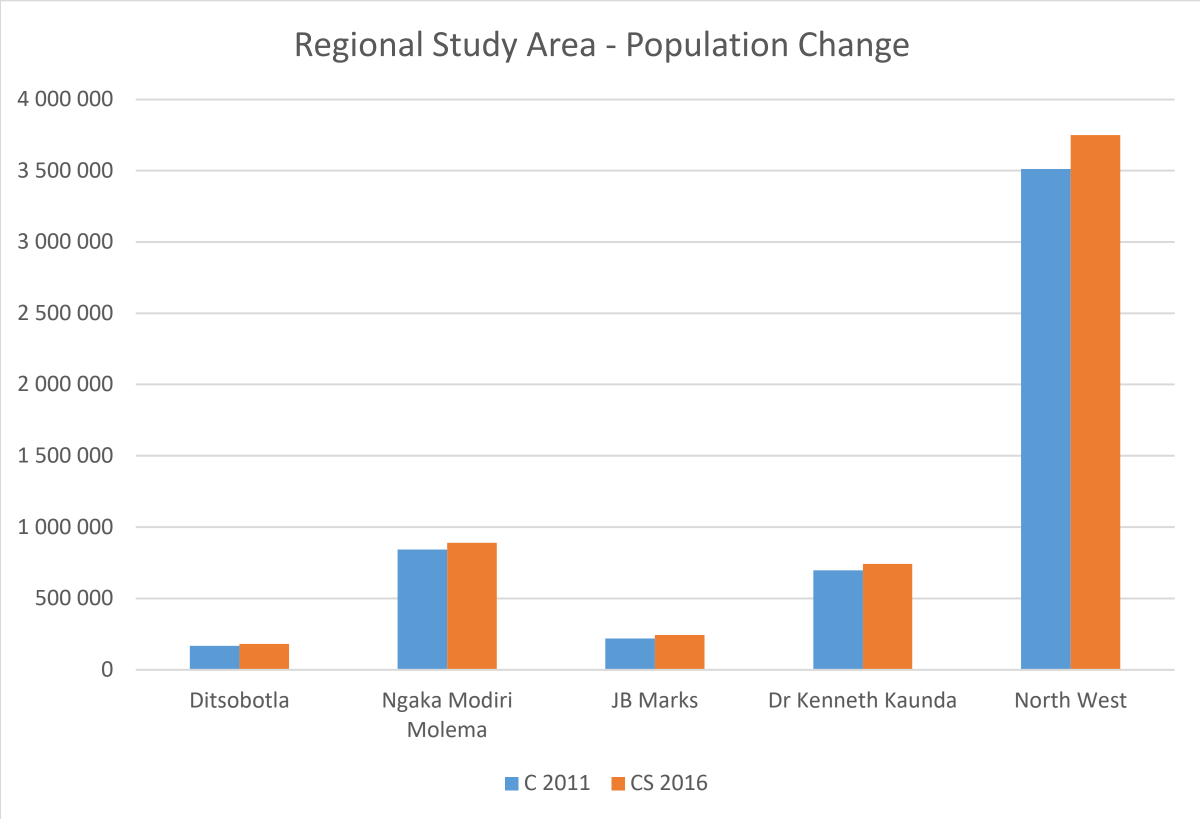


Figure 7: Regional Study Area Population

The population growth rate for the Distobotla Local Municipaliy, at 1.8% is greater than the growth rate for the district, at 1.1%, indicating that the municipality is relatively more attractive to residents than the district. The same trend is displayed in the case of the JB Marks Local Municipality, which has a population growth rate almost double that of the Dr Kenneth Kaunda District Municipality. Both growth rates are above that of the 1.5% annual population growth rate of South Africa (Community Survey 2016).

The age breakdown of the regional study area contains the data provided in Table 4 below.

Table 4: Regional Study Area Age Breakdown

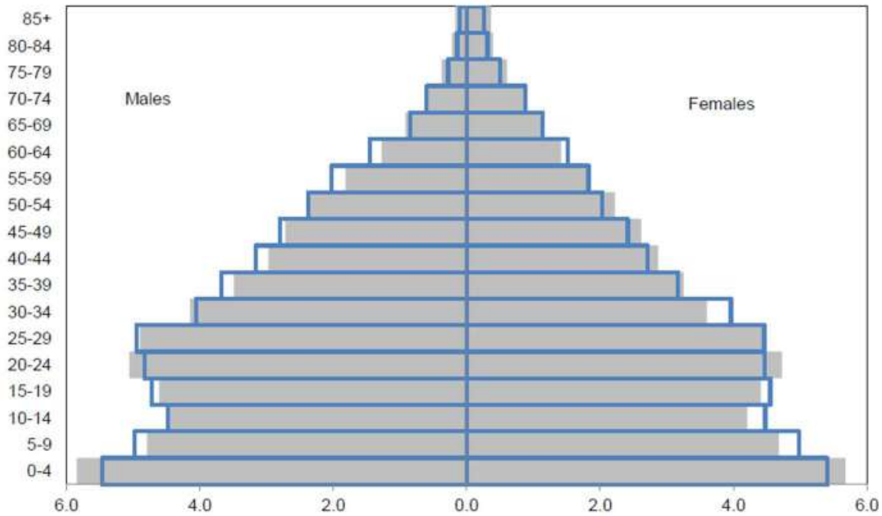
Administrative Area	Total	> 14 years old	15 to 60 years old	> 60 years old
Ditsobotla	181 865	49 043	118 592	14 230
		27%	65%	8%
Ngaka Modiri Molema	889 108	240 142	575 665	73 302
		27%	65%	8%
JB Marks	243 528	68 724	155 361	19 442
		28%	64%	8%
Dr Kenneth Kaunda	742 821	217 947	466 499	58 375
		29%	63%	8%
North West	3 748 435	1 116 352	2 331 259	300 825

Administrative Area	Total	> 14 years old	15 to 60 years old	> 60 years old
		30%	62%	8%

Source: Statistics SA: Community Survey 2016

The population structure shows that the younger cohort contribute more to the overall population numbers than the older cohort. This statistic indicates that the area is at a stage of higher birth rates and high death rates, indicative of a less developed economy.

A population pyramid of the Northwest Province demonstrates this trend more clearly. The pyramid resembles that for South Africa, with evidence of the start of a widening at the middle age groups. This feature shows that the province (and the country) is undergoing a transition towards increased development. There is no evidence in these figures of an exodus of adults of working age from the regional study area. The indications are that people remain in the regional study area, rather than leave to seek work in more economically active areas.



6.5 Household Dynamics

The Community Survey recorded 134 651 households in 2016 for both municipalities. The average household size was 3.1. The equivalent number of households enumerated during Census 2011 was 110 983, an increase of 4.3 annual. To achieve this despite a slower population growth rate, the average household size dropped from 3.5 in 2011. This indicates that households are being formed by younger household heads, with families not living together as much as in the past.

Table 5: Regional Study Area Household Formation

Administrative Area	C 2011		CS 2016	
	Households	Size	Households	Size
Ditsobotla	43 885	3.8	54 154	3.4
Ngaka Modiri Molema	227 001	3.7	269 977	3.3
JB Marks	67 098	3.3	80 572	3.0
Dr Kenneth Kaunda	80 572	3	240 543	3.1
North West	1 061 998	3.3	1 248 766	3.0

Eighty percent of the population of the regional study area live in formal housing. The next largest housing type is informal dwellings, with 16% of the JB Marks Local Municipality living in informal dwellings. It was observed that most of the informal dwellings are in the Potchefstroom area, and not near the project area of Ventersburg. Ten percent of the residents of the Ditsobotla Local Municipality live in informal dwellings. The figures for informal housing are lower than the general level prevalence of informal housing in the Northwest Province, which standards at 18%.

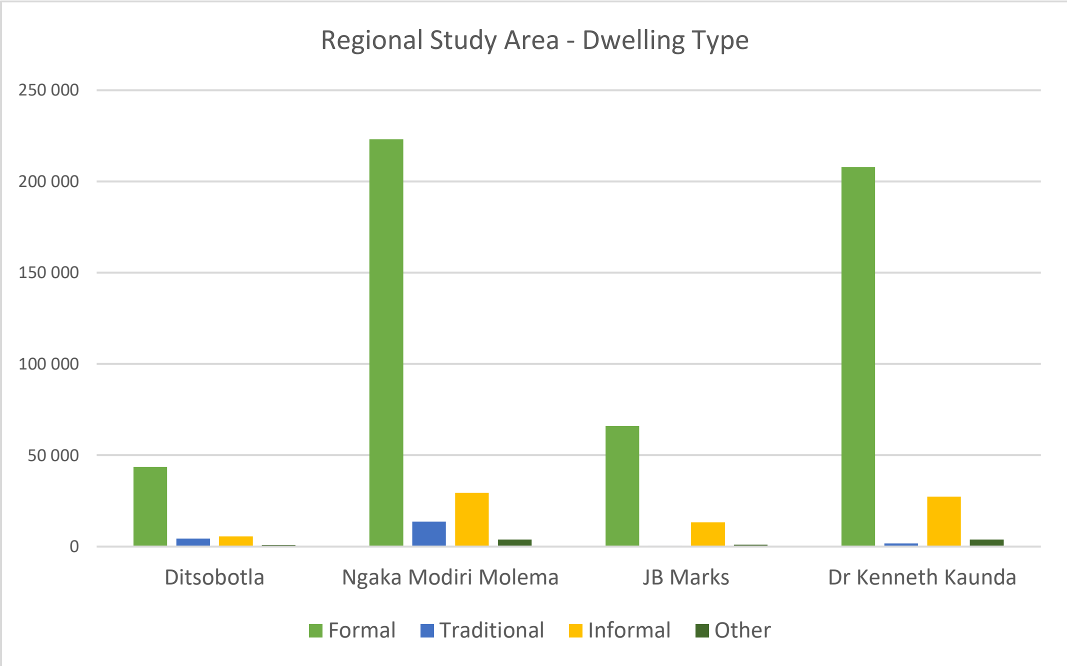


Figure 8: Regional Study Area - Dwelling Type

Source: Statistics SA: Community Survey 2016

The Sesotho language is the most frequently spoken at home by the majority of inhabitants of the North West Province, at 71,5%. The next most frequently spoken home language was Afrikaans at 7,2%. Other important languages in the province are Sesotho, IsiXhosa and Xitsonga (StatsSA, 2016).

6.6 Education

The South African constitution has made access to quality basic education; including adult basic education a right that should be made available and accessible to everyone irrespective of race and gender. The JB Marks Local Municipality has 27% of the population with a primary school and lower level of the education, the figure for the Ditsobotla Local Municipality is 35%. (StatsSA, 2016).

Table 4 presents the education profile of the regional study area below.

Table 6: Education Profile for Those above 20 Years of Age

Administrative Area	Total	No Schooling	Primary School	Secondary School	Higher Education
Ditsobotla	47 163	9 999	6 711	28 639	1 814.0

Administrative Area	Total	No Schooling	Primary School	Secondary School	Higher Education
		21.2%	14.2%	60.7%	3.8%
Ngaka Modiri Molema	240 852	62 704	27 622	139 007	11 519.0
		26.0%	11.5%	57.7%	4.8%
JB Marks	74 637	13 571	6 837	46 906	7 322.0
		18.2%	9.2%	62.8%	9.8%
Dr Kenneth Kaunda	218 013	41 031	21 368	141 400	14 214.0
		18.8%	9.8%	64.9%	6.5%
North West	1 033 709	199 626	114 215	672 483	47 384.0
		19.3%	11.0%	65.1%	4.6%

Source: Statistics SA: Community Survey 2016

The percentage of residents who have higher than matric education is 3.8% in the Ditsobotla Local Municipality, and 9.8% on the JB Marks Local Municipality. This compares to the 4.6% in the Northwest province. Thus, residents of Ditsobotla are relatively less education than the average in the regional study area, and in the province.

6.7 Employment

The employment status was the subject of detailed study during Census 2011. The result of the study is shown in the table below.

Table 7: Employment Profile for The Regional Study Area

Administrative Area	Total	Do not know	In the formal sector	In the informal sector	Not applicable	Private household
Ditsobotla	166 952	488	24 038	5 225	129 583	7 618
		0.3%	14.4%	3.1%	77.6%	4.6%
Ngaka Modiri Molema	842 698	2 267	97 692	25 063	690 713	26 963
		0.3%	11.6%	3.0%	82.0%	3.2%
JB Marks	219 464	1 490	41 033	12 393	154 563	9 985
		0.7%	18.7%	5.6%	70.4%	4.5%
Dr Kenneth Kaunda	695 933	3 727	131 215	27 992	506 238	26 761
		0.5%	18.9%	4.0%	72.7%	3.8%
North West	3 509 953	18 290	585 824	128 017	2 651 558	126 264
		0.5%	16.7%	3.6%	75.5%	3.6%

Source: Statistics SA: Census 2011

Census 2011 reported that 14% of the residents of Ditsobotla Local Municipality worked in the formal sector, with a further 3% working in the informal sector. Fully 78% of the responses were that employment was not applicable, meaning that either the respondent was not a member of the workforce, through either being too young or too old, but also were not able to find employment, and were thus a member of the long-term unemployed.

Similar figures were found for the JB Marks Local Municipality, 19% of residents worked in the formal sector, with a further 4% working in the informal sector. In this case 70% of the responses were that employment was not applicable. These figures are graphically represented below.

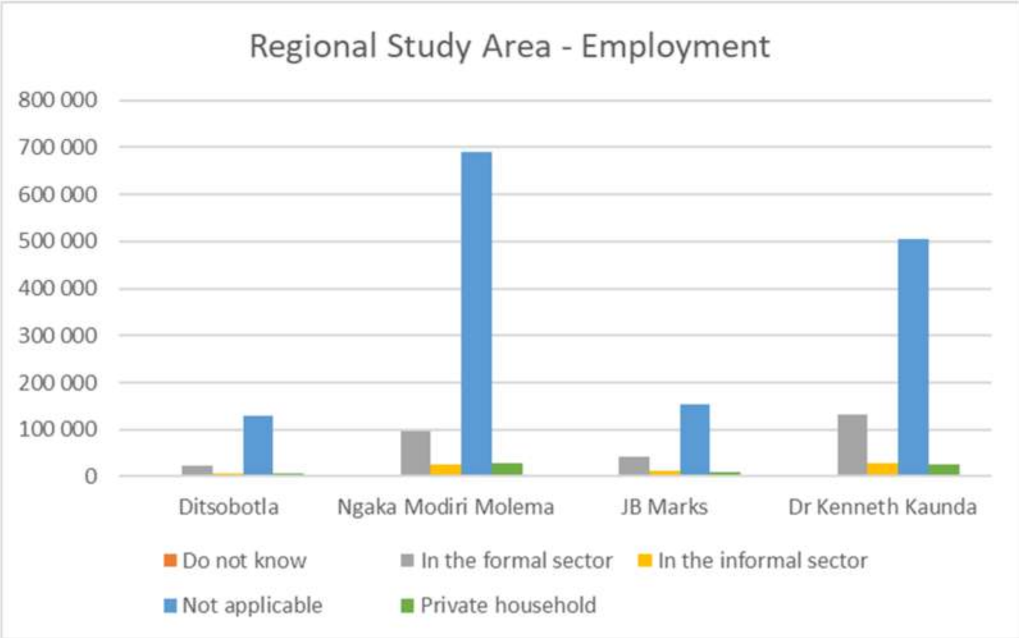


Figure 9: Regional Study Area - Employment

The level of unemployment found in the communities in 2011 was assessed to be broadly unchanged since then, judging by the responses to the social survey undertaken as part of this project.

6.8 Household Income

Household figures were taken from Census 2011 for the regional study area. Judging from the site rapid rural assessment conducted as part of this study, there is no reason to believe that the economic conditions have changed materially in the 10 years since the census taken in 2011.

The figure below shows the result for the JB Marks Local Municipality.

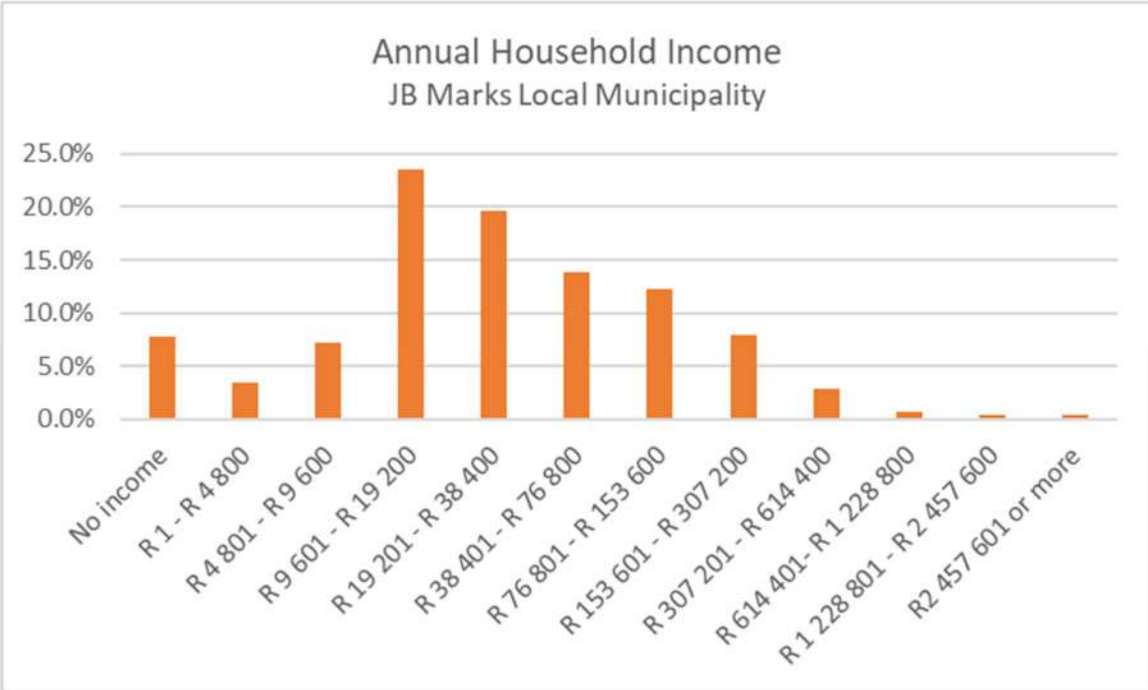


Figure 10: Annual Household Income – JB Marks Local Municipality

The figure demonstrates that 62% of the population had an annual household income of less than R38 000 in 2011. This is equivalent to R6 300 per household per month in 2023, assuming a wage growth rate of 7% per annum. Sixty seven percent of this population had an annual household income of just half that, at R19 200 per annum.

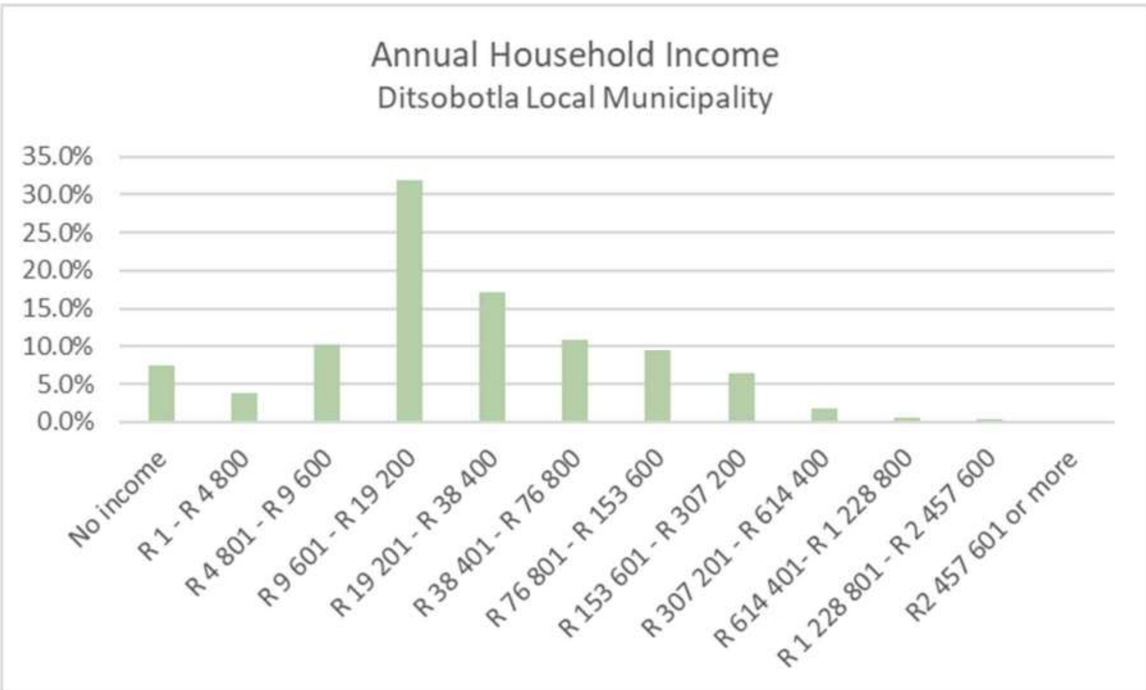


Figure 11: Annual Household Income – Ditsobotla Local Municipality

The figure above is provided for the Ditsobotla Local Municipality. It shows that 71% of the population had an annual household income of less than R38 000 in 2011. This is equivalent to R6 300 per household per month in 2023, assuming a wage growth rate of 7% per annum. Three quarters of this population had an annual household income of just half that, at R19 200 per annum.

The national minimum wage for farm workers, which is the most common occupation in the direct study area, is R25.42 per hour, equivalent to R4 067 per month for a 160-hour month. The figures derived show that most households have an income equivalent of less than the wages of one and half farm workers, just less than three quarters of this population survived on income of less than a single farm worker.

The analysis is supplemented by data from the Community Survey 2016, which indicate the percentage of households which have skipped a meal in the past 12 months owing to a shortage of resources to take that meal.

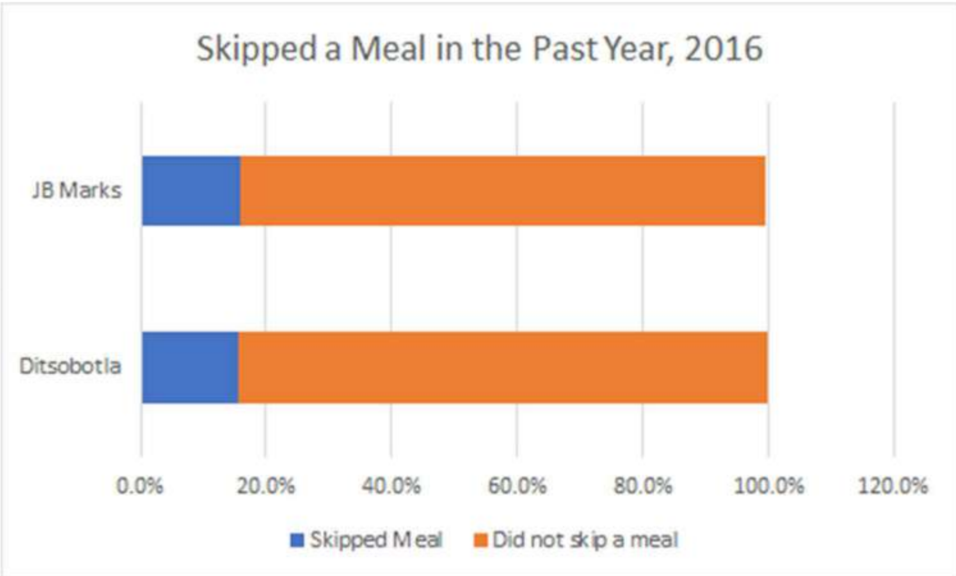


Figure 12: Households Skipping a Meal

The results show that 15% of the residents of both JB Marks and Ditsobotla Local Municipalities skipped a meal in the previous 12-months.

These figures illustrate the high level of poverty, and hence vulnerability, in the local municipality.

6.9 Access to Electricity

Electrical connections to households are widespread in the regional study area. The figures below are taken from the Community Survey 2016.

Table 8: Household Electricity Connections

Municipality	In-house conventional meter	In-house pre paid meter	Other supply which household pays for	Other supply, connected for free	No. of Households	% of Households Connected
Ditsobotla	3 560	43 664	705	274	54 154	89%
Ngaka Modiri Molema	15 617	225 695	2 744	557	269 977	91%
JB Marks	13 231	56 003	1 910	645	80 572	89%
Dr Kenneth Kaunda	40 321	177 094	4 751	1 020	240 543	93%
North West	115 573	973 231	25 347	4 870	1 248 766	90%

Electrical connections to households exceeded 89% of households in the JB Marks and Ditsobotla Local Municipalities.

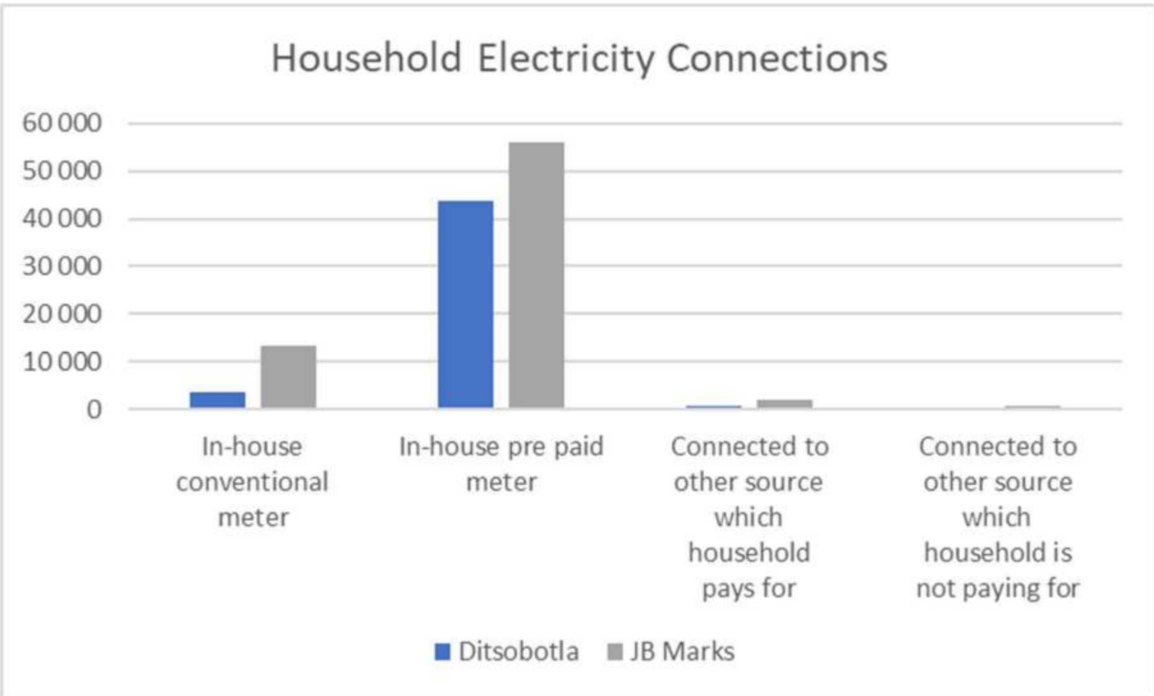


Figure 13:Household Electricity Connections

This is somewhat lower than the overrate for connection across the province, which is at 90% of all households. The highest rate of connection in the relevant area is the Dr Kenneth Kaunda District Municipality, which stood at 93 in 2016.

7 LOCAL STUDY AREA OVERVIEW

This section gives an overview of the local study area and its receiving environment within a five-kilometer radius of the proposed project cluster.

7.1 Land Use and Infrastructure

The project land use is commercial agriculture, dotted with low density homesteads in the direct project area.

The project site can be accessed from the below labour sending areas and points;

- Makokskraal village - located eleven kilometres to the south of the project site;
- Lichtenburg town - located at forty kilometres to the west of the site;
- Bodensten town - located along N14 at approximately 15km to the south-west of the project site;
- Ga-Motlatla Village- is located at approximately 5km to the north of the project site; and
- Ventersdorp - located at approximately twenty-four kilometres to the south -east of the project site.

This section of the report relies upon a census of the infrastructure and land-use impacts that has been conducted for this study. The results of the census are contained in Appendix 1.

7.2 Profile of the Receiving Environment

The receiving environment is agricultural land. The identified components of agriculture in this area are livestock, game, and crop farming. Mining activities were also identified in the nearby properties.

7.2.1 Cultural Background

The employment relationship between farm workers and landowners have been continuing from one generation to another between the Afrikaans and the BaTswana people. Over the years, these group of people in this area have built an interlinked cultural background and a keen sense of cultural respect and the valuing of their heritage was observed through engagements during this study.

In Gamotlatla Village there is a tribal administration office which works together with the local councils. The village is located at approximately five kilometres north of the project site and it is home to some of the farm workers in the vicinity of the project area.

Figure 14: Gamotlatla Tribal Offices

7.2.2 Access to basic services

Farm dwellers rely on farmers to provide basic services such as water, electricity, and sanitation. The main supplier of electricity is Eskom and the impact of loadshedding is negative for continuous water supply. This is due to reservoir pumps being are unable to pump water and fill up due to the prolonged loadshedding periods.

Pit latrines are the dominant sanitation facilities in the area for the disadvantaged farming communities. Health and safety measures are of concern and mitigation specific measures should be taken to improve the sanitation conditions in the area.

7.2.3 Identified Economic Activities

The local people depend on agricultural activities such as crop-farming and livestock rearing. Landowners have also allocated a section of their land so that small subsistence farmers can remain economically sustainable and to ensure a distribution of resources. Moreover, local people rely on seasonal farm work, hunting and mining jobs.

The presence of McCain regenerative agricultural farms is aiding the local economy. According to an informant, McCain offers month to month casual employment to the local people. Since most of their work is seasonal, the company is only able to retain people as per their needs. McCain is renting a portion of Goedvooruitzicht for this sustainable initiative.

There is a private mining company located within Goedvooruitzicht farm, at approximately four kilometres to the north-east of the proposed new facility substation. The company offers occasional employment to some of the local people.

One of noticeable economic activity within the study area is private game farming. This activity offers very limited economic opportunities to the local people as they are solely managed by farm owners and skilled people.

7.2.4 Community Facilities

Health facilities are distributed in nearby towns and locations such as Ventersdorp, Lichtenburg, Putfontein, Makokskraal, Bodenstein and Ga-Motlatla. Access to health systems is a major problem for the farming communities as they must travel long distances for medical needs.

Toevlug Primary School and Makokskraal primary schools are situated within ten kilometres from the proposed project area.

7.2.5 Road infrastructure

The main roads servicing the project site are R53 and N14. The feeder roads are gravelled and underdeveloped. Potholes were identified along the project area and local farmers are constantly sand filling the damaged routes as they get eroded repeatedly due to rains and lack of maintenance.

7.2.6 Transport

Farmers provide transport to their workers and other residents. Public transport is not easily accessible, local people hitchhike or walk long distances to nearby central business districts like Lichtenburg or Ventersdorp.

School children rely on school buses for transportation. Figure 11 below shows buses waiting to transport school children from the Makokskraal Primary School to their homes. The school is located within Makokskraal village and to the south of the project area.

Figure 15: School Busses Outside Makokskraal Primary School

A major railway line runs through Makokaskraal. However, it appears from the abandoned and dilapidated station's rusty condition of the railway tracks, that this line is no longer operational.

7.2.7 Livelihoods

The farm community is dominated by the elderly and living conditions are a subject of concern as most of the elderly people face physical challenges. Concerns with regards their livelihoods include declining heath, lack of food, and increased vulnerability to injuries were highlighted during engagements.

Lack of opportunities for women was amongst the main topics that were mentioned during the participatory interviews. Priority is given to men to work in farms and in nearby mines. Women are then obligated to be at home and be subject economic hardships.

Due to seasonal work, local people have seasonal employment. Post matric students or the youth have challenges in gaining skills and employment. Economic opportunities for youth are extremely limited in the project area. Many young people have relocated to either to cities or nearby urban areas to seek for employment.

7.2.8 Crime, Safety and Security

The communities indicated that crime is not a major challenge in the area. Farmers have taken the additional precaution of implementing off-grid solar powered security cameras around the boundaries of their properties and on major entrance routes.

7.3 Stakeholder Engagement

The World Bank's Environmental and Social Framework (2018:97), defines the stakeholder engagement process as a process that is inclusive and conducted throughout the project life cycle. The procedure further supports the development of strong, constructive, and responsive relationships that are important for successful management of a project's environmental and social risks.

The following stakeholder engagement methodologies were carried out as part of either the public participation process of an earlier Scoping process and as part of direct contacts with the affected parties.

7.3.1 Comments Made by the Public

Site notices were placed around the project area to sensitise I&AP about the project and the comment period was closed on 13 February 2023. A database of the potentially affected parties and community elected representatives were sent email notifications which included a Background Information Document (BID). This document provided an overview and description of the proposed project and invited comments from the public.

7.3.2 Primary Data Collection Report

A baseline study of the area's infrastructure was conducted on Google Earth prior to the site visit. The analysis of properties and infrastructures were observed within a five-kilometre radius around the solar site and on a six-kilometre radius around the proposed new substation. The images in the following table depicts the observations of the key places visited

Table 9: Primary Data Collection Images

	
Diamond Mining	Goedvooruitzicht farm settlement
	
McCain Regenerative Farm	Senwes Grain link Silo: Makokskraal

McCain regenerative farm, the diamond mine and the farm settlement are located within portion of the Goedvooruitzicht farm. The Makokskraal Senwes grain silos is amongst the companies that offers economical opportunities to the local communities.

7.4 Rapid Rural Assessment Process.

A site visit was conducted on 24 January 2023. The purpose of the visit was to compile and collect primary data on the receiving social environment. And to understand the expectation of the local people with reference to the proposed project. During the site visit tour, the following socio-economic aspects were observed in the receiving environment.

The following figure provides images captured during the site visit.

Figure 16: Images Captured During Site Visits

Windmill and mechanical water pump

Feeder Road Condition

Grazing Land

Game Farm

Bonsmara Boerdary Farm

Livestock Farm

7.4.1 Social Assessment Informant Survey

Barrow, CJ (2000) shows that the purpose of random interviews is to involve the diverse public, all groups in decisions making even from those that are reluctant or marginalised. The following interviews took place with the listed people in the table below.

Table 10: List of Interviewed People

Name	Designation	Duration of Residence
Mr K	Resident	26 years
Mr N	Farm worker	5 years
Mr I	Resident	53 years
Mr W	Resident	46 years
Ms M	Farm worker	6 years
Ms B	Agronomist	8 months
Ms F	Resident	60 years
Ms ED	Farm Assistant	-

The purpose of the face-to-face stakeholder interactions were to establish and record unbiased views and or comments of the proposed project, as to ensure that all comments and issues raised during the EIA phase is included in the SIA report.

A questionnaire was compiled and used as a technique to gather inputs and comments from the local communities.

The overall attitudes towards the proposed project were positive in terms of economic expectations. The presence of a solar farm next to the regenerative farm was perceived as being having a positive economic impact and might promote ecotourism. One stakeholder commented that since most young people relocate to larger towns due to lack of economic opportunities locally, this project may create local jobs, which will increase the employment rate in the area.

A stakeholder commented that the current solar farm location would result in a decrease in productive agricultural land in the area and suggested that the facility rather be located at a defunct mine in Ga-Motlatla. Several stakeholders commented that the facility would only yield economic benefits to the landowners, and no economic development would be felt by the local community.

Table 11: Summary of the Community Attitudes

Key Needs / Issues Identified	Mitigation Measure
Livelihood and economic opportunities	• There is a need to create more economic opportunities that will benefit adjacent communities, with special emphasis on the empowerment of women and the youth. • Implementation of diverse economic activities and radically drive farming communities to be fully involved. • Create broad based economic activities, to ensure that economic opportunities reach into local communities.
Development of skills for the youth.	• Introduce skills development programmes that will target matriculants, school leavers and the unemployed as this will curb the employment expectations from the seasonal jobs available in the farms. • Create technology and sustainable innovations that will further develop skills for the youth.

Key Needs / Issues Identified	Mitigation Measure
Roads Development	• Develop new tarred roads as this will encourage more transportation businesses to frequent the area.
Safe and secure housing for the elderly within the farm communities	• There is a need to create housing for the elderly that is self-sustainable, secure and peaceful.

8 IDENTIFICATION OF IMPACTS

8.1 Impacts and Mitigation Framework

Socio-economic impacts are expected to arise because of a proposed project. All impacts discussed in this section will follow a context of nature, extent, magnitude, duration, probability, and significance.

ISO 14001-2004 defines impacts as "any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects".

When considering an assessment of the impacts and their mitigation, the following definitions as per the table below apply.

Table 12: Impact and Mitigation Quantification Framework

Nature	The project could have a positive, negative, or neutral impact on the environment.
Extent	**Local** – extend to the site and its immediate surroundings. **Regional** – impact on the region but within the province. **National** – impact on an interprovincial scale. **International** – impact outside of South Africa.
Magnitude	Degree to which impact may cause irreplaceable loss of resources: **Low** – natural and socio-economic functions and processes are not affected or minimally affected. **Medium** – affected environment is notably altered; natural and socio-economic functions and processes continue albeit in a modified way. **High** – natural or socio-economic functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.
Duration	**Short term** – 0-5 years. **Medium term** – 5-11 years. **Long term** – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention. **Permanent** – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.
Probability	**Almost certain** – the event is expected to occur in most circumstances. **Likely** – the event will occur in most circumstances. **Moderate** – the event should occur at some time. **Unlikely** – the event could occur at some time. **Rare/Remote** – the event may occur only in exceptional circumstances.

Significance	Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows- **0** – Impact will not affect the environment. No mitigation necessary. **1** – No impact after mitigation. **2** – Residual impact after mitigation. **3** – Impact cannot be mitigated.
Mitigation	Information on the impacts together with literature from socio-economic science journals, case studies and field work will be used to provide mitigation recommendations to ensure that any negative impacts are decreased, and positive benefits are enhanced.
Monitoring	Monitoring usually involves developing and implementing a monitoring programme to identify deviations from the proposed action and to manage any negative impacts. The recommended mitigation measures will also include monitoring measures.

A well-designed, well implemented, professionally managed solar park can bring significant socio-economic benefits to the communities that it serves. If configured or operated in a way that ignores significant socio-economic needs or potential impacts, the proposed project may have significant socio-economic costs or liabilities for the stakeholders and affected communities.

Therefore, assessing socio-economic impacts is a complex process due to the multi-dimensional nature of the human interactions. This occurs in situations where a particular impact affects a group of stakeholders differently. An inter-connection of impacts can also be encountered whereby several impacts are related and when assessed cumulatively; their impacts may be of significance.

The impact assessment scores both before and after mitigation were arrived at by the specialist team engaging in a modified version of the Delphi technique, where the team discussed the scores, and through a process of iteration arrived at a consensus for each of the values. Where additional information was needed to decide, the technique would be halted, the necessary information would be uncovered and included in the report, and the technique would be recommenced.

8.2 Identification of Activities and Aspects

An "Activity" is defined as a distinct process or risks undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or pieces of infrastructure that are possessed by an organisation (International Organization for Standardization, 2011).

An aspect is defined as elements of an organisation's activities, products, or services that can interact with the environment.

To capture the impacts associated with the proposed infrastructure, an activity – aspect – impact table was created refer to the *table* below.

Table 13: Activity, Aspects and Impacts of the Project

Activity	Aspect	Potential Impact – Positive	Potential Impact – Negative
	Land Acquisition		Loss of agricultural production

Activity	Aspect	Potential Impact – Positive	Potential Impact – Negative
Land and Servitude Rights Acquisition			Loss of land (including, structures and cultivated areas) through project infrastructure
			Community dissatisfaction
	Servitude Rights		Some restrictions on use of productive land
Scheme Operations	Electricity generation	Economic growth and induced impacts.	
	Supply of goods and services to the project	Opportunity for local business	
		Opportunity for local labour force	
	Administration and Technical Input	Employment of staff locally	
		Skills development	
Construction Phase	Access into properties		Security concern
			Risk of intrusion
	Solar Park Construction – piling, frame erection and solar panel mounting, electrical installation and rehabilitation	Employment of people locally	
		Sourcing of equipment, machinery, and services locally	
			Noise
			Dust
		Employment of local people	
			Injuries on site
			Increased community conflicts due to employment of outsiders
			Influx of people seeking employment and associated impacts (e.g., cultural conflicts, squatting, demographic changes, anti-social behaviour, and incidence of HIV/AIDS)
		Sourcing of equipment, machinery, and services locally	
			Livestock and game animal safety
	Transport of goods to site and employment of staff		Increased traffic

Activity	Aspect	Potential Impact – Positive	Potential Impact – Negative
	Transmission Line	Employment of people locally	
			Security concerns when contractor's access private property
		Sourcing of equipment, machinery, and services locally	
			Damage or wear to access roads
	Rehabilitation		Security Concerns
			Damage to property or equipment

8.3 Impact and Mitigation Assessment

Taking these impacts into account and based on the project description as well as the applicable legislation and policy and planning issues, the following socio-economic impact variables have been identified as being associated with the project. These impacts are in accordance with Vanclay's list of socio-economic impact variables (Vanclay, 2002; Wong, 2013) clustered under the following seven main categories as follows:

Health and Well-Being Impacts

- Risk of intrusion;
- Injuries;
- Health risks; and
- Social pathologies.

Quality and the Living Environment Impacts

- Risk of intrusion;
- Dust; and
- Noise.

Economic and Material Well-Being Impacts

- Loss of land;
- Restrictions on land;
- Economic and social stimuli;
- Informal settlements; and
- Damage to property.

Cultural Impacts

- Cultural resistance;

- Influx of job seekers; and
- Community conflict over non-local employment.

Gender Relations Impacts

- Cultural resistance; and
- Risk to the vulnerable.

These categories are not exclusive, nor fully inclusive of the project specific impacts, and at times tend to overlap as certain processes may have an impact within more than one category.

Cumulative impacts can be both positive and negative. Cumulative impacts refer to the impacts that are incremental on the environment that results from the impacts of the proposed action when added to the existing and near future actions. These impacts can also be temporary in nature (by being restricted to the construction phase) and permanent (occurring in both the construction and operation phase).

8.4 Impacts during the Planning Phase

The planning phase of any project ensures the analysis of potential impacts, this allows the assessment of any risk to be measured from a scale of high, medium, or low. This pro-active approach ensures the identification of key socio-economic issues that can be mitigated before moving further to other phases of development in the project.

The assessment of the key social issues for the proposed project were identified based on the project related information including specialist studies, primary data collection methodologies, project team's familiarity with the project area and experience with similar project studies.

8.4.1 Institutional, Legal, Political, and Equity

- Loss of land through project infrastructure; and
- Some restrictions on use of productive land.

During the planning phase of the project, it is expected that there will be some legal and institutional challenges that affect both the local community and the project implementers. With the nature of the project being construction, it is understood that a predetermined portion of land will be made available for the purposes. However, since this is farm area, the loss of land to the project will come with economic downsides for those in the community who generally realise agricultural benefits. There will also be restrictions subjected on the use of otherwise productive land because of the infrastructure to be installed. Although these impacts will likely only be felt once the project is operational, the legal aspect that tenders the land acquisition would be made known at the planning phase.

There are mitigation measures that can be planned to account for the negative impacts so that the social experience is not too distressful. These are shown in the table below:

Table 14: Planning Phase Impacts - Institutional, Legal, Political and Equity

<table>
<tr><td colspan="2">Environmental Feature</td><td colspan="5">Institutional, Legal, Political and Equity</td></tr>
<tr><td colspan="2">Project life cycle</td><td colspan="5">All Phases</td></tr>
<tr><td colspan="2">Potential Impact</td><td colspan="5">Proposed Management Objectives / Mitigation Measures</td></tr>
<tr><td colspan="2" rowspan="3">Loss of land through project infrastructure</td><td colspan="5">• Where the construction takes place will result in the land being acquisitioned and so adequate steps must be taken to ensure that the owner is not treated unfairly in the process.</td></tr>
<tr><td colspan="5">• Promptly address any concerns raised by the public in a transparent manner.</td></tr>
<tr><td colspan="5">• Include all relevant community members in decisions affecting them.</td></tr>
<tr><td colspan="2">Some restrictions on use of productive land</td><td colspan="5">• Once the project is operational, the land will be dedicated exclusively to the project and so its prior productivity will no longer apply. This must be clearly communicated and the owner should be adequately compensated.</td></tr>
<tr><td></td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td>Before Mitigation</td><td>Negative</td><td>Site</td><td>Moderate</td><td>Long Term</td><td>High</td><td>2</td></tr>
<tr><td>After Mitigation</td><td>Negative</td><td>Site</td><td>Low</td><td>Long Term</td><td>High</td><td>1</td></tr>
<tr><td>Significance of Impact and Preferred Alternatives</td><td colspan="6">The impact on project progress could be significant if grievances are not addressed. This can be effectively mitigated through the establishment of a grievance procedure and adherence to local by-laws.

The impact has no consequence for project alternatives.</td></tr>
</table>

8.5 Impacts During the Construction Phase

The construction activity will impact the social environment both positively and negatively. Given the nature of the project area, construction activity is likely to cause several social nuisances as well as possible economic implications on the communities and commercial activities. With a project of this nature, most social impacts are experienced during the construction phase, as this is when construction related activities, relating to the influx of labour and the use of construction machinery occurs.

8.5.1 Economic Opportunities

- Economic and social stimuli; and
- Informal trading.

The project is expected to bring economic benefit to the local community through employment opportunities for labourers and locally owned businesses.

In addition to the economic value added, the construction phase was estimated to produce some 2 774 job years in the regional study area. Considering experience with renewable project implementation in South Africa, 222 job years (8%) are likely to accrue to females, and a total of 1 248 years (41%) are likely to accrue to youth.

The official youth unemployment rate in the region is likely higher than the general unemployment rate, this being the trend nationwide. This project has the potential to impact positively on this rate should employment practises targeted at workers (male and female) under 35 years old be adopted.

The high number of impoverished households shows that there are vulnerable communities in the study area. It is recommended that the appointed contractor use local SMME's and local unskilled labour as far as possible during the construction phase to enhance any local economic impact. In addition, this would increase the skills in the area after construction is completed.

In this way more project revenue will stay in the area, raising economic activity and increasing welfare, resulting in induced economic opportunity. In South Africa, most employment is generated through small and medium business. Given the size of the proposed project, should contracts between local SMMEs be implemented, it is likely that there will be an increase in employment by SMMEs for the duration of the contracts.

In particular, the project has the potential to create several opportunities for existing and new local SMMEs. These opportunities range from site clearing, to fencing, parts of the construction scope and supply of materials. There are also opportunities for community members to provide labour, catering, accommodation, and other services to the new workers.

Where possible, the project proponent should support and encourage the procurement of SMMEs and local or regional suppliers in line with government policy.

Education levels provide an indication of the level of skill in the community and the degree to which the community skills base can be increased. Attempts to break the poverty cycle of the project areas will require more than secondary school education. Higher education or further skills training is required. It is therefore important that the community members under-go skills development. It is recommended that the project proponent institute a skills development program during construction.

The project proponent should monitor the employment process. Employment audits should be conducted. It is important that women are also provided employment opportunities. Audits should pay attention to the employment process of women to ensure that exploitation does not take place.

As a result of the analysis above, the following impact/mitigation table has been generated.

Table 15: Construction Phase Impacts - Economic Opportunities

Environmental Feature	Economic Opportunities
Project life-cycle	Construction phase
Potential Impact	Proposed Management Objectives / Mitigation Measures
Economic and social stimuli arising from the developmental initiative of the project.	• Local SMMEs should be given an opportunity to participate in the construction of the project through the supply of services, material or equipment.
	• Youth development should be considered as an initiative so that there is a benefit of transferring skills to the community. This can be achieved through the assistance of the local municipality.

	• The main contractor should employ non-core labour from the regional study area as far as possible during the construction phase.					
Informal trading being established at the site boundaries	• Spaza/informal trader shops may open next to the site to cater for construction workers. These should be controlled by the contractor to limit their footprint and to ensure that the MLM By-laws are complied with.					
	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Positive	Regional	Medium	Short Term	Likely	1
After Mitigation	Positive	Regional	Large	Short Term	Likely	3
Significance of Impact and Preferred Alternatives	Individuals who will benefit during the construction are limited to those who actively participate in the construction activity through employment, sub-contracting or other economic opportunities. Active participation should be encouraged. The benefits on such a construction will take place irrespective of which site alternative is preferred.					

8.5.2 Gender Relations

- Cultural resistance to female workers.

Gender relations are recognised as an important factor in the efforts to achieve equity across society. Particularly in the workforce, more female representation is necessary to account for the number of female-headed households, which in JB Marks Municipality stands at 41%. Construction is a male-dominated industry; however, skills development initiatives directed at women may mean it is an industry that could benefit from equitable representation.

Although equal access to employment across gender lines is a recognised right, the application of this right is often executed without careful consideration of the factors that may frustrate this right amongst women in the workplace. In this regard women are often subjected to cultural factors within the workforce from both peers on the job and from management who may resist both employing and promoting women, often based on cultural prejudices. Consequently, the International Labour Organisation points out that:

"Societies therefore have an obligation to create conducive social environment for all their citizens to be able to exercise their right to work, fully utilizing their human potential. Furthermore, evidence has shown that when women are employed and have their own income in their hands, there exist both direct and indirect social benefits for themselves and their households" (Otobe, 2014, p. 1).

With the employment of women during the construction and operational phases of the project it is important to ensure that cultural factors do not hinder the process of employing women and ensuring that they enjoy equal opportunities to men in the workforce.

Following on from the above, the division of labour is a critical aspect that will also lead to various impacts during both the construction and operational phases of the project. During the construction and operational phases of the project women will be integrated into the workforce, however, this will come with various challenges. Women and men work on different tasks, have different biological, sex, gender and health needs, and have different roles within the family, all of which need to be considered in order to create a workplace, without discrimination, that is accessible to both women and men on an equal basis (World Health Organization, 2006).

In introducing women into the workforce, it must be noted that women are over-represented amongst the poorer sectors of society, particularly within the more rural communities, and under-represented, both vertically in terms of responsibility and seniority as well as horizontally in respect of certain functional areas and job categories (Otobe, 2014, p. 22). This is especially the case in the local project area where the proportion of women to men is higher than the provincial average. Thus, the potential labour force is dominated by women.

As a result of the analysis above, the following impact/mitigation table has been generated.

Table 16:Construction Phase Impacts - Gender Relations

<table>
<tr><td colspan="2">Environmental Feature</td><td colspan="5">Gender Relations</td></tr>
<tr><td colspan="2">Project life-cycle</td><td colspan="5">All phases</td></tr>
<tr><td colspan="2">Potential Impact</td><td colspan="5">Proposed Management Objectives / Mitigation Measures</td></tr>
<tr><td colspan="2" rowspan="8">Cultural resistance towards women because of increased gender representation in the workforce</td><td colspan="5">• Sensitise staff in respect of gender sensitive issues that are pertinent to the workplace.</td></tr>
<tr><td colspan="5">• Ensure gender inclusivity and equity with respect to all compensation.</td></tr>
<tr><td colspan="5">• Prioritise gender inclusivity and equity in access to resources, goods, services and decision making with the aim of empowering women.</td></tr>
<tr><td colspan="5">• Promote equal job opportunities for women and men during the construction and operational processes.</td></tr>
<tr><td colspan="5">• Prioritise and articulate gender inclusivity and equity in the project documents by including specific strategies and guidelines for implementation.</td></tr>
<tr><td colspan="5">• The project documents should also include clear mechanisms through which the actual implementation of the activities and the impact on the ground can be monitored and evaluated.</td></tr>
<tr><td colspan="5">• Develop a grievance procedure to specifically address gender matters.</td></tr>
<tr><td colspan="5">• Factors such as culture should be considered when planning for gender activities since they play a great role in influencing gender relations.</td></tr>
<tr><td></td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td>Before Mitigation</td><td>Negative</td><td>Site</td><td>Moderate</td><td>Short term</td><td>High</td><td>2</td></tr>
<tr><td>After Mitigation</td><td>Negative</td><td>Site</td><td>Low</td><td>Short term</td><td>High</td><td>1</td></tr>
</table>

Significance of Impact and Preferred Alternatives	The impact on project equity promotion would be moderate if this impact were not addressed. This can be effectively mitigated through the design of a specific gender-focused. The impact has no impact on alternative project layouts.

8.5.3 Property and Production

- Risk of intrusion;
- Livestock and game animal safety;
- Loss of agricultural production; and
- Damage to property.

During the construction phase, it is expected that there will be impacts on the agriculture, livestock, and game animals, as well as on the property of locals. As the area of development and its surrounds is farmland, where crops, livestock, and game are kept, the productivity there will inevitably be affected. There is a risk of construction workers intruding on the neighbouring farms, not necessarily with intent to cause harm, but which could nevertheless be dangerous. The livestock and game in the area are valuable and so it is necessary to ensure that there is no chance of them wandering close to the construction site. It is also important to communicate well with the local community about the construction schedule so that farming activities are not unduly interrupted. Also, there is the chance that local property may be damaged during construction.

In relation to the analysis above, the impacts and mitigation measures are presented below:

Table 17:Construction Phase Impacts - Property and Production

Environmental Feature	Property and Production
Project life-cycle	Construction phase
Potential Impact	Proposed Management Objectives / Mitigation Measures
Risk of intrusion	• The project proponent should ensure entrance management and control.
Livestock & game animals Safety	• There should be clear demarcation of the area in development so that livestock and game animals are prevented from wandering nearby.
Loss of agricultural production	• The project proponent should ensure that the schedule for construction is made available to the local community so that they can suitably prepare.
Damage to property	• If a risk exists of damage taking place on a property as a result of construction, a condition survey should be undertaken prior to construction; • The contractor is to make good and acknowledge any damage that occurs on any property as a result of construction work; • Where crops and agricultural machinery are damaged, compensation is to be paid to the farmer for the proven loss of these crops; • The farmer should be compensated for any loss of income experienced at the account of the contractor.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Medium	Short Term	Likely	1
After Mitigation	Positive	Local	Minor	Short Term	Likely	3
Significance of Impact and Preferred Alternatives	Costs related to damage and theft should be borne by the developer. There are no alternatives suggested.					

8.5.4 Disturbances Arising from Construction

- Increase in dust; and
- Noise impacts.

During the construction phase, there is a potential for communities to be exposed to increased dust, noise, and other disturbances. The site is in an isolated area where the number of community receptors is limited.

The generation of dust stems from activities such as clearing of vegetation, piling and vehicle movement during the construction phase. This situation will be worse during the dry season and during windy seasons. Airborne particulates may pose a hazard to residents downwind of the construction site that suffer from upper respiratory tract problems. Mitigation through dust suppression will allow for this impact to be effectively managed.

During the construction, equipment will be required for the site clearance, and during piling and trench excavation for electrical connections. A degree of noise generation will be unavoidable. The degree of noise, frequency of noise and individual perception are all important considerations when determining the impact on noise. Adequate warning of high noise events such as blasting (if required owing to the nature of the subsoil material) should be communicated to the affected communities prior to carrying out such activities. Construction times should be limited to normal working hours.

As a result of the analysis above, the following impact/mitigation table has been generated.

Table 18: Construction Phase Impacts - Disturbances Arising from Construction

Environmental Feature	Disturbances Arising from Construction
Project life-cycle	Construction phase
Potential Impact	Proposed Management Objectives / Mitigation Measures
Increase in Dust	• Dust and disturbance can be mitigated through the use of appropriate dust suppression mechanisms. • Adherence to road signage can be added as an advantage and a measure to manage the increase in dust levels; • Mitigation measures management should be adhered to according to the relevant specialist studies.

Noise impacts		• Prior notice should be given to surrounding communities of noisy event such as blasting. • Construction work should take place during working hours – defined as 07h00 to 17h00 on weekdays and 07h00 to 14h00 on Saturdays. Should overtime work be required, that will generate noise, consultation with the affected community or landowner should take place.				
	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Medium	Short Term	Likely	2
After Mitigation	Negative	Local	Low	Short Term	Moderate	1
Significance of Impact and Preferred Alternatives	Disturbances and irritation during construction is to be expected. These can then be successfully mitigated through contractor specifications that are issued at a tender stage and through the continuous monitoring of contractor proceedings and performance during construction phase. Negative impacts owing to the construction will unfortunately be experienced irrespective of the site and routing alternative that is most preferred and chosen.					

8.5.5 Worker Health and Safety

- Injuries on site
- Protecting the vulnerable

The impacts of construction can affect the health and safety of those working on the construction site. These impacts can be mitigated in the Environmental Management Programme (EMPr) and through adherence to the Occupational Health and Safety Act 85 of 1993.

Given that the project will employ females are part of the workforce, gender considerations should enjoy priority. The workplace should be free of harassment and employment practises should be transparent and free from any coercion or trading. The workplace should make adequate provision for separate gender changing areas and ablution facilities.

As a result of the analysis above, the following impact/mitigation table has been generated.

Table 19: Construction Phase Impacts - Worker Health and Safety

Environmental Feature	Worker Health and Safety
Project life cycle	Construction Phase
Potential Impact	Proposed Management Objectives / Mitigation Measures
Injuries on Site	• The provisions of the OHS Act 85 of 1993 and the Construction Regulations of 2014 should be implemented on all sites; • Account should be taken of the safety impacts on the local community when carrying out the longitudinal aspects of the project, such as the powerline; • Contractors should establish HIV/AIDS awareness programmes at their site camps.

<table>
<tr><td colspan="2"></td><td colspan="5">Gender sensitive work place practises should be planned for and adopted on site. Employment practises should be demonstrated free of coercion or harassment.</td></tr>
<tr><td colspan="2">Protecting the Vulnerable</td><td colspan="5">There should be a policy on harassment that is well understood by all.
There should be separate changing facilities for men and women, and they should be clearly marked as such.
There should separate toilet facilities for men and women, and they should be clearly marked as such.</td></tr>
<tr><td></td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td>Before Mitigation</td><td>Negative</td><td>Local</td><td>Medium</td><td>Short Term</td><td>Likely</td><td>2</td></tr>
<tr><td>After Mitigation</td><td>Negative</td><td>Local</td><td>Low</td><td>Short Term</td><td>Moderate</td><td>1</td></tr>
<tr><td>Significance of Impact and Preferred Alternatives</td><td colspan="6">The significance of the impact is high as community attitudes can be altered. The implementation of the overall mitigation measures is essential and necessary to minimise the impact from workers’ health and safety and community impacts.</td></tr>
</table>

8.5.6 Influx of Job Seekers

- Job seekers influx into the community
- Community conflict over employment of non-locals
- Increased health risk
- Increased social pathologies

It is expected that this influx will be limited owing to the large pool of potential workers for the project being available in the JB Marks Local Municipality. The fact that Ventersdorp and Lichtenburg are close to the construction site will ensure that labour is able to live at home for the duration of the construction project.

An influx of workers is often characterised by higher health risks, particularly if the influx is male dominated. These include a higher disease burden and rise in HIV/AIDS rates. There is an increased risk associated with the gathering of construction workers in a concentrated area and the availability of disposable income which may attract prostitution. In this regard the World Bank (Gender in Agriculture Sourcebook, 2009, pp. 367-368) indicates that there is a strong link between infrastructure projects and health as:

“Transport, mobility, and gender inequality increase the spread of HIV and AIDS, which along with other infectious diseases, follow transport and construction workers on transport networks and other infrastructure into rural areas, causing serious economic impacts.”

It is expected that this influx will be limited owing to the large pool of potential workers for the project being available in the JB Marks Local Municipality. The fact that Ventersdorp and Lichtenburg are close to the construction site will obviate the need for communal living that may increase the chances for the spread of disease.

There should also be awareness and education campaigns on health and social risks such as HIV/AIDS, COVID-19 and crime prevention. Furthermore, social pathologies, such as alcohol abuse, risky sexual behaviour, and gambling should be considered, and appropriate measures taken to limit adverse consequences from this.

The above discussion above has generated the below impact table.

Table 20: Construction Phase Impacts - Influx of Job Seekers

<table>
<tr><td colspan="2">Environmental Feature</td><td colspan="5">Influx of Job Seekers</td></tr>
<tr><td colspan="2">Project life cycle</td><td colspan="5">Construction Phase</td></tr>
<tr><td colspan="2">Potential Impact</td><td colspan="5">Proposed Management Objectives / Mitigation Measures</td></tr>
<tr><td colspan="2">Job seekers influx into the community.</td><td colspan="5">• All employment of locally sourced labour should be controlled and formalised. No employment should take place from the project gate and contracts of employment should be entered into taking into account the Labour Relations Act;
• If possible, and if the relevant Ward Councillors deems it necessary, the employment process should include the affected Ward Councillors and their ward committee.
• To limit the growth of informal settlements in the project area, labour should be sourced from existing labour sending areas, from people who resided in the area prior to appointment. This process should include the Ward Councillor to ensure that only local residents are employed, rather than labour migrants.
• No staff accommodation should be allowed on site;
• To limit the growth of settlements near the project site the project proponent should provide worker transport to and from the work site for the duration of construction.</td></tr>
<tr><td colspan="2">Increased community conflicts due to employment of local and non-local labourers</td><td colspan="5">• Programmes should be developed to boost the local economy. These can be in the form of Corporate Social Responsibility (CSR) that will favour local empowerment.</td></tr>
<tr><td colspan="2">Increase health risk</td><td colspan="5">• Measures should be taken to provide condoms and, where necessary, access to counselling to address any risks to health.</td></tr>
<tr><td colspan="2">Increased social pathologies such as crime, drug abuse and sexual behaviours.</td><td colspan="5">• The mitigation method will require a change in community values and attitudes; This can be done through creating social awareness, and educating the workforce with regards crime awareness and social pathology prevention</td></tr>
<tr><td></td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td>Before Mitigation</td><td>Negative</td><td>Site</td><td>Moderate</td><td>Short term</td><td>High</td><td>2</td></tr>
<tr><td>After Mitigation</td><td>Negative</td><td>Site</td><td>Low</td><td>Short term</td><td>High</td><td>1</td></tr>
<tr><td>Significance of Impact and Preferred Alternatives</td><td colspan="6">The significance of the impact is high as community attitudes can be altered. The implementation of the overall mitigation measures is essential and necessary to minimise the impact from job-seekers influx and community impacts.</td></tr>
</table>

8.5.7 Security

- Ensuring the security of the project site

There are safety concerns related to the construction activity. Landowners adjacent to similar projects, generally express security concerns, including an increase in crime rates once an area experiences an increase in population owing to the number of construction workers on site.

Mitigation measures include the project proponent, prior to construction, planning for the management of workers by taking measures such as readily identifiable clothing, having the site fenced and secured and taking measures to ensure workers do not congregate outside the site before or after working hours. A security policy must be drafted and strictly enforced by the contractors.

As a result of the analysis above, the following impact/mitigation table has been generated.

Table 21: Construction Phase Impacts - Security

Environmental Feature	Security					
Project life cycle	Construction Phase					
Potential Impact	Proposed Management Objectives / Mitigation Measures					
Ensuring the security of the project site	• The camp site for the project and the longitudinal construction sub-site laid down areas should be fenced for the duration of construction; • All contractors' staff should be easily identifiable through their respective uniforms; • A project policy on management of workers should be developed. This would include education and awareness to be conducted with regards crime, trespassing and not gathering outside the site could be conducted. • Security staff should only be allowed to reside at contractor camps and no other employees.					
	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Medium	Short Term	Likely	2
After Mitigation	Negative	Local	Low	Short Term	Moderate	1
Significance of Impact and Preferred Alternatives	Disturbances and irritation during construction are to be expected. These can then be successfully mitigated through contractor specifications that are issued at a tender stage and through the continuous monitoring of contractor proceedings and performance during construction phase.					

8.6 Impacts on Operational Phase

8.6.1 Economic Impact

- Economic
- Local procurement
- Job creation and skills development

Jobs created during the operational phase of the project will be limited when compared to the construction phase, but 350 jobs will be created directly by the project over its 20-year operational lifespan. In total it was estimated that 193 jobs in total will be created in this timeframe in the South African economy as a result of the project.

Economic opportunities will range from the supply of labour and skills to the project, supply of materials and equipment and an increase in wholesale and retail trade in the regional economy.

To ensure that economic activity derived from the project is localised as far as possible, measures should be adopted to increase local procurement of the human resources.

As a result of the analysis above, the following operational phase impact/mitigation table has been generated.

Table 22: Construction Phase Impacts - Economic Impacts (positive)

<table>
<tr><td colspan="2">Environmental Feature</td><td colspan="5">Economic Impacts (positive)</td></tr>
<tr><td colspan="2">Project life-cycle</td><td colspan="5">Operational Phase</td></tr>
<tr><td colspan="2">Potential Impact</td><td colspan="5">Proposed Management Objectives / Mitigation Measures</td></tr>
<tr><td colspan="2">Economic</td><td colspan="5">• The solar park will stimulate the local economy through the provision of jobs and through local procurement.
• It will contribute to the improvement of the national electricity supply at a price that has been set by a competitive bidding process</td></tr>
<tr><td colspan="2">Local Procurement</td><td colspan="5">• Local SMMEs should be given an opportunity to participate in the operation of the project through the supply of services, material or equipment.</td></tr>
<tr><td colspan="2"></td><td colspan="5">• A procurement policy promoting the use of local business where possible, should be put in place and applied throughout the operational phases of the project.</td></tr>
<tr><td colspan="2">Job Creation and Skills Development</td><td colspan="5">• Women should be given equal employment opportunities and encouraged to apply for positions.</td></tr>
<tr><td colspan="2"></td><td colspan="5">• A skills transfer plan should be put in place at an early stage and workers should be given the opportunity to develop skills whilst in employment.</td></tr>
<tr><td></td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td>Before Mitigation</td><td>Positive</td><td>Regional</td><td>High</td><td>Long Term</td><td>Likely</td><td>3</td></tr>
<tr><td>After Mitigation</td><td>Positive</td><td>Regional</td><td>High</td><td>Long Term</td><td>Likely</td><td>3</td></tr>
<tr><td>Significance of Impact and Preferred Alternatives</td><td colspan="6">The solar park in the regional study area will provide economic stimulus to the regional study area for the long-term. The solar park should adopt policies that are supportive of local procurement and support for local enterprises.

Economic impact considerations require that the most cost-effective transmission power line route be adopted to service the project.</td></tr>
</table>

8.7 Economic and material well-being (negative)

There are indirect impacts from the project that may have economic impact. Impacts in this class for the project are:

- Loss of productive agricultural land/ grazing land.

Loss of productive/ grazing land

The implementation of the proposed project will have an impact on landowners in that land that would otherwise have been used for agriculture would now be re-purposed for use as a solar farm.

The authors view this as a low impact, given that the economic value of the agricultural yield from the land in the area is very much lower than the yield from a solar park. The economic impact – both in terms of contribution of the Gross Value Added to the regional study area, and in terms of jobs created, of the land being used as a solar park will outweigh any likely agricultural use.

The results of the agricultural specialist studies related to agriculture will be relied upon when assessing this impact.

As a result of the analysis above, the following impact/mitigation table has been generated. It applies to the planning phase of the proposed project.

Table 23 :Operational Phase Economic Well Being (Negative) Impact/Mitigation Table

Environmental Feature	Economic and material well-being (negative)					
Project life-cycle	Operational Phase					
Potential Impact	Proposed Management Objectives / Mitigation Measures					
Loss of productive land	• A very low impact that does not require mitigation.					
Loss of grazing land	• A very low impact that does not require mitigation.					
	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Low	Short Term	Low	1
After Mitigation	Negative	Local	Low	Short Term	Low	1
Significance of Impact and Preferred Alternatives	This impact is not considered significant. It should be noted that this study defers to the agricultural specialists with regards the impact of the project on regional production.					

9 ANALYSIS OF ALTERNATIVES

An analysis of the project alternatives is carried out below.

9.1 No-Go Alternative

The No-Go alternative will present the following implications:

- There will be no contribution employment and skills development to the local community.
- The local economy will remain unchanged as the area and will not attract new economic investment.
- The opportunity to improve the overall supply of electricity in the regional will be missed; and
- The economic stimulus presented by the project will be foregone.

There will be less economic development as there will be no opportunities for SMMES and local labourers. Having taken into consideration the project aims of electricity generation using renewable power sources and considering the assessment above which does not indicate any fatal socio-economic flaws, the benefits from the project going ahead, from a socio-economic perspective, will be larger than not proceeding. The “No-go” option is not supported by this study.

9.2 Technical Alternatives

No site alternatives are proposed for this project, and minor layout changes were proposed for the site. The differences between the two layouts do not have any impact on the social assessment for the project. Therefore, the social assessment has not preferred site layout.

10 SITE SENSITIVITY VERIFICATION

The site sensitivity was verified by means of the methodology and findings of this report. There is no social theme for this project in the screening tool, hence this report conforms with the Environmental Impact Assessment regulations requirements.

The methodology establishes existing land use and includes motivation and evidence of such land use. The nature of this study and its impacts dictate that a larger study area than the immediate site and its adjoining properties be assessed. In this sense, the precise nature of the land development on the site is not relevant in this case.

11 IMPACT STATEMENT

An impact statement is required as per the NEMA regulations with regards to the proposed development.

The project site has few social receptors surrounding the site, and the project has a low footprint on the social environment. The social and economic impacts of the project are expected to be positive in the sense that the local economy will be stimulated and broadened. The negative impacts are limited in nature and scope and can be successfully mitigated to an acceptable level. The second, environmental impact report, layout alternative is preferred from a social assessment perspective. It is therefore found that the project, once the recommended mitigation measures have been implemented, has a nett positive impact on the social environment of the regional study area.

12 LIST OF REFERENCES

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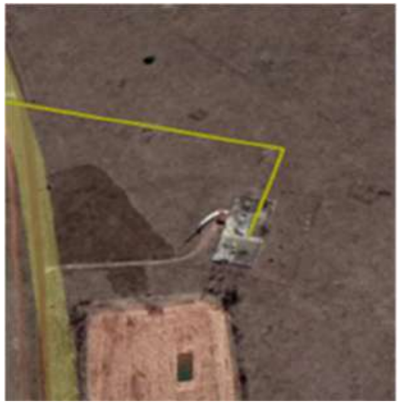
Appendix One: Census of Possible Social Receptors

5km Boundary - Google Flyover of Project Site				
No	**Description**	**Coordinates**	**Satellite Image**	**Actual**
1	Project Site	26°13'13.00" S 26°35'11.50" E		 Entrance to the project area
2	Water Structure	26°13'04.99" S 26°36'17.92" E		

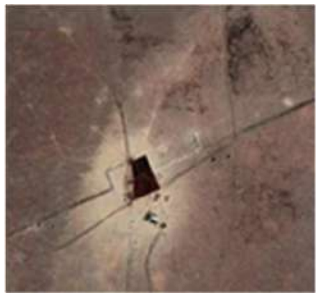
<table>
<tr>
<td>3</td>
<td>Dwellings</td>
<td>26°13'22.76" S
26°36'42.69" E</td>
<td></td>
<td>

Dwellings from the entrance viewpoint</td>
</tr>
<tr>
<td>4</td>
<td>Dwellings</td>
<td>26°13'32.97" S
26°36'37.63" E</td>
<td></td>
<td>

Main entrance to the area of the assigned dwellings.</td>
</tr>
</table>

5	White structures around the water catchment area	26°13'33.26" S 26°36'29.92" E		 Water reservoir,
6	Main substation	26°14'32.77" S 26°37'13.97" E		
7	Dwellings	26°14'49.70" S 26°37'41.21" E		Residence

8	Farm Workers dwellings	26°18'44.80" S 26°37'15.85" E		
9	Dwellings	26°15'24.43" S 26°34'49.07" E		Farm Residential
10	Structures	26°15'12.67" S 26°34'02.92" E		no structure.

11	Dwellings	26°14'57.95" S 26°33'13.18" E		 Farm Dam
12	Farm structures	26°14'39.26" S 26°34'01.17" E		No access
13	Farm Structure	26°12'41.42" S 26°33'31.28" E		No access

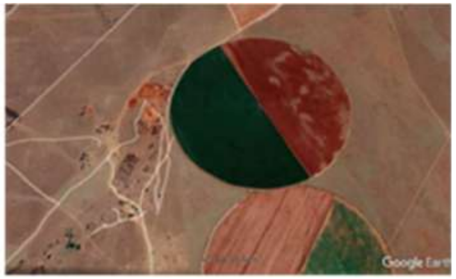
<table>
<tr><td>14</td><td>Powerline</td><td>26°11'38.63" S
26°35'21.61" E</td><td></td><td></td></tr>
<tr><td>15</td><td>Water Structure</td><td>26°11'36.89" S
26°35'41.63" E</td><td></td><td></td></tr>
</table>

16	Water catchment area	26°11'02.13" S 26°36'51.54" E		No access
6km New Substation Boundary- Google Flyover SIA from Project Boundary				
1	New substation Boundary	26°07'25.34" S 26°32'41.30" E		No image
2	Two properties- Dwellings	26°08'51.95" S 26°33'50.69" E 26°09'16.75" S 26°33'15.86" E		No access

3	Dwellings	26°09'03.01" S 26°31'46.93" E		 Dwellings from the entrance viewpoint
4	4 clustered properties	26°08'42.30" S 26°30'56.81" E		  

<table>
<tr><td>5</td><td>Water structures</td><td>26°07'02.74" S
26°30'50.59" E</td><td></td><td>

Mining area</td></tr>
<tr><td>6</td><td>Cluster of properties</td><td>26°06'49.30" S
26°31'05.14" E</td><td></td><td>

Local Community Residential Area</td></tr>
<tr><td>7</td><td>Commercial Farming Area</td><td>26°06'11.20" S
26°30'56.02" E</td><td></td><td>

McCain Farm</td></tr>
</table>

8	Ga-Motlatla Village • Ga-motlatla Cemetery • Boundary 1 • Boundary 2			 Clinic  Local Church  School