APPENDIX E

SPECIALIST REPORTS

APPENDIX E1: Freshwater Aquatic Impact Assessment

Freshwater Assessment for the proposed Oslaagte Solar 2 PV Facility, Free State Province, South Africa

27 MAY 2023

KROONSTAD SOUTH SOLAR PV CLUSTER, FREE STATE PROVINCE

Prepared by

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Executive Summary

Nitai Consulting (Pty) Ltd. was appointed by Nemai Consulting (Pty) Ltd. to undertake a freshwater aquatic assessment for the proposed 460MW Oslaagte Solar 2 Photovoltaic (PV) Facility, Free State Province, South Africa.

The terms of reference for this study are as follows:

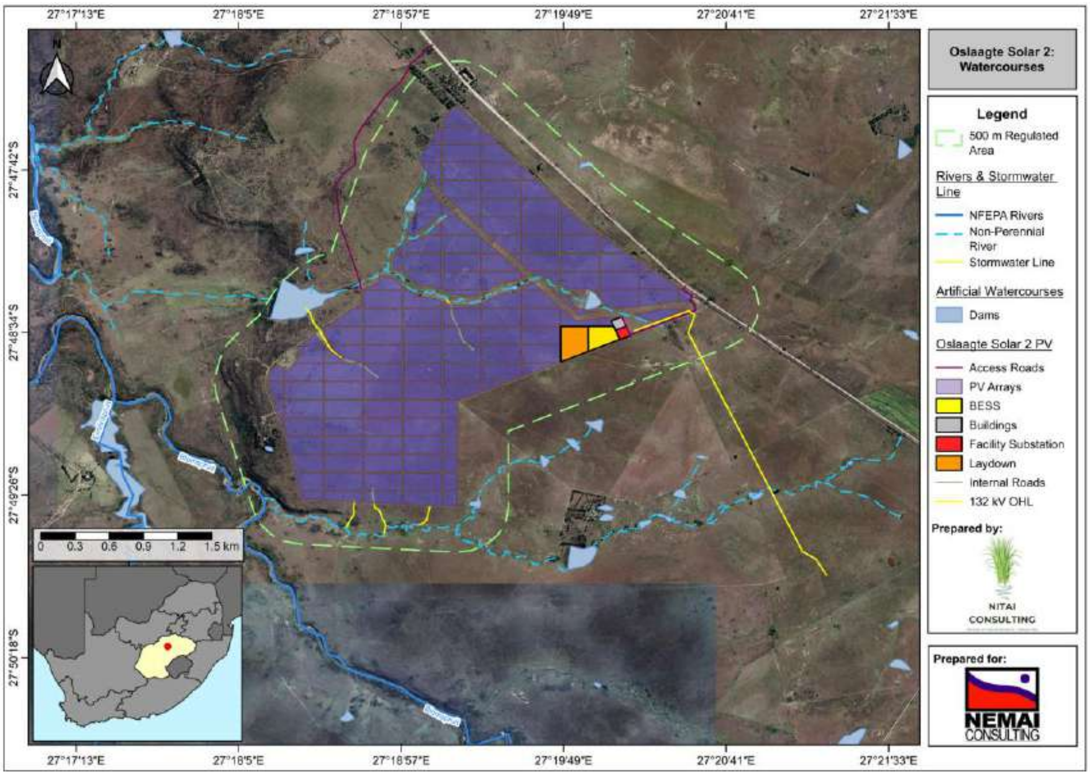
- Identify and delineate of all associated wetlands within the proposed study area;
- Classify each watercourse according to the National Wetland Classification Systems;
- Compile a baseline description of all the potentially impacted aquatic environments according to Government Notice (GN) No. 320, 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.

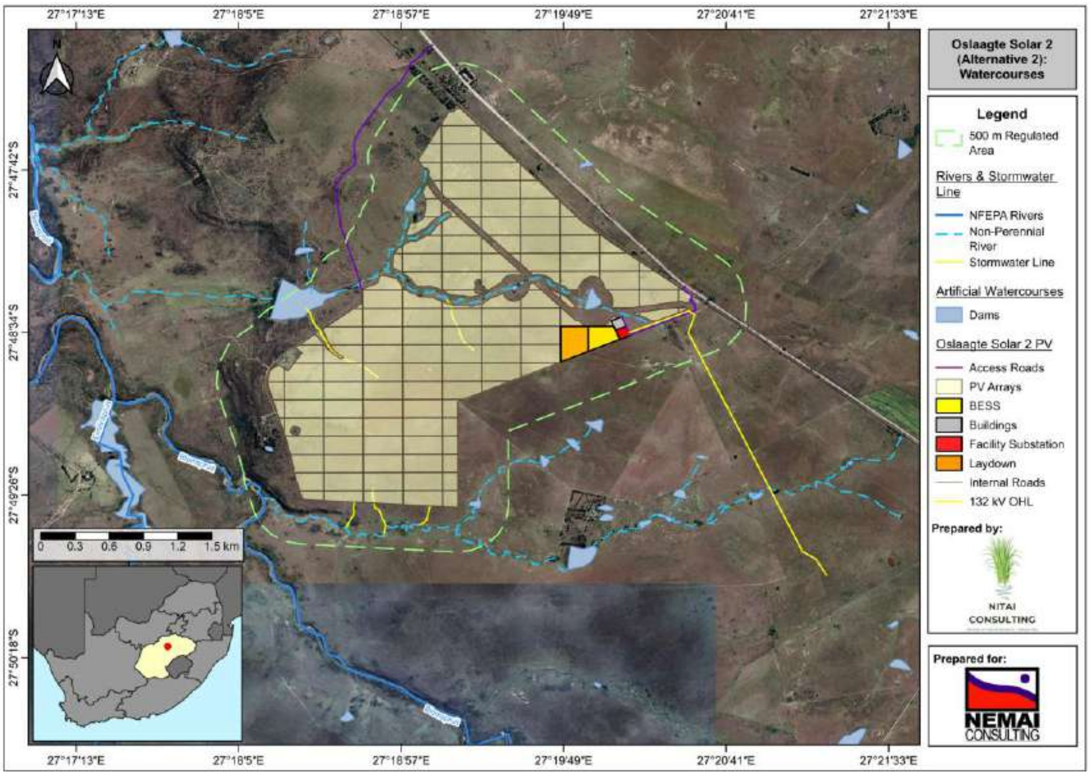
According to the National Web Based Environmental Screening Tool of the Department of Forestry, Fisheries and the Environment, the proposed site sensitivity is **Low** in terms of the Aquatic Biodiversity Theme. However, since watercourses were identified within the Alternative 1 layout, the site sensitivity was classified as **Medium**. Therefore, an Freshwater Impact Assessment was undertaken for the proposed Oslaagte Solar 2 PV Facility (study area).

During site visits to the study area, several non-perennial rivers and stormwater lines were identified in the central, eastern, southern and western portions of the proposed Oslaagte Solar 2 PV facility (Alternative 1) (see Figure below). In addition, one non-perennial and stormwater line is located in the central parts of the PV site (Alternative 1). No wetlands were identified within the footprint of the Oslaagte Solar 2 PV facility. Furthermore, majority of the PV site was classified as **Low** sensitivity while the “no-go” areas as **Medium** and **High** sensitivity. Due to sensitive features identified within the Alternative 1 layout, the layout has been subsequently revised. Therefore, with new revised layout, the Alternative 2 has accommodated these sensitivity features (non-perennial rivers and its associated 32 m buffer zones) (see Figure below). Importantly, due to the low ecological and ecosystem service value of these stormwater lines, these lines were classified as **Low** sensitivity. In addition, the stormwater lines can be used, to their benefit, in conjunction with the stormwater management of the proposed development.

Based on the findings, it is the opinion of the specialist that the proposed development will have a low impact given that the Alternative 2 layout is used as well as following the proposed mitigation and best pollution control measures. The specialist has confirmed the **Low**

sensitivity and 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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List of Abbreviations

BA	Basic Assessment
BESS	Battery Energy Storage System
CBA	Critical Biodiversity Area
CR	Critical
CVB	Channel Valley-Bottom
C-Plan	Conservation Plan
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
EC	Ecological Category
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
F	Floodplain
FL	Flat
FS	Free State
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
m	Meters
MTS	Main Transmission Substation
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
NW	North West
PES	Present Ecological State
PV	Photovoltaic
REC	Recommended Ecological Category
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
VEGRAI	Riparian Vegetation Response Assessment Index
VU	Vulnerable
WMA	Water Management Area
WRC	Water Research Commission
WUL	Water Use License
WULA	Water Use License Application
WSS	Water Supply Scheme
WTW	Water Treatment Works

1 INTRODUCTION

1.1 Background

Oslaagte Solar 2 (Pty) Ltd. (hereafter referred to as the proponent) proposes the 460MW Oslaagte Solar 2 PV Facility (hereafter referred to as the study area) near Kroonstad, Free State Province, South Africa (Figure 1). 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 wetland delineation and risk assessment as part of the Environmental Impact Assessment (EIA) of the proposed Oslaagte Solar 2 PV Facility.

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.

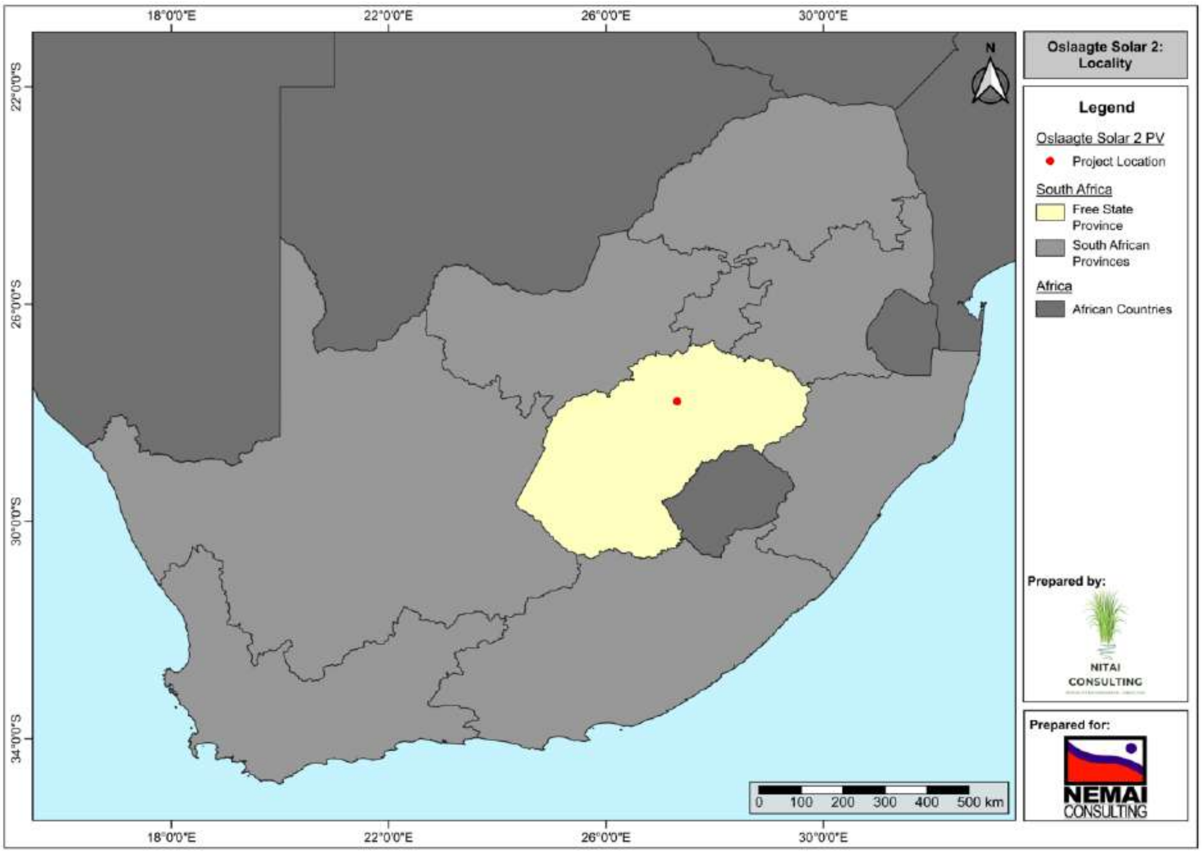

Figure 1: Study area locality in relation to South Africa

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 50cm 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 6.4.2
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 Oslaagte Solar 2 PV Facility is situated west of Kroonstad, Free State Province, South Africa (see Figure 2 below). Moreover, the proposed study area is located within the Fezile Dabi District Municipality and the Moqhaka Local Municipality. The study area can be accessed via the N1.

3.2 Project Description

The proponent proposes the development of two Alternative Layout options of the 460MW Oslaagte Solar 2 PV Facility located on Portion 0 of the Farm Oslaagte No. 2564, south east of Kroonstad, in the Free State Province (Figure 3).

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

- PV modules and mounting structures that will consist of either Monofacial or Bifacial PV panels, mounted on either fixed-tilt, single-axis tracking, and/or double-axis tracking systems;
- Inverters and transformers;
- A Battery Energy Storage System (BESS) (up to 5 hectares (ha)),
- Operation and Maintenance buildings including a gate house and security building, control centre, offices, warehouses and workshops for storage and maintenance;
- Facility grid connection infrastructure, including:
    - 33 kilovolt (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 proposed Main Transmission Substation (MTS).
- Temporary construction laydown area (up to 7 ha);
- Permanent laydown area (up to 1 ha) and located within the demarcated temporary laydown area;
- Internal roads (up to 6 m wide) providing access to Solar PV panels; and finally,
- Main access road (up to 8 m wide).

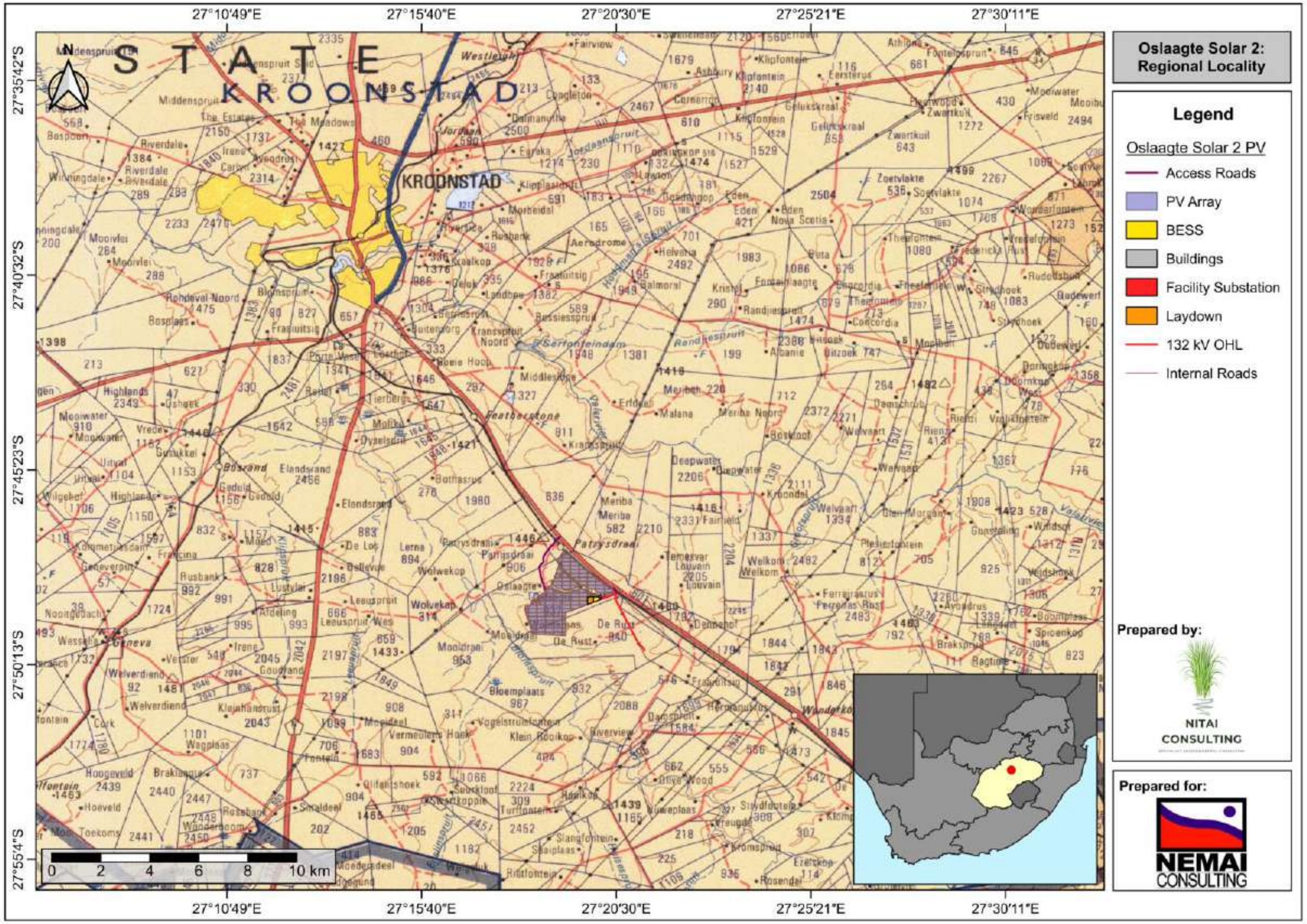

Figure 2: Regional Locality of the proposed study area (Alternative 1)

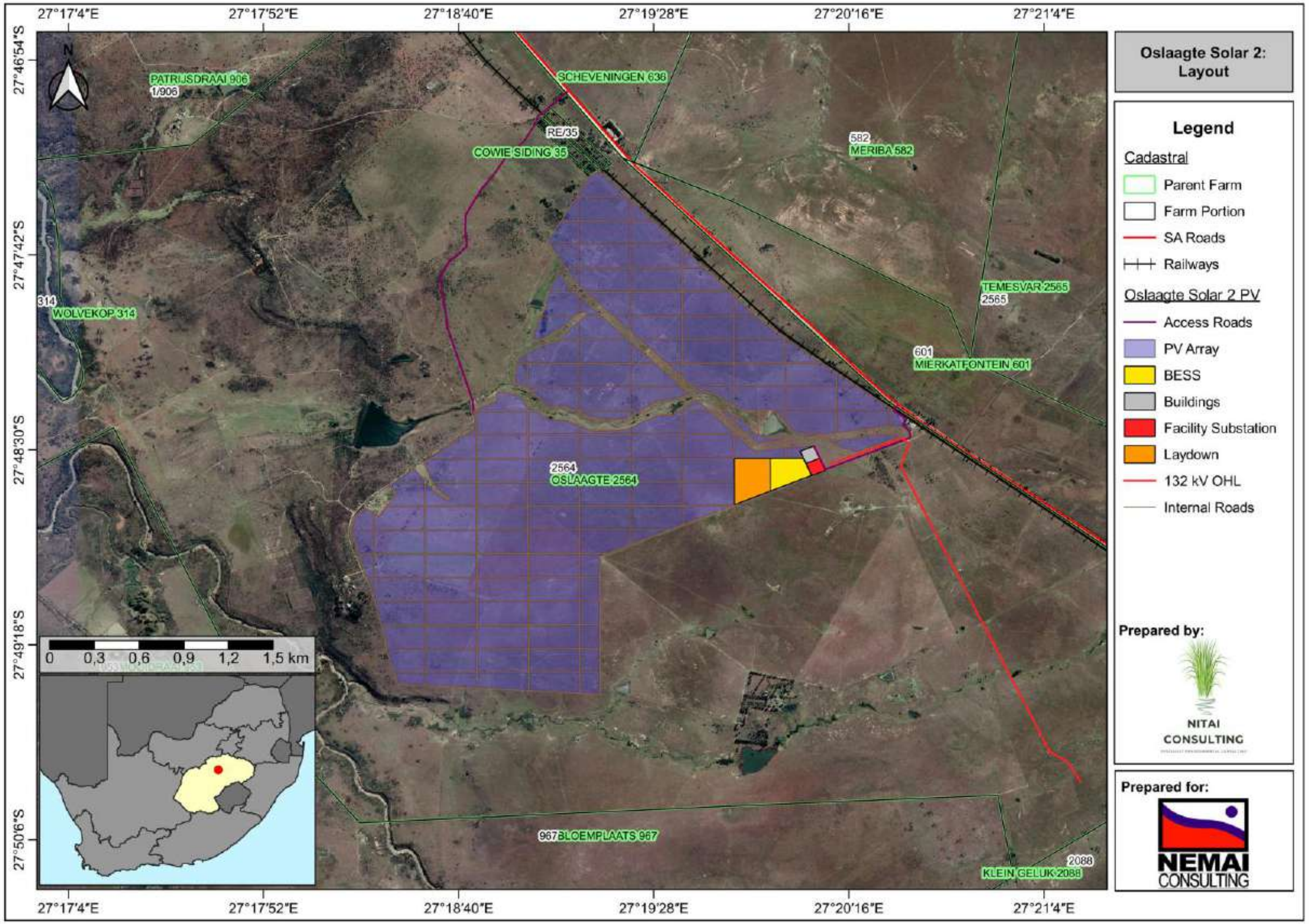

Figure 3: Proposed Alternative 1 layout of the Oslaagte Solar 2 PV Facility

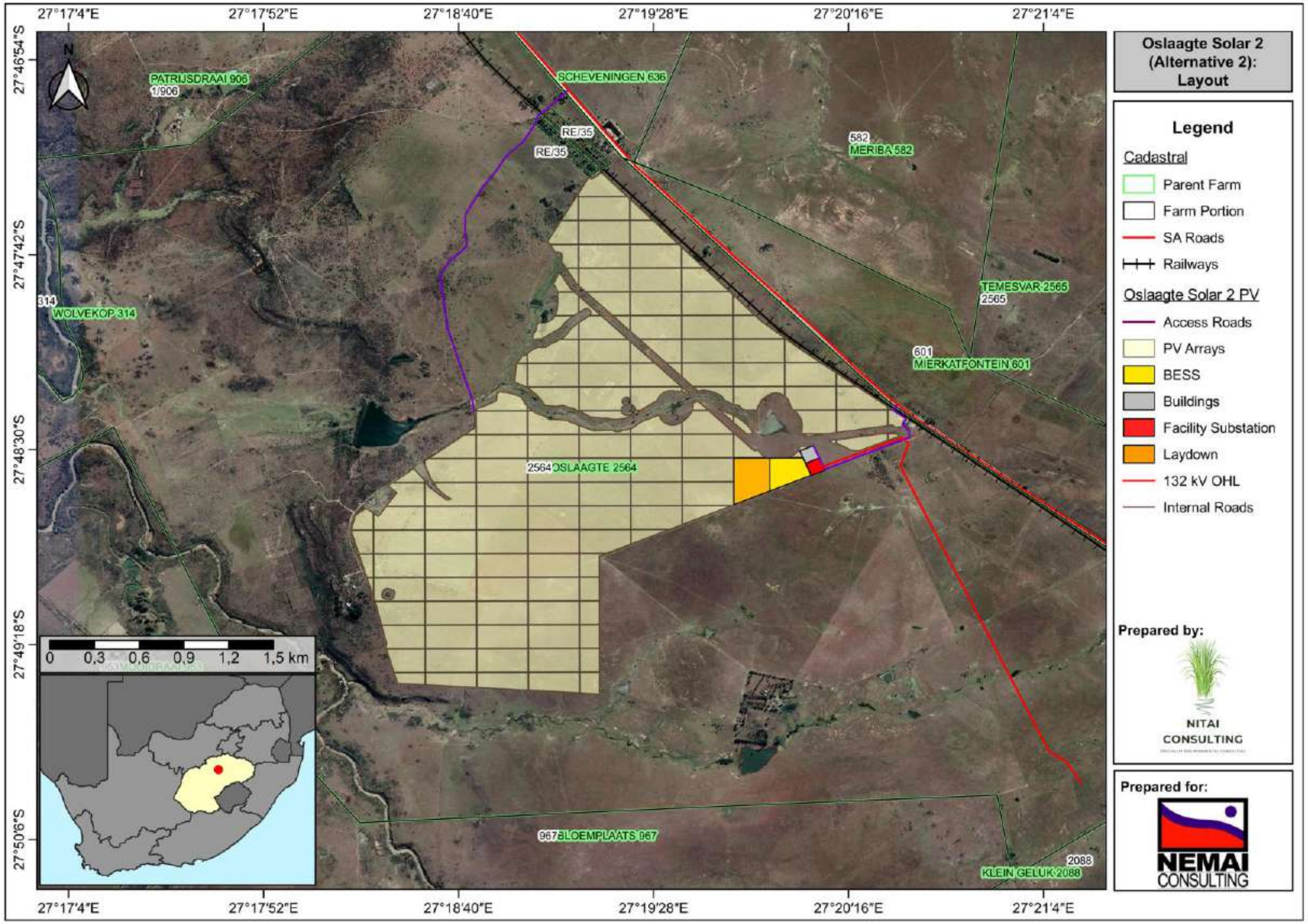

Figure 4: Proposed Alternative 2 layout (Preferred Layout) of the Oslaagte Solar 2 PV Facility

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 Oslaagte Solar 2 PV Facility 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);
- Free State Critical Biodiversity Areas (CBA's) and Ecological Support Areas (ESA's) (Collins, 2016);
- 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 5 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.

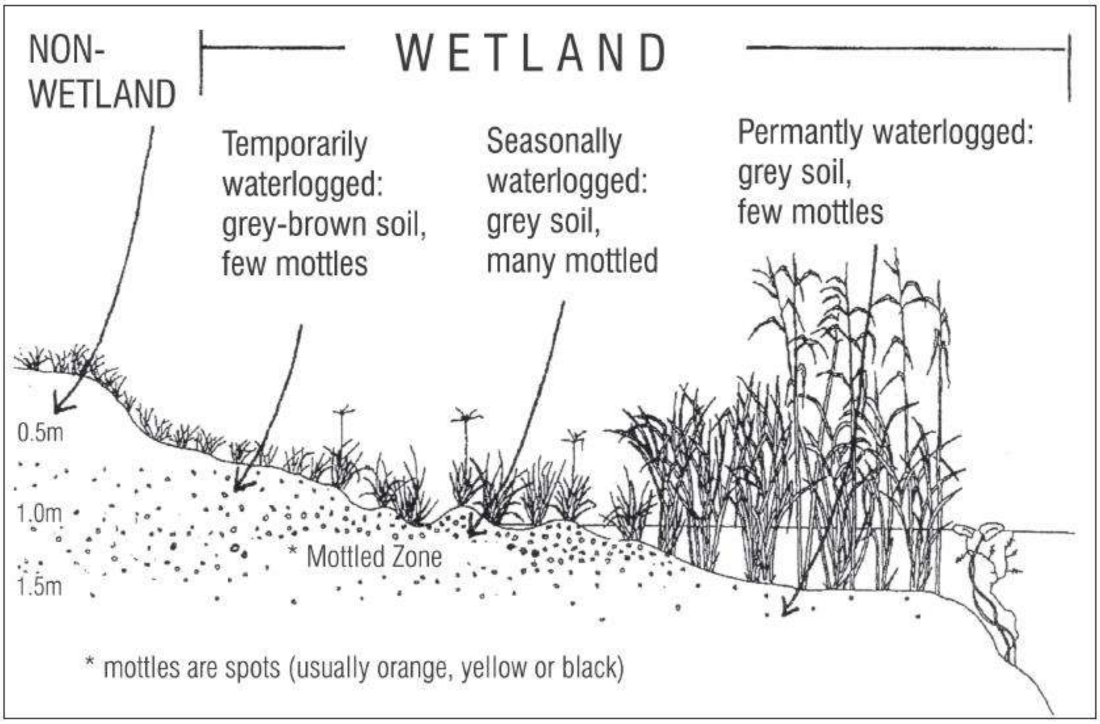

Figure 5: Cross-section through a wetland, indicating how soil wetness and vegetation indicators changes as one moves along a gradient (Extracted from DWAF 2005).

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 Present Ecological Category (EC) of Riparian Zones

To determine the EC of riparian zones, the method of Kleynhans *et al*. (2007): Module F: Riparian Vegetation Response Assessment Index (VEGRAI) was used. The Excel-based tool combines the degree of change of marginal and non-marginal vegetation to provide an Ecological Category or EC score for the riparian zones. Please see Table 3 below for EC and their scores.

Table 3: Generic Ecological Categories for EcoStatus components (adapted from Kleynhans, 1996 & Kleynhans, 1999)

Ecological Category	Description	% Score
A	Unmodified, natural.	90 – 100
B	Largely natural with few modifications. A small change in in natural habitats and biota may have taken place. However, ecosystem functions remain unchanged.	80 – 89
C	Moderately modified. Loss and change of natural habitats and biota have taken place but ecosystem functions remain predominantly unchanged.	60 – 79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem function has occurred.	40 – 59
E	Seriously modified. An extensive loss of natural habitat, biota and basic ecosystem function has occurred.	20 – 39
F	Critically modified. Modifications has reached a critical point and the lotic system has been completely modified	0 – 19

	with an almost complete loss of natural habitat and biota. Worst case, basic ecosystem function has been destroyed and changes are irreversible.	

4.1.6 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 (Rountree *et al*., 2013).

Table 4: 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

4.1.7 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).

4.1.8 Determination of Buffer Zones

The appropriate buffer zones for the proposed Oslaagte Solar 2 PV Facility were determined using the “Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands, and Estuaries” by Macfarlane and Bredin (2017).

4.1.9 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 5:

Table 5: 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.

4.1.10 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; and
- **The assessment of wetlands presented in this report is limited to the proposed project footprint and does not include the extended 500 m radius regulated area of the Oslaagte Solar 2 PV Facility. Therefore, this report cannot be used for WUL application.**

5 STATUS QUO ANALYSIS

The following sections provide context of the aquatic environment in relation to the proposed Oslaagte Solar 2 PV Facility.

5.1 Regional context

5.1.1 Climate

The study area is within the BSk (cold semi-arid steppe) climate according to the Koppen-Geiger classification. The area is characterised by summer-rainfall seasonal precipitation with an overall Mean Annual Precipitation (MAP) of 560 mm. Most of the study area's rainfall is of convectional origin and peaks in December and January. Temperatures around the study area is around 15 ºC. In addition, incidence of frost is relatively (43 days on average) (Mucina & Rutherford, 2006).

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 6 with the location and extent shown in Figure 6.

Table 6: Description of the Ecoregion classified for the study area

Ecoregion (Level I)	Ecoregion (Level II)	Description
11	11.03 & 11.08	**Highveld:** Plains with 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.

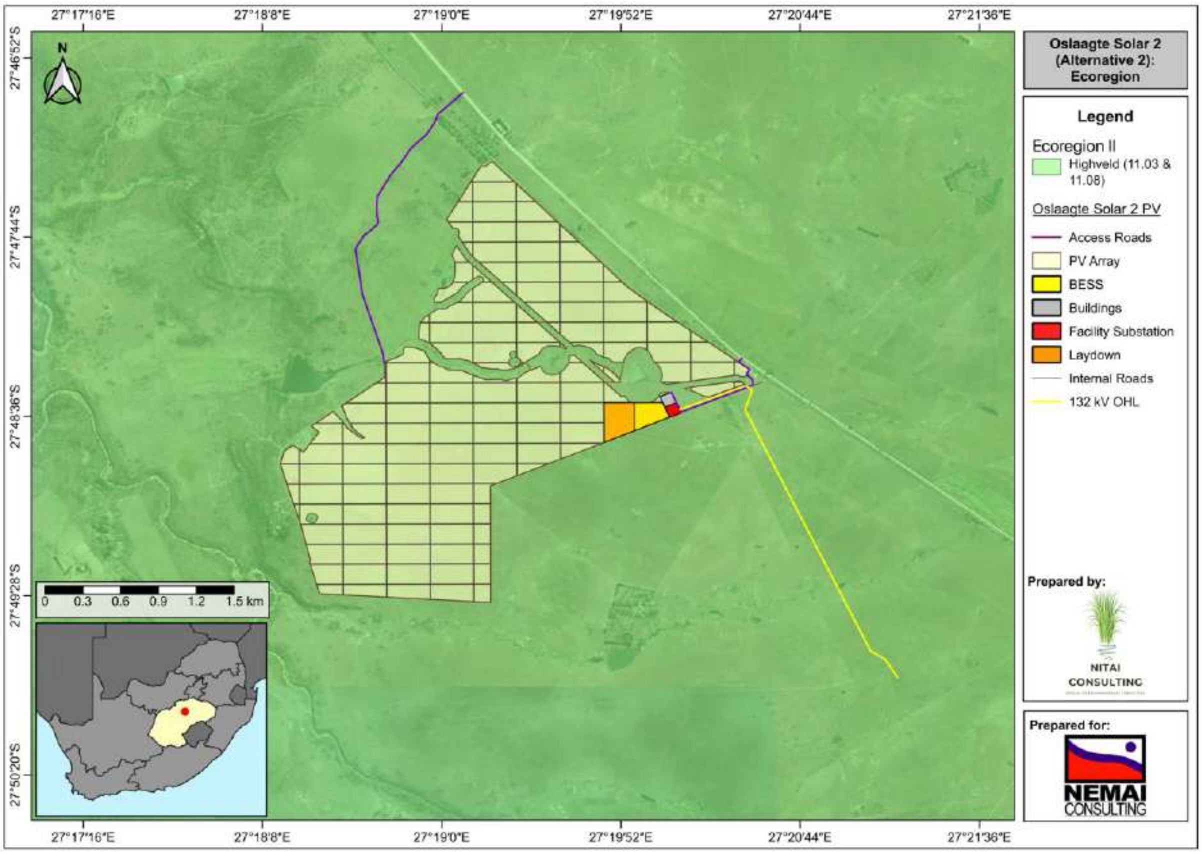

Figure 6: Map indicating the location of the Ecoregion relevant to the study area (Preferred Layout)

5.1.3 Geology and Soils

The underlying geology of the study area varies, and is comprised of Mudstone and Arenite. Both these geology types are part of the Karoo Supergroup formation (mostly Adelaide Subgroup and the Beaufort Group) (Figure 5 and Figure 6). These formations and types give rise to vertic, melanic and red soils (typical soils forms include Arcadia, Bonheim, Kroonstad, Valsrivier and Rensburg). In addition, soil forms such as Clovelly, Avalon and Westleigh also occur. The dominant land type is Bd (Eutrophic; red soils not widespread), however, Bc (Eutrophic; red soils widespread), Ae (Red, high base status, >300 mm deep (no dunes), Dc (One or more of: vertic, melanic, red structured horizons) and Ba (Dystrophic and/or mesotrophic; red soils widespread) land types also occur (Mucina & Rutherford, 2006; van der Waals *et al*., 2019). From spatial data, the study area is comprised of various different soil types that includes Valsrivier, Swartland, Westleigh, Bonheim, Mispah and Kroonstad (Figure 7).

Between the different land types the soil moisture regime varies. In the Ae land type, the soil moisture leaches from profiles, but can also be one of free drainage. Soils in this land type do not typically show mottling or redox morphology. Wetlands could occur within these land types, however, they are confined to the immediate watercourse in depressions (van der Waals *et al*., 2019). Within the B land type (Plinthic landscapes with almost no upland duplex and margalitic soils), the moisture regime is dominated by the presence of restricting rock layers at depths that leads to perching of water in localised water tables and lateral seepage zones. As such, soils tend to express clear redox morphology characteristics due to distinctive zones of water fluctuation and prolonged saturation zones. In addition, zones where water manifests close to the surface is also prominent in this land type. Moreover, land types Ba and Bc (red soil dominated plinthic landscapes) tends to express smaller wetland soil distributions than the Bb and Bd land types (bleached and yellow soil dominated plinthic landscapes) (van der Waals *et al*., 2019). The D land type is characterised as Duplex soils with distinct differences between saturated and unsaturated hydraulic connectivity. Within this land type, wetlands are often in areas identified with E horizons and shallow lateral seepage as a result of perching of the water on the structure subsoil (van der Waals *et al*., 2019).

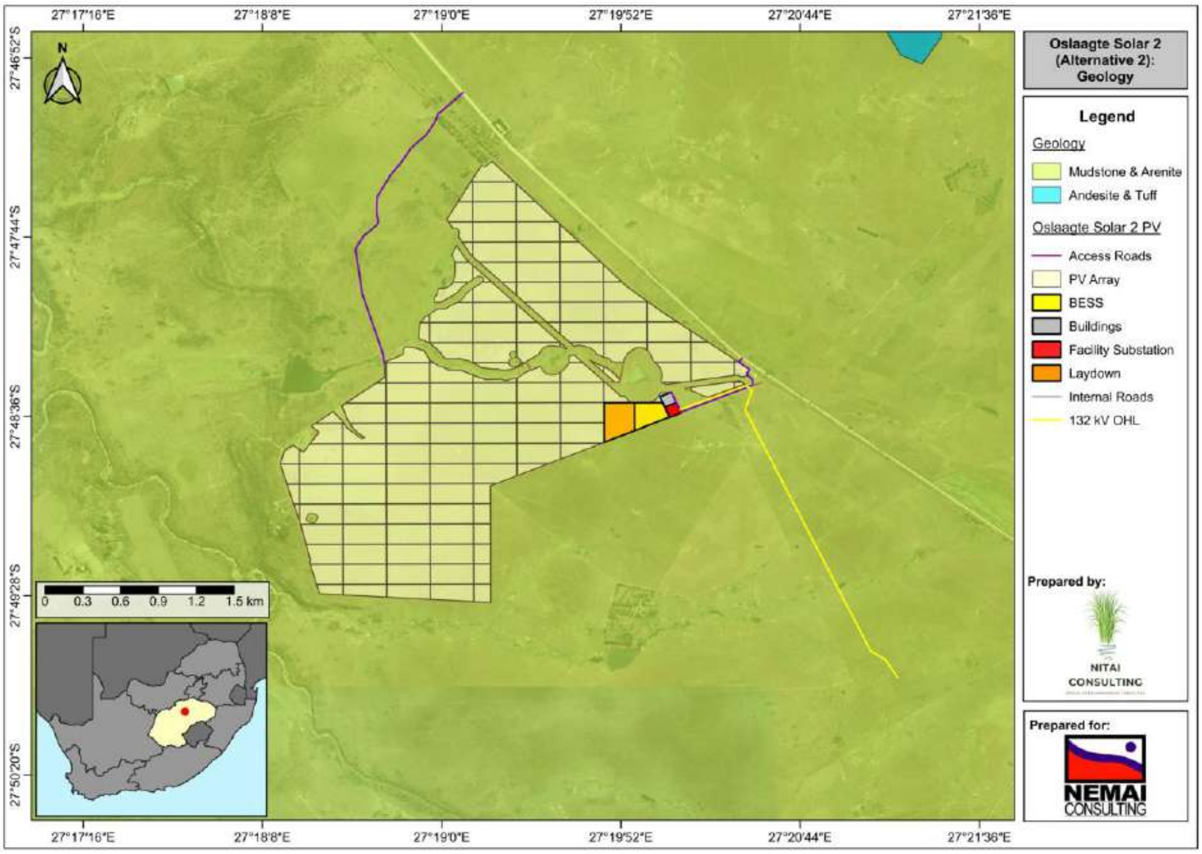

Figure 7: Map indicating the various Geology types associated with the study area (Preferred Layout)

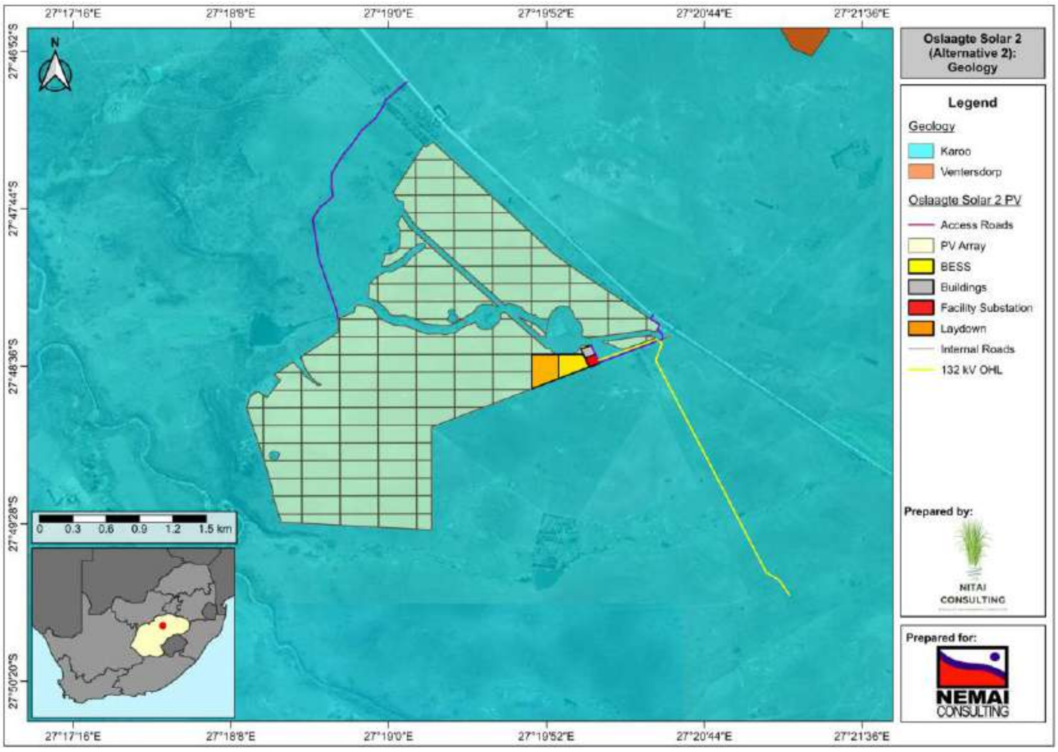

Figure 8: Map indicating the extent of the various different Geology groups associated with the study area (Preferred Layout)

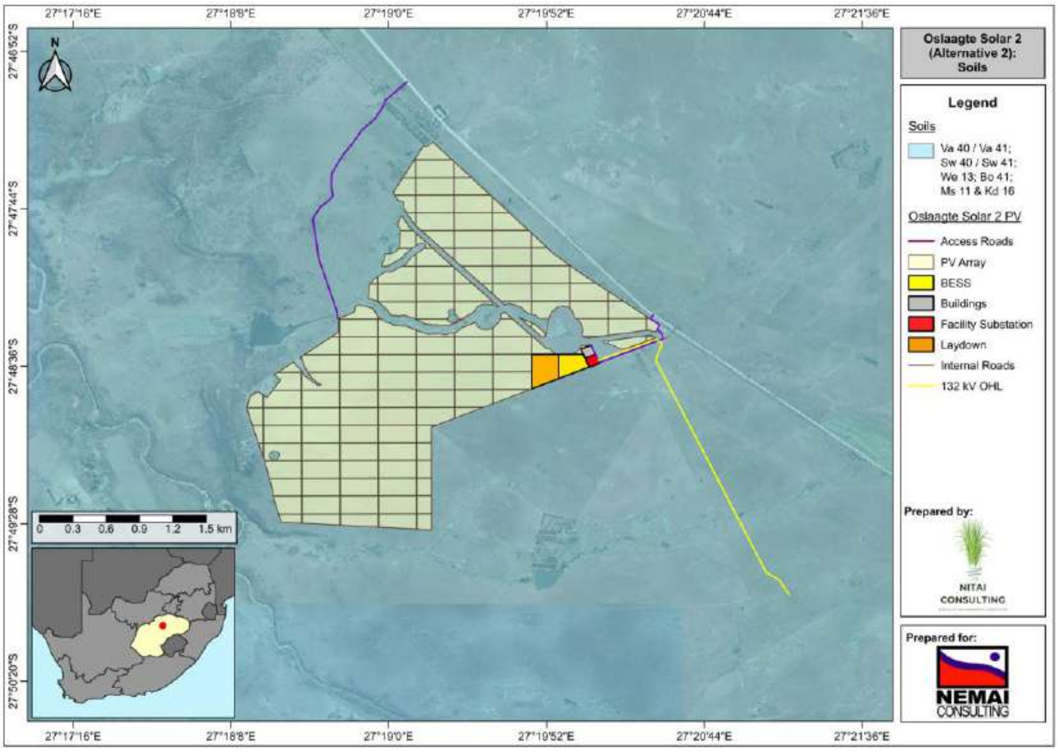

Figure 9: Soil map indicating the various different soil forms associated with the study area (Preferred Layout)

5.1.4 Vegetation characteristics

The study area falls within the Dry Highveld Grassland Bioregion (Gh6) and is characterized as the Central Free State Grassland (Figure 10). The Central Free State Grassland is characterized as undulating plains supporting short grassland, in natural condition dominated by *Themeda triandra* while *Eragrostis curvula* and *E. chloromelas* become dominant in degraded habitats (Mucina & Rutherford, 2006). The dwarf karoo bushes establish in several degraded clayey bottomlands while in heavy clayey the encroachment of *Acacia karroo* are very prominent in overgrazed and trampled low-lying areas (Mucina & Rutherford, 2006).

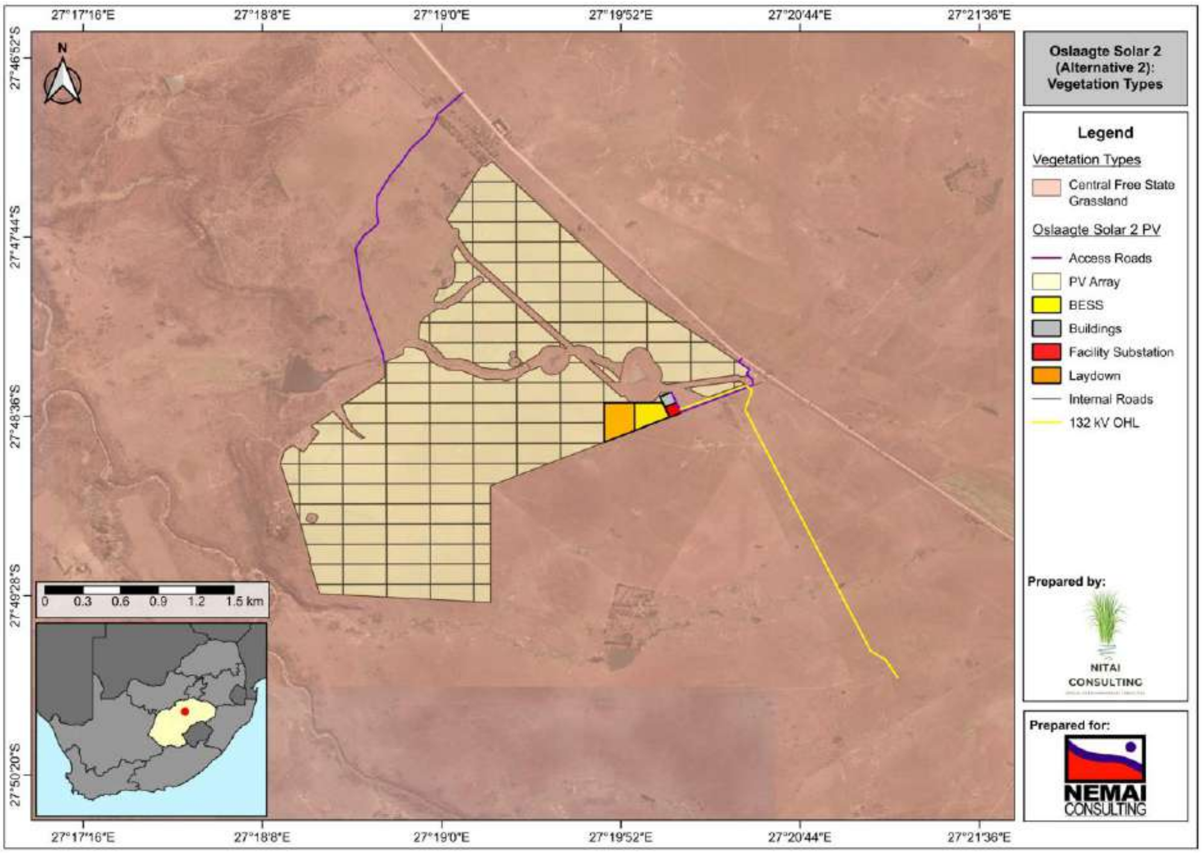

Figure 10: Vegetation type associated with the study area (Preferred Layout)

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 11). 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).

The study area is located within the C60F Quaternary Catchment (Blomspruit sub-catchment) while parts of the access road is located within the C60D Quaternary Catchment (Vals River sub-catchment) (see Figure 12). 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 C60F Quaternary Catchment, DWS has determined a PES as C (Moderately modified). In addition, the EIS was determined as C (Moderate Ecological Importance and Sensitivity) (DWS, 2014). Also, DWS has determined for the C60D Quaternary Catchment that the PES is D (Largely Modified) and the EIS as B (High Ecological Importance and Sensitivity) (DWS, 2014). According to the Classes and Resource Quality Objectives of Water Resources for Catchments of the Middle Vaal (GN No. 469 in Government Gazetted No. 39943 published on 22 April 2016), the Recommended Ecological Category (REC) for the Blomspruit sub-catchment has been determined as C (Moderate) (DWS, 2014).

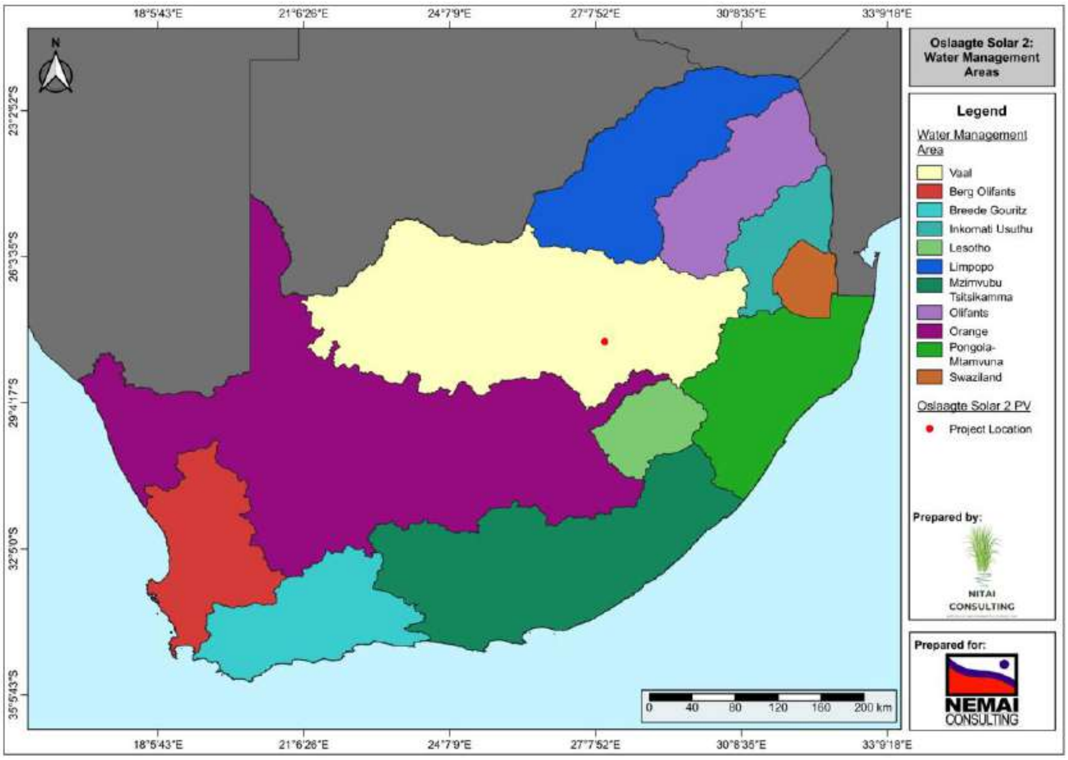

Figure 11: Water Management Area associated with the study area

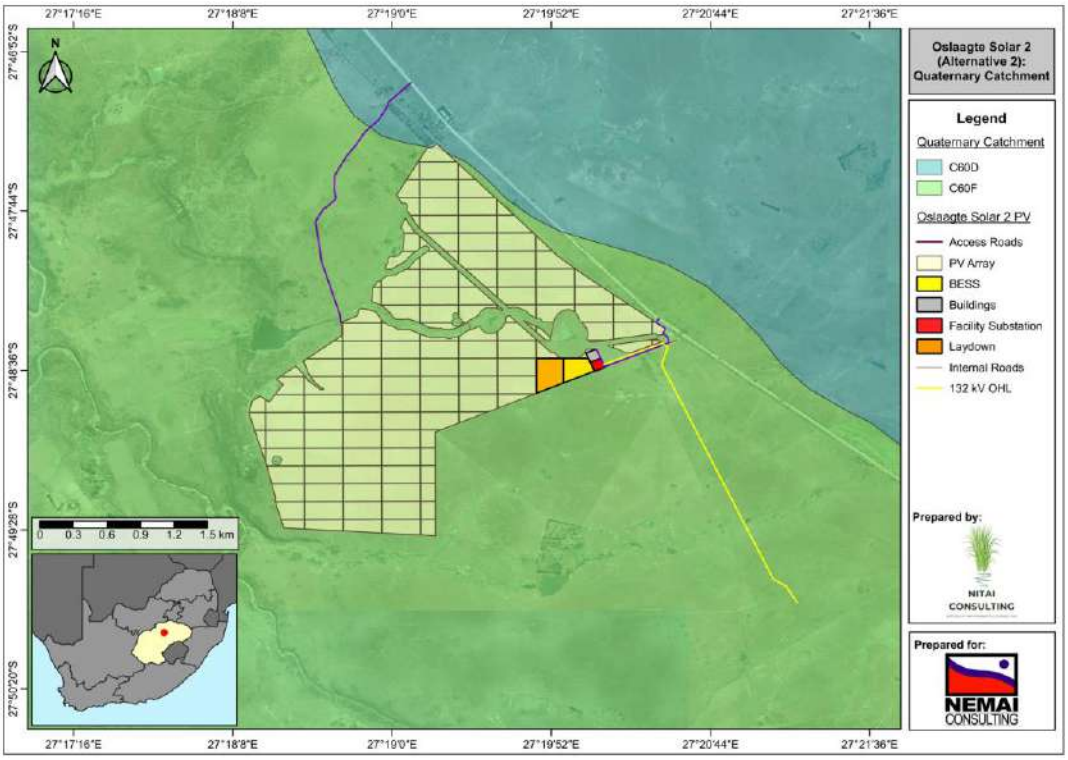

Figure 12: Quaternary Catchments associated with the study area (Preferred Layout)

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 13 shows the remaining extent of Threatened Ecosystems in the region surrounding the study area. Majority of Oslaagte Solar 2 PV is situated within **Least Concern (LC)** areas while parts of the PV site is within **Unclassified** areas.

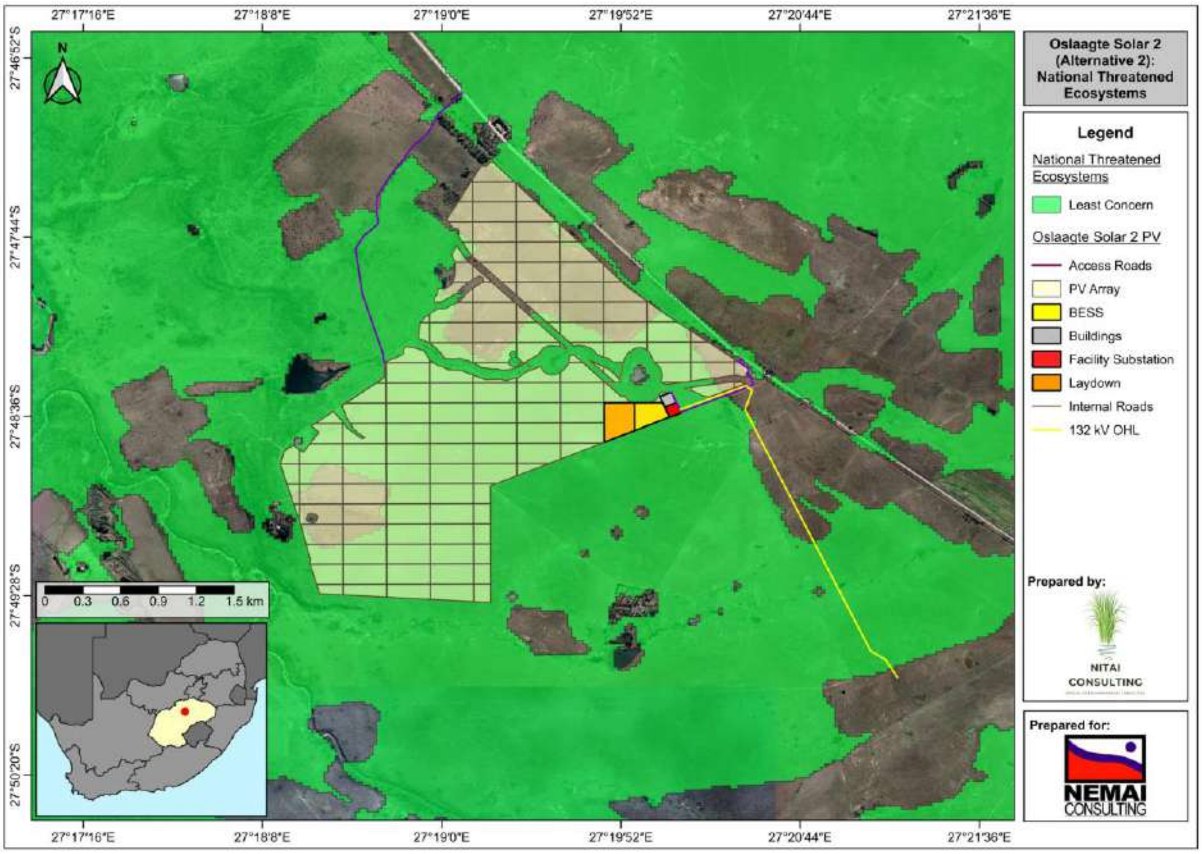

Figure 13: Map showing the location of the study area (Preferred Layout) in relation of the estimated remaining extent of the identified Threatened Ecosystems (SANBI, 2021)

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 14. The study area is situated in unclassified land and **Priority Focus Areas**. In addition, a small section of the powerline route is within unclassified land while majority of the route situated in a **Priority Focus Area**.

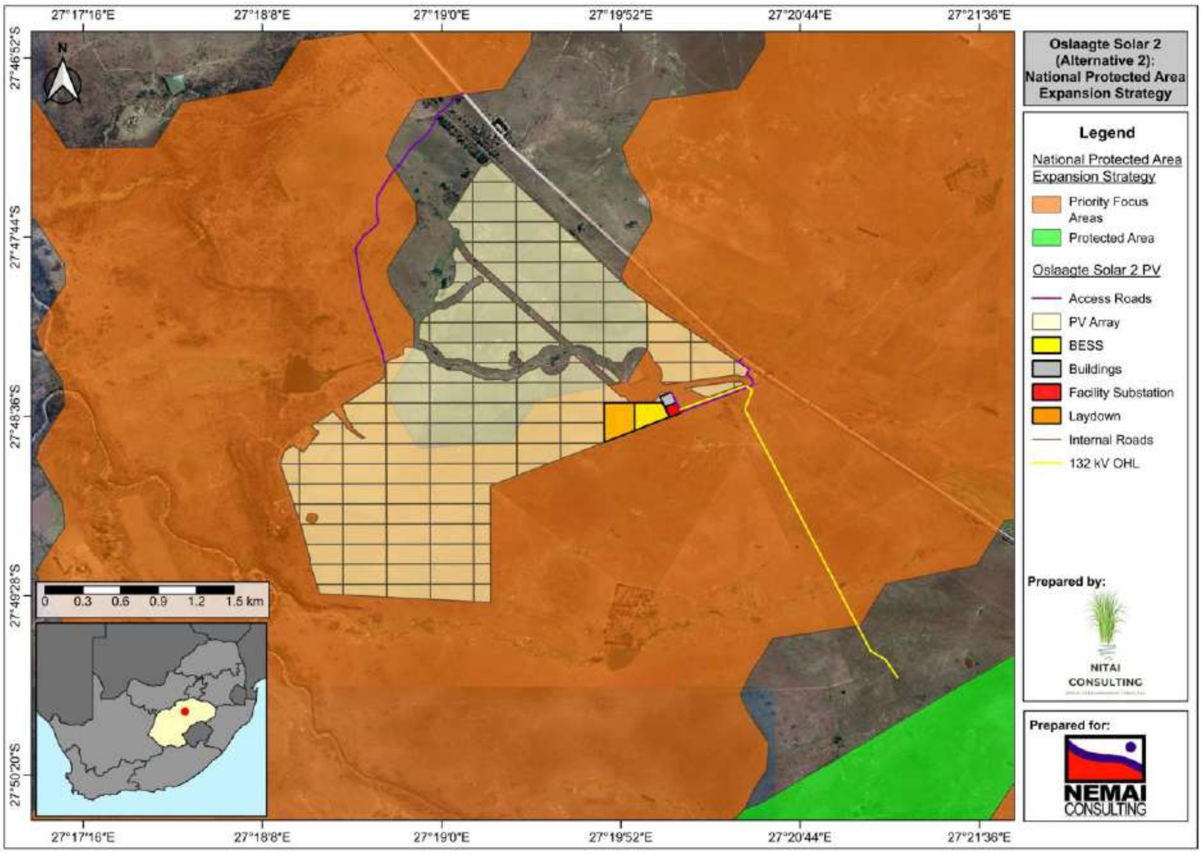

Figure 14: Map showing the study area (Preferred Layout) in relation to the National Protected Areas Expansion Strategy

5.2.1.3 Watercourses

National Freshwater Ecosystem Priority Areas (NFEPA) rivers

The watercourses map in Figure 15 highlights the NFEPA rivers, non-perennial rivers and dams associated with the study area (Alternative 1). The Blomspruit (a tributary of the Vals River) is the largest perennial river the flows in a northerly direction before draining into the Vals River further north. Furthermore, several small non-perennial rivers are found within the northern, south eastern, southern and western parts of the study area. A few small and large agricultural dams are located in these non-perennial rivers. Not much information on the Blomspruit is currently available. Due to these non-perennial rivers, the layout has been revised to accommodate these rivers. As such, the new layout (also the preferred layout) is situated outside any sensitive features (Figure 16). The study area is not situated within any river FEPA catchments (areas that achieve biodiversity targets for river ecosystems and fish species) and these catchments are identified in rivers that are currently in good condition (Ecological category of A or B).

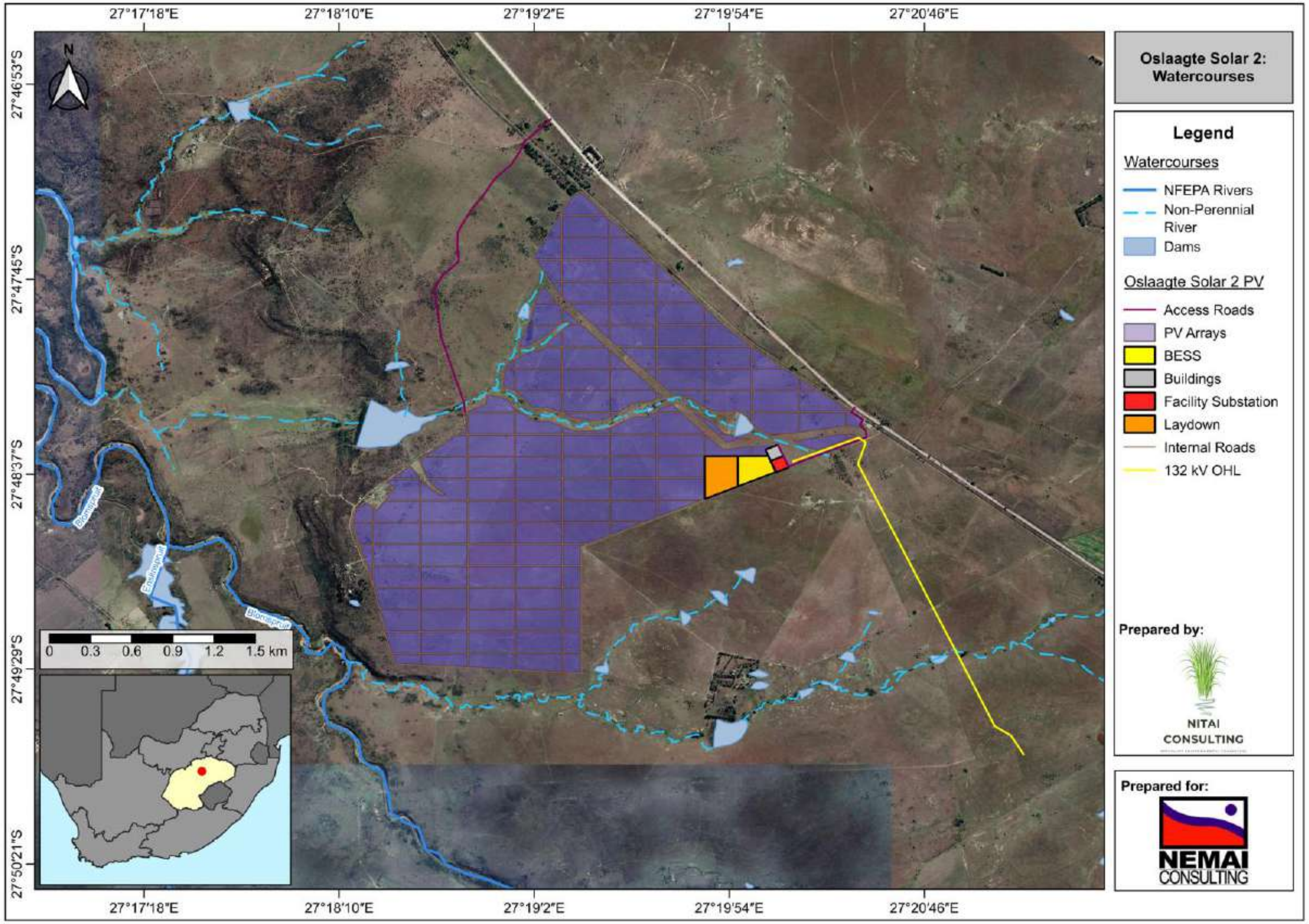

Figure 15: Map showing watercourses (NFEPA rivers, non-perennial rivers and Dams) associated with the study area (Alternative 1)

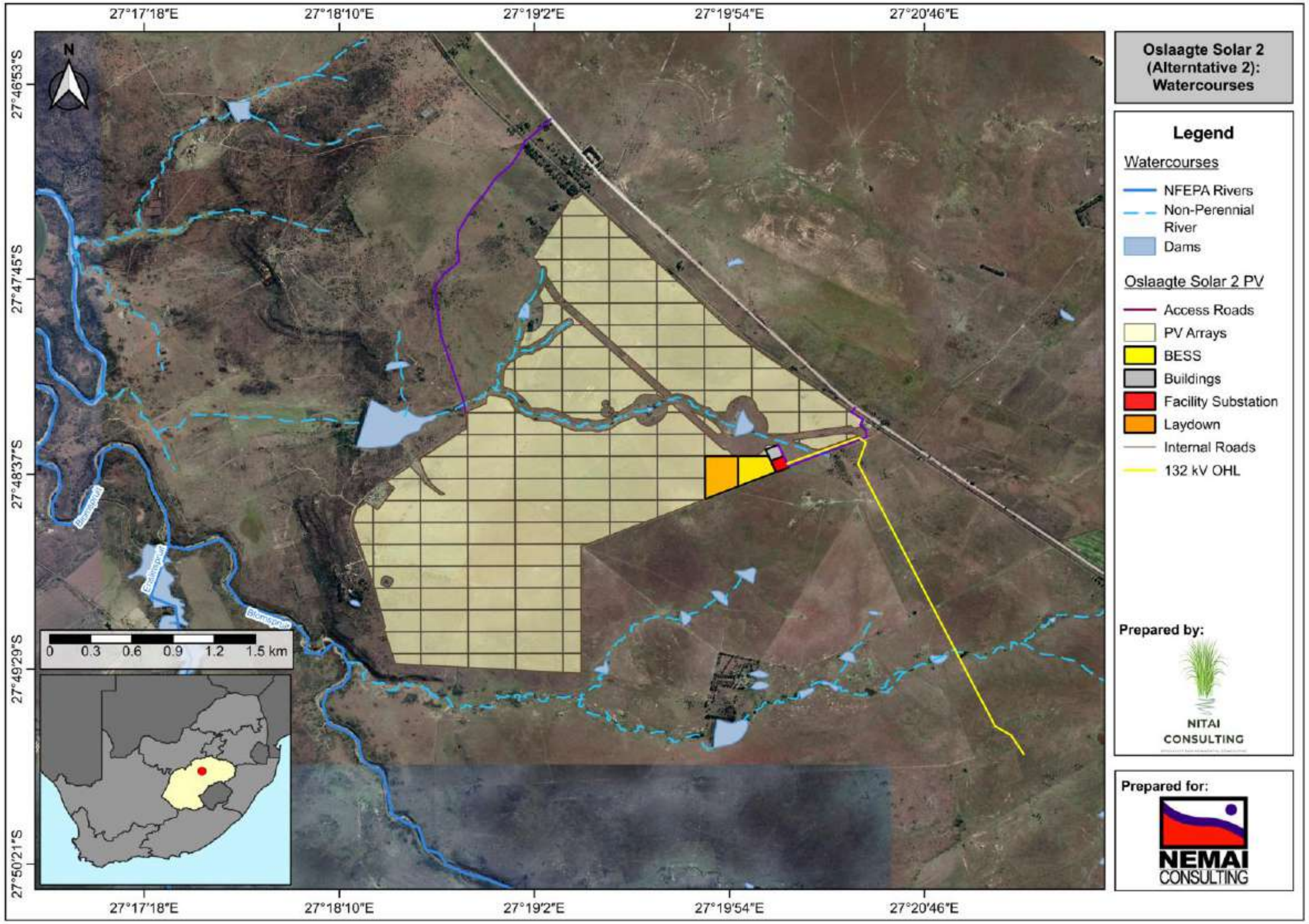

Figure 16: Map showing watercourses (NFEPA rivers, non-perennial rivers and Dams) associated with the study area (Alternative 2 & Preferred Layout)

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, and within the 500 m regulated area, there is no HGM units according to the NBA 2018 NWM 5 spatial data (Figure 17).

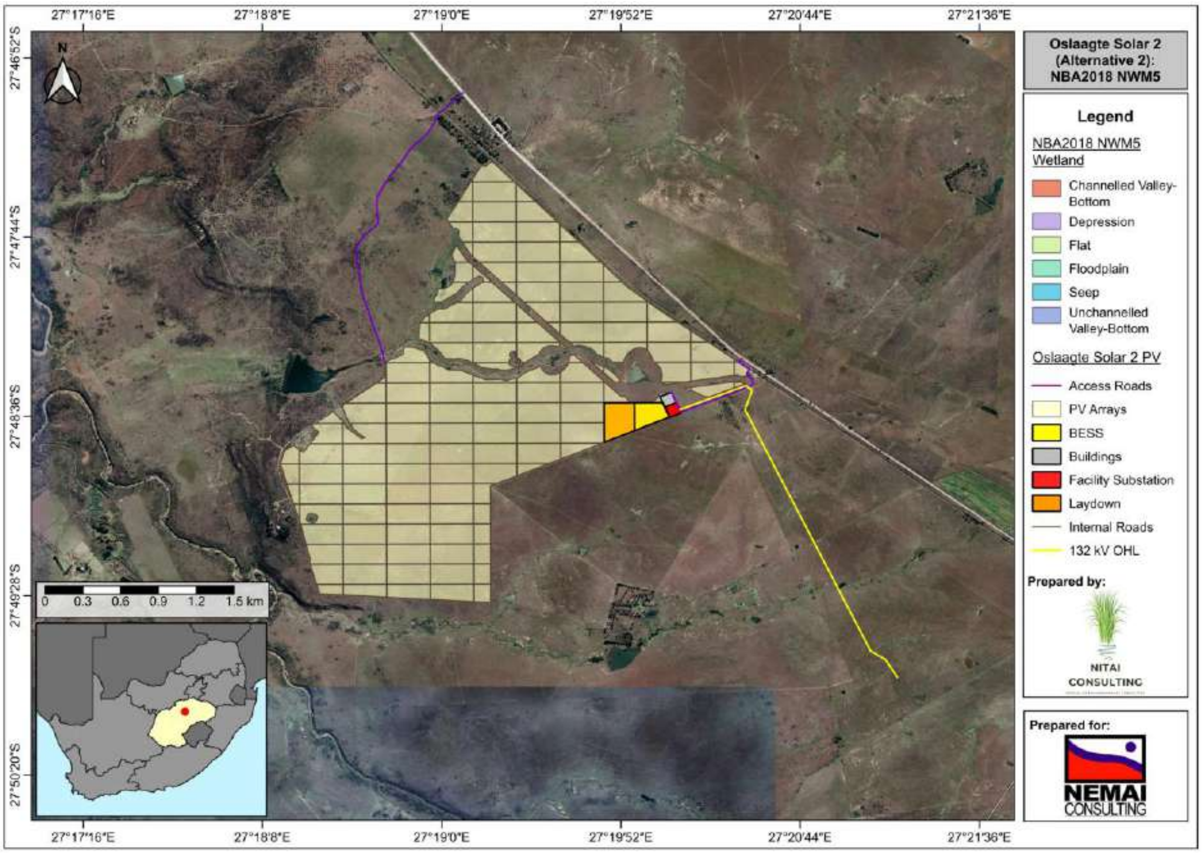

Figure 17: Map indicating the wetland hydrogeomorphic units associated with the study area (Preferred Layout)

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 area is not situated within any of South Africa's three SWSA's (Figure 18).

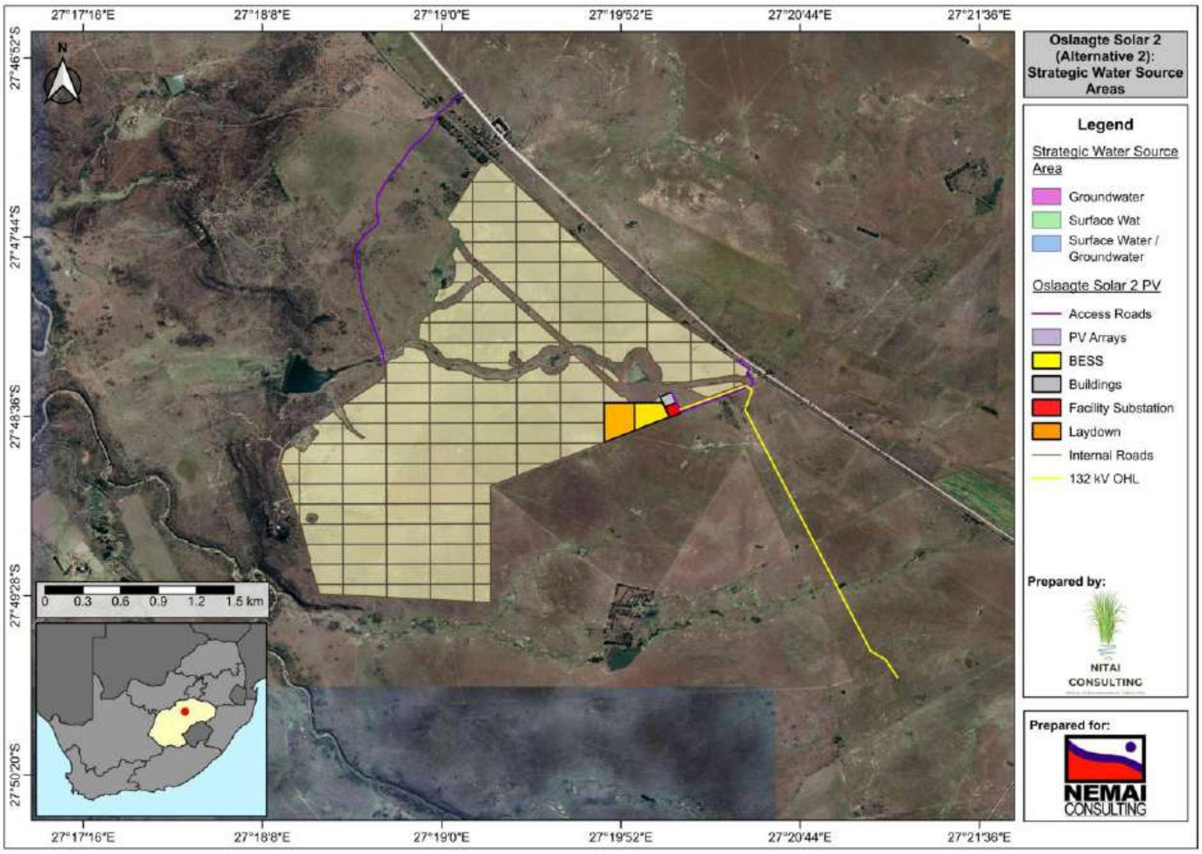

Figure 18: Map indicating the Strategic Water Source Areas in relation to the study area (Preferred Layout)

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 Free State (FS) Biodiversity Plan (Collins, 2016). The biodiversity plan identifies areas that are important for the representation and persistence of terrestrial and aquatic species and ecosystems. These areas are referred to as Critical Biodiversity Areas (CBA's) which is the minimum area required to ensure the persistence and representation of biodiversity (Collins, 2016). Critical Biodiversity Areas within the FS are planning units that when not included in the final portfolio will result in targets not being met. As such, these areas are identified based on irreplaceability output of the Conservation Plan (C-Plan) or the frequency of selection analysis of Marxan (Collins, 2016). Furthermore, CBA 1 and CBA 2 areas are areas of high biodiversity that will result in targets not achieved when excluded from the final portfolio (CBA 1) and areas that will not necessarily result in loss of achievable targets from the final portfolio

(CBA 2). These areas account for 12 % of the biodiversity plan (Collins, 2016). Importantly, aquatic features have yet to be included in the FS Biodiversity Plan, with the exception of FEPA catchments and wetland clusters (which is included as Ecological Support Areas).

The spatial dataset from Collins (2016) highlights that the proposed Oslaagte Solar 2 PV facility is not located within either CBA 1 or CBA 2 areas (Figure 19).

5.2.2.2 Ecological Support Areas (ESA's)

Ecological Support Areas (ESA's) are areas required to support the persistence of terrestrial and/or aquatic species. In the Free State, the ESA's covers a total of 53% area of the biodiversity plan (Collins, 2016).

From the FS Biodiversity spatial data, majority of the PV site is located within an ESA 2 with small portions of the PV site with ESA 1 areas. In addition, a small section of the PV site is within degraded land while the 132 kV powerline route is within land classified as other and degraded land (Figure 19) (Collins, 2016).

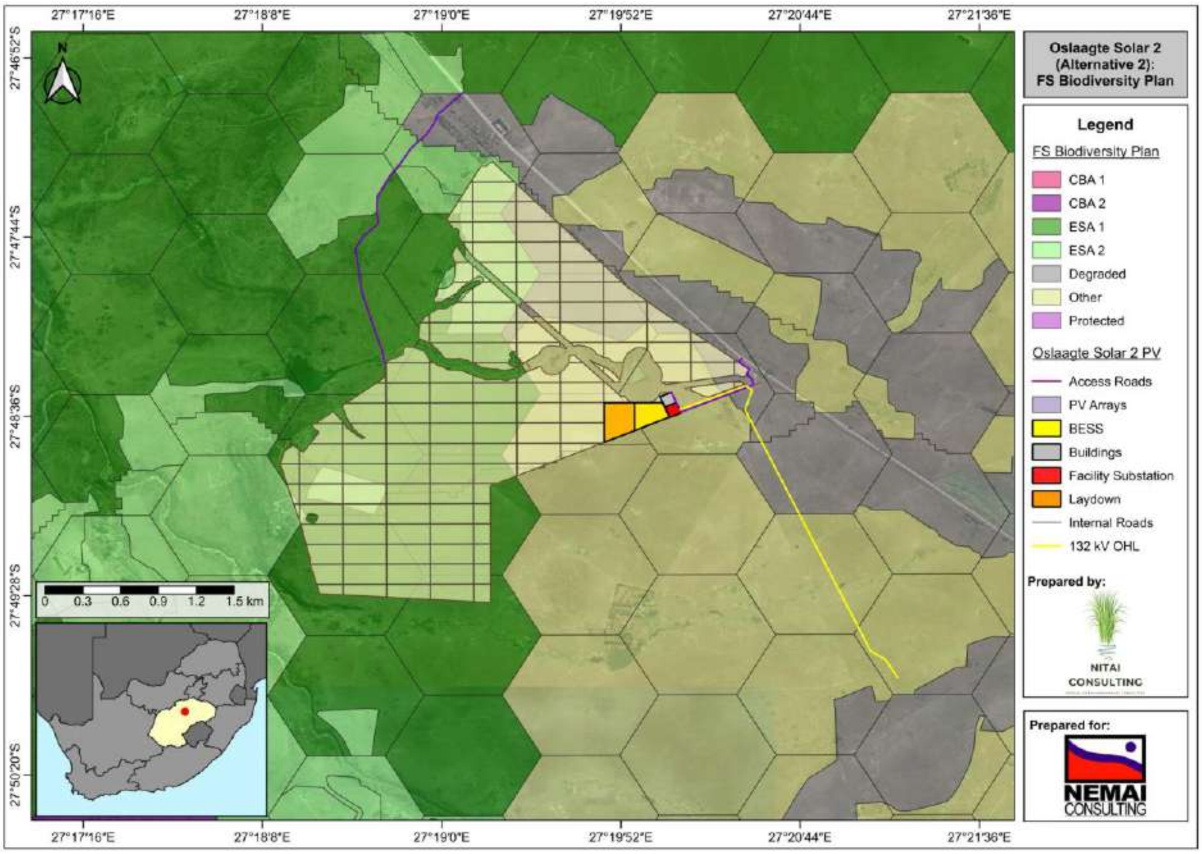

Figure 19: Map indicating the Free State Biodiversity Plan in relation to the study area (Preferred Layout)

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 20).

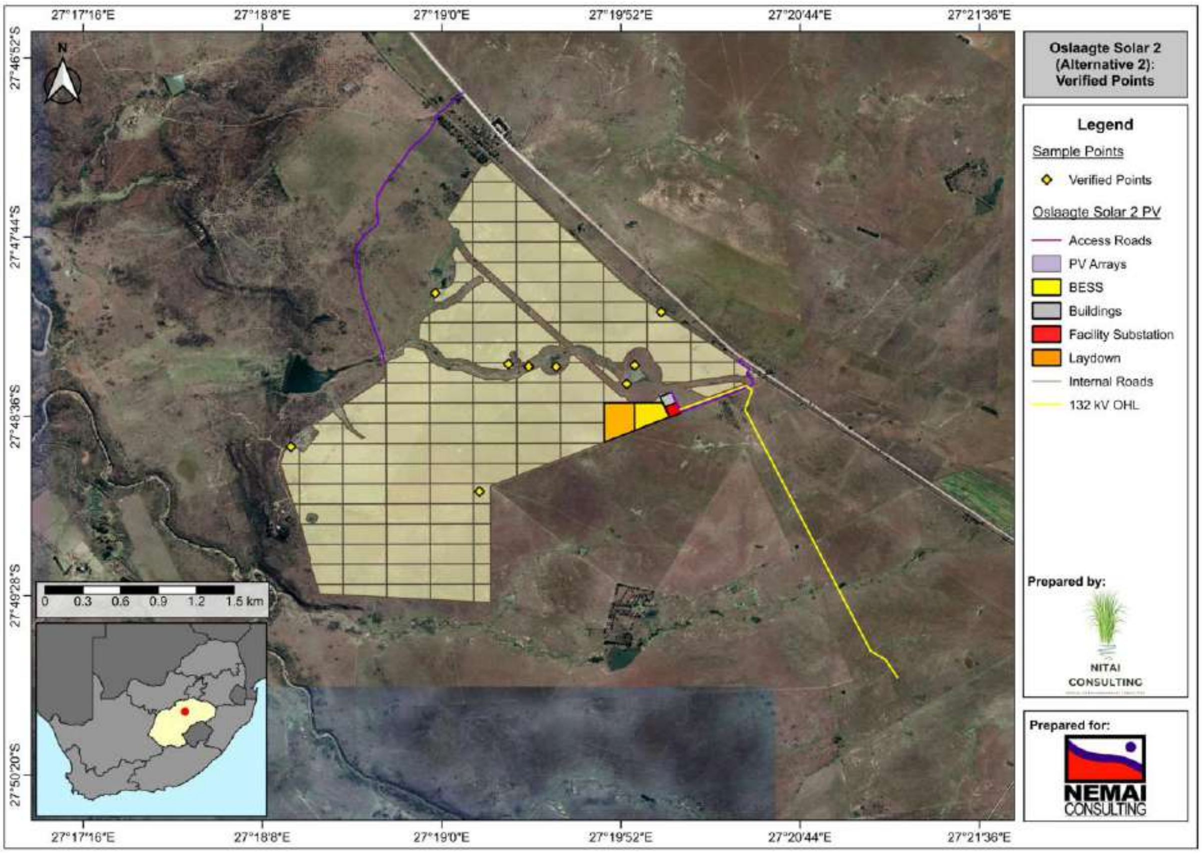

Figure 20: Map indicating the flagged potential wetland areas within the study area (Alternative 2)

6.2 Available information (rivers and wetlands)

To date, no previous Freshwater Assessments have been conducted within the study area. The Blomspruit is located to the west of the study area and flows in a north westerly direction before draining into the Vals River. Little to no information is available on the Blomspruit. The PES and EIS categories have been calculated by DWS (2014) for the Blomspruit and the PES and EIS have been calculated as C (Moderately modified) and C (Moderate Ecological Importance and Sensitivity). Furthermore, the study has concluded that the Riparian and Wetland zone continuity modifications is small, meaning that, the modifications are limited to very few localities and the impact on habitat quality, diversity, size, and variability are also very small. In addition, the potential flow modifications are regarded as serious, meaning that, the modifications are frequently present and that habitat quality, diversity, size, and variability in almost the whole of the defined area are affected. Only small areas are not influenced (DWS, 2014).

6.3 Ecological findings of the Assessment

During the site visits to the study area in Fall (11 – 13 April 2023), the study area is situated within and within the 500 m regulated area of several identified watercourses (wetlands, rivers and stormwater line) (see Figure 21 below). Due to freshwater sensitivity within the Alternative 1 layout, the proponent has revised the layout (hereafter referred to as Alternative 2). As such, each section of the ecological findings was sub-divided into Alternative 1 and Alternative 2.

Alternative 1

During site visits to the study area, the study area is situated within and within the 500 m regulated area of several non-perennial rivers (Figure 21). Several slightly disturbed stormwater lines were further identified within the proposed Oslaagte Solar 2 PV facility. In addition, several agricultural dams are located in close proximity to the study area (see Figure 21). The non-perennial rivers identified on site flows in a westerly direction before draining into the Blomspruit (Figure 21).

Alternative 2

The 2nd alternative option takes into account majority of the identified watercourses within the study area (Figure 22). As such, the Oslaagte Solar 2 PV footprint is outside of all delineated non-perennial watercourses (rivers).

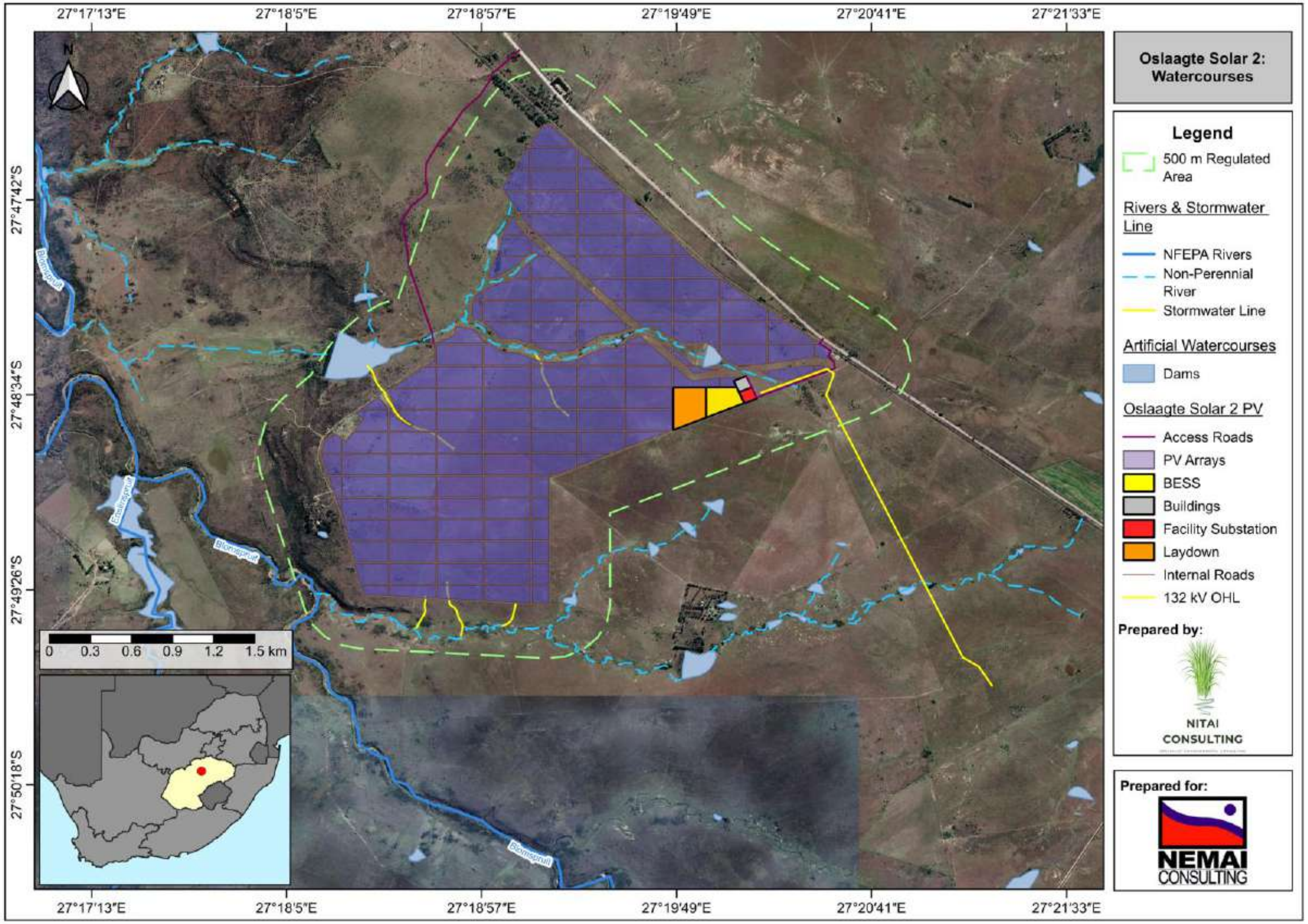

Figure 21: All watercourses associated with Alternative 1 of the Oslaagte Solar 2 PV Facility as well as the 500 m regulated area

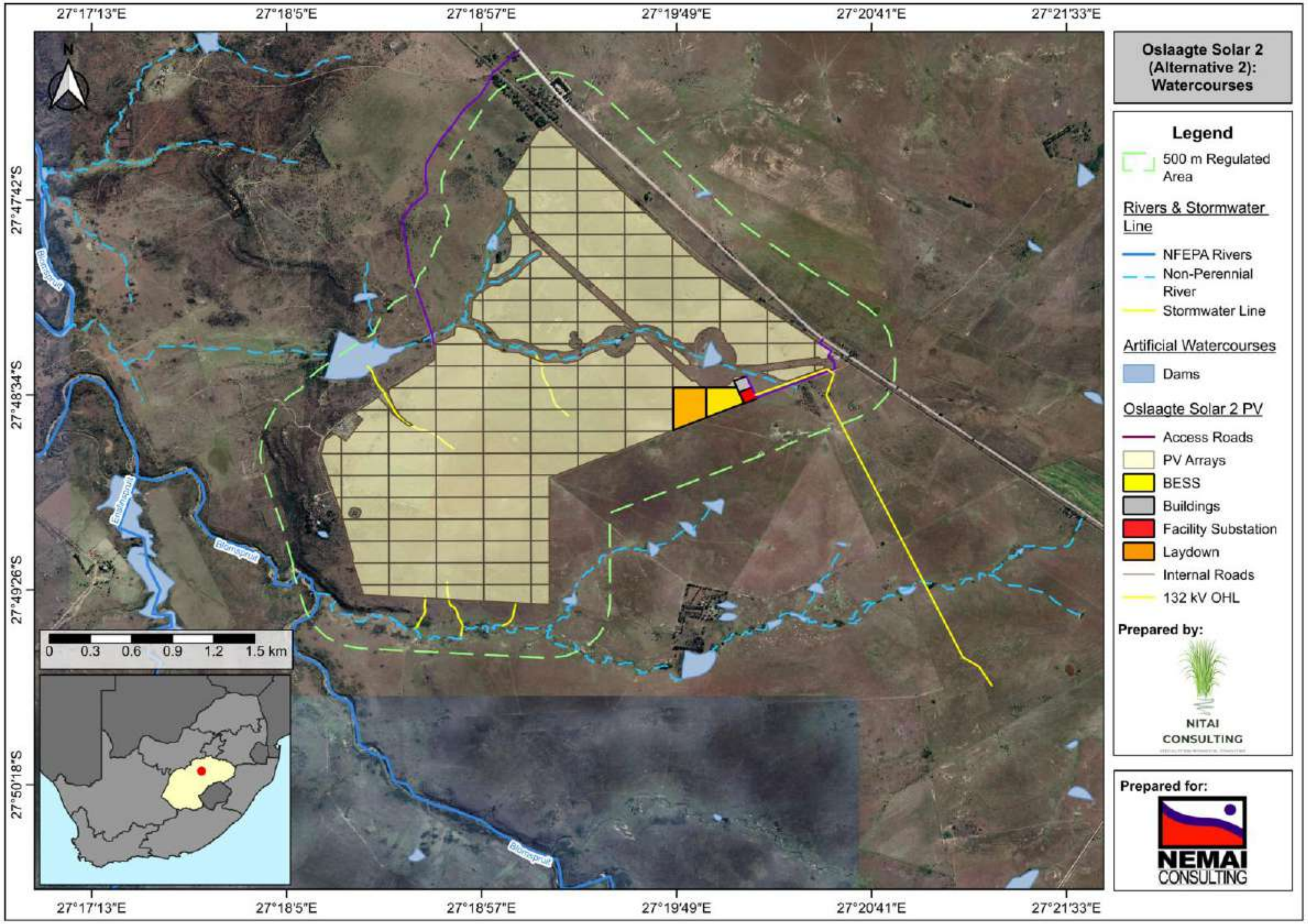

Figure 22: All watercourses associated with Alternative 2 of the Oslaagte Solar 2 PV Facility as well as the 500 m regulated area

6.3.1 Wetlands

6.3.1.1 Alternative 1

No wetlands were identified within the Alternative 1 layout of the proposed Oslaagte Solar 2 PV development.

6.3.1.2 Alternative 2

No wetlands were identified within the Alternative 1 layout of the proposed Oslaagte Solar 2 PV development.

6.3.2 Rivers and Stormwater Line

6.3.2.1 Alternative 1

One perennial river (Blomspruit) was identified to the west of the proposed Oslaagte Solar 2 PV facility (Figure 23). In addition, several small non-perennial rivers were identified and is connected to the above-mentioned Blomspruit. Also, some of these non-perennial rivers were identified to be within the PV site (Figure 23). Although some wetland indicators were present, the overall functioning of the system resembles largely that of a high energy system such as rivers. Therefore, the indicators closely resemble a non-perennial watercourse than that of a wetland and were therefore classified as such. General photographs of these rivers are shown in Table 7 below. As a result, a freshwater sensitivity map was generated to highlight the Low, Medium and High sensitivities associated with the proposed development. Please refer to **Section 6.4: Sensitivities and buffer zones** and Figure 31 for the Sensitivity Map of the Alternative 1 Layout.

6.3.2.2 Alternative 2

The revised layout for Oslaagte Solar 2 PV has taken into account the several non-perennial channels draining into several agricultural dams before draining into the Blomspruit (Figure 24). This alternative does not take into account the stormwater lines, however, these slightly disturbed stormwater lines are of low sensitivity and could therefore benefit the proposed Oslaagte Solar 2 PV facility’s stormwater management. The Sensitivity Map for the Preferred Alternative 2 layout can be found in **Section 6.4: Sensitivities and buffer zones** as well as Figure 32.

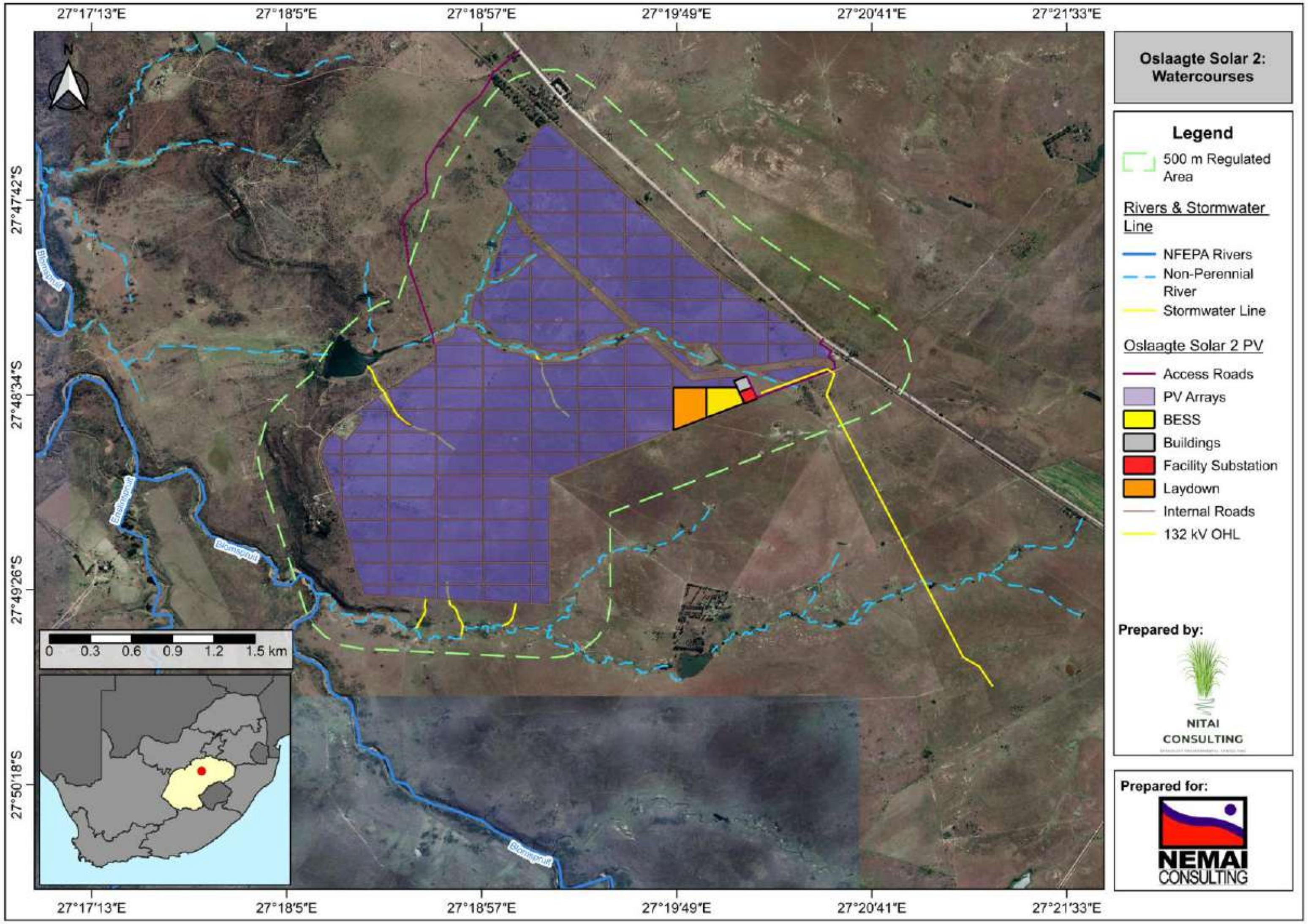

Figure 23: All identified rivers and stormwater lines within the Alternative 1 Layout of the study area

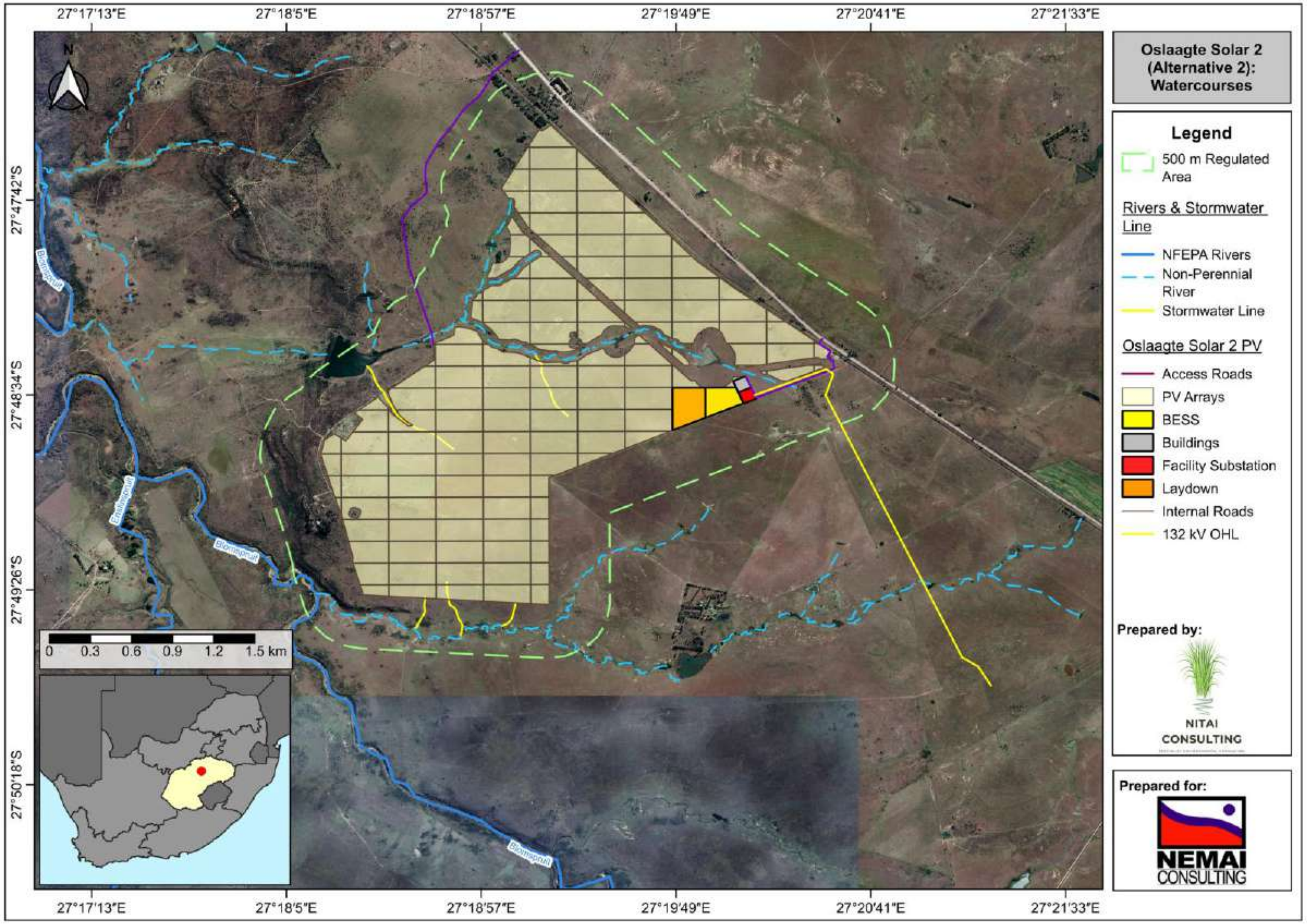

Figure 24: All identified rivers and stormwater lines within the Alternative 2 Layout of the study area (Preferred Layout)

Table 7: Rivers flowing adjacent to the study area as well as within 500 m regulated area

River	Upstream	Downstream
Blomspruit		
Non-perennial Rivers		

6.3.3 Other watercourses

One agricultural dam is situated within the study area (Figure 25). Additionally, several agricultural dams are located on the south eastern and central boundaries of the PV facility. Some of these dams are highlighted in Figure 26 below. Figure 27 below shows the general environment around areas of interest within the study area.

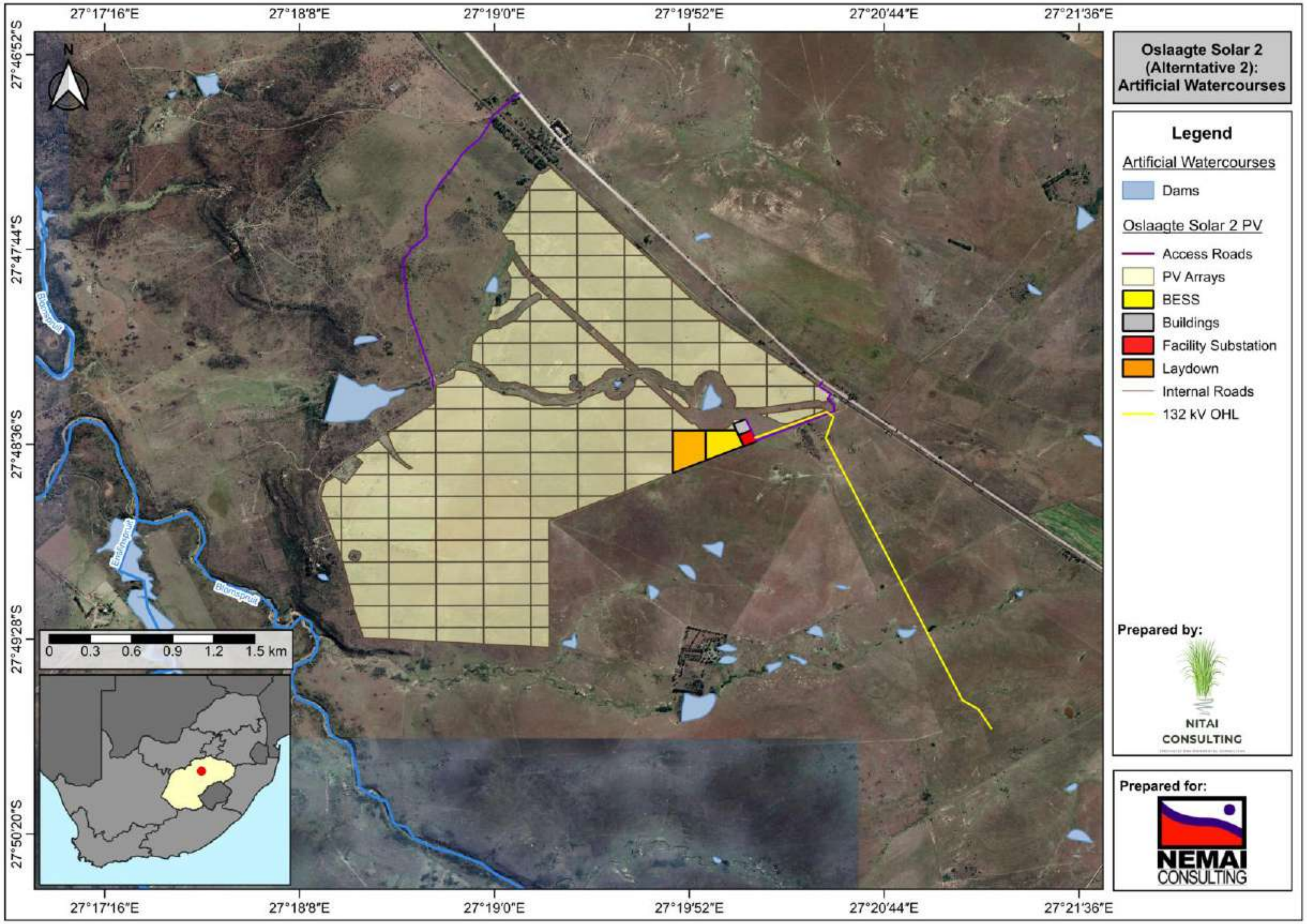

Figure 25: Map showing the location of the dams in and around the study area (Alternative 2: Preferred Layout)

Figure 26: Photographs showing some of the dams located within and around the study area

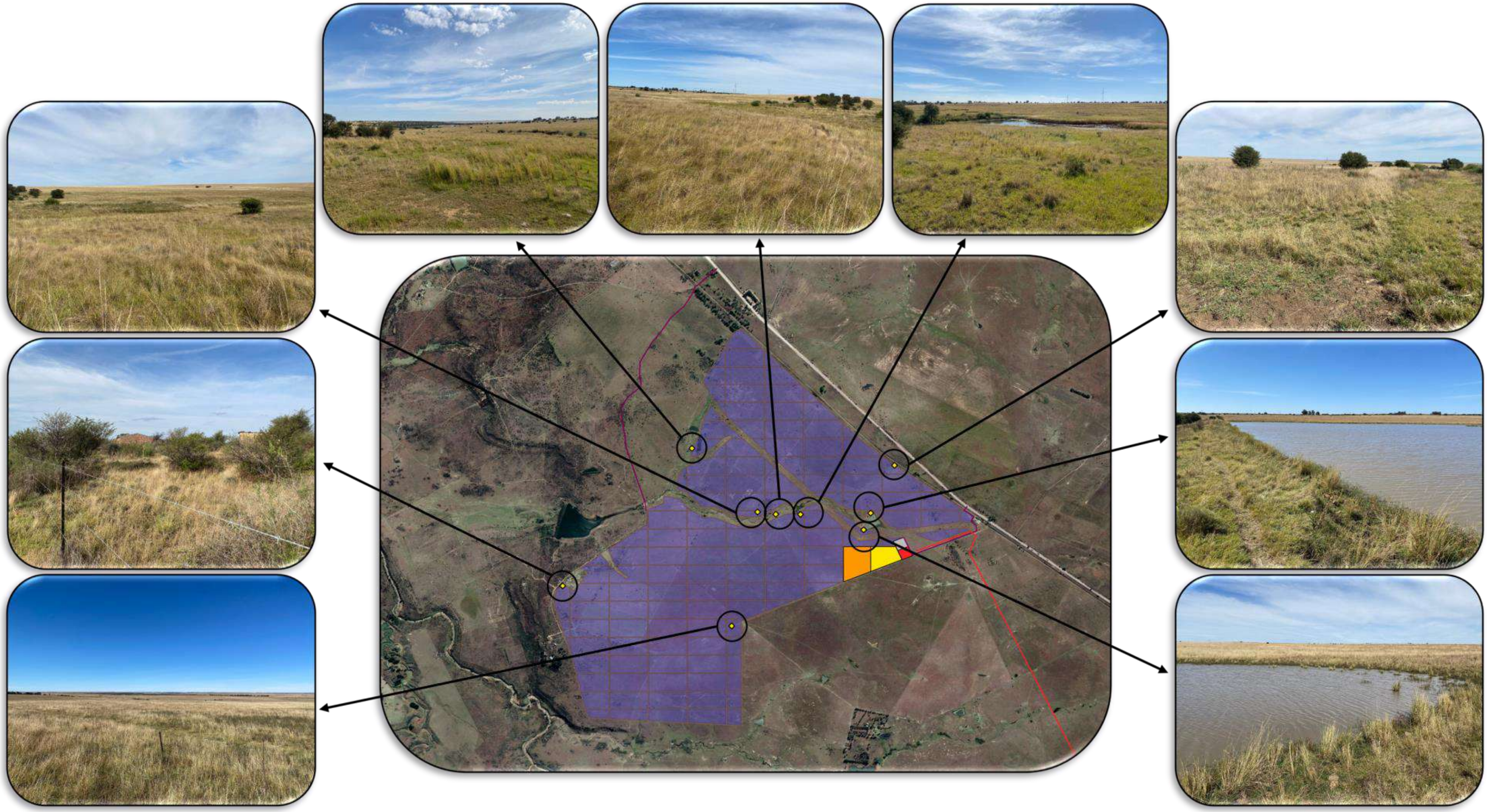

Figure 27: Photographs indicating the general environment around areas of interest within the study area

6.3.4 Vegetation characteristics

The study area is largely comprised of indigenous terrestrial vegetation, and no plants indicative of a moisture gradient were recorded in the targeted areas. In fact, the only vegetation species indicative of a moisture gradient was rather limited to within the agricultural dams as well as within the non-perennial rivers itself. These species include, *Persicaria lapathifolia*, *Cyperus fastigiatus*, *Juncus effesus*, and *Paspalum dilatatum* (Figure 28).

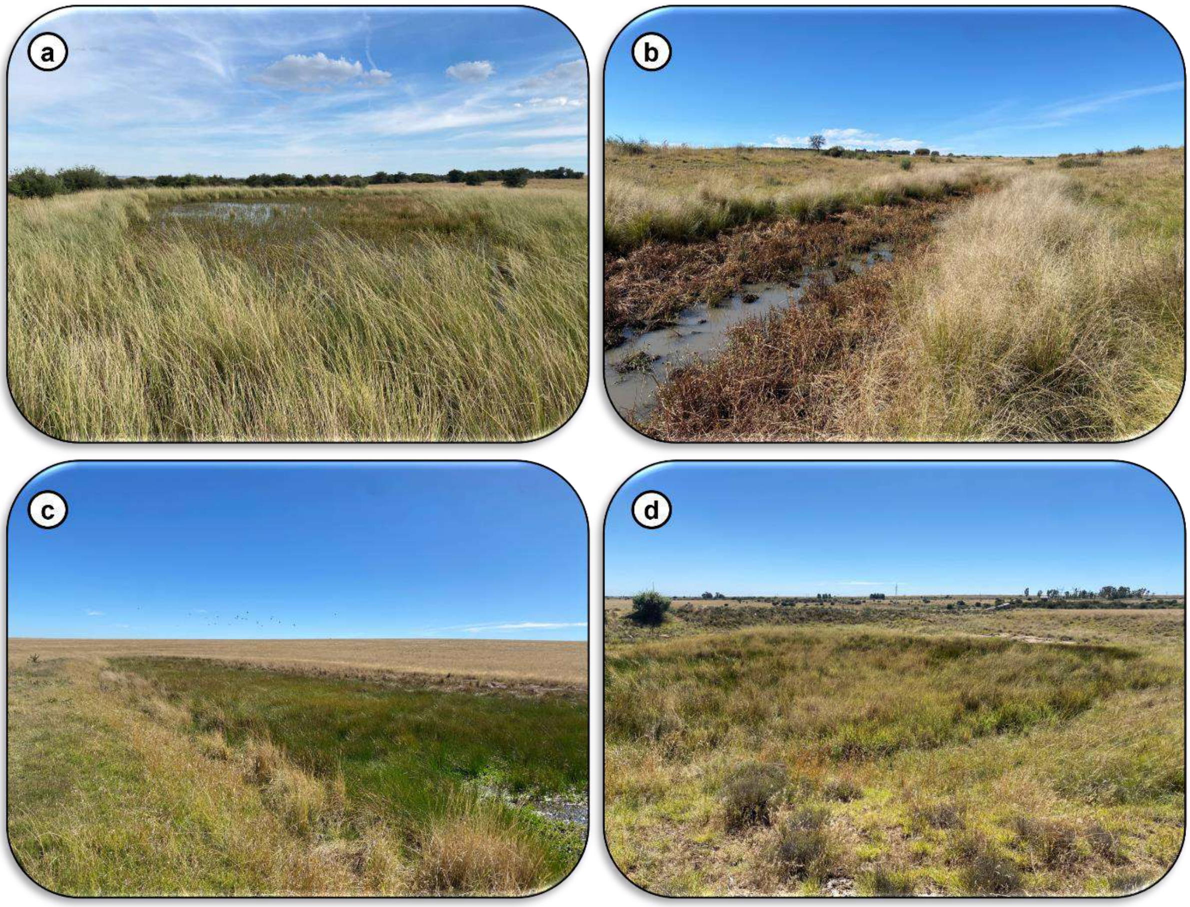

Figure 28: Vegetation species indicating a moisture gradient found within agricultural dams and non-perennial watercourses. Photographs highlight the different species (a) Persicaria lapathifolia, (b) Cyperus fastigiatus, (c) Juncus effesus, and (d) Paspalum dilatatum

6.3.5 Soil characteristics

Soil samples collected along these rivers did exhibit mottling characteristics (Figure 29a and Figure 29b) whereas soil samples collected outside these "wet" areas did not exhibit any mottling (Figure 29c and Figure 29d). Soils in and around the non-perennial rivers were identified as Sepane (orthic A-horizon over a Pedocutanic B-horizon with Unconsolidated material with signs of wetness) and Valsrivier (orthic A-horizon over a structure Pedocutanic B-horizon with Unconsolidated material without signs of wetness soils. This soil falls within categories of soils indicating signs of wetness (van der Waals *et al*., 2019). Furthermore, soils in terrestrial habitats were identified as Bonheim (Melanic A-horizon over a Peducutanic B-horizon) soils. According to the DWAF guidelines (2005) this soil is not regarded as soils indicating signs of wetness (DWAF, 2005; van der Waals *et al*., 2019). In addition, all three soils do tend to show high clay content meaning that these soils have a high potential to hold water for long periods of time.

Figure 29: Typical soils associated with the proposed Oslaagte Solar 2 PV. Photographs (a) and (b) indicating the Sepane soils, photograph (c) indicating the gleyed content within the Valsrivier soils. Additionally, photographs (d) and (e) indicating the Bonheim soils

6.3.6 Present Ecological Category (EC): Riparian Zone

The PES has not been determined for the rivers and was only determined for the non-perennial riparian zone using the Riparian Vegetation Response Assessment Index (VEGRAI) (Kleynhans *et al*., 2007). In addition, the only intact riparian zone found on site was the riparian zone of the large non-perennial river to the east of the proposed footprint, therefore the VEGRAI was only determined for that watercourse. The VEGRAI for the non-perennial riparian zone was determined as a Category D (Largely Modified) (Table 8). The assessment considered the severe influences of cattle grazing. The high density of livestock in areas along the riparian zone has contributed to the change and loss of natural habitat. Therefore, the riparian zone ecosystem function has been modified due to existing disturbances.

Table 8: Riparian Vegetation Response Assessment Index score calculated for the non-perennial riparian zone

Level 3 Assessment					
Metric Group	**Calculated Rating**	**Weighted Rating**	**Confidence**	**Rank**	**% Weight**
Marginal	63.3	28.1	3.3	2.0	80.0
Non-marginal	40.0	22.2	3.3	1.0	100.0
	2.0				180.0
Level 3 VEGRAI (%)				**50.4**	
VEGRAI EC				**D**	
Average Confidence				3.3	

6.3.7 Ecological Importance and Sensitivity (EIS)

Following the method of Rountree *et al*. (2013), the EIS was determined for the unnamed non-perennial river adjacent and to the east of the Oslaagte Solar 2 PV footprint (Table 9). The EIS for the non-perennial river was determined as 1.40 which translates to a Category C (**Moderate**). The score reflects the Ecological Importance and Sensitivity due to the riparian zone located within an ESA. In addition, the score also reflects the Hydrological/Functional Importance of the Riparian Zone in the role it plays in flood attenuation and sediment trapping for the downstream Blomspruit.

Table 9: Ecological Importance and Sensitivity of one HGM unit

River	Ecological Importance and Sensitivity
Non-perennial River	**Moderate (1,40)** • Ecological Importance & Sensitivity: 2.0 • Hydrological/Functional Importance: 1.9 • Direct Human Benefits: 0.3

6.3.8 Wetland Ecosystems Services

Since no wetland was found within the Oslaagte Solar 2 PV footprint, Wetland Ecosystem Services (Kotze *et al*., 2020) was determined for the unnamed non-perennial river adjacent and east of the PV site (Table 10). Please refer to Table 11 for description of impact category ratings. The riparian zone is moderately important for food for livestock and cultivated foods since the area is being used for livestock grazing as well as game. In addition, the riparian zone is situated within an ESA that increases its importance 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. Moreover, the riparian zone is of low importance for harvestable resources and cultivated foods.

Table 10: Wetland Ecosystem Services calculated for the one HGM unit

Ecosystem Services		Score	
		Non-perennial River Score	Importance
Regulating and Supporting Services	Flood attenuation	0.0	Very Low
	Stream flow regulation	0.0	Very Low
	Sediment trapping	0.3	Very Low
	Erosion control	0.4	Very Low
	Phosphate assimilation	0.1	Very Low
	Nitrate assimilation	0.0	Very Low
	Toxicant assimilation	0.0	Very Low
	Carbon storage	0.2	Very Low
	Biodiversity maintenance	0.2	Very Low
Provisioning services	Water for human use	0.0	Very Low
	Harvestable resources	0.5	Very Low
	Food for livestock	2.2	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 11: 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 Oslaagte Solar 2 PV Facility an Environmental Screening tool from Department of Forestry, Fisheries & the Environment (DFFE) was 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 **Low** sensitivity for the PV site (Figure 30). The very high sensitivity just north of the PV site indicates the Groundwater SWSA of South Africa.

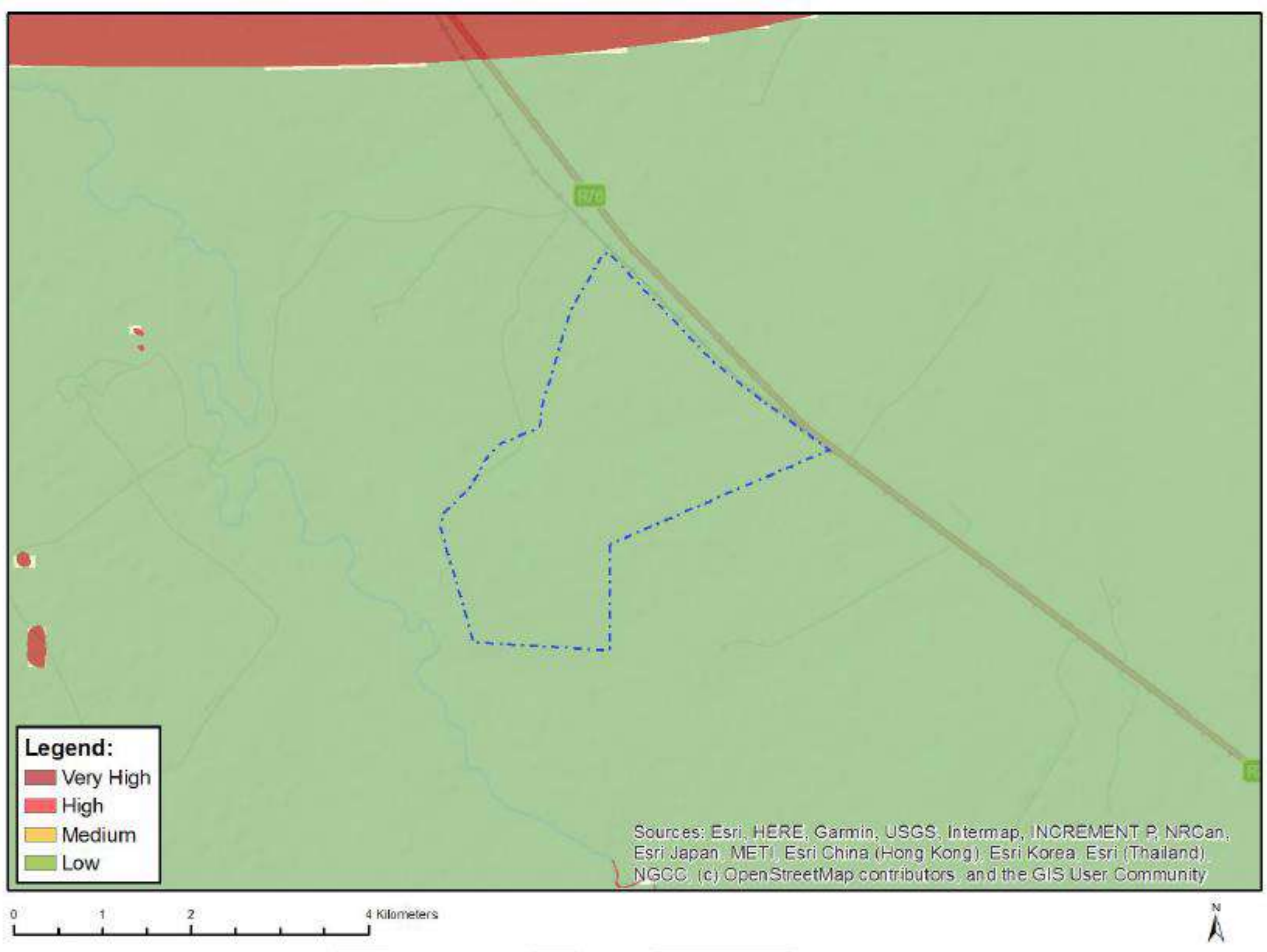

Figure 30: Aquatic Biodiversity Sensitivity Theme from the Department of Forestry, Fisheries & the Environment Screening Tool

6.4.2 Ground Truthing

Ground truthing the Alternative 1 layout with site visits during Fall (11 – 13 April 2023), the study area could be classified as **Medium** sensitivity due to the PV site encroaching into a few non-perennial rivers. In addition, majority of the Alternative 1 layout was classified as **Low** sensitivity whereas the non-perennial rivers and its associated buffer zone was classified as **High** and **Medium** sensitivity, respectively (Figure 31). In addition, the stormwater lines found on site are not of **High** or **Medium** sensitivity, rather **Low** sensitivity, however, the ecological function of these stormwater lines has been modified due to farm roads and the encroachment of terrestrial species. Therefore, the stormwater lines are seen as a **Low** sensitivity towards the proposed development. Moreover, these lines can be used in conjunction with the proposed Oslaagte Solar 2 PV facility’s stormwater management.

As a result, the PV site layout has been revised and the Alternative 2 layout (preferred layout) is outside of these non-perennial rivers as well as its buffer zones (discussed below) (Figure 32). 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**.

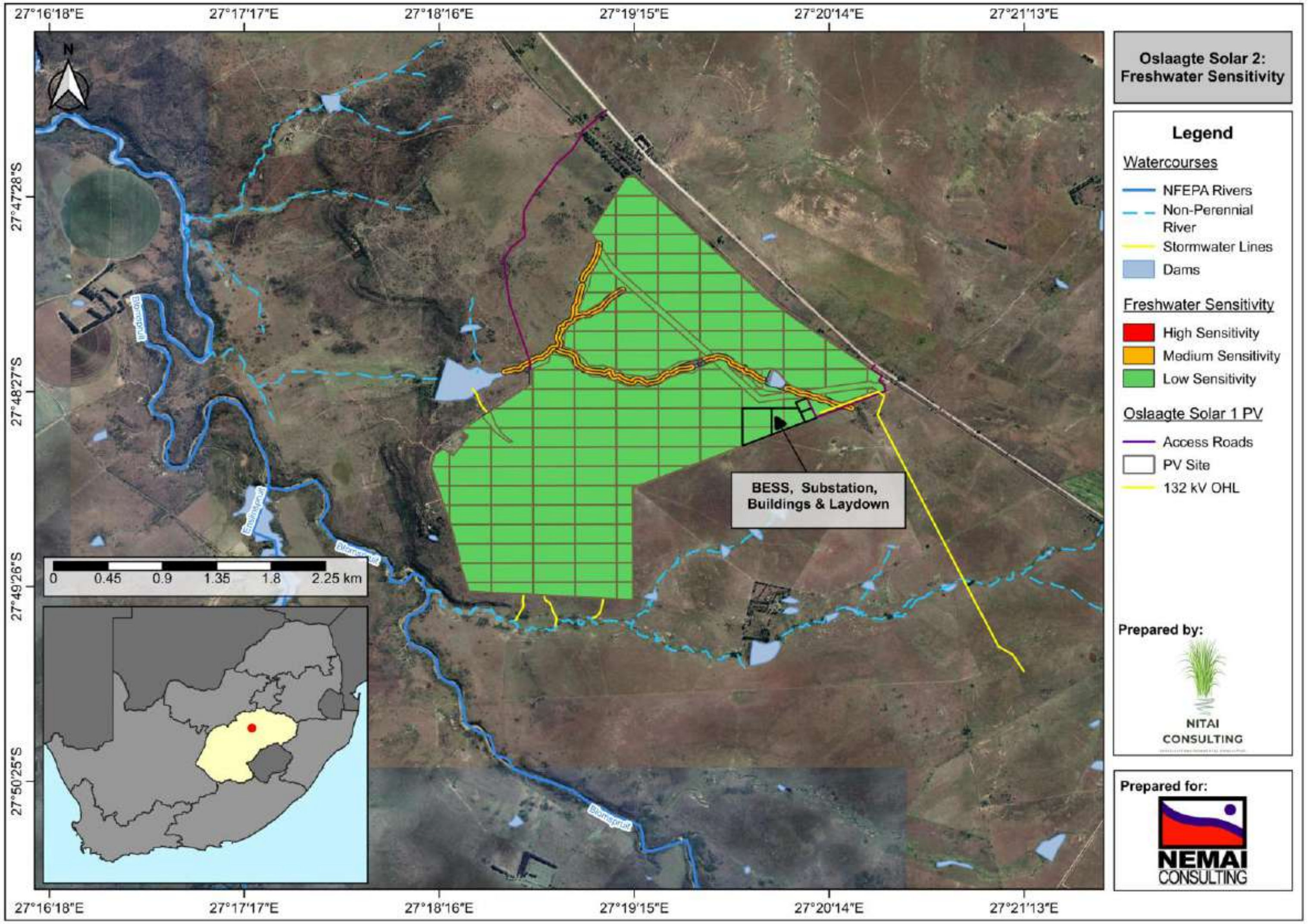

Figure 31: Freshwater Sensitivity surrounding the proposed Alternative 1 Layout of Oslaagte Solar 2 PV

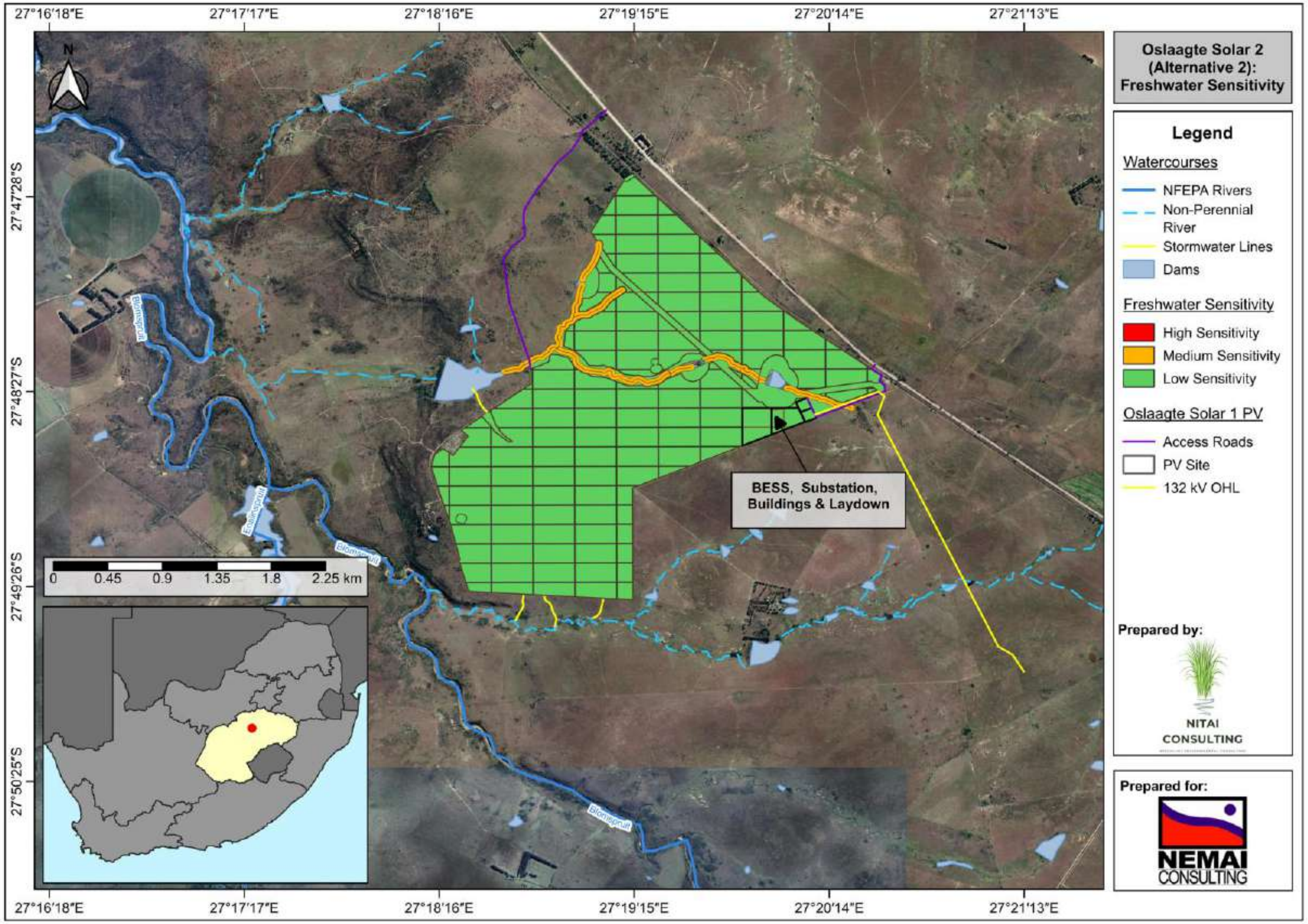

Figure 32: Freshwater Sensitivity surrounding the proposed Alternative 2 Layout of Oslaagte Solar 2 PV

6.4.3 Buffer Zones

Buffer zones for all non-perennial watercourses (rivers) were determined based on the current condition of these watercourses. The buffer zones determined for the rivers and drainage lines were based on the Macfarlane and Bredin (2017) guidelines. As such, the minimum buffer zones were determined as 32 m (Figure 33 and Figure 34).

Between the two alternatives for Oslaagte Solar 2 PV Facility, Alternative 1 is encroaching the 32 m buffer zones of the non-perennial rivers. Also, the layout not only encroaches into the buffer zones, but the non-perennial rivers as well (Figure 33). Alternative 2 has made provision for the non-perennial rivers and its associated 32 m buffer zones and therefore avoids these freshwater features (Figure 34).

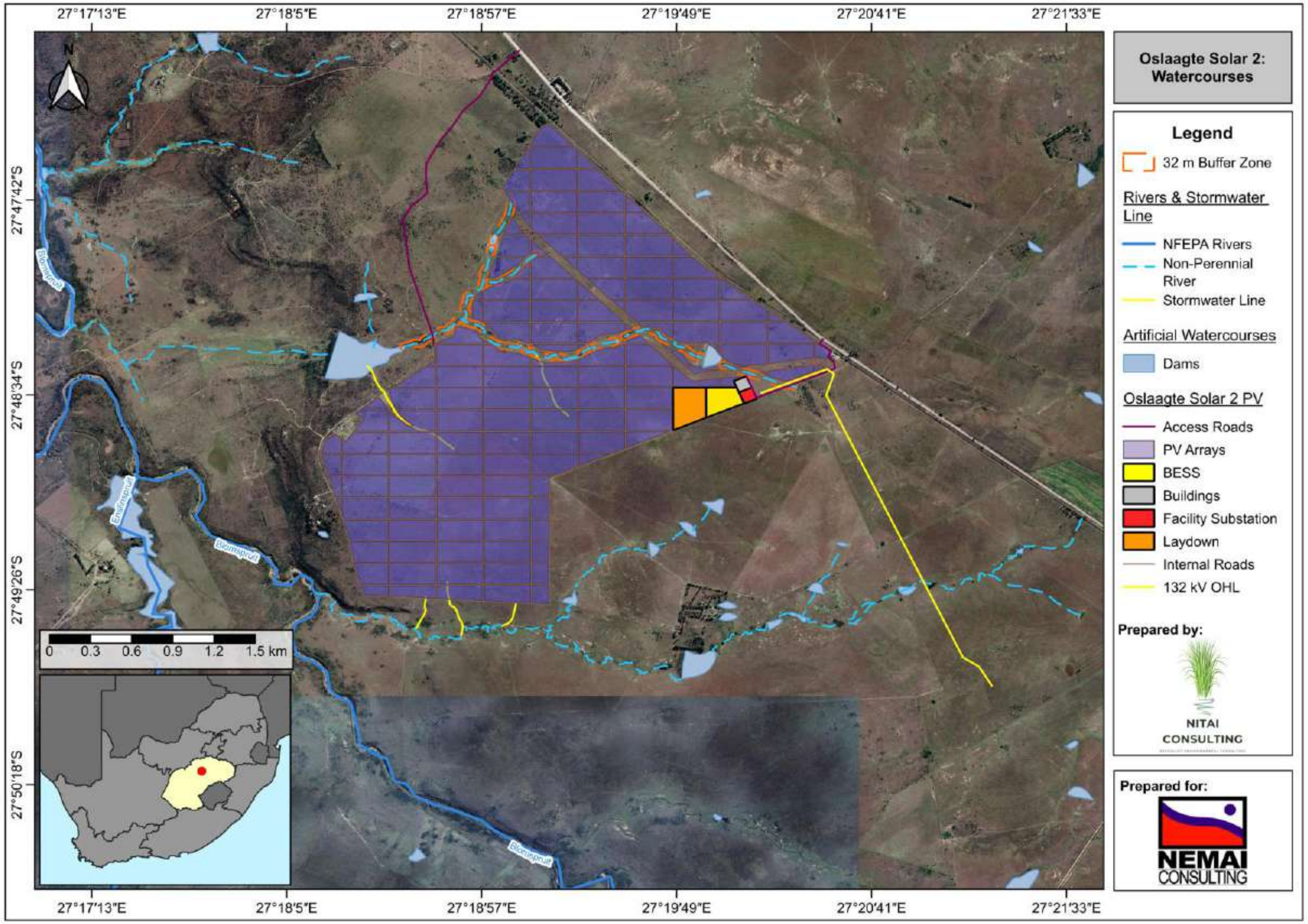

Figure 33: Buffer zones determined for all watercourses associated with the Alternative 1 Layout

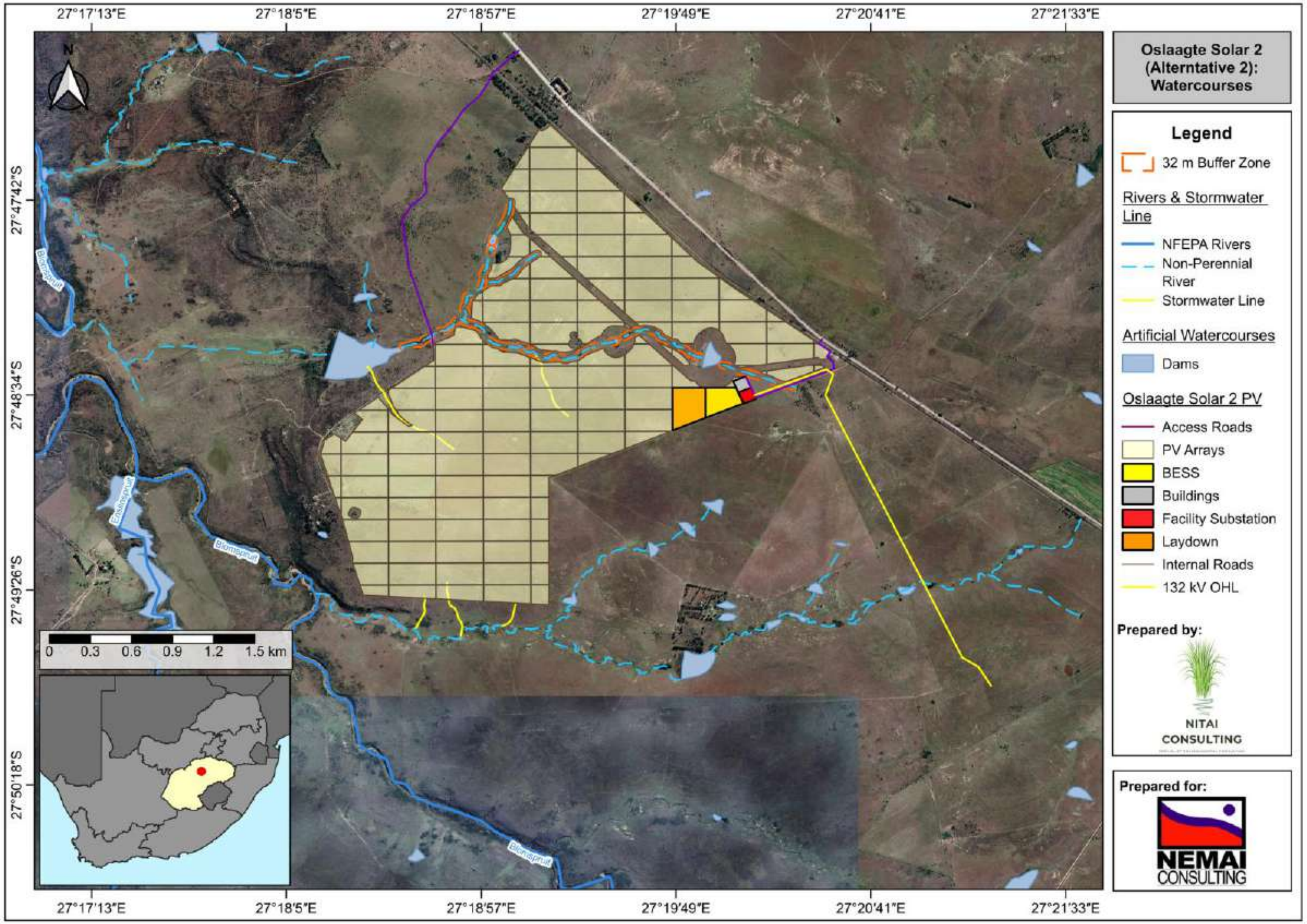

Figure 34: Buffer zones determined for all watercourses associated with the Alternative 2 Layout

7 RISK-BASED IMPACT ASSESSMENT

7.1 Impacts and Mitigation Framework

Since watercourses have been identified within the study area and that could be potentially significantly affected by the proposed development of the Oslaagte Solar 2 PV Facility, 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 12: 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 13: 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 14: 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 15: 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 16 to Table 19 below indicate the impact scores for the potential watercourse impacts surrounding the construction and operational phases of Oslaagte Solar 2 PV Facility. Furthermore, the tables below indicates the impact scores for both alternative options.

Table 16: 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;
- The area is still likely prone to erosion around these areas should poor stormwater management be implemented. As such, a comprehensive stormwater management plan is required for the project;
- Effective stormwater and erosion 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 erosion;
- All stormwater runoff from the panels should enter the systems through diffuse channels fitted with flow attention/energy dissipation structures;
- Stormwater runoff and runoff from the cleaning of panels would be increased and therefore increases the erosion potential in the surrounding areas;
- Panels should be fitted with stormwater gutters to control the runoff in an ecologically sensitive manner to prevent erosion;
- With regards to the powerline and road construction, the recommended buffer zones must be strictly adhered to during the construction phase with the exception when activities and structures required to traverse the watercourse. Pylons should be constructed outside the delineated watercourses;
- All areas where vegetation was cleared should be re-vegetated in order to limit the erosion potential;
- Sedimentation and erosion protection measures (such as sand bags, silt traps and fences) should be installed prior to construction;
- Roads crossing low-lying areas/potentially wet areas require permeable paving in order to lower the risk of habitat damage and possible erosion;
- Inspect all pylons, road network and influences areas 1 month following the conclusion of the construction activities as well as after the first rainfall event. Routing monitoring should take place for the duration of the project. Should erosion develop, then eroded areas should be immediately addresses through appropriate measures;
- All roads traversing delineated low-lying areas should be kept to a minimum to ensure hydrological connectivity;

• Construction of watercourse crossings (if needed) must take place from existing disturbed areas; • Prevent uncontrolled access of vehicles through 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 17: 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 river, erosion, 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 rivers; • Protect all areas susceptible to erosion through installing erosion berms that can prevent gully formation and siltation of watercourses; • 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 erosion, sedimentation and polluting downstream water resources; • 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 18: 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	Unlikely (2)	Rare (1)	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	**16 (Low)**	**8 (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 an Alien and Invasive Plant Management Plant forms part of the operational processes of the PV facility.

Table 19: 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 rivers, riparian 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 not only affect local water quality but regional water quality as well. This is considered as a significant 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 Oslaagte Solar 2 PV facility is situated in the Moqhaka Local Municipality, near Kroonstad, Free State Province, South Africa. According to the spatial data, there are several non-perennial rivers along the boundary of the PV site. Furthermore, these rivers are located within the edges of the PV site. No wetland was identified to be within the study area, and this was verified by the absence of wetland vegetation indicators as well as wetland soil indicators. However, although some wetland soil and vegetation indicators were present, the overall function of the system is that of a high energy system was therefore classified as a non-perennial watercourse. Furthermore, the vegetation recorded throughout the site is not associated with wetlands and rather with terrestrial vegetation.

Since that the Oslaagte Solar 2 PV facility layout has been revised based on the “no-go” areas (non-perennial rivers and their buffer zones), it is the opinion of this specialist that the proposed works will have a low impact on the watercourses given that the Alternative 2 option is used and that mitigation measures are followed and best practise pollution control. Importantly, based on the current condition of the surrounding habitat of the proposed Oslaagte Solar 2 PV facility 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 **Low** sensitivity from an Aquatic Biodiversity Theme perspective. This was confirmed (if Alternative 2 layout) by the specialist. **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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van Der Waals, J.H., Grundling, A.T. & Paterson, D.G. 2019. Developing wetland distribution and transfer functions from land type data as a basis for the critical evaluation of wetland delineation guidelines by inclusion of soil water flow dynamics in catchment areas: Volume 3. *WRC Report No: 2461/3/18*.

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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:

- 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*.
- 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., 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 CCUS 3D Seismic Survey & Drilling

2023, Wetland Specialist, Proposed CCUS Injection within the Leandra area, Mpumalanga Province, South Africa, Assess and map all wetlands within the footprint of the survey area.

4.12 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.

4.13 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.

4.14 Arnot-Kendal power line re-stringing

2023, Wetland Specialist, Proposed Eskom Arnot-Kendal power line re-stringing, Mpumalanga Province, South Africa, Conduct a Risk Matrix for an General Authorisation.

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.

12/05/2023

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.

12/05/2023

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.

AB ootsma

__________________________________ **29/05/2023**

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

Wetland Specialist

APPENDIX E2: Terrestrial Biodiversity Compliance Statement

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

Terrestrial Biodiversity Compliance Statement for the proposed Oslaagte Solar 2 PV Facility, Free State Province, South Africa

TERRESTRIAL BIODIVERSITY COMPLIANCE STATEMENT

09 May 2023

Submitted to : Nemai Consulting

Prepared by:

Helena Elizabeth Human (Pr. Sci. Nat 147031)

Nitai Consulting (PTY) Ltd.

147 Bram Fischer Drive

Ferndale

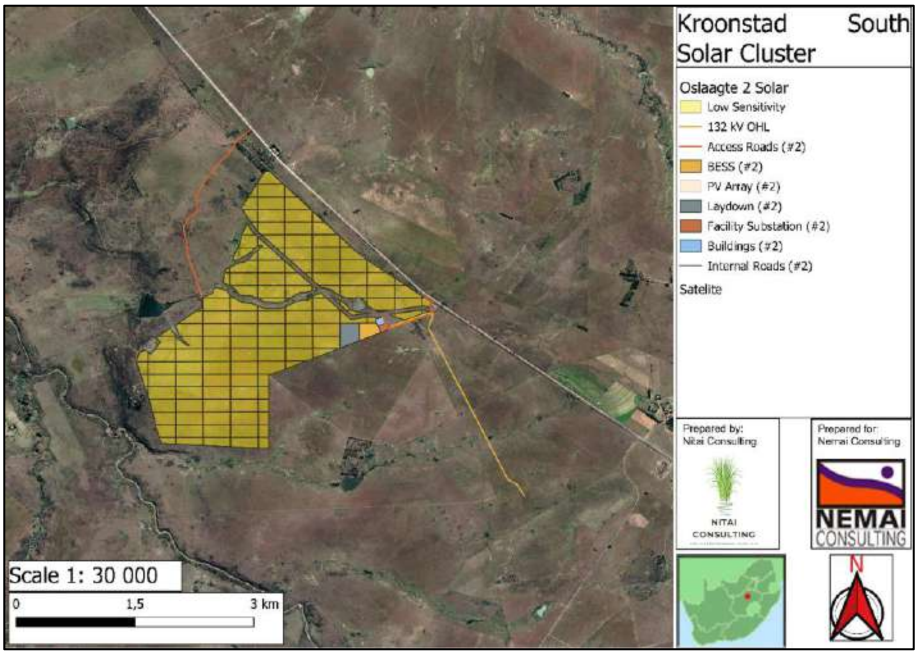
2194

Executive Summary

Nitai Consulting (Pty) Ltd. was appointed by Nemai Consulting (Pty) Ltd. to undertake a terrestrial biodiversity assessment for the proposed Kroonstad Cluster Solar project in the North West Province, South Africa.

According to the National Web Based Environmental Screening Tool (the “Screening Tool”), the terrestrial biodiversity sensitivity theme is “Very High” due to the presence of Ecological Support Areas and Protected Areas expansion Strategy.

Based on the site surveys undertaken, it was clearly evident that there was no sensitive biodiversity features/SCC's as the project development area has been heavily overgrazed by large livestock i.e. cattle.



A site survey was undertaken to verify the site sensitivity in compliance with the section 3.2 of the protocols and found that the area has experienced long-term and continuous disturbance, mostly due to the grazing practices and associated impacts. The area has a lack of suitable habitat for SCC for permanent residence or breeding. The project area is modified and degraded and as such is assigned a sensitivity rating of ‘Low’ in terms of terrestrial biodiversity.

The screening report classified the plant sensitivity theme as ‘Low’ and the animal sensitivity theme as ‘medium’. Following the field survey findings, the animal species themes has been re-classified as having ‘Low’ sensitivities. This is since there is limited suitable habitat available to support the regular occurrence of any faunal SCC within the project area.

The completion of the Terrestrial Biodiversity Assessment led to a confirmation of ‘Low’ classification for the plant species theme sensitivity as allocated by the National Environmental Screening Tool. The provincially protected plant species are not threatened and occur commonly throughout the country. These species are also indicators of environmental degradation. There was a dispute of the ‘Very High’ classification for the terrestrial biodiversity theme sensitivity as allocated by the National Environmental Screening Tool. The project area has instead been assigned a ‘Low’ sensitivity, because of the extent of environmental disturbance that has taken place, and the fact that no SCC were observed (provincially protected plants) and favour the degradation and disturbance of the system to proliferate.

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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
VU	Vulnerable

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

1 Introduction

1.1 Terms of Reference

1.1.1 Terrestrial Biodiversity

The specialist study is required to follow the published Protocols, provided in full below for the assessment of impacts on Terrestrial Biodiversity. 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.

PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON TERRESTRIAL BIODIVERSITY

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.

1. General information

1.1. An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified on the screening tool as being of “very high sensitivity” for terrestrial biodiversity, must submit a Terrestrial Biodiversity Specialist Assessment.

1.2. An applicant intending to undertake an activity identified in the scope of this protocol on a site identified by the screening tool as being “low sensitivity” for terrestrial biodiversity, must submit a Terrestrial Biodiversity Compliance Statement.

1.3. However, where the information gathered from the site sensitivity verification differs from the designation of “very high” terrestrial biodiversity sensitivity on the screening tool and it is found to be of a “low” sensitivity, then a Terrestrial Biodiversity Compliance Statement must be submitted.

1.4. Similarly, where the information gathered from the site sensitivity verification differs from that identified as having a “low” terrestrial biodiversity sensitivity on the screening tool, a Terrestrial Biodiversity Specialist Assessment must be conducted.

1.5. If any part of the proposed development footprint falls within an area of “very high” sensitivity, the assessment and reporting requirements prescribed for the “very high” sensitivity apply to the entire footprint, excluding linear activities for which impacts on terrestrial biodiversity are temporary and the land in the opinion of the terrestrial biodiversity specialist, based on the mitigation and remedial measures, can be returned to the current state within two years of the completion of the construction phase, in which case a compliance statement applies. Development footprint in the context of this protocol means the area on which the proposed development will take place and includes any area that will be disturbed.

2. Terrestrial Biodiversity Specialist Assessment

2.1. The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of terrestrial biodiversity.

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

2.2. The assessment must be undertaken on the preferred site and within the proposed development footprint.

2.3. The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:

2.3.1. a description of the ecological drivers or processes of the system and how the proposed development will impact these;

2.3.2. ecological functioning and ecological processes (e.g. fire, migration, pollination, etc.) that operate within the preferred site;

2.3.3. the ecological corridors that the proposed development would impede including migration and movement of flora and fauna;

2.3.4. the description of any significant terrestrial landscape features (including rare or important flora-faunal associations, presence of strategic water source areas (SWSAs) or freshwater ecosystem priority area (FEPA) sub catchments;

2.3.5. a description of terrestrial biodiversity and ecosystems on the preferred site, including:

(a) main vegetation types;

(b) threatened ecosystems, including listed ecosystems as well as locally important habitat types identified;

(c) ecological connectivity, habitat fragmentation, ecological processes and fine- scale habitats; and

(d) species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement

patterns identified;

2.3.6. the assessment must identify any alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification; and

2.3.7. the assessment must be based on the results of a site inspection undertaken on the preferred site and must identify:

2.3.7.1. terrestrial critical biodiversity areas (CBAs), including:

(a) the reasons why an area has been identified as a CBA;

(b) an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;

(c) the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s);

(d) the impact on ecosystem threat status;

(e) the impact on explicit subtypes in the vegetation;

(f) the impact on overall species and ecosystem diversity of the site; and

(g) the impact on any changes to threat status of populations of species of conservation concern in the CBA;

2.3.7.2. terrestrial ecological support areas (ESAs), including:

(a) the impact on the ecological processes that operate within or across the site;

(b) the extent the proposed development will impact on the functionality of the ESA; and

(c) loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;

2.3.7.3. protected areas as defined by the National Environmental Management: Protected Areas Act, 2004 including-

(a) an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan;

2.3.7.4. priority areas for protected area expansion, including-

(a) the way in which the proposed development will compromise or contribute to the

expansion of the protected area network;

2.3.7.5. SWSAs including:

(a) the impact(s) on the terrestrial habitat of a SWSA; and

(b) the impacts of the proposed development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses);

2.3.7.6. FEPA sub catchments, including-

(a) the impacts of the proposed development on habitat condition and species in the FEPA sub catchment;

2.3.7.7 indigenous forests, including:

(a) impact on the ecological integrity of the forest; and

(b) percentage of natural or near natural indigenous forest area lost and a statement on the

implications in relation to the remaining areas.

2.4. The findings of the assessment must be written up in a Terrestrial Biodiversity Specialist Assessment Report.

4. Terrestrial Biodiversity Compliance Statement

4.1. The compliance statement must be prepared by a specialist registered with the SACNASP and having expertise in the field of ecological sciences.

4.2. The compliance statement must:

4.2.1. be applicable to the preferred site and proposed development footprint;

4.2.2. confirm that the site is of “low” sensitivity for terrestrial biodiversity; and

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

4.2.3. indicate whether or not the proposed development will have any impact on the biodiversity feature.

4.3. The compliance statement must contain, as a minimum, the following information:

4.3.1. the contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;

4.3.2. a signed statement of independence by the specialist;

4.3.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;

4.3.4. a baseline profile description of biodiversity and ecosystems of the site;

4.3.5. the methodology used to verify the sensitivities of the terrestrial biodiversity features on the site, including equipment and modelling used, where relevant;

4.3.6. in the case of a linear activity, confirmation from the terrestrial biodiversity specialist 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;

4.3.7. where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr;

4.3.8. a description of the assumptions made and any uncertainties or gaps in knowledge or data; and

4.3.9. any conditions to which this statement is subjected.

4.4. A signed copy of the compliance statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report

1.1.2 Terrestrial Plants

The specialist study is required to follow the published Protocols, provided in full below for the assessment of impacts on Terrestrial Plant 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.

PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON TERRESTRIAL PLANT SPECIES

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.

General information

1.1 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of “very high” or “high” sensitivity for terrestrial plant species, must submit a Terrestrial Plant Species Specialist Assessment Report.

1.2 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of “medium sensitivity” for terrestrial plant species, must submit either a Terrestrial Plant Species Specialist Assessment Report or a Terrestrial Plant Species Compliance Statement, depending on the outcome of a site inspection undertaken in accordance with paragraph 4.

1.3 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of “low” sensitivity for terrestrial plant species, must submit a Terrestrial Plant Species Compliance Statement.

1.4 Where the information gathered from the site sensitivity verification differs from the screening tool designation of “very high” or “high” for terrestrial plant species sensitivity on the screening tool, and it is found to be of a “low” sensitivity, then a Terrestrial Plant Species Compliance Statement must be submitted.

1.5 Where the information gathered from the site sensitivity verification differs from the screening tool designation of “low” terrestrial plant species sensitivity and it is found to be of a “very high” or “high” terrestrial plant species sensitivity, a Terrestrial Plant Species Specialist Assessment must be conducted.

1.6 If any part of the development falls within an area of confirmed “very high” or “high” sensitivity, the assessment and reporting requirements prescribed for the “very high” or “high” sensitivity, apply to the entire development footprint. Development footprint in the context of this protocol, means the area on which the proposed development will take place and includes the area that will be disturbed or impacted.

1.7 The Terrestrial Plant Species Specialist Assessment and the Terrestrial Plant Species Compliance Statement must be undertaken within the study area.

1.8 Where the nature of the activity is not expected to have an impact on species of conservation concern (SCC) beyond the boundary of the preferred site, the study area means the proposed development footprint within the preferred site.

1.9 Where the nature of the activity is expected to have an impact on SCC beyond boundary of the preferred site, the project areas of influence (PAOI) must be determined by the specialist in accordance with Species Environmental Assessment Guideline, and the study area must include the PAOI, as determined.

2. Terrestrial Plant Species Specialist Assessment

2.1 The assessment must be undertaken by a specialist registered with the South African Council for Natural Scientific Professions (SACNASP), within a field of practice relevant to the taxonomic groups (“taxa”) for which the assessment is being undertaken.

2.2 The assessment must be undertaken within the study area.

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

2.3 The assessment must be undertaken in accordance with the Species Environmental Assessment Guideline and must:

2.3.1 Identify the SCC which were found, observed or are likely to occur within the study area;

2.3.2 provide evidence (photographs) of each SCC found or observed within the study area, which must be disseminated by the specialist to a recognized online database facility immediately after the site inspection has been performed (prior to preparing the report contemplated in paragraph 3);

2.3.3 identify the distribution, location, viability and detailed description of population size of the SCC identified within the study area;

2.3.4 identify the nature and the extent of the potential impact of the proposed development to the population of the SCC located within the study area;

2.3.5 determine the importance of the conservation of the population of the SCC identified within the study area, based on information available in national and international databases including the IUCN Red List of Threatened Species, Red List of South African Plants, and/or other relevant databases;

2.3.6 determine the potential impact of the proposed development on the habitat of the SCC located within the study area;

2.3.7 include a review of relevant literature on the population size of the SCC, the conservation interventions as well as any national or provincial species management plans for the SCC. This review must provide information on the need to conserve the SCC and indicate whether the development is compliant with the applicable species management plans and if not, a motivation for the deviation;

2.3.8 identify any dynamic ecological processes occurring within the broader landscape, that might be disrupted by the development and result in negative impact on the identified SCC, for example, fires in fire-prone systems;

2.3.9 identify any potential impact on ecological connectivity within the broader landscape, and resulting impacts on the identified SCC and its long term viability;

2.3.10 determine buffer distances as per the Species Environmental Assessment Guidelines used for the population of each SCC; and

2.3.11 discuss the presence or likelihood of additional SCC including threatened species not identified by the screening tool, Data Deficient or Near Threatened Species, as well as any undescribed species; and

2.3.12 identify any alternative development footprints within the preferred development site which would be of “low” sensitivity” or “medium” sensitivity as identified by the screening tool and verified through the site sensitivity verification.

2.4 The findings of the assessment must be written up in a Terrestrial Plant Species Specialist Assessment Report.

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

Terrestrial plant species compliance statement

Where the sensitivity in the Screening Report from the web-based Online Screening Tool has been confirmed to be LOW, a Plant Species Compliance Statement is required, either (1) for areas where no natural habitat remains, or (2) in natural areas where there is no suspected occurrence of SCC.

The compliance statement must be prepared by a SACNASP registered specialist under one of the two fields of practice (Botanical Science or Ecological Science).

The compliance statement must:

1. be applicable within the study area

2. confirm that the study area is of "low" sensitivity for terrestrial plant species; and

3. indicate whether or not the proposed development will have any impact on SCC.

The compliance statement must contain, as a minimum, the following information:

1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;

2. a signed statement of independence by the specialist;

3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;

4. a baseline profile description of biodiversity and ecosystems of the site;

5. the methodology used to verify the sensitivities of the terrestrial biodiversity and plant species features on the site including the equipment and modelling used where relevant;

6. in the case of a linear activity, confirmation from the terrestrial biodiversity specialist 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;

7. where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr;

8. a description of the assumptions made as well as any uncertainties or gaps in knowledge or data; and

9. any conditions to which this statement is subjected.

A signed copy of the compliance statement must be appended to the Basic Assessment

Report or Environmental Impact Assessment Report

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

1.1.3 Terrestrial Animals

The specialist study is required to follow the published Protocols, provided in full below for the assessment of impacts on 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.

PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR

ENVIRONMENTAL IMPACTS ON TERRESTRIAL ANIMAL SPECIES

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.

1. General information

1.1 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of “very high” or “high” sensitivity for terrestrial animal species, must submit a Terrestrial Animal Species Specialist Assessment Report.

1.2 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of “medium sensitivity” for terrestrial animal species, must submit either a Terrestrial Animal Species Specialist Assessment Report or a Terrestrial Animal Species Compliance Statement, depending on the outcome of a site inspection undertaken in accordance with paragraph 4.

1.3 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of “low” sensitivity for terrestrial animal species, must submit a Terrestrial Animal Species Compliance Statement.

1.4 Where the information gathered from the site sensitivity verification differs from the screening tool designation of “very high” or “high” for terrestrial animal species sensitivity on the screening tool, and it is found to be of a “low” sensitivity, then a Terrestrial Animal Species Compliance Statement must be submitted.

1.5 Where the information gathered from the site sensitivity verification differs from the screening tool designation of “low” terrestrial animal species sensitivity and it is found to be of a “very high” or “high” terrestrial animal species sensitivity, a Terrestrial Animal Species Specialist Assessment must be conducted.

1.6 If any part of the development falls within an area of confirmed “very high” or “high” sensitivity, the assessment and reporting requirements prescribed for the “very high” or “high” sensitivity, apply to the entire development footprint. Development footprint in the context of this protocol, means the area on which the proposed development will take place and includes the area that will be disturbed or impacted.

1.7 The Terrestrial Animal Species Specialist Assessment and the Terrestrial Animal Species Compliance Statement must be undertaken within the study area.

1.8 Where the nature of the activity is not expected to have an impact on species of conservation concern (SCC) beyond the boundary of the preferred site, the study area means the proposed development footprint within the preferred site.

1.9 Where the nature of the activity is expected to have an impact on SCC beyond boundary of the preferred site, the project areas of influence (PAOI) must be determined by the specialist in accordance with Species Environmental Assessment Guideline, and the study area must include the PAOI, as determined.

2. Terrestrial Animal Species Specialist Assessment

2.1 The assessment must be undertaken by a specialist registered with the South African Council for Natural Scientific Professions (SACNASP), within a field of practice relevant to the taxonomic groups ("taxa") for which the assessment is being undertaken.

2.2 The assessment must be undertaken in accordance with the Species Environmental Assessment Guideline and must:

2.2.1 Identify the SCC which were found, observed or are likely to occur within the study area;

2.2.2 provide evidence (photographs) of each SCC found or observed within the study area, which must be disseminated by the specialist to a recognized online database facility immediately after the site inspection has been performed (prior to preparing the report contemplated in paragraph 3);

2.2.3 identify the distribution, location, viability and detailed description of population size of the SCC identified within the study area;

2.2.4 identify the nature and the extent of the potential impact of the proposed development to the population of the SCC located within the study area;

2.2.5 determine the importance of the conservation of the population of the SCC identified within the study area, based on information available in national and international databases including the IUCN Red List of Threatened Species, South African Red List of Species, and/or other relevant databases;

2.2.6 determine the potential impact of the proposed development on the habitat of the SCC located within the study area;

2.2.7 include a review of relevant literature on the population size of the SCC, the conservation interventions as well as any national or provincial species management plans for the SCC. This review must provide information on the need to conserve the SCC and indicate whether the development is compliant with the applicable species management plans and if not, a motivation for the deviation;

2.2.8 identify any dynamic ecological processes occurring within the broader landscape, that might be disrupted by the development and result in negative impact on the identified SCC, for example, fires in fireprone systems;

2.2.9 identify any potential impact on ecological connectivity in relation to the broader landscape, resulting in impacts on the identified SCC and its long term viability;

2.2.10 determine buffer distances as per the Species Environmental Assessment Guidelines used for the population of each SCC;

2.2.11 discuss the presence or likelihood of additional SCC including threatened species not identified by the screening tool, Data Deficient or Near Threatened Species, as well as any undescribed species, or roosting and breeding or foraging areas used by migratory species where these species show significant congregations, occurring in the vicinity; and

2.2.12 identify any alternative development footprints within the preferred development site which would be of “low” or “medium” sensitivity as identified by the screening tool and verified through the site sensitivity verification.

2.3 The findings of the assessment must be written up in a Terrestrial Animal Species Specialist Assessment Report.

5. Terrestrial Animal Species Compliance Statement

5.1 The compliance statement must be prepared by a SACNASP registered specialist under one of the two fields of practice (Zoological Science or Ecological Science).

5.2 The compliance statement must:

5.2.1 be applicable within the study area;

5.2.2 confirm that the study area is of “low” sensitivity for terrestrial animal species; and

5.2.3 indicate whether or not the proposed development will have any impact on SCC.

5.3 The compliance statement must contain, as a minimum, the following information:

5.3.1 contact details and relevant experience as well as the SACNASP registration number of the specialist preparing the compliance statement including a curriculum vitae;

5.3.2 a signed statement of independence by the specialist;

5.3.3 a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;

5.3.4 a description of the methodology used to undertake the site survey and prepare the compliance statement, including equipment and modelling used where relevant;

5.3.5 the mean density of observations/ number of samples sites per unit area;

5.3.6 where required, proposed impact management actions and outcomes or any monitoring requirements for inclusion in the EMPr;

5.3.7 a description of the assumptions made and any uncertainties or gaps in knowledge or data;

5.3.8 any conditions to which the compliance statement is subjected.

A signed copy of the Terrestrial Animal Species Compliance Statement must be appended to the Basic Assessment Report or the Environmental Impact Assessment Report.

2 LEGISLATION

Legislation relevant to this project is discussed below.

2.1 Convention on Biological diversity (CBD)

South Africa became a signatory to the United Nations Convention on Biological Diversity (CBD) in 1993, which was ratified in 1995. The CBD requires signatory states to implement objectives of the Convention, which are the conservation of biodiversity; the sustainable use of biological resources and the fair and equitable sharing of benefits arising from the use of genetic resources. According to Article 14 (a) of the CBD, each Contracting Party, as far as possible and as appropriate, must introduce appropriate procedures, such as environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biological diversity, to avoid or minimize these effects and, where appropriate, to allow for public participation in such procedures.

2.2 National Environmental Management Act, Act No. 107 of 1998 (NEMA)

NEMA is the framework environmental management legislation, enacted as part of the government's mandate to ensure every person’s constitutional right to an environment that is not harmful to his or her health or wellbeing. It is administered by the Department of Forestry, Fisheries and the Environment (DFFE) but several functions have been delegated to the provincial environment departments. One of the purposes of NEMA is to provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment. The Act further aims to provide for institutions that will promote cooperative governance and procedures for coordinating environmental functions exercised by organs of state and to provide for the administration and enforcement of other environmental management laws. NEMA requires, inter alia, that:

- “development must be socially, environmentally, and economically sustainable”;
- “disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied”; and
- “a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions”.

NEMA states that “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 people’s common heritage.”

2.3 National Environmental Management: Biodiversity Act, Act No. 10 of 2004 (NEM:BA)

As the principal national act regulating biodiversity protection, NEM:BA, is concerned with the management and conservation of biological diversity, as well as the use of indigenous biological resources in a sustainable manner. In terms of NEM:BA, the developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA Regulations).
- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area is in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

Chapter 4 of the Act relates to threatened or protected ecosystems or species. According to Section 57 of the Act, "Restricted activities involving listed threatened or protected species":

- A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7.

Such activities include any that are “of a nature that may negatively impact on the survival of a listed threatened or protected species”.

Alien and Invasive Species

Chapter 5 of NEMBA relates to species and organisms posing a potential threat to biodiversity. The Act defines alien species and provides lists of invasive species. The Alien and Invasive Species (AIS) Regulations, in terms of Section 97(1) of NEMBA, was published in Government Notice R598 in Government Gazette 37885 in 2014 (NEMBA, 2014). The Alien and Invasive Species (AIS) lists were subsequently published in Government Notice R 864 of 29 July 2016 (NEMBA, 2016).

NEMBA regulates all invasive organisms in South Africa, including a wide range of fauna and flora. Chapter 5 of the Act relates to species and organisms posing a potential threat to biodiversity. The purpose of Chapter 5 is:

a) to prevent the unauthorized introduction and spread of alien species and invasive species to ecosystems and habitats where they do not naturally occur;
b) to manage and control alien species and invasive species to prevent or minimize harm to the environment and to biodiversity in particular;
c) to eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats;

According to Section 65 of the Act, "Restricted activities involving alien species":

1) A person may not carry out a restricted activity involving a specimen of an alien species without a permit issued in terms of Chapter 7. Restricted activities include the following:
    a) Importing into the Republic, including introducing from the sea, any specimen of a listed invasive species.
    b) Having in possession or exercising physical control over any specimen of a listed invasive species. c. Growing, breeding or in any other way propagating any specimen of a listed invasive species, or causing it to multiply.
    c) Conveying, moving or otherwise translocating any specimen of a listed invasive species.
    d) Selling or otherwise trading in, buying, receiving, giving, donating or accepting as a gift, or in any other way acquiring or disposing of any specimen of a listed invasive species.
    e) Spreading or allowing the spread of any specimen of a listed invasive species.
    f) Releasing any specimen of a listed invasive species. h. Additional activities that apply to aquatic species.
2) A permit referred to in subsection (1) may be issued only after a prescribed assessment of risks and potential impacts on biodiversity is carried out.

An **"alien species**" is defined in the Act as:

a. a species that is not an indigenous species; or
b. an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by means of migration or dispersal without human intervention.

According to Section 71 of the Act, "**Restricted activities involving listed invasive species**":

1. A person may not carry out a restricted activity involving a specimen of a listed invasive species without a permit issued in terms of Chapter 7.
2. A permit referred to in subsection (1) may be issued only after a prescribed assessment of risks and potential impacts on biodiversity is carried out.

An "**invasive species**" is defined in the Act as any species whose establishment and spread outside of its natural distribution range:

a. threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species; and
b. may result in economic or environmental harm or harm to human health.

A **"listed invasive species**" is defined in the Act as any invasive species listed in terms of section 70(1). According to Section 73 of the Act, "Duty of care relating to listed invasive species":

2) A person who is the owner of land on which a listed invasive species occurs must:
   a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land;
   b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and c) take all the required steps to prevent or minimize harm to biodiversity.

According to Section 75 of the Act, "Control and eradication of listed invasive species":

1. Control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs.
2. Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment.
3. The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

Government Notice No. 47526 of 2022: The revised National List of ecosystems that are threatened and in need of protection.

This notice, published under Section 52(1)(a) of NEMBA, provides for the listing of threatened or protected ecosystems based on national criteria. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment (2004).

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.

Government Notice No. 40733 of 2017: Draft National Biodiversity Offset Policy

Published under NEMA. The aim of the Policy is to ensure that significant residual impacts of developments are remedied as required by NEMA, thereby ensuring sustainable development as required by section 24 of the Constitution of the Republic of South Africa, 1996. This policy should be taken into consideration with every development application that still has significant residual impact after the Mitigation Sequence has been followed. The mitigation sequence entails the consecutive application of avoiding or preventing loss, then at minimizing or mitigating what cannot be avoided, rehabilitating where possible and, as a last resort, offsetting the residual impact. The Policy specifies that one impact that has come across consistently as unmitigatable is the rapid and consistent transformation of certain ecosystems and vegetation types, leading to the loss of ecosystems and extinction of species. The Policy specifically targets ecosystems where the ability to reach protected area targets is lost or close to being lost. However, the Policy states that *"[w]here ecosystems remain largely untransformed, intact and functional, an offset would not be required for developments that lead to transformation, provided they have not been identified as a biodiversity priority"*. Biodiversity offsets should be considered to remedy residual negative impacts on biodiversity of 'medium' to 'high' significance. Residual impacts of 'very high' significance are a fatal flaw for development and residual biodiversity impacts of 'low' significance would usually not require offsets. The Policy indicates that impacts should preferably be 18 avoided in protected areas, Critical Biodiversity Areas (CBA), verified wetland and river features and areas earmarked for protected area expansion.

2.4 National Forests Act, Act no. 84 of 1998

Protected trees

According to this Act, the Minister may declare a tree, group of trees, woodland, or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'. Forests Prohibits the destruction of indigenous trees in any natural forest without a licence.

2.5 National Water Act, Act 36 of 1998

Any areas that are defined in the National Water Act as a water resource that might be impacted on by certain activities that are contemplated require authorisation (Section 21 of the National Water Act of 1998). A "watercourse" in terms of the National Water Act (Act 36 of 1998) means:

- 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, and a reference to a watercourse includes, where relevant, its bed and banks.

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

2.6 Conservation of Agricultural Resources, Act No. 43 of 1983 as amended in 2001.

Declared Weeds and Invaders in South Africa are categorised according to one of the following categories:

- Category 1 plants: are prohibited and must be controlled.
- Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread.
- Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the flood line of watercourses and wetlands.

2.7 National Veld and Forest Fire Act, Act No. 101 of 1998

Provides requirements for veldfire prevention through firebreaks and required measures for firefighting. Chapter 4 of the Act places a duty on landowners to prepare and maintain firebreaks. Chapter 5 of the Act places a duty on all landowners to acquire equipment and have available personnel to fight fires.

2.8 Free State Nature Conservation Ordinance, No 8 of 1969

This Act provides for the management and conservation of the Free State Province's biophysical environment and protected areas within the framework of the National Environmental Management Act, 1998 (Act No 107 of 1998); to provide for the protection of species and ecological- systems that warrant provincial protection; to provide for the sustainable use of indigenous biological resources; and to provide for matters connected therewith.

Amongst other regulations, the following may apply to the current project:

- Various species are protected;
- The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species. The Act provides lists of protected species for the Province.

The Act provides lists of protected species for the province. According to the Free State Nature Conservation Ordinance, a permit is required for the removal of any species on this list.

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

3 PROJECT DETAILS

3.1 Project Background and Motivation

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 in order 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 the up to 460MW Oslaagte 2 Solar PV Project south east of Kroonstad, in the Free State Province.

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.

3.2 Project Description

The Applicant has proposed the development of up to 460MW Oslaagte Solar 2 Photovoltaic (PV) Project near Kroonstad, in the Free State Province (the "Project"). The electricity generated by the Project will be transmitted through a 132kV power line between facility substation and the Eskom Collector Switching Station/Main Transmission Substation (MTS).

The Project is located approximately 17.5km to the south east of Kroonstad's central business district (CBD) and falls within Ward 1 of the Moqhaka Local Municipality (MLM), in the Free State Province. The R76 runs along the eastern boundary of the site.

The proposed Oslaagte 2 Solar PV facility will cover approximately 600ha and will include the following infrastructure:

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

- Temporary and permanent laydown area
- Facility grid connection infrastructure, including:
    - 33 kV cabling between the project components and the facility substation
    - A 33 kV or 132 kV facility substation
    - 33 kV cabling or a 132 kV powerline between the facility substation and the Eskom Collector Switching Station/Main Transmission Substation (MTS).

3.3 Technical Details of the PV Plants

Capacity of on-site substation	It is estimated that the maximum size of the facility substation will not exceed 1ha. The facility substation will collect the power from the facility and transform it from 33 kV to up to 132 kV. 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 585 ha
Area occupied by both permanent and construction laydown areas	Temporary construction laydown area up to 5 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 ha
Length of internal roads	17 km – internal
Width of internal roads	The internal roads will be up to 6 m wide. The access roads will be up to 8 m wide.
Height of fencing	Up to 3.5m

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

3.4 Location

The Project is located approximately 17.5km to the south east of Kroonstad's central business district (CBD) and falls within Ward 1 of the Moqhaka Local Municipality (MLM), in the Free State Province. The R76 runs along the eastern boundary of the site (**Error! Reference source not found.**). The project footprint covers a combined area of approximately 480 hectares (ha) and will be situated on the farm Oslaagte 2564. The electricity generated by the Project will be transmitted through a 132kV power line between the facility substation and the Eskom Collector Switching Station/Main Transmission Substation (MTS).

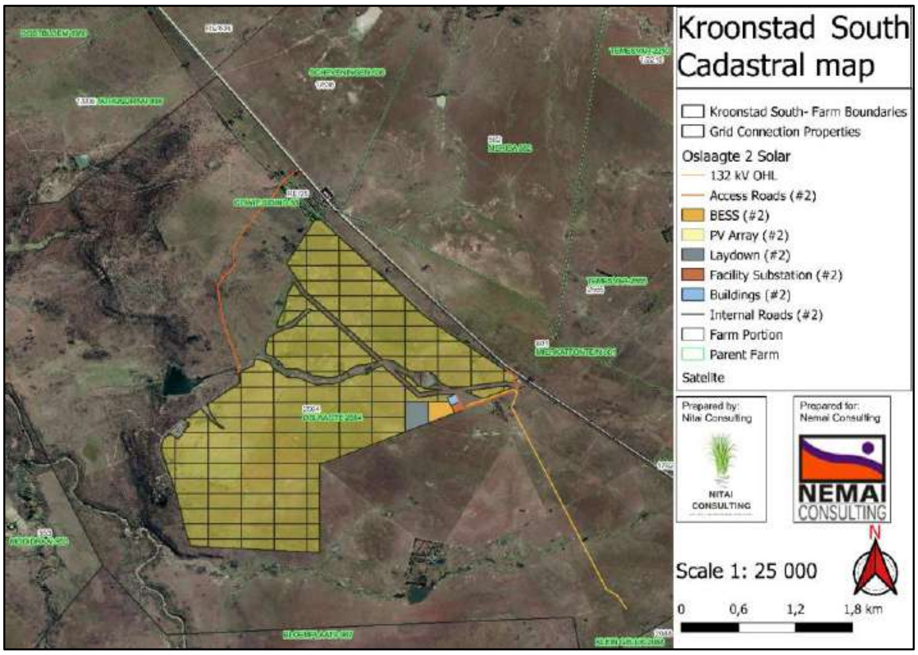


Figure 1: Project Locality

4 METHODS

4.1 Geographic Information Systems (GIS) Mapping

Existing 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:

Western Cape

- Free State Biodiversity Sector Plan of 2016 (DETEA, 2016)
- 2022 National Biodiversity Assessment (DFFE, 2022);
- Vegetation Map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006);
- SA Protected and Conservation Areas Databases, 2022 (DFFE 2022);
- National Protected Areas Expansion Strategy, 2016 (DEA, 2016);
- Important Bird and Biodiversity Areas, 2015 (Marnewick *et al.,* 2015);

Brief descriptions of the standardised methodologies applied are provided below. More detailed descriptions of survey methodologies are available upon request.

4.2 Desktop Vegetation and Botanical 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 2). 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.

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

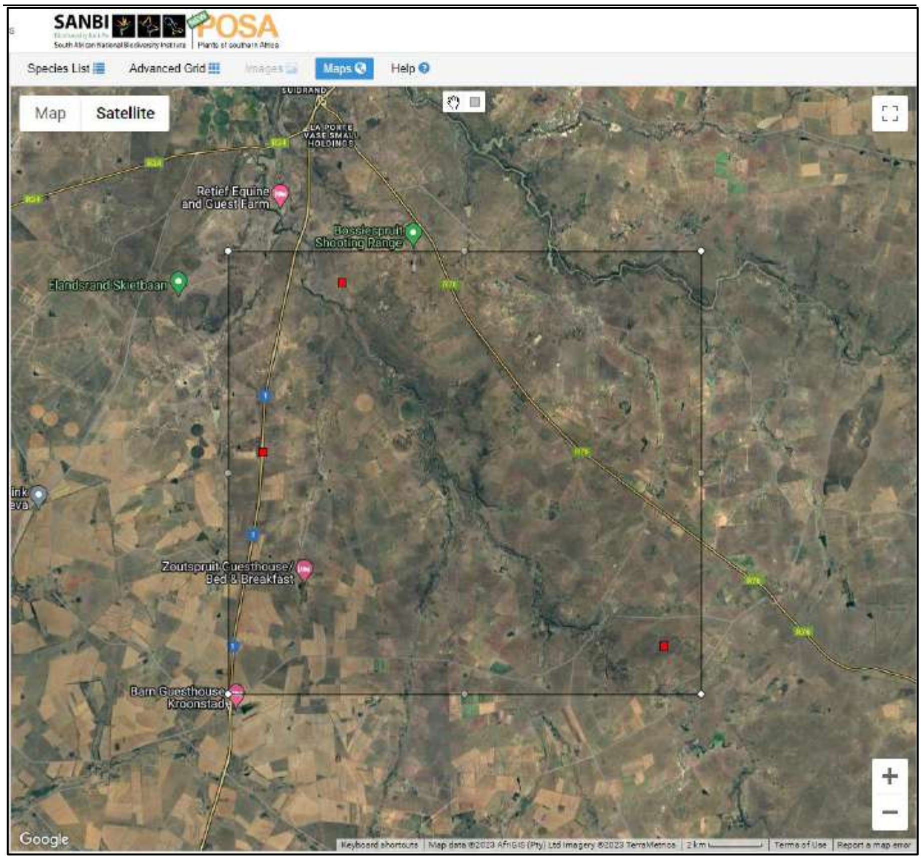


Figure 2: Plant distribution data.

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).

4.3 Floristic Fieldwork Survey and Analysis

The wet season fieldwork (completed during January and April 2023) and sample sites were placed within targeted areas (i.e., target sites) perceived as ecologically sensitive based on the preliminary interpretation of satellite imagery (Google Corporation) and GIS analysis (which included the latest applicable biodiversity datasets) available prior to the fieldwork. The focus of the fieldwork was therefore to maximise coverage and navigate to each target site in the field to perform a rapid vegetation and ecological assessment at each sample site. Emphasis was placed on sensitive habitats, especially those overlapping with the proposed project area.

Homogenous vegetation units were subjectively identified using satellite imagery and existing land cover maps. The floristic diversity and search for protected plants and flora SCC were conducted through timed meanders within representative habitat units delineated during the scoping fieldwork. Emphasis was placed on any sensitive habitats overlapping with the proposed project area.

The timed random meander method is a highly efficient method for conducting floristic analysis, specifically in detecting protected plants and flora SCC and maximising floristic coverage. In addition, the method is time and cost effective and highly suited for compiling observed flora species lists and therefore gives a rapid indication of flora diversity. 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., roads, erosion etc.), and this included the subjective recording of dominant vegetation species and any sensitive features (e.g., old lands, rock outcrops etc.). In addition, opportunistic observations were made while navigating through the project area.

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

- A field guide to Wild flowers (Pooley, 1998);
- Field Guide to the Wild Flowers of the Highveld (van Wyk & Malan, 1998);
- Guide to the Aloes of South Africa (Van Wyk & Smith, 2014);
- Identification guide to southern African grasses. An identification manual with keys, descriptions and distributions (Fish et al., 2015); and
- Field guide to trees of Southern Africa, Struik Publishers (Van Wyk & Van Wyk, 1997).

The field work methodology included the following survey techniques:

<u>Timed meanders:</u>

- Sensitivity analysis based on structural and species diversity;
- Identification of protected floral species; and
- Identification of floral red-data or red-listed species (Species of Conservation Concern).

4.4 <u>Faunal Assessment</u>

4.4.1 Desktop Assessment

The faunal desktop assessment involved the following:

- Compilation of expected species lists;

- Identification of any red-data/red-listed species or Species of Conservation Concern potentially occurring in the area; and
- Emphasis was placed on the probability of occurrence of species of provincial, national, and international conservation importance.

Distribution and SCC data is generally obtained from the following information sources:

- Animal Demography Unit (https://vmus.adu.org.za/)); and Southern African Bird Atlas Project 2 (SABAP2, 2019);
- South African Reptile Conservation Assessment (SARCA) (sarca.adu.org);
- Atlas and Red list of Reptiles of South Africa, Lesotho and Swaziland (Bates et al., 2014);
- Red Data Book of Birds (Birdlife South Africa, 2015);
- Atlas and Red Data Book of Frogs of South Africa (Mintner et al., 2004);
- South Africa's official site for Species Information and National Red Lists (SANBI, 2022);
- The 2016 Red List of Mammals of South Africa (EWT, 2016); and
- The IUCN Red List of Threatened Species. Version 2021-3 (IUCN, 2021).

4.4.2 Field Survey

The field survey component of the assessment utilised a variety of sampling techniques including, but not limited to, the following:

- Visual observations (involving the use of binoculars and specialist camera equipment);
- Active hand-searches, used for species that shelter in or under particular micro-habitats (typically rocks, exfoliating rock outcrops, fallen trees, leaf litter, bark etc.);
- Identification of tracks and signs; and the utilization of local knowledge.

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

- Roberts Bird Guide, Second Edition (Chittenden et al., 2016);
- A Guide to the Reptiles of Southern Africa (Alexander & Marais, 2007);
- Field guide to Snakes and other Reptiles of Southern Africa (Branch, 1998);
- A Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers, 2009);
- The Mammals of the Southern African Subregion (Skinner & Chimimba, 2005);
- Spiders of Southern Africa (Leroy & Leroy, 2003); and

4.5 Site Ecological Importance

The different habitat types within the assessment area were delineated and identified based on observations during the field assessment as well as information from 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 (SCC) 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 1).

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

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

[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 2).

Table 2: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 (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 3:Determining the BI

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) (Table 4) 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'.

Table 4: Resilience criteria

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 5) and interpreted accordingly (Table 6):

Table 5: Determining the SEI.

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 6: Guidelines for interpreting SEI 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.

4.6 Limitations and Assumptions

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

- It is assumed that all information received from the client is accurate;
- All datasets accessed and utilised for this assessment are considered to be representative of the most recent and suitable data for the intended purposes;
- The handheld GPS utilised for the fieldwork had a maximum accuracy of 5 m. As such, any features spatially logged and mapped as part of this report may be offset by approximately 5 m; and
- Only a single season survey was conducted for the respective studies, this would constitute a wet season survey, however the data received is considered sufficient to derive a meaningful baseline; since most species are present during the wet season survey apart from winter flowering plants.

5 Receiving Environment

5.1 Desktop Spatial Baseline

Table 7: Desktop Spatial features below has been produced in terms of the spatial data collected and analysed (as provided by various sources such as the national and provincial environmental authorities and SANBI). It presents a summative breakdown of the ecological boundaries considered and the associated relevance that each has to the region or project area. Where a feature is regarded as relevant it is considered an ecologically important landscape feature and discussed further as part of the sub-sections that follow.

Table 7: Desktop Spatial features examined.

Desktop Information considered	Relevant	Reasoning	Section
Free State Biodiversity plan of (2016)	Yes	Project area overlaps with an ESA and Degraded area.	5.1.1
Ecosystem Protection Level (SANBI & DFFE, 2021)	Yes	The project falls within an ecosystem of "Least Concern" and is considered "Endemic".	5.1.2.1
National Protected Areas Expansion Strategy, 2016 (DEA, 2016)	Yes	The project area does overlap with a priority focus area	5.1.3
Important Bird and Biodiversity Areas, 2015	No	No IBAs occur nearby	-
South African Protected and Conservation Areas Databases, 2022	Yes	Protected areas within 5 km of the of the study site.	5.1.4

5.1.1 Free State Biodiversity Sector Plan

The Free State Biodiversity Sector Plan (FSBSP) strives to improve landscape level conservation and management of biodiversity and ecosystems in the province. This is achieved by providing information on biodiversity in a standardised format that can be used to inform forward planning (e.g. Spatial Development Frameworks) and reactive management (e.g. environmental impact assessment) processes.

The purpose of a Biodiversity Sector Plan is to inform land use planning, environmental assessments, land and water use authorisations, as well as natural resource management, undertaken by a range of sectors whose policies and decisions impact on 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.

- 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. In other words, 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.
    - The Free State Biodiversity Sector plan (FSBSP) differentiates between **CBA 1 and CBA 2.**
        - CBA 1 (Irreplaceable) areas include: Critical Patches: Ecosystem Status – Critically Endangered Ecosystems; irreplaceable Sites; Critical Biodiversity Corridors Linkages; Important Terrestrial Habitats: Expert Areas; and Important Terrestrial Habitats: Kloofs.
            - A site that is irreplaceable or near irreplaceable for meeting biodiversity targets. There are no or very few other options for meeting biodiversity targets for the features associated with the site. Such sites are therefore critical and they need to be maintained to ensure that features targets are achieved and that such features persist.
        - CBA2 (Optimal) areas include: Critical Patches: Ecosystem Status – Endangered and Vulnerable Ecosystems; Important Habitats: Features; and Important Habitats: Focus Wildlife Areas.
            - A site that has been selected based on its complementarity for meeting biodiversity targets. CBA Optimal sites are therefore important but their maintenance is not critical to ensure that features targets are achieved and that such features persist.
- Ecological Support Areas (ESAs) are terrestrial and aquatic areas that are not essential for meeting biodiversity representation targets (thresholds), but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree or extent of restriction on land use and resource use in these areas may be lower than that recommended for CBAs.

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

The project area does fall in a CBA and ESA category and is designated as "ESA1 and ESA 2" and "Degraded Areas" (Figure 3).

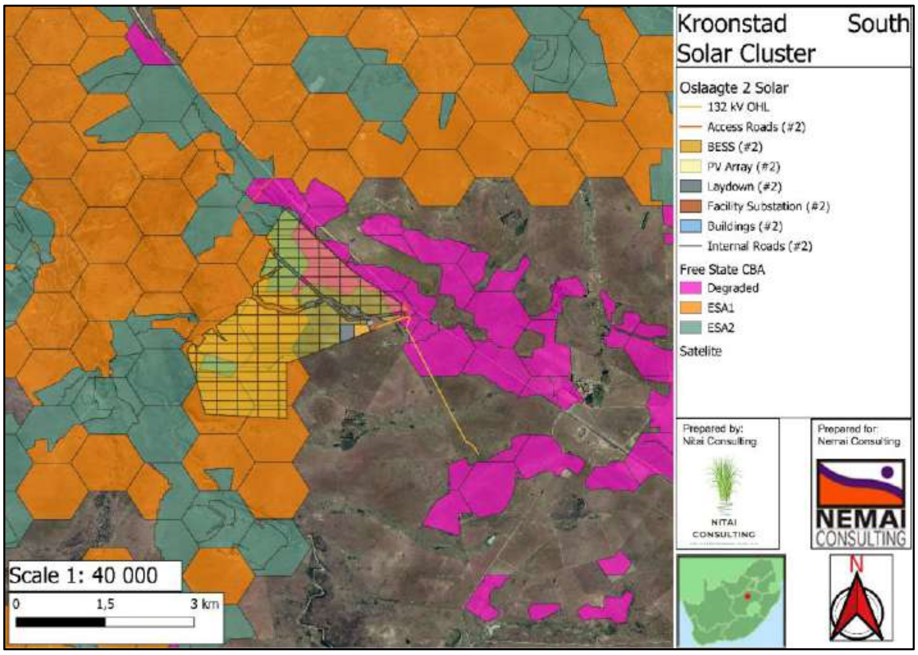


Figure 3: CBA areas for study site.

5.1.2 The National Biodiversity Assessment

5.1.2.1 Ecosystem Threat status

The 2011 list focussed on terrestrial ecosystems and is referred to in Listing Notice 3 (Government Notice R985, published under NEMBA in 2014) which identifies activities that require environmental authorisation when undertaken in a threatened ecosystem, as identified in the list.

The 2011 list has also been used throughout South Africa as a decision-making support tool, especially in environmental authorisation application processes and to inform bioregional planning. The revised list, known as the 2022 Red List of Ecosystems, was developed between 2016 and 2021, incorporating the best available information on terrestrial ecosystem extent, condition, pressures, and drivers of change.

The revised list 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. The updated input data and alignment with global methods provides for a substantially improved list but also limits direct comparison between 2011 and 2022 because some ecosystem types have changed threat status category due to the change in methods, and others have changed due to land cover change or other pressures in the landscape.

Going forward, comparisons between versions of the list will be possible, facilitating trend analysis and monitoring. The 2022 Red List of Ecosystems identifies 120 threatened terrestrial ecosystem types (55 Critically Endangered, 51 Endangered and 14 Vulnerable types).

The project area was superimposed on the Ecosystem Protection Level map to assess the protection status of the terrestrial ecosystem associated with the project area. Based on the dataset, the ecosystem is rated as least concern but is endemic (Figure 4 and Figure 5).

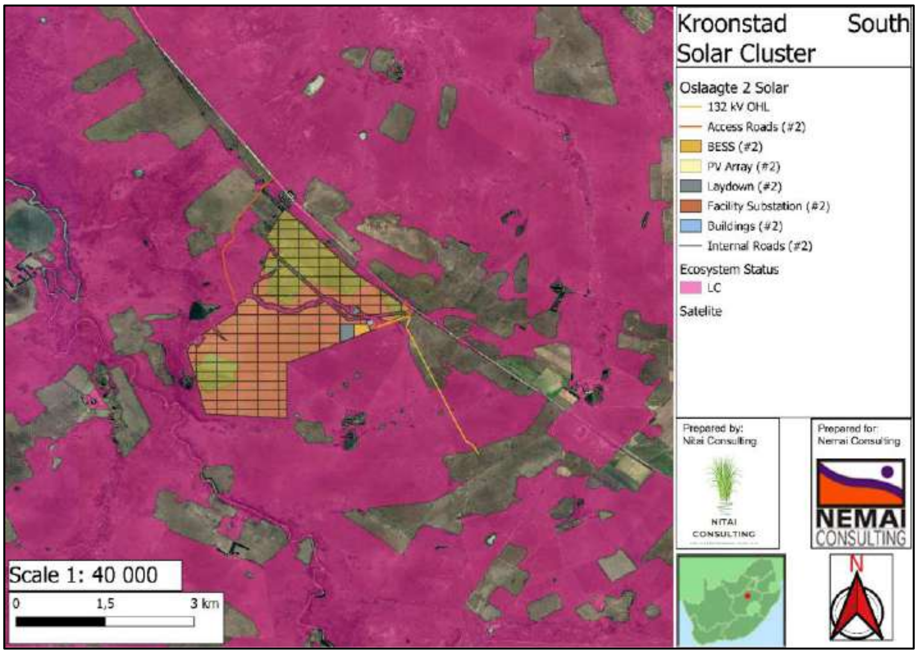


Figure 4: Red list Ecosystem status.

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

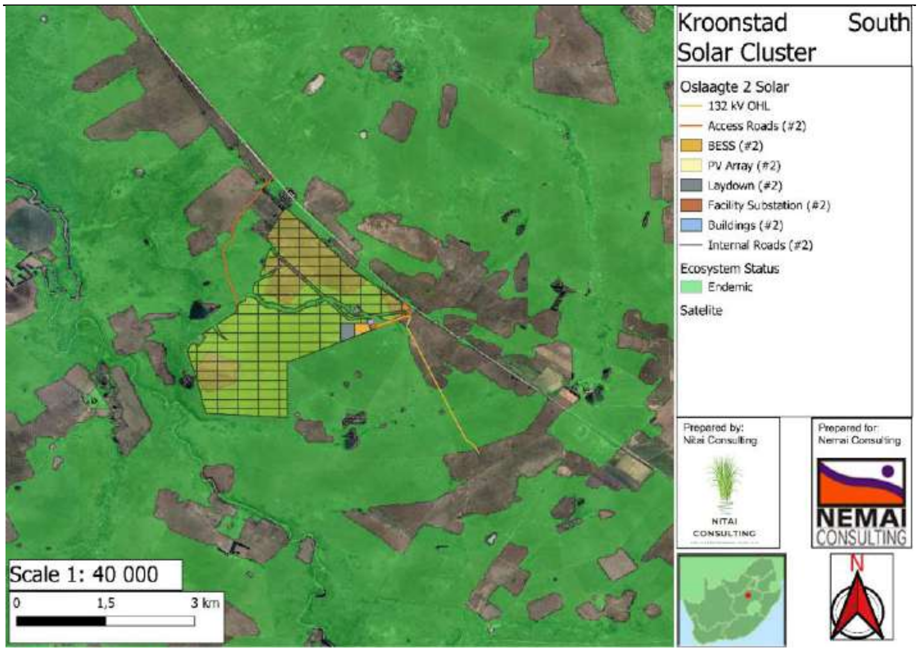


Figure 5: Ecosystem endemism status.

5.1.3 South African Protected and Conservation Areas

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).

The project area does overlap with a priority focus area for expansion according to the 2016 NPAES dataset but is not under negotiation and the habitat is disturbed and degraded and does not contribute significantly to ecological corridors (Figure 6).

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

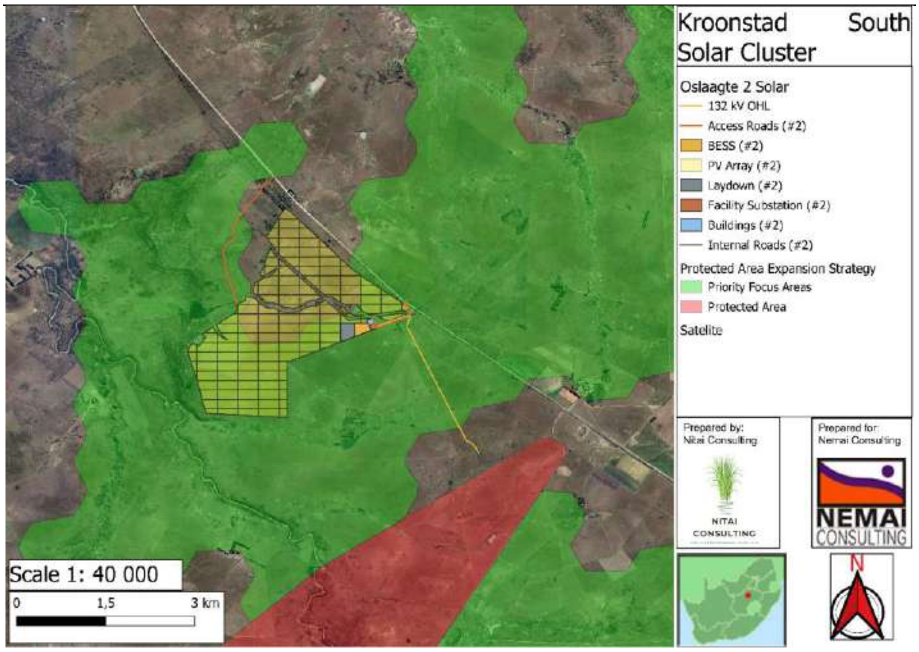


Figure 6: Protected Areas Expansion Framework for study site.

5.1.4 Protected Areas

According to the spatial data for SAPAD (2022) and SACAD (2022), the main project area lies within the 5 km buffer for Serndipidie Private Nature Reserve and is thus inside any regulated area. The area inside the buffer is current agricultural land and in various stages of disturbance. The project should not have any significant impacts on the nature reserve (Figure 7).

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

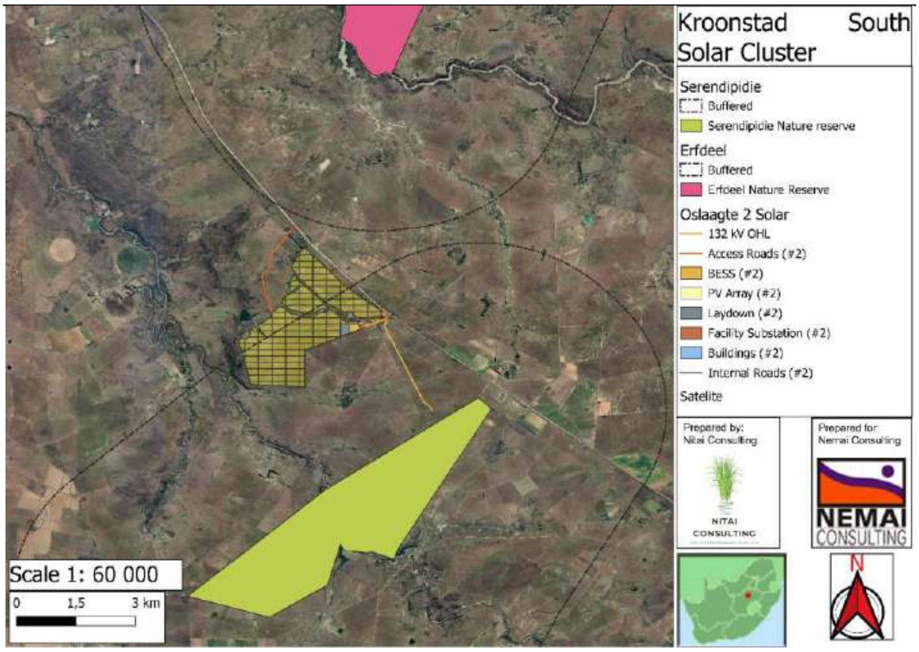


Figure 7: Map illustrating the project area in relation to the nearest protected areas.

5.2 Ecological Desktop Baseline

5.2.1 Vegetation Assessment

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 Central free Sate Grassland (Figure 8).

5.2.1.1 Central Free State Grassland

Distribution: Free State Province and marginally into Gauteng Province: A broad zone from around Sasolburg in the north to Dewetsdorp in the south. Other major settlements located within this unit include Kroonstad, Ventersburg, Steynsrus, Winburg, Lindley and Edenville

Altitude: 1 300–1 640 m.

Vegetation & Landscape Features: Undulating plains supporting short grassland, in natural condition dominated by *Themeda triandra* while *Eragrostis curvula* and *E. chloromelas* become dominant in degraded habitats. Dwarf karoo bushes establish in severely degraded clayey bottomlands. Overgrazed and trampled low-lying areas with heavy clayey soils are prone to *Acacia karroo* encroachment.

Geology & Soils: Sedimentary mudstones and sandstone mainly of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) as well as those of the Ecca Group (Karoo Supergroup) found in the extreme northern section of this grassland, giving rise to vertic, melanic and red soils (typical forms are Arcadia, Bonheim, Kroonstad, Valsrivier and Rensburg)—typical of Dc land type (dominating the landscape). The less common intrusive dolerites of the Jurassic Karoo Dolerite Suite support dry clayey soils typical of the Ea land type

Climate: Summer-rainfall seasonal precipitation region, with MAP 560 mm. Much of the rainfall is of convectional origin and peaks in December to January. The overall MAT around 15°C. Incidence of frost relatively high (43 days on average).

Important Taxa

Graminoids: *Aristida adscensionis (d), A. congesta (d), Cynodon dactylon (d), Eragrostis chloromelas (d), E. curvula (d), E. plana (d), Panicum coloratum (d), Setaria sphacelata (d), Themeda triandra (d), Tragus koelerioides (d), Agrostis lachnantha, Andropogon appendiculatus, Aristida bipartita, A. canescens, Cymbopogon pospischilii, Cynodon transvaalensis, Digitaria argyrograpta, Elionurus muticus, Eragrostis lehmanniana, E. micrantha, E. obtusa, E. racemosa, E. trichophora, Heteropogon contortus, Microchloa caffra, Setaria incrassata, Sporobolus discosporus.*

Herbs: *Berkheya onopordifolia var. onopordifolia, Chamaesyce inaequilatera, Conyza pinnata, Crabbea acaulis, Geigeria aspera var. aspera, Hermannia depressa, Hibiscus pusillus, Pseudognaphalium luteo-album, Salvia stenophylla, Selago densiflora, Sonchus dregeanus.*

Geophytic Herbs: *Oxalis depressa, Raphionacme dyeri. Succulent Herb: Tripteris aghillana var. integrifolia.*

Low Shrubs: *Felicia muricata (d), Anthospermum rigidum subsp. pumilum, Helichrysum dregeanum, Melolobium candicans, Pentzia globosa*.

Conservation Status: The ecosystem is rated as Least concern according to the 2022 Red List ecosystem data since there is 66% remaining of this ecosystem. It has experienced low rates of natural habitat loss and biotic disruptions, placing this ecosystem at low risk of collapse and 2.3% is currently formally protected (DFFE, 2022).

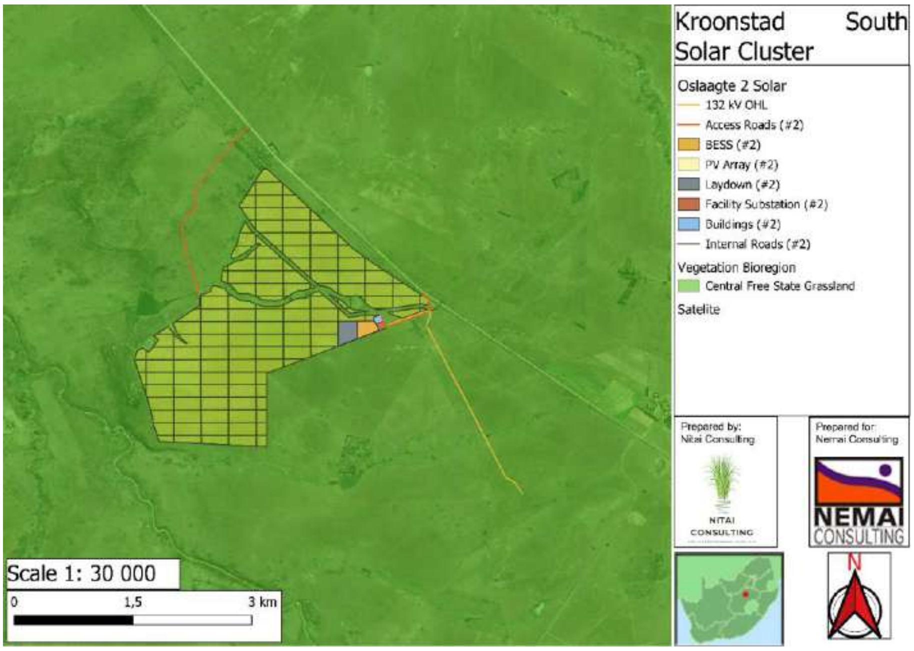


Figure 8: Vegetation region of study site.

5.2.1.2 Botanical Assessment

Based on the Plants of Southern Africa (BODATSA-POSA, 2019) database, only 41 plant species could potentially occur on the study site. None are regarded as threatened. The screening tool identifies no potential SCC species and rated the area "Low".

5.2.2 Faunal Assessment

Largely based on the South African Bird Atlas Project Version 2 (SABAP2, 2022), IUCN Digital Distribution Maps (IUCN, 2016), and the Animal Demography Unit (ADU, 2020) databases, Table 8

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

summarises the total number of animal species that have the potential to occur in or around the project area, and the corresponding number of SCC. A supplementary sensitivity assessment was conducted for Sensitive species 15. See Appendix F section 7.1.4

Table 8: Total number of potential fauna species present, and corresponding SCC

Fauna type		Total potential number	Number of SCC
Avifauna		153	2
Mammals		57	5
Herpetofauna	Amphibians	15	0
	Reptiles	20	1

These numbers include animals that only occur within nature reserves and private reserves. Of the 2 avifaunal SCC, none are likely to be found resident in the project area due to a lack of suitable habitat and the associated modified nature of the project area and surrounds.

Of the 57 total mammals listed, none of the mammal SCC are likely to be found resident within the project area.

None of the herpetofauna SCC are likely to be found within the project area.

The general modified state of the area coupled with the with high levels of agricultural disturbance, results in a high level of disturbance degradation, and unsuitable environmental conditions.

6 Results

6.1 Field Survey

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 the 17th and 18th of April 2023 from 7:00 to 16:00. This is at the end of the wet season but the previous week the study area has had rainfall. The vegetation was still green and easily identifiably using phenological characters.

6.1.1 Terrestrial Flora and Fauna

During the terrestrial survey the floral and faunal communities within the project area were assessed and photographs were captured, some of which are provided in this section of the report. For ease of reading, the observations and discussions pertaining to the floral and the faunal species recorded are separated below.

6.1.1.1 Flora and Vegetation Condition

The project area was found in a heavily modified condition, mainly attributed to the agricultural practices and its associated impacts, resulting in the area being largely disturbed in some way. Grazing practices, old lands and piospheres have degraded the veld severely. These aspects further limit the functional capacity of the project area. Much of the development footprint is located within degraded areas or along roads or transformed areas and their associated servitudes, which are considered as low sensitivity. Species marked in blue are alien species but not classified as invasive. Species marked in green are alien invasive according to Nemba. Species marked in red are protected in Free State province. A total of 76 tree, shrub, herbaceous and graminoid plant species were recorded in the project area during the field assessment (Table 9). The three species protected provincially are of least concern according to the Red List of Plants and the IUCN database. These species indicate disturbance in ecosystems and are commonly found throughout the country.

Table 9: Trees, shrub and herbaceous plant species recorded in the project area.

Family	Taxon	Common name	Protection Status	Endemism	Invasive
Amaranthaceae	*Alternanthera pungens,*	Paper Thorn	LC	Not Indigenous, naturalised	
Amaranthaceae	*Gomphrena celosioides*	Batchelor's button	LC	Not Indigenous, naturalised	
Amaranthaceae	*Guilleminea densa,*	Small matweed	LC	Not Indigenous, naturalised	
Amaranthaceae	*Kyphocarpa angustifolia*	Silver Burrweed	LC	Indigenous	
Asparagaceae	*Asparagus laricinus*	Emperor's asparagus	LC	Indigenous	
Asteraceae	*Arctotis arctotoides,*	Botter blom	LC	Indigenous	
Asteraceae	*Felicia muricata*	Bloublommetjie	LC	Indigenous; Endemic	
Asteraceae	*Geigeria burkei,*	Vermeerbos	LC	Indigenous	

Asteraceae	*Helichrysum acutatum*	Sticky Everlasting	Protected FS	Indigenous	Protected Free State
Asteraceae	*Helichrysum nudifolium*	Hottentot's Tea	Protected FS	Indigenous	Protected Free State
Asteraceae	*Helichrysum rugulosum*	Wrinkly Everlasting	Protected FS	Indigenous	Protected Free State
Asteraceae	*Nidorella hottentotta,*	Grassland Vleiweed	LC	Indigenous	
Asteraceae	*Nidorella resedifolia*	Stinkkruid	LC	Indigenous	
Asteraceae	*Senecio inaequidens*	Canary Weed	LC	Indigenous	
Asteraceae	*Seriphium plumosa*	Bankrupt bush	LC	Indigenous	
Asteraceae	*Tagetes minuta*	Khaki weed	LC	Not indigenous; Naturalised; Invasive	
Caryophyllaceae	*Pollichia campestris*	Barley Sugar Bush	LC	Indigenous	
Cyperaceae	*Bolboschoenus glaucus,*	Glaucus tuber-bulrush	LC	Indigenous	
Cyperaceae	*Bulbostylis hispidula,*	Slender Sedge	LC	Indigenous	
Cyperaceae	*Cyperus congestus,*	Purple Umbrella Sedge	LC	Indigenous	
Cyperaceae	*Cyperus denudatus,*		LC	Indigenous	
Cyperaceae	*Cyperus fastigiatus,*		LC	Indigenous	
Cyperaceae	*Kyllinga alba*	Witbiesie	LC	Indigenous	
Cyperaceae	*Kyllinga erecta,*	Greater Kyllinga	LC	Indigenous	
Dipsacaceae	*Scabiosa columbaria*	Rice Flower	LC	Indigenous	
Fabaceae	*Vachelia robusta*	Ankle thorn	LC	Indigenous	
Geraniaceae	*Monsonia glauca*	Grey Dysentery-Herb	LC	Indigenous	
Juncaceae	*Juncus oxycarpus,*		LC	Indigenous	
Lamiaceae	*Ocimum americanum,*	Wild Basil	LC	Indigenous	

Malvaceae	*Hibiscus trionum,*	Venice Mallow	LC	Indigenous	
Phyllanthaceae	*Phyllanthus angolensis*		LC	Indigenous	
Poaceae	*Aristida canescens*	Pale Three Awn	LC	Indigenous	
Poaceae	*Aristida congesta subsp. barbicollis,*	Spreading Three Awn	LC	Indigenous	
Poaceae	*Aristida congesta subsp. congesta*	Tassle Three-Awn	LC	Indigenous	
Poaceae	*Brachiaria serrata,*	Velvet Signal Grass	LC	Indigenous	
Poaceae	*Chloris virgata*	Feather-top Chloris	LC	Indigenous	
Poaceae	*Cymbopogon caesius,*	Broad-leaved Turpentine Grass	LC	Indigenous	
Poaceae	*Cymbopogon pospischilii*	Bushveld turpentine Grass	LC	Indigenous	
Poaceae	*Cynodon dactylon,*	Couch Grass	LC	Indigenous	
Poaceae	*Eragrostis chloromelas,*	Blue Lovegrass	LC	Indigenous	
Poaceae	*Eragrostis curvula,*	Weeping Love Grass	LC	Indigenous	
Poaceae	*Eragrostis gummiflua*	Gum Grass	LC	Indigenous	
Poaceae	*Eragrostis obtusa*	Dew Grass	LC	Indigenous	
Poaceae	*Eragrostis superba,*	Saw tooth love Grass	LC	Indigenous	
Poaceae	*Hyparrhenia hirta*	Common Thatching grass	LC	Indigenous	
Poaceae	*Melinis repens,*	Natal Red Top	LC	Indigenous	
Poaceae	*Panicum coloratum,*	Bamboeskweek	LC	Indigenous	
Poaceae	*Panicum maximum,*	Guinea Grass	LC	Indigenous	
Poaceae	*Perotis patens.*	Cat's tail	LC	Indigenous	

Poaceae	*Setaria pumila*	Garden Bristle Grass	LC	Indigenous	
Poaceae	*Setaria sphacelate var torta*	Creeping Bristle Grass	LC	Indigenous	
Poaceae	*Sporobolus africanus.*	Rats tail dropseed	LC	Indigenous	
Poaceae	*Sporobolus ioclados*	Pan Dropseed	LC	Indigenous	
Poaceae	*Sporobolus pyramidalis,*	Vlei Grass	LC	Indigenous	
Poaceae	*Themeda triandra*	Red Grass	LC	Indigenous	
Poaceae	*Tragus berteronianus,*	Carrot Seed Grass	LC	Indigenous	
Poaceae	*Urochloa mossambicensis*	Bushveld Signal Grass	LC	Indigenous	
Rubiaceae	*Oldenlandia herbacea*	False Spurry	LC	Indigenous	
Rubiaceae	*Pygmaeothamnus zeyheri,*	Common Sand Apple	LC	Indigenous	
Solanaceae	*Solanum elaeagnifolium*	Silverleaf Nightshade	LC	Not Indigenous, Invasive	Nemba 1b
Solanaceae	*Solanum mauritianum*	Bugweed	LC	Not Indigenous, Invasive	Nemba 1b
Verbenaceae	*Verbena bonariensis*	Wild Verbena	LC	Not Indigenous, Invasive	Nemba 1b
Verbenaceae	*Verbena tenuisecta*		LC	Not indigenous; Naturalised	

Refer to the images below for photographs showing the habitats and the overall state of the project area (Figure 9).

6.1.1.2 Fauna

Mammal activity was low, due to the extent of disturbance in general with cattle grazing the area, as well as the poor habitat condition. The species present are most likely not resident due to the modified state of the area. No SCC were observed during the field survey.

Figure 9: General condition of the study site

6.1.2 Habitat Survey and Site Ecological Importance

The main habitat types identified across the project area were initially identified and pre-delineated largely based on aerial satellite imagery. These habitat types were then refined based on the field coverage and data collected during the survey.

The degraded habitat has been modified from its natural state, and it represents habitat that has been historically impacted, and has not recovered. This habitat is largely limited to areas that have been impacted through effects from agricultural grazing practices and associated impacts, roads, and land use, as well as mismanagement and inadequate rehabilitation procedures. These habitats are not entirely transformed, but exist in a constant degraded state, as they cannot recover to a more natural state, due to the ongoing disturbances and impacts received.

Transformed habitat was present in the form of the existing roads, existing infrastructure, or any other areas devoid of vegetation, artificially. Due to the transformed nature of this habitat, it is regarded as having a low sensitivity.

Based on the criteria provided in section 4.5 of this report, the three delineated habitat types have each been allocated a sensitivity category, or SEI, and this breakdown is presented in Table 10 below.

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

To identify and spatially present sensitive features in terms of the relevant specialist discipline, the sensitivities of each of the habitat types delineated within the project area are mapped in (Figure 10).

It is important to note that this map does not replace any local, provincial, or national government legislation relating to these areas or the land use capabilities or sensitivities of these environments.

Table 10: Site Ecological Importance assessment summary of the habitat types delineated within the project area.

Habitat Type	**Conservation Importance**	**Functional Integrity**	**Biodiversity importance**	**Receptor resilience**	**Site Ecological Importance**
Transformed	Low (No confirmed or highly likely populations of SCC).	Medium (Mostly minor current negative ecological impacts with some major impacts).	Low	Medium (Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality)	Low
Degraded Grassland	Low (No confirmed or highly likely populations of SCC).	Medium (Mostly minor current negative ecological impacts with some major impacts).	Low	Medium (Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the	Low

				receptor functionality)	

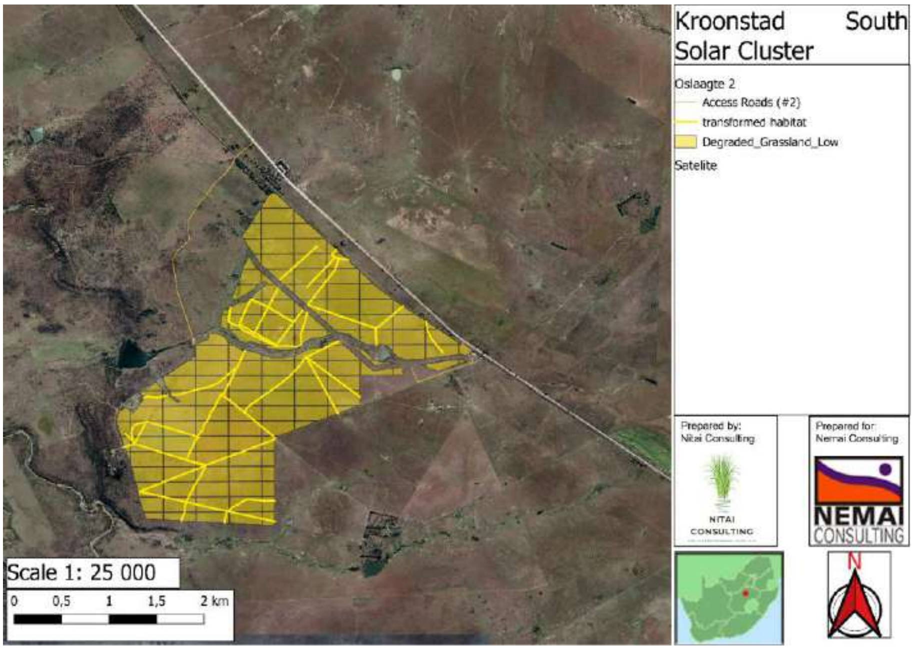
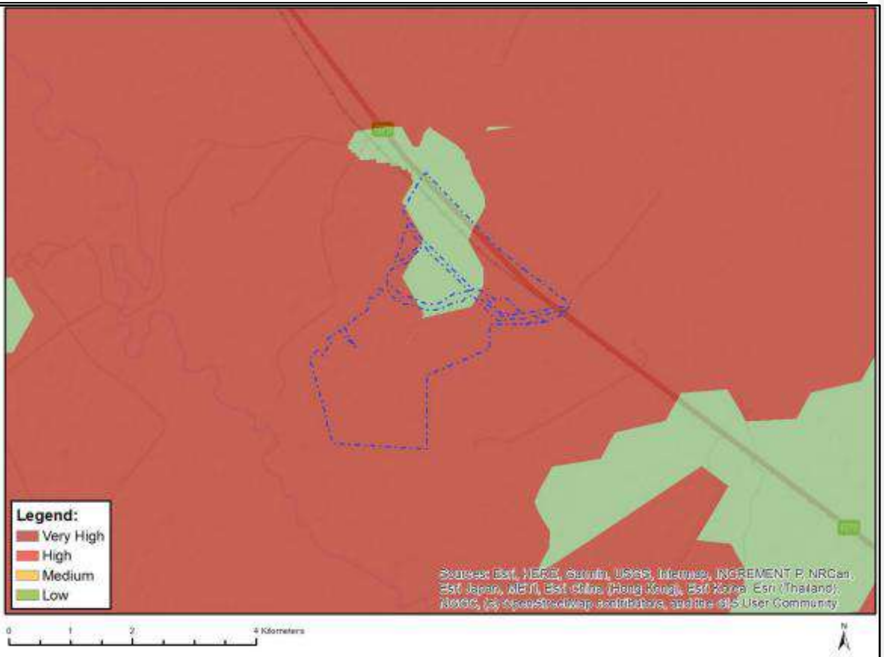


Figure 10:Biodiversity SEI delineation relevant to the project area

6.2 Site Sensitivity

The terrestrial biodiversity theme sensitivity as indicated in the screening report (compiled by the National Web based Environmental Screening Tool) was derived to be 'Very High' (Figure 11).

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

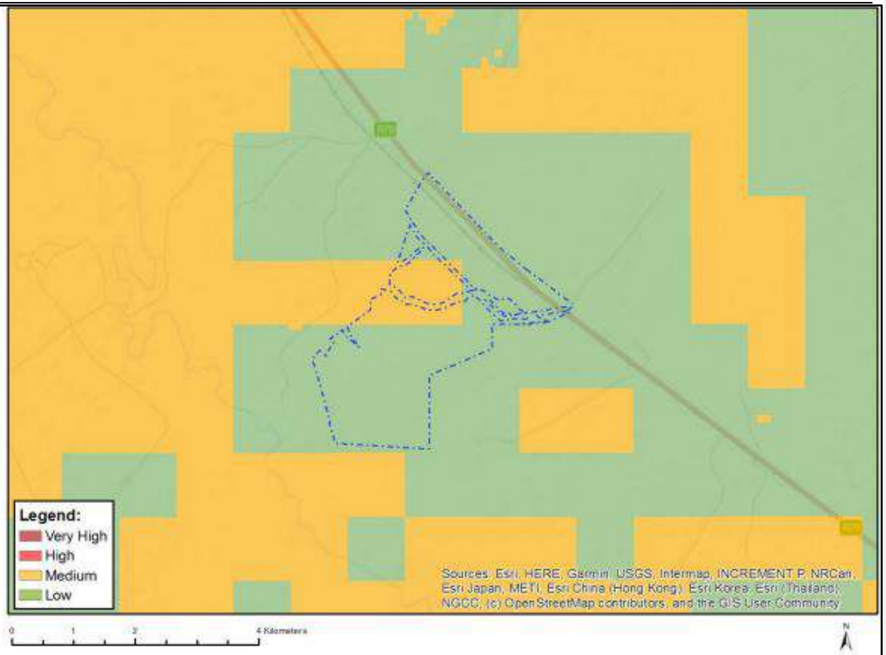
Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Very High	Ecological support area 1
Very High	Ecological support area 2
Very High	Protected Areas Expansion Strategy

Figure 11: Biodiversity Sensitivity of the project area according to the Screening Report.

The completion of the terrestrial desktop and field studies disputes the 'Very High' sensitivity presented by the screening report. As discussed above (**Error! Reference source not found.**, Table 10, Figure 10), the project area is largely modified and as such is assigned a sensitivity rating of 'Low'.

The screening report classified the animal theme sensitivity as 'medium' (Figure 12).



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	Mammalia-Hydrictis maculicollis

Figure 12: Animal Sensitivities theme according to the Screening tool.

Following the field survey findings, the animal species themes has been re-classified as having 'low' sensitivity. As discussed above (**Error! Reference source not found.**, Table 10, Figure 10) this is since there is limited suitable habitat available to support the regular occurrence of any faunal SCC within the project area.

The Screening toll classified the plant theme sensitivity as 'low' (Figure 13).

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

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity

Figure 13: Plant sensitivity Theme from according to the Screening tool.

During the field surveys it was confirmed that the plant sensitivity is indeed ‘low’ even though there are provincially protected plants present. These species are indicators of disturbance and are considered least concern according to the Red Data List of Plants and the IUCN database. These species grow in virtually every habitat type in the country and are a very common occurrence all over (**Error! Reference source not found.**, Table 10, Figure 10).

7 PROPOSED IMPACT MANAGEMENT OUTCOMES

The aim of the management outcomes is to present mitigation actions in such a way that they can be incorporated into the Environmental Management Programme (EMPr) for the project, which should in turn allow for a more successful implementation and auditing of the mitigations and monitoring guidelines.

The focus of impact management outcomes is to reduce the significance of potential impacts associated with the development and thereby to:

- Prevent the further loss and fragmentation of vegetation communities within the ESA areas in the vicinity of the project area;
- Reduce the negative fragmentation effects of the development and enable the safe movement of faunal species; and
- Prevent the direct and indirect loss and disturbance of floral and faunal species and communities (including any potential Species of Conservation Concern nearby).

The following mitigation measures are recommended to address potential impacts:

7.1.1 Vegetation and habitats

- 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.
- 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 in order for any individual that may be removed or destroyed due to the development. High visibility flags must be placed near any threatened/protected plants in order to avoid any damage or destruction of these specimens.
- 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.
- Prior to commencement of construction, compile an Alien Plant Management Plan.
- 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.

7.1.2 Fauna

- A qualified environmental control officer must be on site when construction begins. A site walk through is recommended by a suitably experienced 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) 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.

7.1.3 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.

7.1.4 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

7.1.5 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.

7.1.6 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.

7.1.7 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.

7.2 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: see Appendix E: Alien plant and Rehabilitation Plan

- 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: see Appendix E: Alien plant and Rehabilitation Plan

- Rehabilitation Plan must be compiled by an experienced person
- 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.

8 CONCLUSION

The area has experienced long-term and continuous disturbance, mostly due to the agricultural grazing practices and associated impacts. The project area is modified and as such is assigned a sensitivity rating of ‘Low’.

The screening report classified both the animal and plant theme sensitivity as ‘medium’ and ‘low’. Following the field survey findings, the plant species theme is confirmed as ‘Low’, but the animal theme may be re-classified as having ‘Low’ sensitivities. This is since there is limited suitable habitat available to support the regular occurrence of any faunal SCC within the project area.

Completion of the Terrestrial Biodiversity Assessment led to a dispute of ‘Very High’ classification for the terrestrial biodiversity theme sensitivity as allocated by the National Environmental Screening Tool and to a dispute of the ‘medium’ classification for the animal theme sensitivity as allocated by the National Environmental Screening Tool. The project area has instead been assigned a ‘Low’ sensitivity, because of the extent of environmental disturbance that has taken place, and the fact that no SCC were observed and are unlikely to frequently occur within the project area.

8.1 Specialist Statement

The development of the project area is likely to result in negligible negative impacts, especially considering the extent of 'Low' sensitivity areas confirmed. Therefore, the specialist is of the opinion that the development of the project area may be favourably considered for environmental authorisation, provided that the mitigation measures and recommendations presented above be adhered to.

Consider the following guidelines when interpreting SEI in the context of any proposed development or disturbance activities:

- Very Low: Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.
- Low: Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.

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10 APPENDIX A: SPECIALIST DECLARATION

I, **Helena Elizabeth 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 not, 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.

__________________________________ **10/05/2023**

Helena Elizabeth Human (Pr. Sci. Nat. 147031) **Date**

Terrestrial Biodiversity Specialist

11 Appendix B: 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

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

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

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

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 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.

4.5 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.

4.6 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.

4.7 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.

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

4.8 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.

4.9 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.

5 LANGUAGES:

English - excellent speaking, reading, and writing

Afrikaans – excellent speaking, reading and writing

12 APPENDIX C: LIST OF PLANT SPECIES FOUND

Family	Taxon	Common name	Protection Status	Endemism	Invasive
Amaranthaceae	*Alternanthera pungens,*	Paper Thorn	LC	Not Indigenous, naturalised	
Amaranthaceae	*Gomphrena celosioides*	Batchelor's button	LC	Not Indigenous, naturalised	
Amaranthaceae	*Guilleminea densa,*	Small matweed	LC	Not Indigenous, naturalised	
Amaranthaceae	*Kyphocarpa angustifolia*	Silver Burrweed	LC	Indigenous	

Asparagaceae	*Asparagus laricinus*	Emperor's asparagus	LC	Indigenous	
Asteraceae	*Arctotis arctotoides,*	Botter blom	LC	Indigenous	
Asteraceae	*Felicia muricata*	Bloublommetjie	LC	Indigenous; Endemic	
Asteraceae	*Geigeria burkei,*	Vermeerbos	LC	Indigenous	
Asteraceae	*Helichrysum acutatum*	Sticky Everlasting	Protected FS	Indigenous	
Asteraceae	*Helichrysum nudifolium*	Hottentot's Tea	Protected FS	Indigenous	
Asteraceae	*Helichrysum rugulosum*	Wrinkly Everlasting	Protected FS	Indigenous	
Asteraceae	*Nidorella hottentotta,*	Grassland Vleiweed	LC	Indigenous	
Asteraceae	*Nidorella resedifolia*	Stinkkruid	LC	Indigenous	
Asteraceae	*Senecio inaequidens*	Canary Weed	LC	Indigenous	
Asteraceae	*Seriphium plumosa*	Bankrupt bush	LC	Indigenous	
Asteraceae	*Tagetes minuta*	Khaki weed	LC	Not indigenous; Naturalised; Invasive	
Caryophyllaceae	*Pollichia campestris*	Barley Sugar Bush	LC	Indigenous	
Cyperaceae	*Bolboschoenus glaucus,*	Glaucus tuber-bulrush	LC	Indigenous	
Cyperaceae	*Bulbostylis hispidula,*	Slender Sedge	LC	Indigenous	

Cyperaceae	*Cyperus congestus,*	Purple Umbrella Sedge	LC	Indigenous	
Cyperaceae	*Cyperus denudatus,*		LC	Indigenous	
Cyperaceae	*Cyperus fastigiatus,*		LC	Indigenous	
Cyperaceae	*Kyllinga alba*	Witbiesie	LC	Indigenous	
Cyperaceae	*Kyllinga erecta,*	Greater Kyllinga	LC	Indigenous	
Dipsacaceae	*Scabiosa columbaria*	Rice Flower	LC	Indigenous	
Fabaceae	*Vachelia robusta*	Ankle thorn	LC	Indigenous	
Geraniaceae	*Monsonia glauca*	Grey Dysentery-Herb	LC	Indigenous	
Juncaceae	*Juncus oxycarpus,*		LC	Indigenous	
Lamiaceae	*Ocimum americanum,*	Wild Basil	LC	Indigenous	
Malvaceae	*Hibiscus trionum,*	Venice Mallow	LC	Indigenous	
Phyllanthaceae	*Phyllanthus angolensis*		LC	Indigenous	
Poaceae	*Aristida canescens*	Pale Three Awn	LC	Indigenous	
Poaceae	*Aristida congesta subsp. barbicollis,*	Spreading Three Awn	LC	Indigenous	
Poaceae	*Aristida congesta subsp. congesta*	Tassle Three-Awn	LC	Indigenous	
Poaceae	*Brachiaria serrata,*	Velvet Signal Grass	LC	Indigenous	
Poaceae	*Chloris virgata*	Feather-top Chloris	LC	Indigenous	

Poaceae	*Cymbopogon caesius,*	Broad-leaved Turpentine Grass	LC	Indigenous	
Poaceae	*Cymbopogon pospischilii*	Bushveld turpentine Grass	LC	Indigenous	
Poaceae	*Cynodon dactylon,*	Couch Grass	LC	Indigenous	
Poaceae	*Eragrostis chloromelas,*	Blue Lovegrass	LC	Indigenous	
Poaceae	*Eragrostis curvula,*	Weeping Love Grass	LC	Indigenous	
Poaceae	*Eragrostis gummiflua*	Gum Grass	LC	Indigenous	
Poaceae	*Eragrostis obtusa*	Dew Grass	LC	Indigenous	
Poaceae	*Eragrostis superba,*	Saw tooth love Grass	LC	Indigenous	
Poaceae	*Hyparrhenia hirta*	Common Thatching grass	LC	Indigenous	
Poaceae	*Melinis repens,*	Natal Red Top	LC	Indigenous	
Poaceae	*Panicum coloratum,*	Bamboeskweek	LC	Indigenous	
Poaceae	*Panicum maximum,*	Guinea Grass	LC	Indigenous	
Poaceae	*Perotis patens.*	Cat's tail	LC	Indigenous	
Poaceae	*Setaria pumila*	Garden Bristle Grass	LC	Indigenous	
Poaceae	*Setaria sphacelate var torta*	Creeping Bristle Grass	LC	Indigenous	
Poaceae	*Sporobolus africanus.*	Rats tail dropseed	LC	Indigenous	

Poaceae	*Sporobolus ioclados*	Pan Dropseed	LC	Indigenous	
Poaceae	*Sporobolus pyramidalis,*	Vlei Grass	LC	Indigenous	
Poaceae	*Themeda triandra*	Red Grass	LC	Indigenous	
Poaceae	*Tragus berteronianus,*	Carrot Seed Grass	LC	Indigenous	
Poaceae	*Urochloa mossambicensis*	Bushveld Signal Grass	LC	Indigenous	
Rubiaceae	*Oldenlandia herbacea*	False Spurry	LC	Indigenous	
Rubiaceae	*Pygmaeothamnus zeyheri,*	Common Sand Apple	LC	Indigenous	
Solanaceae	*Solanum elaeagnifolium*	Silverleaf Nightshade	LC	Not Indigenous, Invasive	Nemba 1b
Solanaceae	*Solanum mauritianum*	Bugweed	LC	Not Indigenous, Invasive	Nemba 1b
Verbenaceae	*Verbena bonariensis*	Wild Verbena	LC	Not Indigenous, Invasive	Nemba 1b
Verbenaceae	*Verbena tenuisecta*		LC	Not indigenous; Naturalised	

13 Appendix D: List of Animals Potentially occurring on site.

Family	Scientific name	Common name	Red list category
Bufonidae	*Sclerophrys capensis*	Raucous Toad	Least Concern (IUCN, 2016)

Bufonidae	*Sclerophrys gutturalis*	Guttural Toad	Least Concern (IUCN, 2016)
Bufonidae	*Sclerophrys capensis*	Ranger’s Toad	Least Concern (IUCN, 2016)
Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	Least Concern (IUCN, 2016)
Phrynobatrachidae	*Phrynobatrachus natalensis*	Snoring Puddle Frog	Least Concern (IUCN, 2013)
Pipidae	*Xenopus laevis*	Common Platanna	Least Concern (IUCN 2020)
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	Least Concern (2017)
Pyxicephalidae	*Amietia fuscigula*	Cape Rana	Least Concern (IUCN, 2016)
Pyxicephalidae	*Amietia poyntoni*	Poynton’s River Frog	Least Concern (IUCN, 2016)
Pyxicephalidae	*Cacosternum boettgeri*	Boettger’s caco	Least Concern (IUCN, 2016)
Pyxicephalidae	*Pyxicephalus adspersus*	African Bullfrog	Least Concern (IUCN, 2016)
Pyxicephalidae	*Strongylopus fasciatus*	Striped Stream Frog	Least Concern (IUCN, 2016)
Pyxicephalidae	*Tomopterna cryptotis*	Common Sand Frog	Least Concern (IUCN, 2016)
Pyxicephalidae	*Tomopterna natalensis*	Natal Sand Frog	Least Concern (IUCN, 2016)
Pyxicephalidae	*Tomopterna tandyi*	Tandy’s Sand Frog	Least Concern (IUCN, 2016)

Family	**Scientific name**	**Common name**	**Red list category**

Amphisbaenidae	*Monopeltis capensis*	Cape Worm Lizard	Least Concern (IUCN, 2017)
Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	Least Concern (IUCN, 2017)
Cordylidae	*Smaug giganteus*	Giant Girdled Lizard	Vulnerable (IUCN, 2017)
Elapidae	*Elapsoidea sundevalli*	Sundevall's Garter Snake	Least Concern (IUCN, 2017)
Elapidae	*Naja nivea*	Cape Cobra	Least Concern (IUCN, 2017)
Elapidae	*Hemachatus haemachatus*	Rinkhals	Least Concern (IUCN, 2017)
Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	Least Concern (IUCN, 2017)
Lacertidae	*Nucras holubi*	Holub's Sandveld Lizard	Least Concern (IUCN, 2017)
Lacertidae	*Nucras intertexta*	Spotted Sandveld Lizard	Least Concern (IUCN, 2017)
Lacertidae	*Pedioplanis lineoocellata*	Spotted Sand Lizard	Least Concern (IUCN, 2017)
Lamprophiidae	*Lamprophis aurora*	Aurora House Snake	Least Concern (IUCN, 2017)
Lamprophiidae	*Lycophidion capense*	Cape Wolf Snake	Least Concern (IUCN, 2017)
Lamprophiidae	*Psammophylax rhombeatus*	Spotted Grass Snake	Least Concern (IUCN, 2017)
Pelomedusidae	*Pelomedusa galeata*	South African Marsh Terrapin	Least Concern (IUCN, 2017)
Psammophiidae	*Psammophis leightoni*	Cape Whip Snake	Least Concern (IUCN, 2017)

Psammophiidae	*Psammophylax rhombeatus*	Rhombic Skaapsteker	Least Concern (IUCN, 2017)
Scincidae	*Trachylepis punctatissima*	Montane Speckled Skink	Least Concern (IUCN, 2017)
Scincidae	*Trachylepis varia*	Common Variable Skink Complex	Least Concern (IUCN, 2017)
Testudinae	*Stigmochelys pardalis*	Leopard Tortoise	Least Concern (IUCN, 2017)
Varanidae	*Varanus albigularis*	Rock Monitor	Least Concern (IUCN, 2017)
Varanidae	*Varanus niloticus*	Water monitor	Least Concern (IUCN, 2017)
Chamaeleonidae	*Chamaeleo dilepis*	Flap necked chameleon	Least Concern (IUCN, 2017)

Family	**Scientific name**	**Common name**	**Red list category**
Bovidae	*Alcelaphus buselaphus caama*	Red Hartebeest	Least Concern (IUCN, 2016)
Bovidae	*Antidorcas marsupialis*	Springbok	Least Concern (IUCN, 2016)
Bovidae	*Connochaetes gnou*	Black Wildebeest	Least Concern (IUCN, 2016)
Bovidae	*Connochaetes taurinus taurinus*	Blue Wildebeest	Least Concern (IUCN, 2016)
Bovidae	*Damaliscus pygargus phillipsi*	Blesbok	Least Concern (IUCN, 2016)
Bovidae	*Kobus ellipsiprymnus*	Waterbuck	Least Concern (IUCN, 2016)

Bovidae	*Oryx gazella*	Gemsbok	Least Concern (IUCN, 2016)
Bovidae	*Raphicerus campestris*	Steenbok	Least Concern (IUCN, 2016)
Bovidae	*Sylvicapra grimmia*	Bush Duiker	Least Concern (IUCN, 2016)
Bovidae	*Syncerus caffer*	African Buffalo	Least Concern (IUCN, 2016)
Bovidae	*Tragelaphus s oryx*	Common Eland	Least Concern (IUCN, 2016)
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern (IUCN, 2016)
Erinaceidae	*Atelerix frontalis*	South African hedgehog	Least Concern (IUCN, 2016)
Felidae	*Caracal caracal*	Caracal	Least Concern (IUCN, 2016)
Felidae	*Felis lybica*	African Wildcat	Least Concern (IUCN, 2016)
Herpestidae	*Cynictis penicillata*	Yellow Mongoose	Least Concern (IUCN, 2016)
Herpestidae	*Ichneumia albicauda*	White Tailed Mongoose	Least Concern (IUCN, 2016)
Herpestidae	*Herpestes sanguineus*	Slender Mongoose	Least Concern (IUCN, 2016)
Herpestidae	*Suricata suricatta*	Meerkat	Least Concern (IUCN, 2016)
Hyaenidae	*Parahyaena brunnea*	Brown Hyena	Near Threatened (IUCN, 2016)

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

Hyaenidae	*Proteles cristata*	Aardwolf	Least Concern (IUCN, 2016)
Hyracoidea	*Procavia capensis*	Rock dassie	Least Concern (IUCN, 2016)
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern (IUCN, 2016)
Leporidae	*Lepus victoriae*	African Savanna Hare	Least Concern (IUCN, 2016)
Macroscelididae	*Elephantulus myurus*	Eastern Rock Elephant Shrew	Least Concern (IUCN, 2016)
Molossidae	*Tadarida aegyptiaca*	Egyptian free-tailed bat	Least Concern (IUCN, 2016)
Muridae	*Aethomys ineptus*	Tete Veld Aethomys	Least Concern (IUCN, 2016)
Muridae	*Gerbilliscus brantsii*	Highveld Gerbill	Least Concern (IUCN, 2016)
Muridae	*Gerbilliscus leucogaster*	Bushveld Gerbil	Least Concern (IUCN, 2016)
Muridae	*Mastomys coucha*	Southern African Mastomys	Least Concern (IUCN, 2016)
Muridae	*Micaelamys namaquensis*	Namakwa Rock rat	Least Concern (IUCN, 2016)
Muridae	*Mus musculus*	Southern African Pygmy Mouse	Least Concern (IUCN, 2016)
Muridae	*Otomys auratus*	Vlei Rat	Near Threatened (IUCN, 2016)
Muridae	*Rattus rattus*	Roof Rat	Least Concern (IUCN, 2016)

Muridae	*Rhabdomys dilectus*	Mesic four-striped grass rat	Least Concern (IUCN, 2016)
Mustelidae	*Ictonyx striatus*	Striped Polecat	Least Concern (IUCN, 2016)
Mustelidae	*Mellivora capensis*	Honey Badger	Least Concern (IUCN, 2016)
Mustelidae	*Poecilogale albinucha*	African Stripe weasel	Least Concern (IUCN, 2016)
Nesomyidae	*Malacothrix typica*	Gerbil Mouse	Least Concern (IUCN, 2016)
Nesomyidae	*Mystromys albicaudatus*	White-tailed rat	Vulnerable (IUCN, 2016)
Nesomyidae	*Saccostomus campestris*	Southern African Pouched Mouse	Least Concern (IUCN, 2016)
Nesomyidae	*Steatomys krebsii*	Krebs's Fat Mouse	Least Concern (IUCN, 2016)
Nesomyidae	*Steatomys pratensis*	Common African Fat Mouse	Least Concern (IUCN, 2016)
Nycteridae	*Nycteris thebaica*	Egyptian Slit-faced Bat	Least Concern (IUCN, 2016)
Orycteropodidae	*Orycteropus afer*	Aardvark	Least Concern (IUCN, 2016)
Pedetidae	*Pedetes capensis*	South African Spring Hare	Least Concern (IUCN, 2016)
Pteropodidae	*Eidolon helvum*	Straw-coloured fruit bat	Least Concern (IUCN, 2016)
Rhinolophidae	*Rhinolophus clivosus*	Geoffroy's horseshoe bat	Least Concern (IUCN, 2016)

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

Rhinolophidae	*Rhinolophus darlingi*	Darling's horseshoe bat	Least Concern (IUCN, 2016)
Sciuridae	*Xerus inauris*	Ground Squirrel	Least Concern (IUCN, 2016)
Soricidae	*Crocidura cyanea*	Reddish-gray Musk Shrew	Least Concern (IUCN, 2016)
Soricidae	*Suncus varilla*	Lesser dwarf Shrew	Least Concern (IUCN, 2016)
Suidae	*Phacochoerus africanus*	Common Warthog	Least Concern (IUCN, 2016)
Vespertilionidae	*Myotis welwitschii*	Welwitch's Bat	Least Concern (IUCN, 2016)
Vespertilionidae	*Neoromicia capensis*	Cape Serotine	Least Concern (IUCN, 2016)
Vespertilionidae	*Neoromicia zuluensis*	Zulu Serotine	Least Concern (IUCN, 2016)
Vespertilionidae	*Scotophilus dinganii*	Yellow-bellied House Bat	Least Concern (IUCN, 2016)
Viverridae	*Genetta genetta*	Small Spotted Genet	Least Concern (IUCN, 2016)

14 Appendix E: Alien plant and Rehabilitation Plan

Invasive Alien Plant Management

- The purpose of the invasive alien management plan is:
  - to ensure that alien plants do not become established on site;

- to ensure that alien plant species do not become dominant in all or parts of the landscape;
- to implement a monitoring programme to detect the presence of alien plant species as well as to monitor the success of the alien management plant

- Control Guidelines
  - Prevention
    - A prevention strategy should be considered and established, including regular surveys and monitoring for invasive alien plants, effective rehabilitation of disturbed areas and prevention of unnecessary disturbance of natural areas. Prevention could also include measures such as washing the working parts and wheels of earth-moving equipment prior to it being brought onto site, visual walk-through surveys every three months.
  - Early identification and eradication
    - Keeping up to date on which weeds are an immediate threat to the site is important, but efforts should be planned to update this information on a regular basis. When new Invasive Alien Plant Species are spotted an immediate response of locating the site for future monitoring and either hand-pulling the weeds or an application of a suitable herbicide should be planned. It is, however, better to monitor regularly and act swiftly than to allow invasive alien plants to become established on site.
  - Containment and control
    - If any alien invasive plants are found to become established on site, action plans for their control should be developed, depending on the size of the infestations, budgets, manpower considerations and time. Appropriate registered chemicals and other possible control agents should be considered in the action plans for each site/species. The key is to ensure that no invasions get out of control.

- Alien invasive control methods

There are various means of managing invasive alien plants. These include mechanical, chemical and biological control.

- Mechanical control

  - This entails damaging or removing the plant by physical action. Different techniques could be used, e.g. uprooting, felling, slashing, mowing, ringbarking or bark stripping. This control option is only really feasible in sparse infestations or on small scale, and for controlling species that do not coppice after cutting. Species that tend to coppice need to have the cut stumps or coppice growth treated with herbicides following the mechanical treatment. Mechanical control is labour intensive and therefore expensive and could cause severe soil disturbance and erosion.

- Chemical control
  - Chemical control involves the use of registered herbicides to kill the target weed. Managers and herbicide operators must have a basic understanding of how herbicides function. The use of inappropriate herbicides and the incorrect use of the appropriate herbicides are wasteful, expensive practices and often do more harm than good, especially when working close to watercourses. Some herbicides can quickly contaminate fresh water and/or be transported downstream where they may remain active in the ecosystem. Contractors using herbicides are required to have a permit according to Fertilizer, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947). Herbicides are either classified as selective or non-selective. Selective herbicides are usually specific to a particular group of plants, e.g. those specified for use on broad leaf plants, but should not kill narrow-leaf plants such as grasses. Non-selective herbicides can kill any plant that they come into contact with and are therefore not suitable for use in areas where indigenous vegetation is present. Chemical application techniques include foliar (leaf) application, stem applications (basal stem, total frill, stem injections) and stump applications (cut stump, total stump, scrape and paint).

- Biological control
  - Biological weed control consists in the use of natural enemies to reduce the vigour or reproductive potential of an invasive alien plant. Biological control agents include insects, mites, and micro- organisms such as fungi or bacteria. They usually attack specific parts of the plant, either the reproductive organs directly (flower buds, flowers or fruit) or the seeds after they have dropped. The stress caused by the biological control agent may kill a plant outright or it might impact on the plants reproductive capacity. In certain instances, the reproductive capacity is reduced to zero and the population is effectively sterilized. All of these outcomes will help to reduce the spread of the species. To obtain biocontrol agents, provincial representatives of the Working for Water Programme or the Directorate: Land Use and Soil Management

(LUSM), Department of Agriculture, Forestry and Fisheries (DAFF) can be contacted.

Vegetation Rehabilitation programme

- No till planting technique is recommended to reduce further disturbance of soil and promoting opportunistic long lived alien species in the seedbank to grow.
- Reseeding of herbaceous plants typical to the area
    - All plant species for use by the project must be reviewed and approved by qualified specialists prior to use on site.
    - Sodding may be done at any time of the year, but seeding must be done by sowing appropriate seed mixtures at the most suitable time under the guidance of a qualified specialist.
    - Planting should preferably be done during the rainy season.
    - Establish further specifications for sods, runners and hand seeding

15 APPENDIX F: SENSITIVITY ASSESSMENT FOR SENSITIVE SPECIES 15

A

TERRESTRIAL ANIMAL SPECIES SPECIALIST REPORT FOR SITES IDENTIFIED FOR SOLAR FARM DEVELOPMENTS: KROONSTAD DISTRICT FREE STATE PROVINCE

GIANT GIRDLED LIZARD (Smaug giganteus)

Commissioned by Nitai Consulting

147 Bram Fischer Drive, Ferndale, 2194, South Africa

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

PROF BRIAN REILLY

ECOFIN & BK REILLY CONSULTING ECOLOGISTS

APRIL 2023

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1. DECLARATION OF INDEPENDENCE

I, Brian Kevin Reilly as sole proprietor of Ecofin Consulting Ecologists and BK Reilly Consulting Ecologist hereby confirm my independence as a specialist and declare that I have no interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which Nitai Consulting or Nemai Consulting was appointed as environmental assessment practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for worked performed, specifically in connection with the proposed new Kroonstad South Cluster Solar PV Facility near Kroonstad in the Free State Province. I further declare that I am confident in the results of the studies undertaken and conclusions drawn because of it – as is described in this report.

____

Full Name: Brian Kevin Reilly

Title / Position: Ecologist

Qualification(s): BSc (Hons) Wildlife Management UP; MSc Wildlife management UP; PhD Nature Conservation US

Experience (years/ months): 40 years

Registration: SACNASP (400164/08)

Tel: +27 82 784 1895

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Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

2. TERMS OF REFERENCE

As part of the scoping process of the proposed developments the Endangered Wildlife Trust (EWT)[1] indicated that certain areas fall within the distribution of the Giant Girdled Lizard (*Smaug giganteus*) and requested a walk-through survey for presence or absence by a specialist specifically the farms Leeuspruit and Oslaagte in the proposed Kroonstad South development. Instruction was given by the primary consultants, Nitai Consulting[2] for walk-through surveys to be conducted on the Kroonstad South development sites.

These surveys were conducted on the 27th and 28th April 2023.

3. EXPERTISE OF SPECIALIST

Currently Extended Full Professor and retired Head of Department, Department of Nature Conservation, Tshwane University of Technology, Pretoria, Past Adjunct Associate Professor, Department of Fisheries, Wildlife and Conservation Biology, University of Minnesota and Associated Full Professor and Fellow, Conservation Biology, University of Free State. He is a registered category A Professional Natural Scientist in the field of practice of ecology with the SA Council for Natural and Allied Scientific Professions and a member of the Royal Society of SA. He has practiced as an ecologist since 1984 and has consulted widely on environmental, ecological and wildlife management issues both locally and internationally.

[1] Plot 27 and 28 Austin Road, Glen Austin AH, Midrand, 1685 Gauteng, South Africa

[2] 147 Bram Fischer Drive, Ferndale, 2194, South Africa

He specializes in wildlife management and monitoring, biological conservation, ecological decision support systems, corporate governance, sustainability, higher education and training and quantitative biology.

Widely published as a biologist with over a hundred authorships and co-authorships with 69 in scientific Journals. These include co-authoring the seven-volume *magnum opus "A critical evaluation of conservation and development in sub-Saharan Africa.* He has presented 73 papers and keynote addresses at scientific symposia including several workshops and keynote addresses.

He has specifically provided specialist inputs into impact studies for numerous developments since 1984 and these include developments by Anglo American, Anglo Platinum, Northam Platinum and Eskom in Limpopo, Mpumalanga, Northern Cape, Northwest, and KwaZulu Natal Provinces. Specific to these inputs he has undertaken the monitoring of girdled lizards for Eskom in Southeastern Mpumalanga.

4. AREA DESCRIPTION

The Kroonstad South Cluster (Leeuwspruit 1 and 2; Oslaagte 1, 2 and 3) is predominantly underlain mostly the Ecca group with parts underlain by the Ventersdorp Supergroup made up of andesite and gneiss and giving rise to more sandy soils with orthic A horizons. Vegetation is considered mostly Central Free State Grassland of Vaalvet Sandy Grassland from the southwest which is considered an endangered vegetation unit.

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

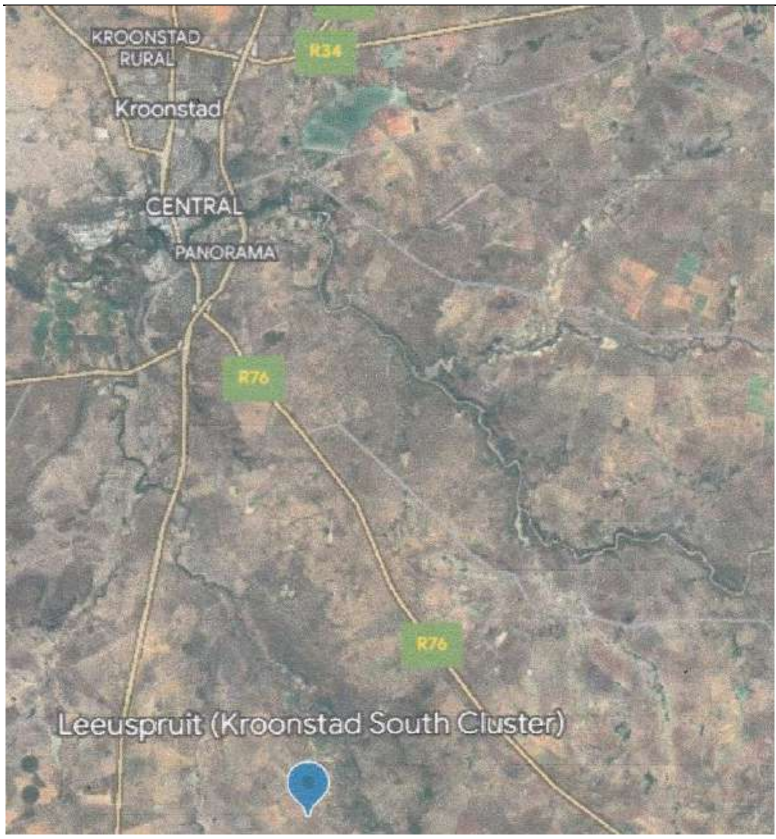

Figure 14: Google earth image showing orientation of the proposed development sites in relation to Kroonstad, northern Free State Province.

5. METHODOLOGY

Initial interaction with the primary consultant established the terms of reference and information was gleaned on their site surveys of the vegetation and general habitat. They provided comprehensive maps covering the sensitivity of the area and other basic information. A field walk-through survey was undertaken on the 27th and 28th April. This was preceded by vehicle reconnaissance to establish the boundaries of the sites, general familiarization, proposed development footprints and likely habitats. Likely habitats were then traversed on foot with the primary objective to identify burrows either abandoned or active. Special attention was given to more open sandy areas. An English pointer was also used to range the area in conjunction with the walk through as reptiles give off a strong scent. Informal conversations were held with landowners, managers and farm labourers on the potential occurrence and whereabouts of lizards and these areas used as focal points. Active interaction was undertaken with the EWT Highlands Grassland Field Officer Bradley Gibbons before and during the survey on their findings from recent field surveys. The terrestrial ecologist also completed a Specialist assessment during January and April and did not find evidence of lizard activity on Oslaagte 1,2, and 3.

6. THE GIANT GIRDLED LIZARD (*SMAUG GIGANTEUS*)

Smaug giganteus (formerly *Cordylus giganteus*) (fig 2) is the largest of the girdled lizard family and inhabits parts of the grasslands of Northwest Province, northern Free State and Mpumalanga (Bates *et al*. 2014). They are a large diurnal terrestrial lizard and are endemic to South Africa (Van Wyk 2000). They generally self-excavate burrows and occur in small groups (Gibbons 2014) at approximately four burrows per hectare (Jacobsen *et al*. 1990) in Mpumalanga and four to six burrows per hectare in the Free State (Stolz & Blom 1981). Jacobsen *et al*. (1990) found density to be relatively low at six and a half individuals per hectare whilst Van Wyk's (1992) seminal study in the northeastern Free State found between nine and 11 individuals per hectare. Females give birth to one or two live young after a long gestation period. They feed almost exclusively on invertebrates and are themselves preyed upon by various meso carnivores.

Figure 15: Smaug giganteus photographed on the 28th April east of the Kroonstad South Cluster

They are classified as vulnerable in the IUCN red list (Bates *et al*. 2014) and are under threat from the muthi trade, open cast mining and agriculture. Their threat status is directly aligned to the conservation status of South Africa's grasslands and habitat fragmentation is probably the single greatest factor in isolating populations that cannot disperse and may ultimately sink below effective population size and ultimately disappear.

7. RESULTS

7.1. KROONSTAD SOUTH CLUSTER

7.1.1. LEEUSPRUIT 1

7.1.1.1 Sensitivity

The sensitivity map for the Leeuspruit 1 Alternative 1 PV is included as Figure 3 and is listed as moderately sensitive.

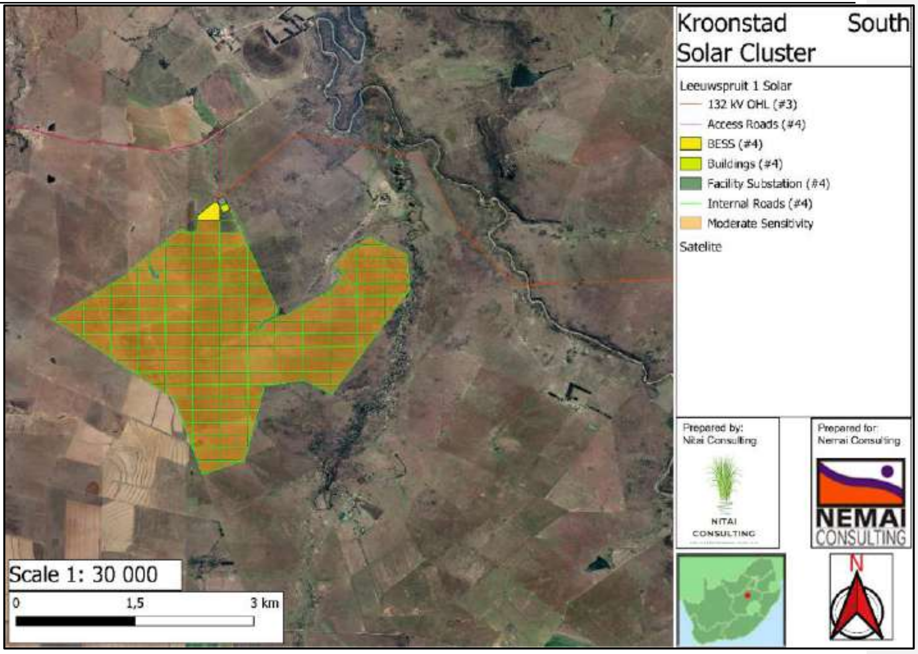

Figure 16: Proposed Leeuspruit 1 Alternative 1 PV development on the farms Leeuspruit 659 and Mooidraai 659.

This overlaps significantly with two ESA's on the farms Leeuspruit 659 and Mooidraai 653. These areas are highly sensitive as far as girdled lizards are concerned. The sandier soils (Avalon and Clovelly) of elements of the Vaalvet Sandy Grassland are suitable habitat in this area. A search centered on an area indicated by the landowner as historically having girdled lizards. These are upper landscapes to the southwest are grasslands used for grazing primarily and interspersed with drainage lines and streams. The latter dominated by shrubs and stunted trees are not suitable habitat. No evidence was found of burrows or lizards in the areas covered on the 28th of April although Gibbons (*pers comm*)[3] confirmed presence of lizards in this area and adjacent properties in the preceding week.

The Leeuwspruit 1 Alternative 2 sensitivity is regarded as low since all the sensitive areas

[3] Plot 27 and 28 Austin Road, Glen Austin AH, Midrand, 1685 Gauteng, South Africa

are avoided an no suitable habitat for girdled lizards are found in Alternative 2 (Figure 4).

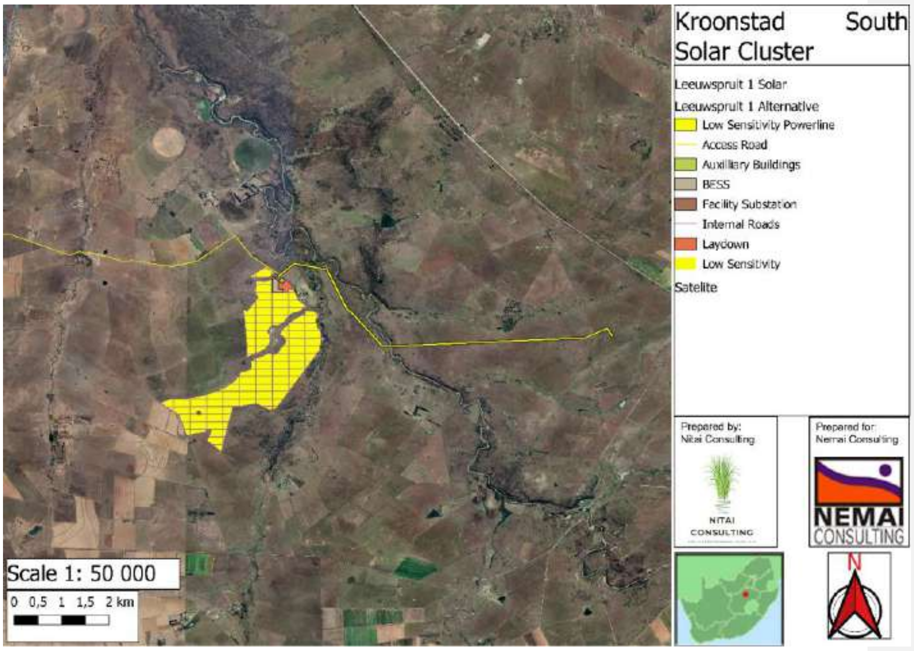

Figure 17: Proposed Leeuspruit 1 Alternative 2 PV development on the farms Mooidraai 659 and portion 1 of Vogelstruisfontein 311

7.1.1.2 Impacts

Current impacts include planted pastures and crop fields. Many historical grassland areas have differential anthropogenic histories of fire and overgrazing with some showing woody encroachment. This development could have a significant impact (Table 1) on remnant girdled lizard populations if Alternative 1 is chosen.

Table 11: Site Ecological Importance assessment summary of the habitat types delineated within the project area.

Proposed solar photovoltaic (PV) (Kroonstad South) projects located south of Kroonstad, Free State Province.

Habitat Type	**Conservation Importance**	**Functional Integrity**	**Biodiversity importance**	**Receptor resilience**	**Site Ecological Importance**
Disturbed Grassland	High	Medium	Medium	Medium	Medium

7.1.1.3 Mitigation

Leeuwspruit 1 Alternative 1

Development in this area would require significant mitigation and the following is suggested as possible scenarios:

- No development at all.
- Development with significant mitigation which would include avoidance of all areas where girdled lizards occur with significant buffer zones and corridors. This would have to be mapped and include an intensive ground survey and may include translocation of animals.
- Point 2 above with the addition of a significant offset at a ratio of 30:1 (lizard habitat) to be managed for biodiversity conservation with the girdled lizard as flagship species.
- Point 3 above with the creation of a conservation trust fund based on financial value of a proportion of power generated after a pre-determined profitability is achieved to create and manage offsets, conservation areas and corridors in perpetuity. This option will meet all requirements of Environmental, Social and Governance (ESG) standards and will serve as "non-financial profit" in sustainability reporting. Offsets to be owned by the trust.
- Points 2, 3 and 4 above can be included in any lease agreements with landowners.

Mitigation for alternative 2

Development of this proposed PV site would not require mitigation for girdled lizards. This is since this development alternative avoids all suitable habitat and sensitive areas for girdled lizards.

7.1.2 LEEUWSPRUIT 2

7.1.2.1 Sensitivity

The sensitivity map of Leeuwspruit 2 Alternative 1 PV is displayed as figure 5. The sensitivity map of Leeuwspruit 2 Alternative 2 PV is displayed in figure 6.

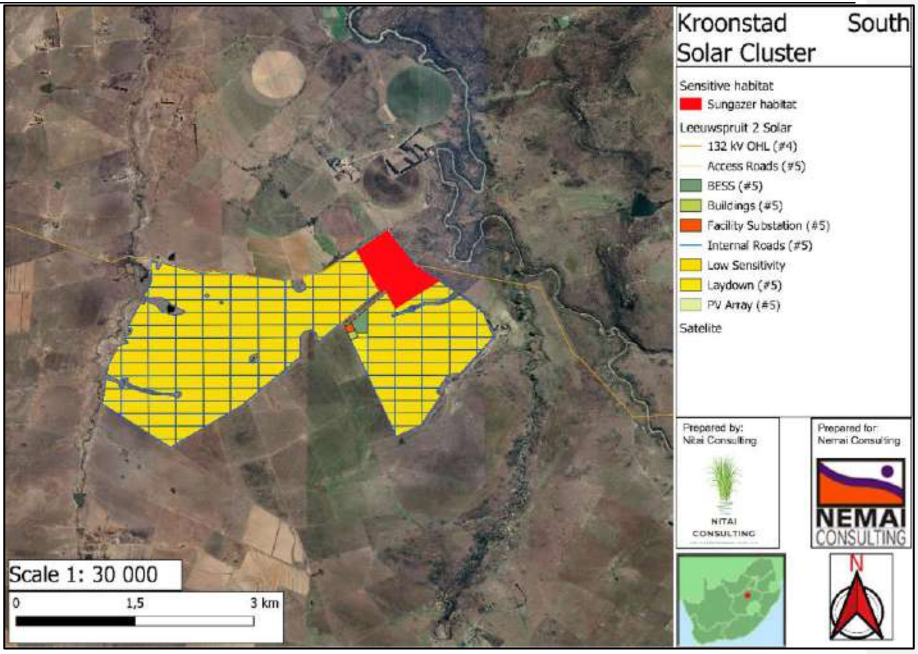

Figure 18: Proposed Leeuspruit 2 Alternative 1 PV development on the farms Leeuspruit 659 and Mooidraai 659.

Commented [MJ1]: Please check farm numbers

This overlaps significantly with two ESA's on the farms Leeuspruit 659 and Mooidraai 653. These areas are highly sensitive as far as girdled lizards are concerned. The sandier soils (Avalon and Clovelly) of the Vaalvet Sandy Grassland are the more suitable habitat in this area. Search centered on an area indicated by the landowner as historically having girdled lizards. These upper landscapes to the southwest are grasslands used for grazing primarily and interspersed with drainage lines and streams. The latter dominated by shrubs and stunted trees are not suitable habitat. No evidence was found of burrows or lizards in the areas covered on the 28th of April although Gibbons (*pers comm*)[4] confirmed presence of lizards in this area and adjacent properties in the preceding week.

[4] Plot 27 and 28 Austin Road, Glen Austin AH, Midrand, 1685 Gauteng, South Africa

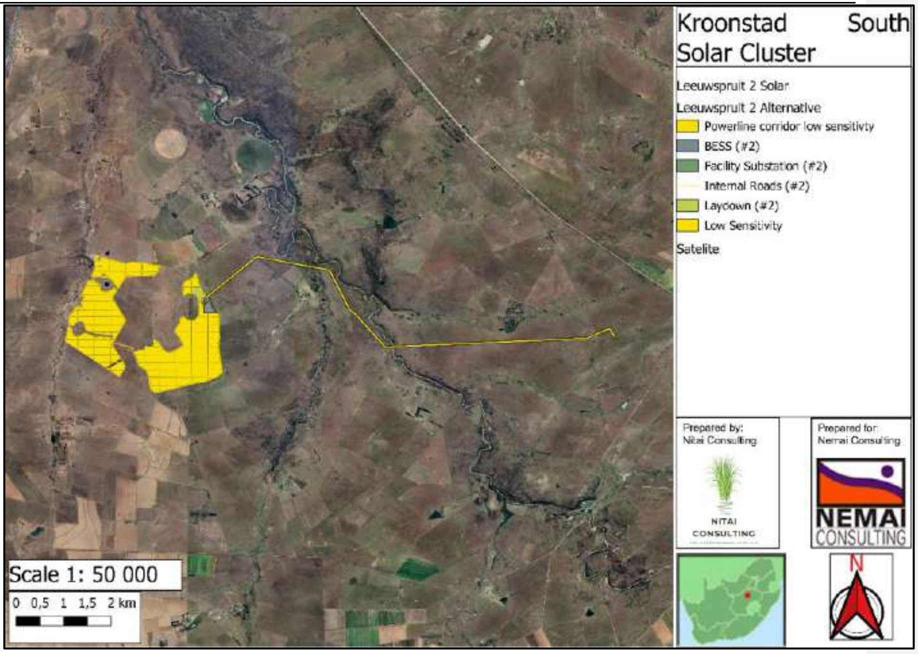

Figure 19: Proposed Leeuspruit 2 Alternative 2 PV development.

Alternative 2 of the project avoids all sensitive areas for girdled lizard habitat and as such has a low sensitivity. This is the preferred alternative for the project.

7.1.2.2 Impacts

Leeuwspruit 2 Alternative 1

The areas are currently impacted by mixed agriculture with planted fields and pastures. Pastures have been heavily grazed with lack of fire and each camp exhibits individual unique anthropogenic derived histories. This development could have a significant impact on girdled lizard populations (Table 2).

Table 12: Site Ecological Importance assessment summary of the habitat types delineated within the project area for Alternative 1.

Habitat Type	**Conservation Importance**	**Functional Integrity**	**Biodiversity importance**	**Receptor resilience**	**Site Ecological Importance**
Historical habitat (remnants)	High	High	High	Medium	High
Degraded Grassland	Low	Medium	Low	Medium	Low
Woodland	Low	Medium	Low	Medium	Low

7.1.2.3 Mitigation for alternative 1

Development in this area would require significant mitigation and the following is suggested as possible scenarios:

1. No development at all.
2. Development with significant mitigation which would include avoidance of all areas where girdled lizards occur with significant buffer zones and corridors. This would have to be mapped and include an intensive ground survey and may include translocation of animals.
3. Point 2 above with the addition of a significant offset at a ratio of 30:1 (lizard habitat) to be managed for biodiversity conservation with the girdled lizard as flagship species.
4. Point 3 above with the creation of a conservation trust fund based on financial value of a proportion of power generated after a pre-determined profitability is

achieved to create and manage offsets, conservation areas and corridors in perpetuity. This option will meet all requirements of Environmental, Social and Governance (ESG) standards and will serve as “non-financial profit” in sustainability reporting. Offsets to be owned by the trust.

5. Points 2, 3 and 4 above can be included in any lease agreements with landowners.

Figure 20: Site on the farm Leeuspruit, Kroonstad South Cluster indicated by the landowner as a historical site of occurrence of girdled lizards.

7.1.2.4 Mitigation for alternative 2

Development of this proposed PV site would not require mitigation for girdled lizards. This is since this development alternative avoids all suitable habitat and sensitive areas for girdled lizards.

7.1.3 OSLAAGTE 1

7.1.3.1 Sensitivity

This is displayed in Figure 10 and is considered low. This proposed development covers most of the eastern portion of the property Oslaagte 2564

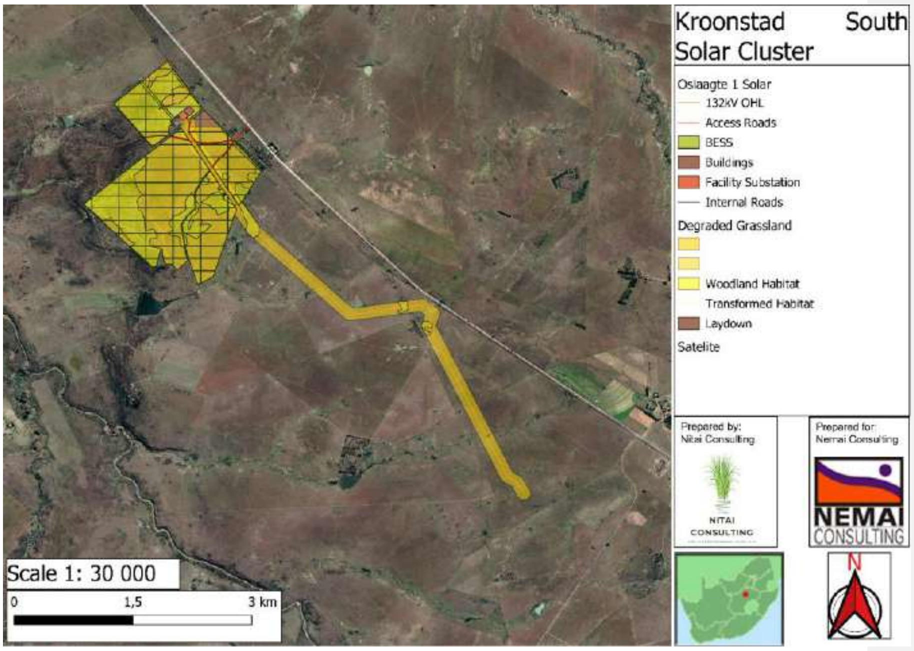

Figure 21: Sensitive areas of the proposed Oslaagte 1 PV.

7.1.3.2 Impacts

Current impacts arise mostly from various stages of over grazing by domestic stock and as the eastern floodplain of the Vals river lower landscapes are dominated by shrubs *Asparagus laricinus*, *Searsia pyroides* and stunted *Vachelia karoo.* There are also several intersecting drainage lines. Soils are generally unsuitable for girdled lizards.

7.1.3.3 Mitigation

Development of this proposed PV site would not require mitigation for girdled lizards. This is since this development alternative avoids all suitable habitat and sensitive areas for girdled lizards.

7.1.4 OSLAAGTE 2

7.1.4.1 Sensitivity

Sensitivity is low and displayed in figure 9 and covers the property Oslaagte 2564.

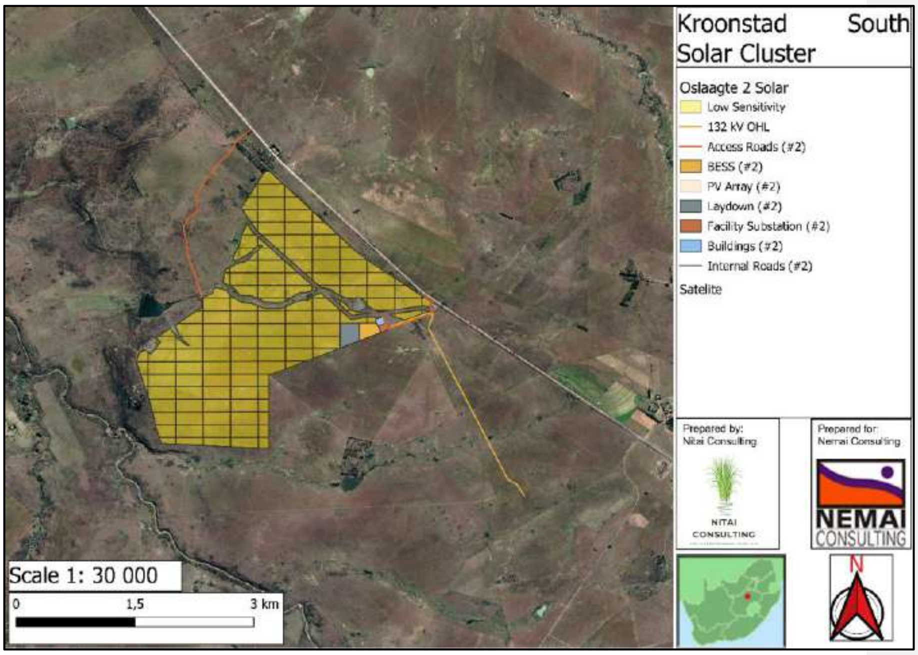

Figure 22: Sensitive areas in the proposed Oslaagte 2 PV development.

7.1.4.2 Impacts

Current impacts include planted pastures and crop fields. Many historical grassland areas have differential anthropogenic histories of fire and overgrazing with some showing woody encroachment. No active or inactive burrows were found in the field survey and this development is likely to have minor impact on any girdled lizards that may be present.

7.1.4.3 Mitigation

Development of this proposed PV site would not require mitigation for girdled lizards. This is since this development alternative avoids all suitable habitat and sensitive areas for girdled lizards.

7.1.5 OSLAAGTE 3 AND GRID CONNECTION

7.1.5.1 Sensitivity

Sensitivity is low and displayed in figure 10 and covers the properties Oslaagte 2564, Welbedacht 1913, Zonderweg 1699, Fraaiuitzicht 576, Damspruit 1584 and Klein Geluk 2088.

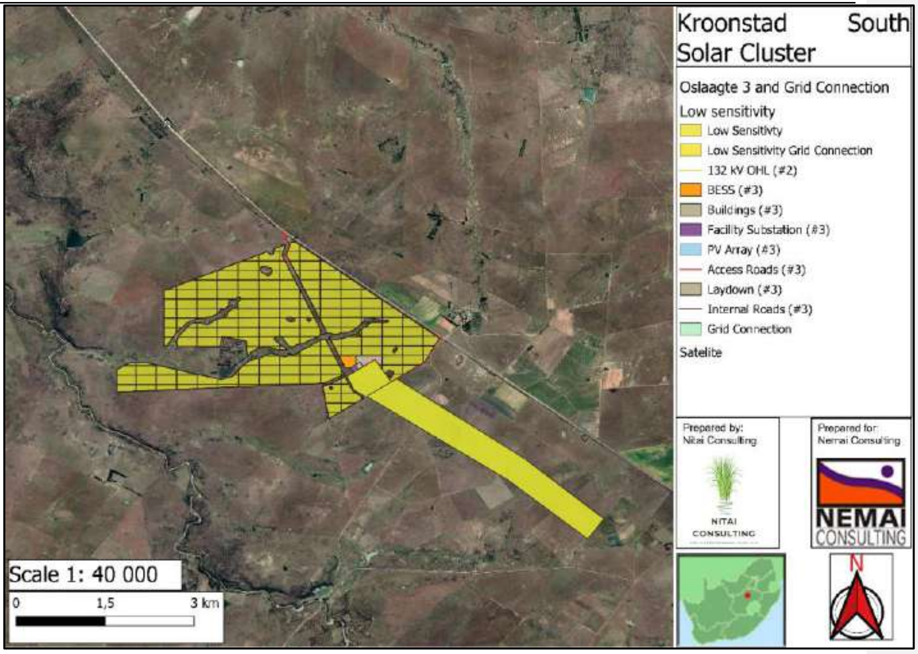

Figure 23: Sensitivity of properties envisaged in the Oslaagte 3 and grid connection.

7.1.5.2 Impacts

Current impacts include planted pastures and crop fields. Many historical grassland areas have differential anthropogenic histories of fire and overgrazing with some showing woody encroachment. No active or inactive burrows were found in the field survey and this development is likely to have minor impact on any girdled lizards that may be present.

7.1.5.3 Mitigation

Development of this proposed PV site would not require mitigation for girdled lizards.

This is since this development alternative avoids all suitable habitat and sensitive areas for girdled lizards.

8 SUMMARY AND CONCLUSION

Presence of girdled lizards could not be confirmed in this walk-through survey of the Kroonstad South Clusters. Historical evidence (previous 10 years)[5] and confirmation by the EWT survey of April 2023 does confirm their presence in the surrounding areas of the Kroonstad South Cluster.

The impacts for girdled lizards on Leeuwspruit 2 (Alternative 1) would be very high since this is suitable habitat for the species in which to occur and moderate for Leeuwspruit 1 (Alternative 1) since there is suboptimal habitat remaining in the sandy grassland areas. With consideration of Alternative option 2 for both sites the sensitivity is low since all sensitive areas and features have been avoided. The impact for the three Oslaagte sites is low since the habitat is degraded and overgrazed including incompatible soil types for girdled lizard burrows.

In areas of low sensitivity, no mitigation is required but for areas of moderate and high sensitivity the area should be totally avoided, or extensive mitigation measures are required in terms of substantial offsets, relocation of individuals the creation of corridors and buffer areas.

This survey was limited in terms of time during the optimal survey season and an intensive survey of both the Leeuwspruit Alternative 1 project footprints are

[5] Landowner confirmed the presence of this species on his property in the past.

recommended in the hot wet season of 2023 and 2024 immediately post good rains to accurately map their occurrence if development in Alternative 1 chosen. Their presence was confirmed by landowners approximately 4 kms east of the Kroonstad South Cluster at the time of the survey. These sites have been communicated to the EWT team but remain confidential.

9 REFERENCES

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APPENDIX E3: Avifaunal Baseline and Impact Assessment

Avifauna Assessment for the proposed Oslaagte 2 Photovoltaic (PV) Facility

Kroonstad, Free State Province

April 2023

CLIENT

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1 Introduction

1.1 Background

The Biodiversity Company was appointed to undertake an avifauna assessment for the proposed Kroonstad South Solar Photovoltaic (PV) cluster project (Figure 1-1 and Figure 1-2). The proposed cluster of Solar PV projects are located in the Free State Province, approximately 15 to 20 km south east of Kroonstad within the Moqhaka Local Municipality. A Regime 2 avifauna assessment was completed for this project, with surveys undertaken from 19th to the 23rd of December 2022 and from the 6th to 10th of March 2023. The field work component for these projects was conducted for the cluster, however the information in this report pertains only to Oslaagte Solar 2 (Figure 1-3).

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). The National Web based Environmental Screening Tool has characterised the terrestrial theme sensitivity of the PAOI as "Very High" and the animal theme sensitivity as "Medium".

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 details of the proposed Solar PV Projects are presented in Table 1-1 as per Nemai (2022).

Table 1-1 Details of the proposed Solar PV Projects

No	Applicant	MW output	Properties affected
1	Oslaagte Solar 1 Pty Ltd	Up to 240MW	Farm Oslaagte 2564, approximately 16,5 km south east of Kroonstad. The proposed Oslaagte Solar 1 will cover up to approximately 334 ha.
2	Oslaagte Solar 2 Pty Ltd	Up to 460MW	Farm Oslaagte 2564, approximately 17,5 km south east of Kroonstad. The proposed Oslaagte Solar 2 will cover up to approximately 600 ha.
3	Oslaagte Solar 3 Pty Ltd	Up to 480MW	Farm Oslaagte 2564, approximately 20 km south east of Kroonstad. The proposed Oslaagte Solar 3 will cover up to approximately 810 ha.
4	Leeuwspruit Solar 1 Pty Ltd	Up to 320MW	Farm Mooidraai 953, Portion 1 of the Farm Vogelstruis-Fontein 311 and the Farm Leeuwspruit 659, approximately 19 km south of Kroonstad. The proposed Leeuwspruit Solar 1 will cover up to approximately 490 ha.
5	Leeuwspruit Solar 2 Pty Ltd	Up to 300MW	Farm Mooidraai No. 953, the Farm Wolvekop No. 314 and the Farm Leeuwspruit No. 659, an access road crossing Portion 1 of Farm No. 666 and the Remaing Extent of Farm No. 666, and

			grid connection infrastructure crossing Farm Oslaagte No. 2564
Integrated Grid Connection			
6		Farm Oslaagte 2564, , Farm Welbedatch 1913, Farm Zonderweg 1699, Farm Fraaiuitzicht 576, Farm Damspruit 1584 and the Farm Klein Geluk 2088.	A new 132/400 kV Main Transmission Substation (MTS). 400 kV powerlines (LILO) between the new proposed MTS and the existing Eskom 400 kV powerlines

- The proposed Solar PV facilities include the following infrastructure:
- PV modules and mounting structures which will consist of either Monofacial or Bifacial PV panels, mounted on either fixed-tilt, single-axis tracking, and/or double-axis tracking systems;
- Inverters and transformers;
- Battery Energy Storage System (BESS) area up to 5ha;
- Operation and Maintenance buildings including a gate house and security building, control centre, offices, warehouses and workshops for storage and maintenance;
- Facility grid connection infrastructure, including:
  - 33kV cabling between the project components and the facility substation;
  - A 132kV facility substation;
  - 33kV or 132kV cabling or powerline between the facility substation and the proposed Main Transmission Substation or the Kroonstad Switching Station;
- Temporary construction laydown area;
- Permanent laydown area up to 1 ha (to be located within the area demarcated for the temporary construction laydown);
- Internal roads will be up to 6 m wide, to allow access to the Solar PV modules for operations and maintenance activities.
- Main access road is up to 8 m wide:
- For Oslaagte Solar 1, Oslaagte Solar 2 and Oslaagte Solar 3, the access road planned off the R76;
- For Leeuwspruit Solar 1 and Leeuwspruit Solar 2, the access road is off the N1.
- 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.

The proposed integrated grid connection infrastructure will include the following:

- A 132/400 kV Main Transmission Substation (MTS) with an extent of up to 600 m x 600 m.
- 400 kV powerlines (LILO) between the new proposed MTS and the existing Eskom 400 kV powerlines.

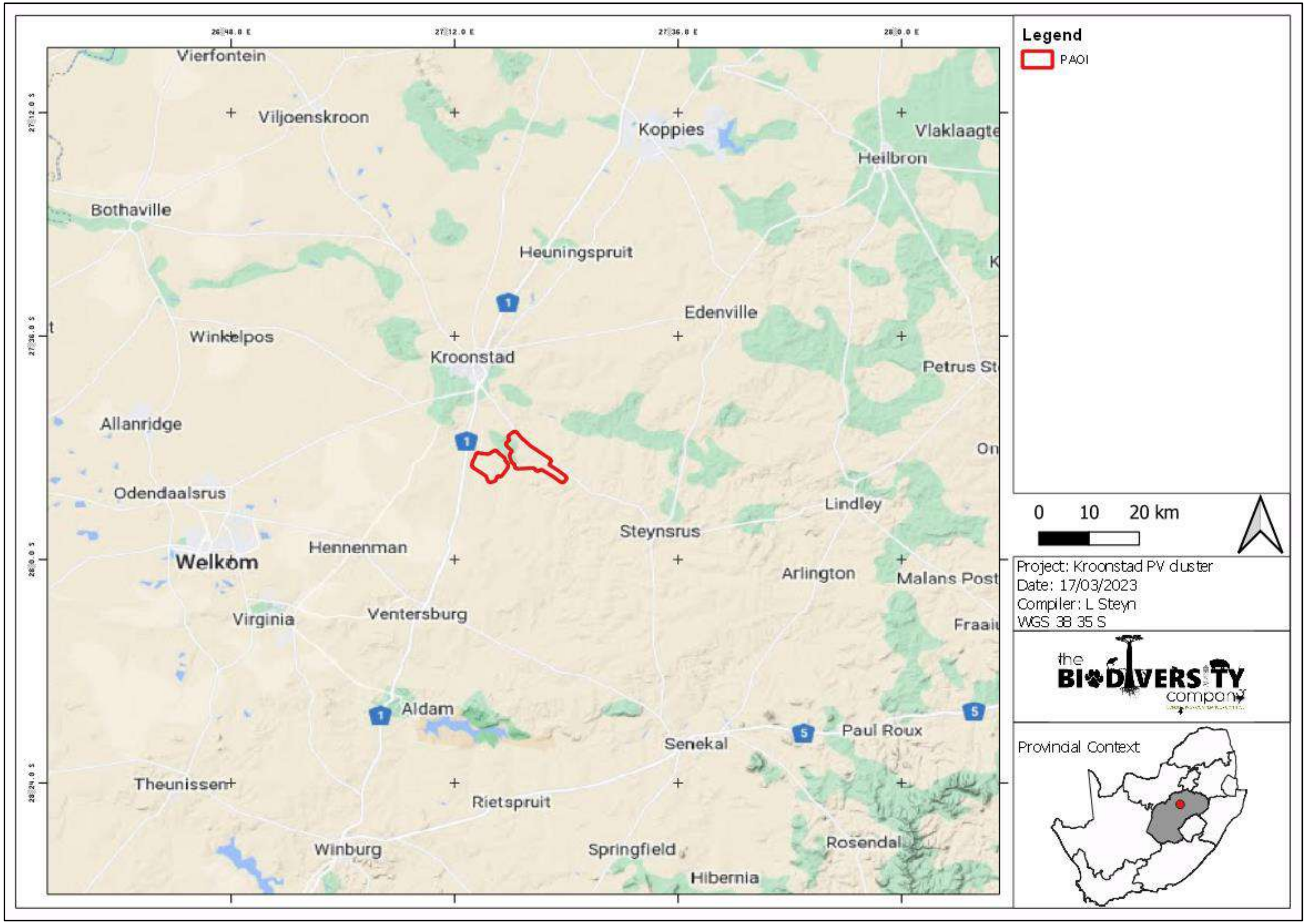


Figure 1-1 ***Proposed location of the cluster PAOI in relation to the nearby towns***

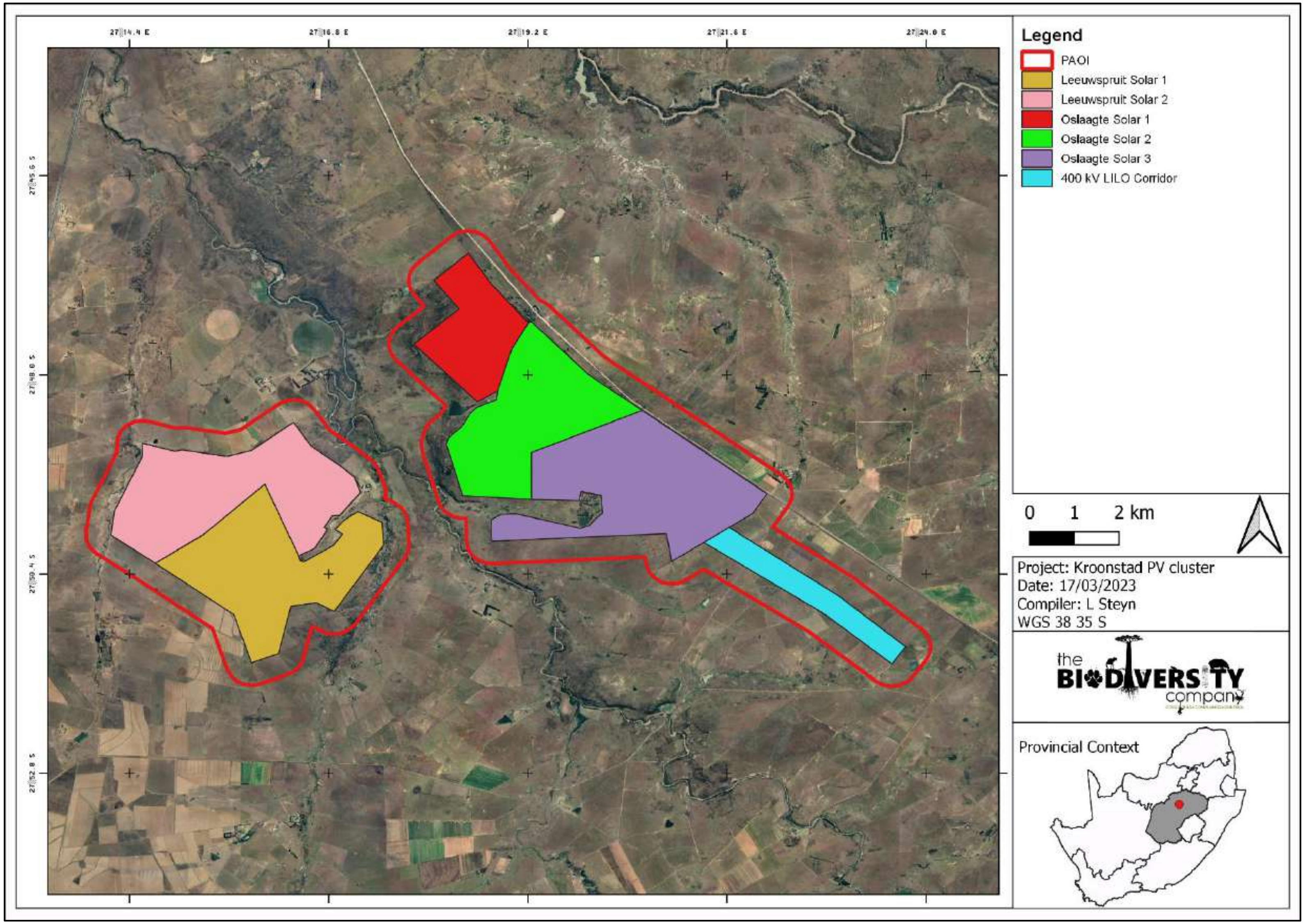


Figure 1-2 The cluster PAOI and the various solar projects associated with the project

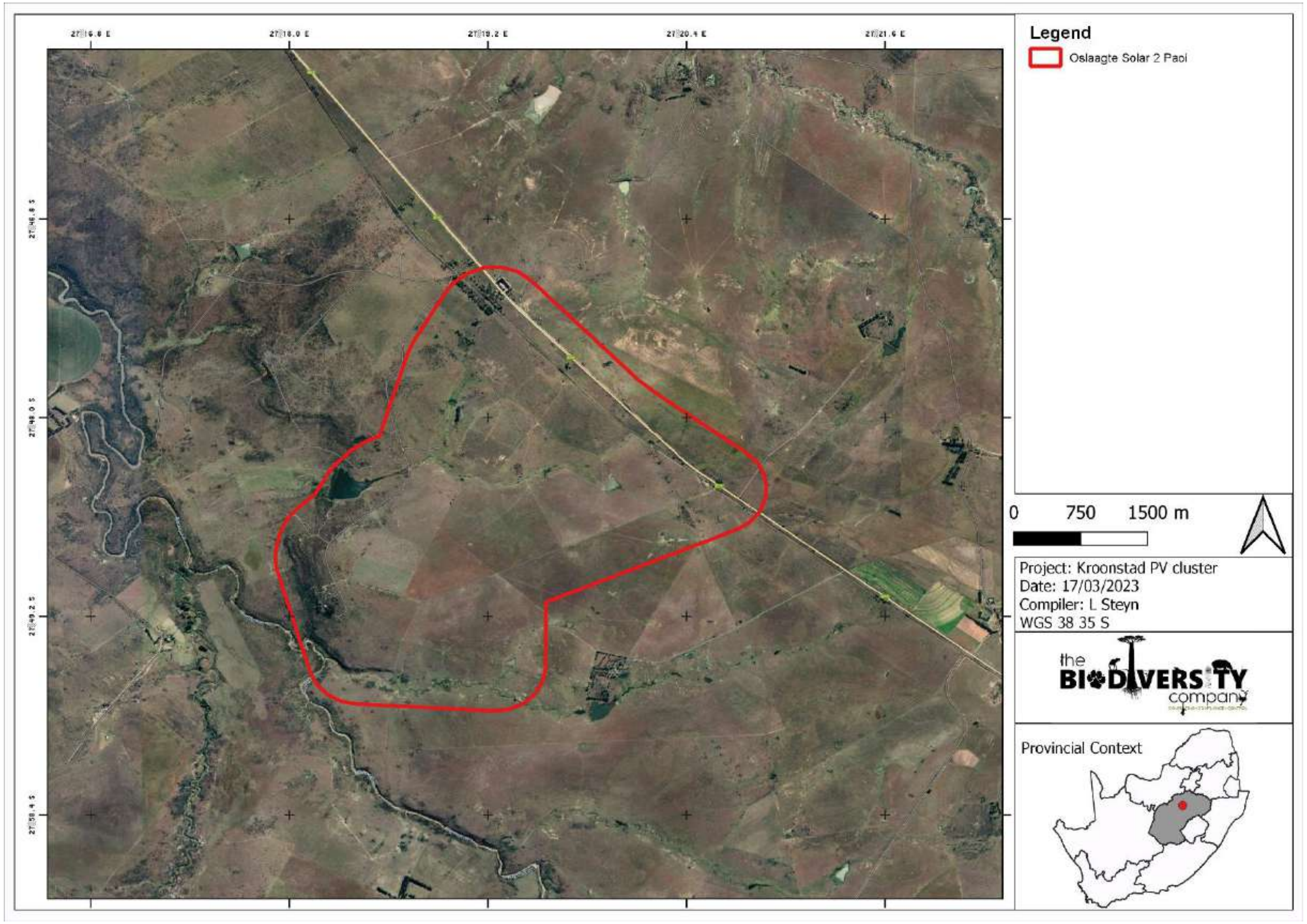


Figure 1-3 ***The Oslaagte Solar 2 PAOI***

1.3 Specialist Details

Report Name	**Avifauna Assessment for the proposed Oslaagte 2 Photovoltaic (PV) Facility**
Reference	**Kroonstad South PV**
Submitted to	NEMAI CONSULTING
Field Work	**Ernest Porter** Ernest has gained birding experience in the Northern Cape, North West, Mpumalanga, Limpopo, KwaZulu Natal, Free State, Western Cape and also Gauteng. He is a qualified FGASA NQF2 Field Guide and a committee member of Black Eagle Project Roodekrans and The Botanical Society of South Africa (Bankenveld Branch).
Report Writer	**Lindi Steyn** Dr Lindi Steyn has completed her PhD in Biodiversity and Conservation from the University of Johannesburg. Lindi is a terrestrial ecologist with a special interest in ornithology. She has completed numerous studies ranging from Basic Assessments to Environmental Impact Assessments following IFC standards.
Reviewer	**Andrew Husted** Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 13 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.

1.4 Scope of Work

The assessment was achieved according to the above-mentioned legislation 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 assessment included the following:

- Desktop assessment to identify the relevant ecologically important geographical features within the 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.

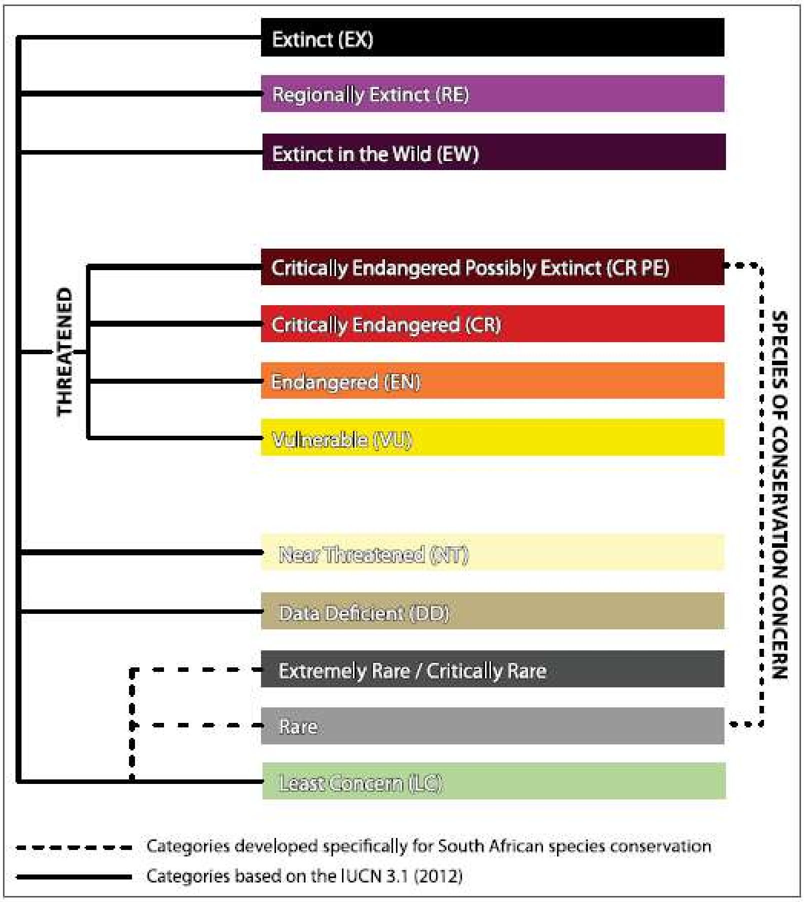


Figure 1-4 ***The different categories of Species of Conservation Concern modified from the IUCN's extinction risk categories. Source: SANBI (2020).***

2 Key Legislative Requirements

The legislation, policies and guidelines listed below in Table 2-1 are applicable to the current project. The list below, although extensive, may not be complete and other legislation, policies and guidelines may apply in addition to those listed below.

Table 2-1 ***A list of key legislative requirements relevant to biodiversity and conservation in the Free State Province***

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

	National Biodiversity Framework (NBF, 2009)
	National Forest Act (Act No. 84 of 1998)
	National Veld and Forest Fire Act (101 of 1998)
	National Water Act (NWA) (Act No. 36 of 1998)
	Municipal Systems Act (Act No. 32 of 2000)
	Alien and Invasive Species Regulations and, Alien and Invasive Species List 20142020, published under NEMBA
	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA)
Provincial	Boputhatswana Nature Conservation Act 3 of 1973
	Free State Nature Conservation Ordinance 8 of 1969

3 Methods

3.1 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.

3.1.1 Desktop Avifaunal Assessment

The avifaunal desktop assessment comprised of the following, compiling an expected species list:

- Avifauna list, generated from the SABAP2 dataset by looking at pentads 740_2705; 2740_2710; 2740_2715; 2745_2705; 2745_2710; 2745_2715; 2750_2710; 2750_2715; 2735_2710; 2815_2705; 2815_2710.

3.1.2 Ecologically Important Landscape Features

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

- National Biodiversity Assessment 2018 (Skowno *et al*, 2019) (NBA) - The purpose of the NBA is to assess the state of South Africa's biodiversity based on best available science, with a view to understanding trends over time and informing policy and decision-making across a range of sectors. The NBA deals with all three components of biodiversity: genes, species, and ecosystems; and assesses biodiversity and ecosystems across terrestrial, freshwater, estuarine and marine environments. The two headline indicators assessed in the NBA are:
    - *Ecosystem Threat Status* – indicator of an ecosystem's wellbeing, based on the level of change in structure, function or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Least Concern (LC), based on the proportion of the original extent of each ecosystem type that remains in good ecological condition.
    - *Ecosystem Protection Level* – indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. NP, PP or MP ecosystem types are collectively referred to as under-protected ecosystems.

- Protected areas - South Africa Protected Areas Database (SAPAD) (DEA, 2021) – The SAPAD Database contains spatial data pertinent to the conservation of South African biodiversity. It includes spatial and attribute information for both formally protected areas and areas that have less formal protection. SAPAD is updated on a continuous basis and forms the basis for the Register of Protected Areas, which is a legislative requirement under the National Environmental Management: Protected Areas Act, Act 57 of 2003.
- National Protected Areas Expansion Strategy (NPAES) (SANBI, 2016) – The NPAES provides spatial information on areas that are suitable for terrestrial ecosystem protection. These focus areas are large, intact and unfragmented and therefore, of high importance for biodiversity, climate resilience and freshwater protection.
- Conservation/Biodiversity Sector Plan:

  A Free State Conservation Plan map was produced as part of this plan and sites were assigned to the following CBA categories based on their biodiversity characteristics, spatial configuration and requirement for meeting targets for both biodiversity pattern and ecological processes:

  - Critical Biodiversity Area 1;
  - Critical Biodiversity Area 2;
  - Ecological Support Area 1;
  - Ecological Support Area 2;
  - Other Natural Area;
  - Protected Area; and
  - Degraded.

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

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

3.1.3 Field Survey

Two field surveys were undertaken during the 19th to the 23rd of December 2022 and from the 6th to 10th of March 2023. Sampling consisted of standardized 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 a 10 min period. The horizontal detection limit was set at 150m. 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. To supplement the species inventory with cryptic and illusive species that may not be detected during the rigid point count protocol, diurnal and nocturnal incidental searches were conducted. This involved the opportunistic sampling of species between point count periods, random meandering and road cruising. Effort was made to cover all the different habitat types within the limits of time and access (Figure 3-1).

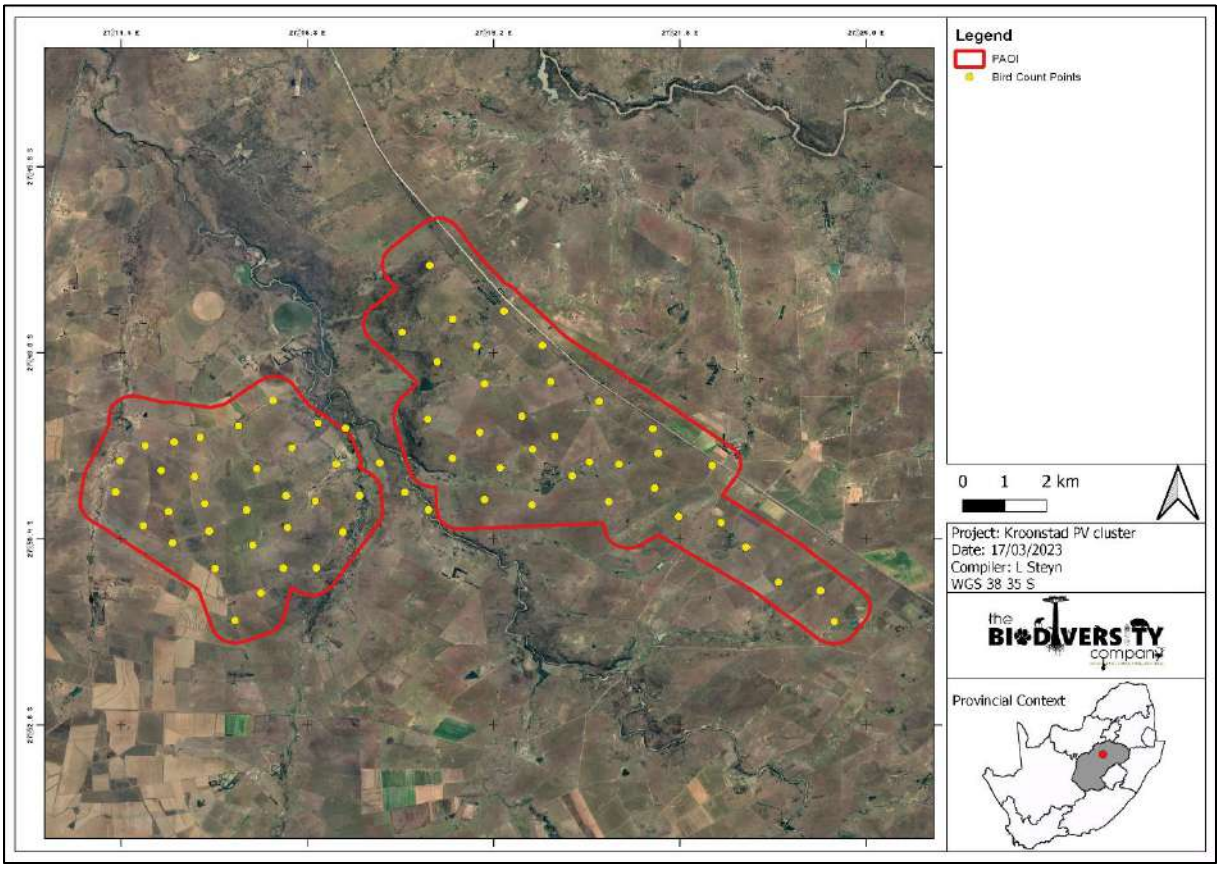


Figure 3-1 ***Map illustrating the field survey area and locations of standardised point counts for the proposed Solar PV PAOI***

3.1.4 Data Analysis

The analyses described below only used the data collected from the standardised point counts. See Appendix A for the point count raw data.

Point count data was arranged into a matrix with point count samples in rows and species in columns. The table formed the basis of the various subsequent statistical analyses. This data was first used to distinguish similarities / differences in the species composition between the two identified avifaunal habitats, the matrix was converted into a Bray-Curtis dissimilarity matrix. The data was subject to fourth root transformation to downscale the contribution of very abundant species while upscaling the influence of less abundant species. However, the effect was negligible and ultimately the raw data proved more informative. Thirdly, raw count data was converted to relative abundance values and used to establish dominant species and calculate the diversity of each habitat. The Shannon Diversity Index (H’) was the metric used to estimate diversity. Lastly, 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).

3.1.5 Site Ecological Importance (SEI)

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

Table 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.
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 Resource Resilience (RR) criteria

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

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

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

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

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

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

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

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

3.2 Assumptions and Limitations

The following assumptions and limitations are applicable for this assessment:

- The assessment area was based on the area provided by the client and any alterations to the footprint and/or missing GIS information pertaining to the assessment area would have affected the assessment;
- Fieldwork was undertaken for the cluster, whereas reporting has made consideration for the separate Solar PV projects;
- No nocturnal assessments were conducted due to safety risks.

4 Results & Discussion

4.1 Desktop Assessment

4.1.1 Ecologically Important Landscape Features

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

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

Desktop Information Considered	Description	Section
Ecosystem Threat Status	Overlaps with a Least Concern Ecosystem.	4.1.1.1
Ecosystem Protection Level	Overlaps with a Poorly Protected Ecosystem.	4.1.1.2
Protected Areas	The PAOI is 3 km the Seredipendie Private Nature Reserve	4.1.1.4
National Protected Areas Expansion Strategy	The PAOI overlap with a priority focus area	4.1.1.5
Critical Biodiversity Area	The PAOI overlaps with ESA1, ESA2, Other and Degraded classified areas	4.1.1.3
Important Bird and Biodiversity Areas	The PAOI is located 39 km from the Willem Pretorius Game Reserve IBA.	4.1.1.6
REDZ	The PAOI is 58 km from the Klerksdorp Renewable Energy Development Zone.	-

Powerline Corridor	The PAOI does not overlap with any corridors.	-
South African Inventory of Inland Aquatic Ecosystems	The PAOI overlaps with a CR river.	4.1.1.7
National Freshwater Priority Area	The PAOI overlaps with numerous unclassified wetlands and an unclassified river.	4.1.1.8
Coordinated Avifaunal Road Count	The PAOI is 2.8 km from the closest CAR route	4.1.1.9
Coordinated Waterbird Count	The PAOI is 55 km from the Toronto Pan, Flamingo Pan, St Helena Mine Dam CWAC	4.1.1.10

4.1.1.1 Ecosystem Threat Status

The Ecosystem Threat Status is an indicator of an ecosystem's wellbeing, based on the level of change in structure, function or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Least Concern (LC), based on the proportion of the original extent of each ecosystem type that remains in good ecological condition. According to the spatial dataset the proposed PAOI overlaps with a LC ecosystem (Figure 4-1).

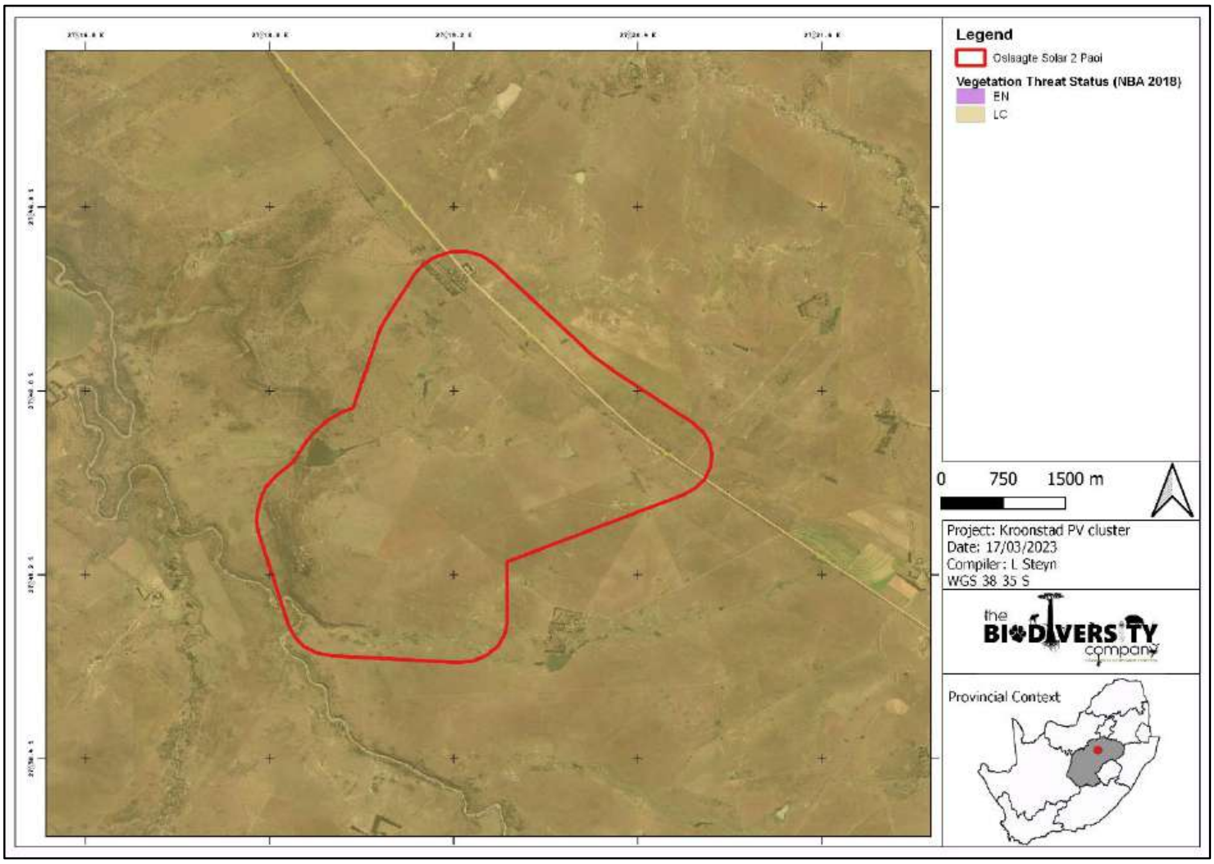


Figure 4-1 Map illustrating the ecosystem threat status associated with the PAOI

4.1.1.2 Ecosystem Protection Level

This is an indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. NP, PP or MP ecosystem types are collectively referred to as under-protected ecosystems. The proposed PAOI overlaps with a PP ecosystem (Figure 4-2).

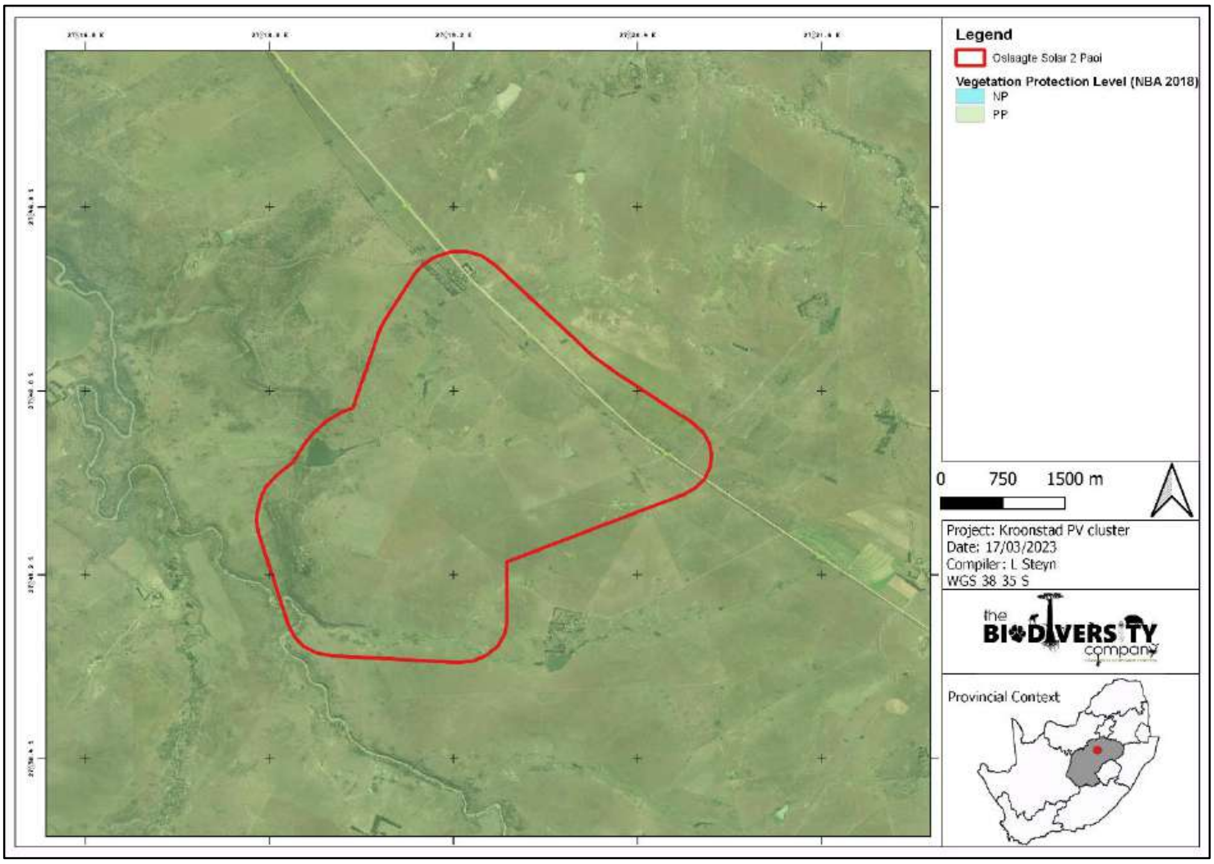


Figure 4-2 Map illustrating the ecosystem protection level associated with the PAOI

4.1.1.3 Critical Biodiversity Areas and Ecological Support Areas

A Free State Conservation Plan map was produced as part of this plan and sites were assigned to the following CBA categories based on their biodiversity characteristics, spatial configuration and requirement for meeting targets for both biodiversity pattern and ecological processes:

- Critical Biodiversity Area 1;
- Critical Biodiversity Area 2;
- Ecological Support Area 1;
- Ecological Support Area 2;
- Other Natural Area;
- Protected Area; and
- Degraded.

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI, 2017).

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

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

Degraded areas are areas in poor ecological condition that have not been identified as CBAs or ESAs. They include all irreversibly modified areas (such as urban or industrial areas and mines), and most severely modified areas (such as cultivated fields and forestry plantations) (SANBI, 2017).

According to the Free State Terrestrial CBA Plan, the proposed PAOI is situated in an area which is regarded as ESA1, ESA2, Other and Degraded (Figure 4-3).

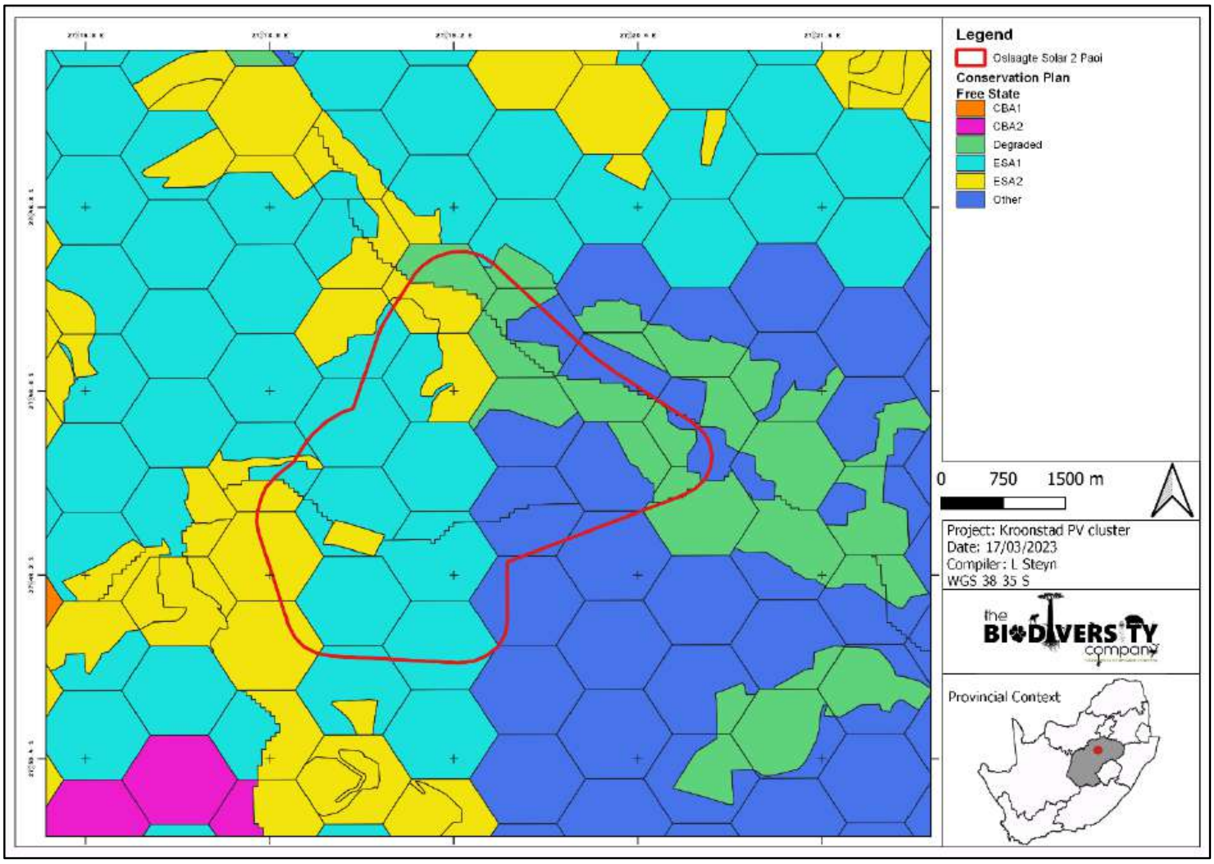


Figure 4-3 Map illustrating the locations of CBAs in the PAOI

4.1.1.4 Protected areas

According to the protected area spatial datasets from SAPAD (2022) and SACAD (2022), the PAOI is 3 km from the Seredipendie Private Nature Reserve (Figure 4-4).

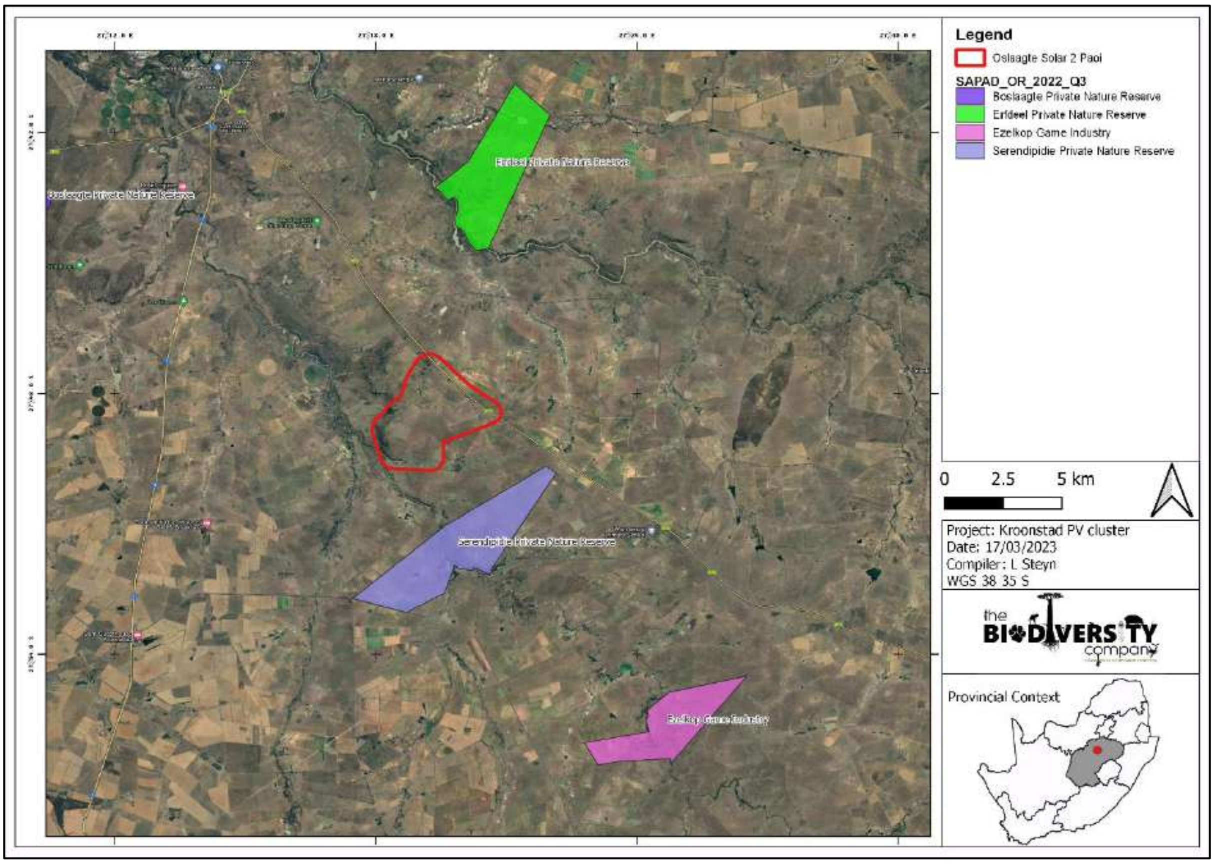


Figure 4-4 The PAOI in relation to the protected areas

4.1.1.5 National Protected Area Expansion Strategy

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

The PAOI overlap with a priority focus area (Figure 4-5).

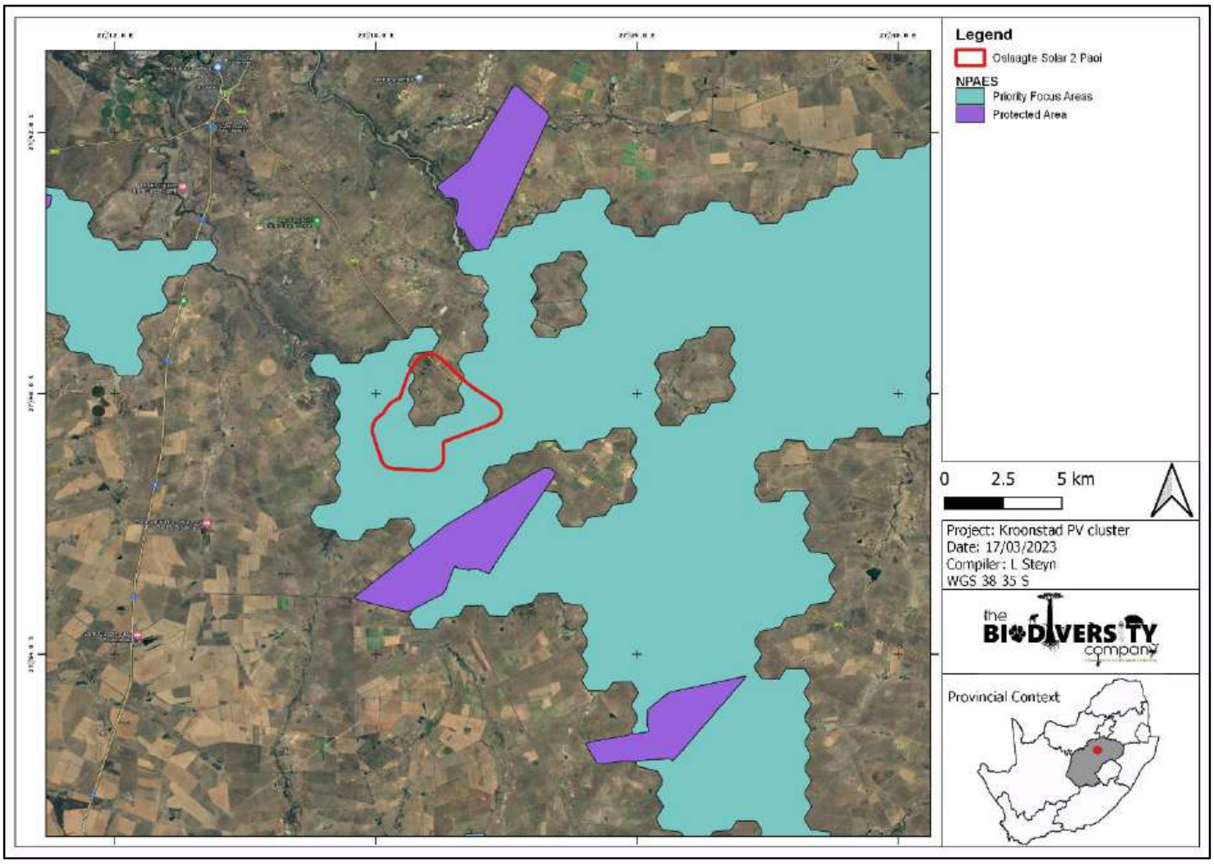


Figure 4-5 ***The PAOI in relation to the National Protected Area Expansion Strategy***

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), the selection of IBAs is achieved through the application of quantitative ornithological criteria, grounded in up-to-date knowledge of the sizes and trends of bird populations. The criteria ensure that the sites selected as IBAs have true significance for the international conservation of bird populations and provide a common currency that all IBAs adhere to, thus creating consistency among, and enabling comparability between, sites at national, continental and global levels. Figure 4-6 shows that the PAOI is located 39 km from the Willem Pretorius Game Reserve IBA.

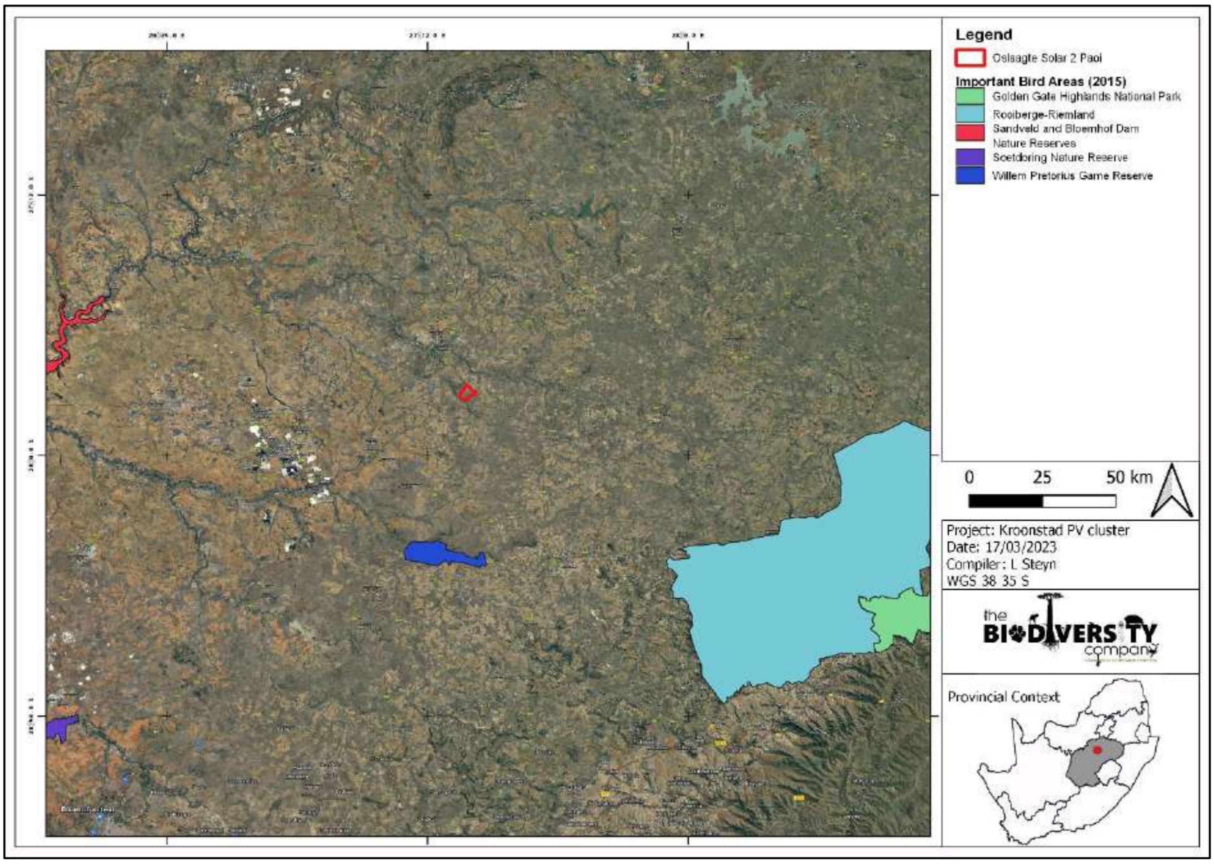


Figure 4-6 The PAOI in relation to the nearest IBAs

4.1.1.7 Hydrological Setting

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was released with the NBA 2018. Ecosystem threat status (ETS) of river and wetland ecosystem types are based on the extent to which each river ecosystem type had been altered from its natural condition. Ecosystem types are categorised as CR, EN, VU or LT, with CR, EN and VU ecosystem types collectively referred to as ‘threatened’ (Van Deventer *et al.,* 2019; Skowno *et al.,* 2019).

The PAOI overlaps with a CR river (Figure 4-7).

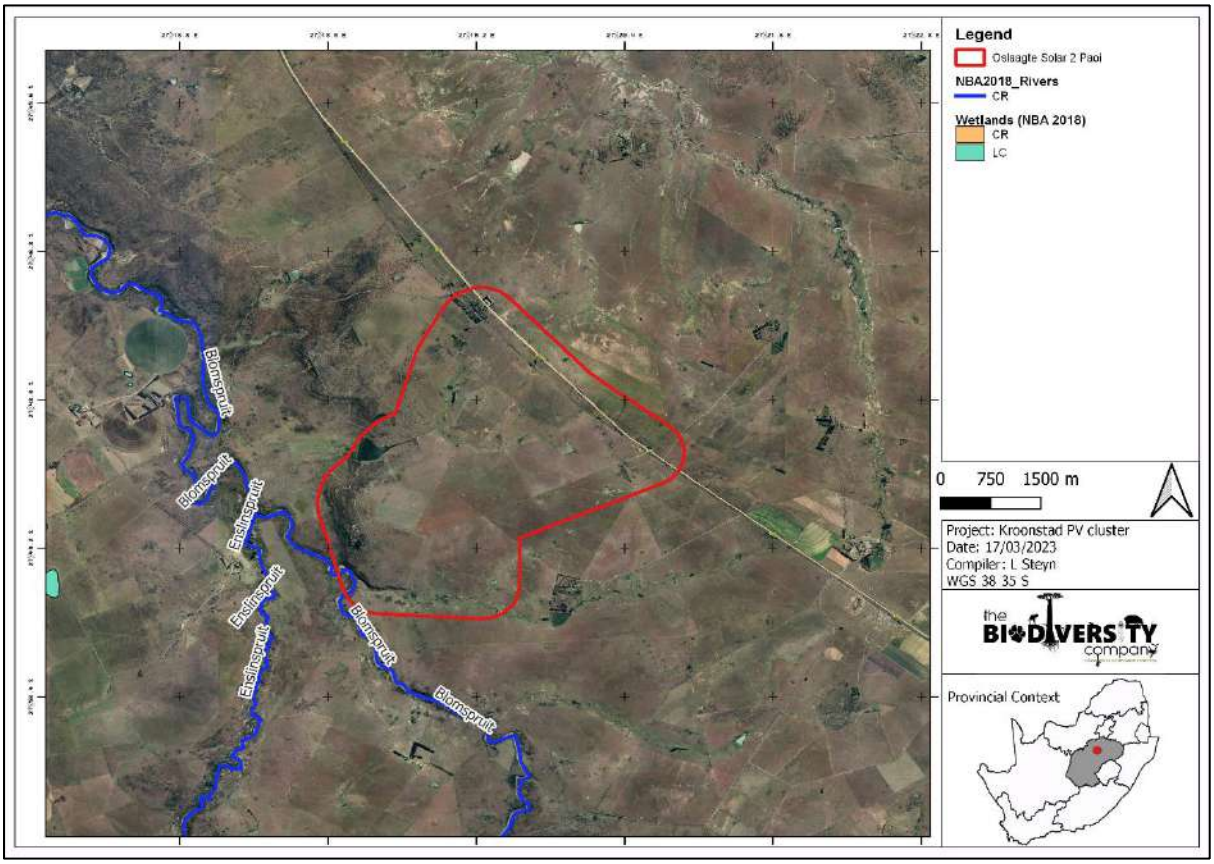


Figure 4-7 Map illustrating ecosystem threat status of rivers and wetland ecosystems in relation to the PAOI

4.1.1.8 National Freshwater Ecosystem Priority Area Status

In an attempt to better conserve aquatic ecosystems, South Africa has categorised its river systems according to set ecological criteria (i.e., ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver *et al.,* 2011). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's (NEM:BA) biodiversity goals (Nel *et al.,* 2011). Figure 4-8 shows that the PAOI overlaps with numerous unclassified wetlands and an unclassified river.

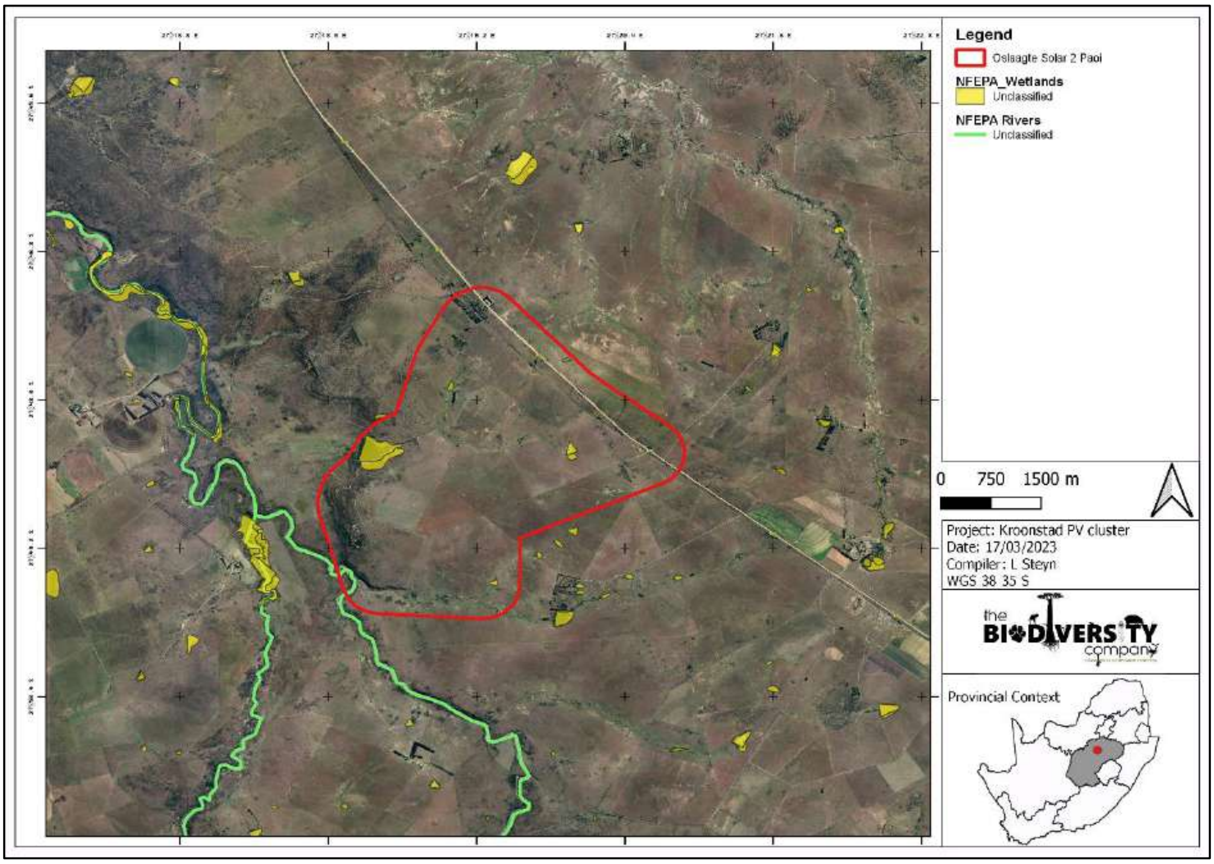


Figure 4-8 The PAOI in relation to the National Freshwater Ecosystem Priority Areas

4.1.1.9 Coordinated Avifaunal Roadcount (CAR)

The ADU/Cape bird club pioneered avifaunal roadcount 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 denhami*. Today it has been expanded to the monitoring of 36 species of large terrestrial birds (cranes, bustards, korhaans, storks, Secretarybird and Southern Bald Ibis) along 350 fixed routes covering over 19 000 km. Twice a year, in midsummer (the last Saturday in January) and midwinter (the last Saturday in July), roadcounts are carried out using this standardised method. These counts are important for the conservation of these larger species that are under threat due to loss of habitat through changes in land use, increases in crop agriculture and human population densities, poisoning as well as man-made structures like power lines. With the prospect of wind and solar farms to increase the use of renewable energy sources monitoring of these species is most important (CAR, 2020). Figure 4-9 shows that the PAOI is 2.8 km from the closest CAR route.

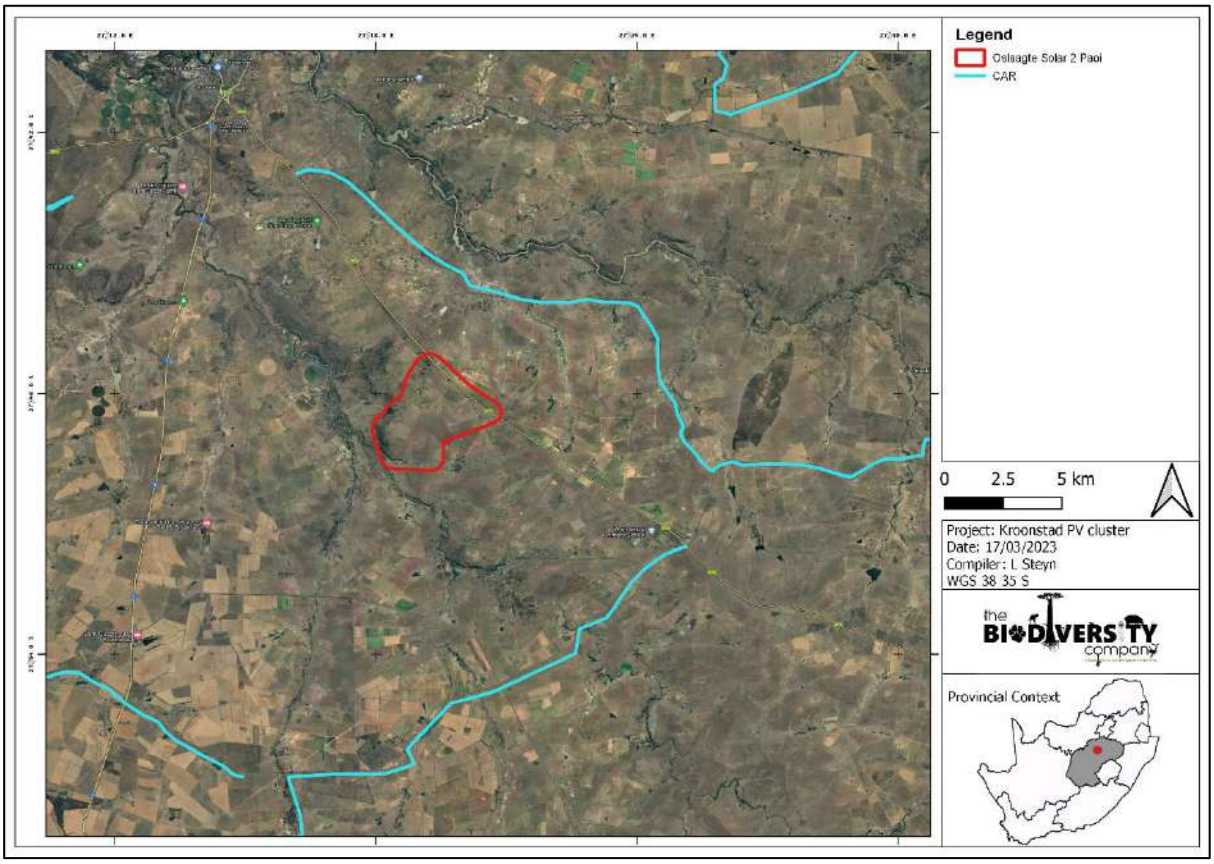


Figure 4-9 The PAOI in relation to the closest CAR route

4.1.2 Avifauna Expected

The SABAP2 Data lists 280 avifauna species that could be expected to occur within the PAOI (Appendix A). Seventeen (17) of these expected species are regarded as threatened (Table 4-2). Three (3) of the species have a low likelihood of occurrence due to the expected lack of suitable habitat in the PAOI, these species can however very likely still move over the PAOI and can still be influenced by the development.

Table 4-2 Threatened avifauna species that are expected to occur within the PAOI.

Species	Common Name	Conservation Status		Likelihood of Occurrence
		Regional (SANBI, 2016)	IUCN (2021)	
Abdim's Stork	*Ciconia abdimii*	NT	LC	High
African Rock Pipit	*Anthus crenatus*	NT	LC	Low
Black Harrier	*Circus maurus*	EN	EN	Moderate
Black-winged Pratincole	*Glareola nordmanni*	NT	NT	Confirmed
Blue Korhaan	*Eupodotis caerulescens*	LC	NT	Confirmed
Caspian Tern	*Hydropogne caspia*	VU	LC	High
Curlew Sandpiper	*Calidris ferruginea*	LC	NT	Moderate
European Roller	*Coracias garrulus*	NT	LC	High
Greater Flamingo	*Phoenicopterus roseus*	NT	LC	Moderate
Lanner Falcon	*Falco biarmicus*	VU	LC	High
Lesser Flamingo	*Phoeniconaias minor*	NT	NT	Moderate
Maccoa Duck	*Oxyura maccoa*	NT	EN	High

Martial Eagle	*Polemaetus bellicosus*	EN	EN	Low
Red-footed Falcon	*Falco vespertinus*	NT	VU	High
Secretarybird	*Sagittarius serpentarius*	VU	EN	Confirmed
Verreaux's Eagle	*Aquila verreauxii*	VU	LC	Low
Yellow-billed Stork	*Mycteria ibis*	EN	LC	High

Ciconia abdimii (Abdim's Stork) is listed as NT on a local and international 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 (IUCN, 2017). Non-breeding visitor to southern Africa, departing from its northern breeding grounds in the period from May-August, eventually arriving in southern Africa at the onset of the rainy season in the period from October-December. It is nomadic in southern Africa, moving in response to food availability. It gathers in large flocks then departs in February, March and early April. It mainly eats large insects, doing most of its foraging on pastures, irrigated land and recently ploughed fields, usually in groups which split up to cover more ground. Suitable habitat can be found in the PAOI, therefore the likelihood of occurrence is rated as high.

Circus maurus (Black Harrier) is endemic to southern Africa, where its core range is in the Western Cape, but also occurs in the Eastern Cape, the Northern Cape and Free State (where it is irruptive in both areas), Lesotho and Namibia (BirdLife International, 2021b). The species occupies coastal and montane fynbos, highland grasslands, Karoo subdesert scrub, open plains with low shrubs and croplands. It often breeds close to coastal and upland marshes with tall shrubs or reeds, occurring in dry steppe and grassland areas further north in the non-breeding season. Local fluctuations in breeding numbers may be related to population cycles in its prey base, such as mice whose numbers fluctuate with rainfall, especially in the more arid regions. The total population is estimated at < 1 000 individuals in South Africa, Lesotho and Eswatini (Taylor *et al,* 2015) with only around 10 mature individuals outside this region. The population is thought to have undergone a major decline of 85% in the past 100 years (17% in 20 years) due to habitat loss (BirdLife International, 2021b). Habitat is primarily lost to agriculture, and this is compounded by the uncontrolled burning of fynbos and grassland, which renders these habitats unsuitable for breeding for about five years. Additional threats include low hatching rates due to pesticide use and overgrazing. This species could occur but the habitat is not ideal for the species.

Glareola nordmanni (Black-winged Pratincole) is a migratory species which is listed as NT both globally and regionally. This species has a very large range, breeding mostly in Europe and Russia, before migrating to southern Africa. Overall population declines of approximately 20% for this species are suspected (IUCN, 2017). This species generally occurs near water and damp meadows, or marshes overgrown with dense grass. Due to it's migratory nature, this species will only be present in South Africa for a few months during the year and will not breed locally. This species was recorded in the PAOI.

Eupodotis caerulescens (Blue Korhaan) is endemic to South Africa and Lesotho and occurs in grassveld usually over 1 500 m above sea level, preferring open, fairly short grassland and a mixture of grassland and karoo dwarf-shrubland within 1 km of water, with termite mounds and few or no trees (BirdLife International, 2017). The total global population is estimated to number between 12 000-15 000 individuals, equivalent to 8 000-10 000 mature individuals, with a decreasing population trend. The main threat is intensive agriculture, especially within the east of its range. This species was recorded in the PAOI.

Sterna caspia (Caspian Tern) is native to South Africa and are known to occur in inland freshwater systems such as large rivers, creeks, floodlands, reservoirs and sewage ponds. Habitat suitability was found to be high and thus the likelihood of occurrence is high.

Calidris ferruginea (Curlew Sandpiper) is migratory species which breeds on slightly elevated areas in the lowlands of the high Arctic, and may be seen in parts of South Africa during winter. During winter, the species occurs at the coast, but also inland on the muddy edges of marshes, large rivers and lakes (both saline and freshwater), irrigated land, flooded areas, dams and saltpans (IUCN, 2017). Due to the presence of some of these habitat types within the PAOI the likelihood of occurrence of this species was rated as moderate.

Coracias garrulous (European Roller) is a summer migrant with the population from South-central Europe and Asia occurring throughout sub-Saharan Africa. The European Roller has a preference for bushy plains and dry savannah areas. It is globally listed as LC (BirdLife International, 2019a) but NT on a regional scale (Taylor *et al,* 2015). Threats include persecution on migration in some Mediterranean countries and numerous individuals are killed for food in Oman and India. The loss of suitable breeding habitat due to changing agricultural practices, conversion to monoculture, loss of nest sites, and use of pesticides (reducing food availability) are the main threats to the species in Europe (BirdLife International, 2019a). It is sensitive to loss of hedgerows and riparian forest in Europe which provide essential habitats for perching and nesting. Based on the suitable habitat in the PAOI the likelihood of occurrence is rated as high.

Phoeniconaias minor (Lesser Flamingo) is listed as NT on a global and regional scale whereas *Phoenicopterus roseus* (Greater Flamingo) is listed as NT on a regional scale only. Both species have similar habitat requirements and the species 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). Some water sources could be suitable but is not ideal habitat, therefore the likelihood of occurrence is rated as moderate for both species.

Oxyura maccoa (Maccoa Duck) has a large range, divided into a northern population occurring in Eritrea, Ethiopia, Kenya and Tanzania, and a southern population found in Angola, Botswana, Namibia, South Africa and Zimbabwe. During the breeding season it inhabits small temporary and permanent inland freshwater lakes, preferring those that are shallow and nutrient-rich with extensive emergent vegetation such as reeds and sedges on which it relies for nesting, although it can breed in anthropogenic systems such as farm dams and sewerage treatment plants (BirdLife International, 2021c). It exhibits a preference for habitats with a bottom of mud or silt and minimal amounts of floating vegetation, since this provides the best foraging conditions. Outside the breeding season it will wander over larger, deeper lakes and brackish lagoons. Currently the links between population trends and threats facing this species are poorly understood. Pollution is a primary concern, since the species feeds mainly on benthic invertebrates, and is therefore more vulnerable to bio-accumulation of pollutants than other duck species (BirdLife International, 2021c). Hunting and poaching, competition with alien benthic fish and habitat alteration by invasive plants are further threats. The species has a high likelihood of occurrence.

Falco biarmicus (Lanner Falcon) is native to South Africa and inhabits a wide variety of habitats, from lowland deserts to forested mountains (IUCN, 2017). They may occur in groups up to 20 individuals, but have also been observed solitary. Their diet is mainly composed of small birds such as pigeons and francolins. The likelihood of incidental records of this species in the project area is rated as high due to the natural veld condition and the presence of many bird species on which Lanner Falcons may predate.

Falco vespertinus (Red-footed Falcon) is known to breed from eastern Europe and northern Asia to north-western China, heading south in the non-breeding season to southern Angola and southern Africa. Within southern Africa it is locally uncommon to common in Botswana, northern Namibia, central Zimbabwe and the area in and around Gauteng, South Africa (Hockey *et al,* 2005). The habitat it generally prefers is open habitats with scattered trees, such as open grassy woodland, wetlands and croplands. Many of these habitats are present in the project area and thus the likelihood of occurrence is rated as high.

Sagittarius serpentarius (Secretarybird) is listed as VU regionally and EN on a global scale (BirdLife International, 2020). The species has a wide distribution across sub-Saharan Africa, but surveyed densities suggest that the total population size does not exceed a five-figure number. Ad-hoc records, localised surveys and anecdotal observations indicate apparent declines in many parts of the species' range, especially in South Africa where reporting rates decreased by at least 60% of quarter degree grid cells used in Southern African Bird Atlas Projects. Threats include excessive burning of grasslands that may suppress populations of prey species, whilst the intensive grazing of livestock is also probably degrading otherwise suitable habitat. Disturbance by humans is likely to negatively affect breeding. The species is captured and traded; however, it is unknown how many deaths occur in captivity and transit. Direct hunting and nest-raiding for other uses and indiscriminate poisoning at waterholes are also further threats. A proposed conservation action is that landowners of suitable properties should join biodiversity stewardship initiatives and to manage their properties in a sustainable way for the species' populations. This species was observed in the PAOI.

Mycteria ibis (Yellow-billed Stork) is listed as EN on a regional scale and LC on a global scale. This species is migratory and has a large distributional range which includes much of sub-Saharan Africa. It is typically associated with freshwater ecosystems, especially wetlands and the margins of lakes and dams (IUCN, 2017). The presence of extensive water bodies within the project area creates a high possibility that this species may occur there.

5 Field Assessment

5.1 First Field Survey

5.1.1 Species List of First Field Survey

During the first assessment performed in the spring (19th to the 23rd of December 2022) 93 species were recorded during the point counts (Appendix B) and 17 during the incidental counts (Appendix C). Some species were observed both as incidental records and during the point counts. The total number of individual species accounts for approximately 33% of the total number of expected species.

Two SCC was recorded during the survey period i.e., *Eupodotis caerulescens* (Blue Korhaan) and *Sagittarius serpentarius* (Secretarybird) observed (Table 5-1 and Figure 5-1). Table 5-1 lists the species recorded, Figure 5-1 are photographic evidence of the species while Figure 5-2 shows the location of the observed species.

Table 5-1 Summary of the avifauna species of conservation concern recorded within the proposed PAOI during the field survey.

Common Name	Scientific Name	Conservation Status (Regional, Global)	Relative abundance	Frequency (%)
Blue Korhaan	*Eupodotis caerulescens*	LC, NT	0,001	1,493
Secretarybird	*Sagittarius serpentarius*	VU, EN	0,001	1,493

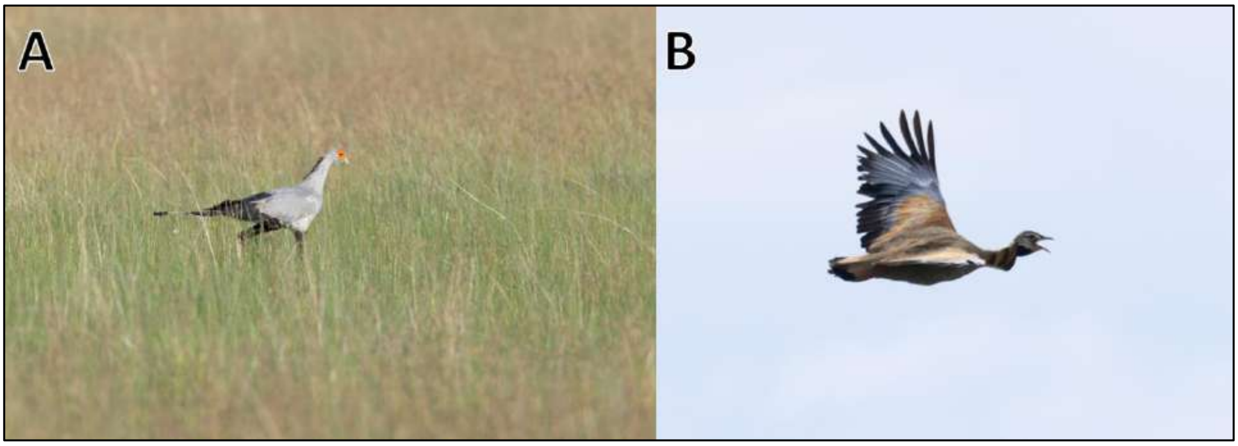


Figure 5-1 Photographs illustrating A) Secretary bird and B) Blue Korhaan recorded in the PAOI. Where the species were recorded is shown in Figure 5-2.

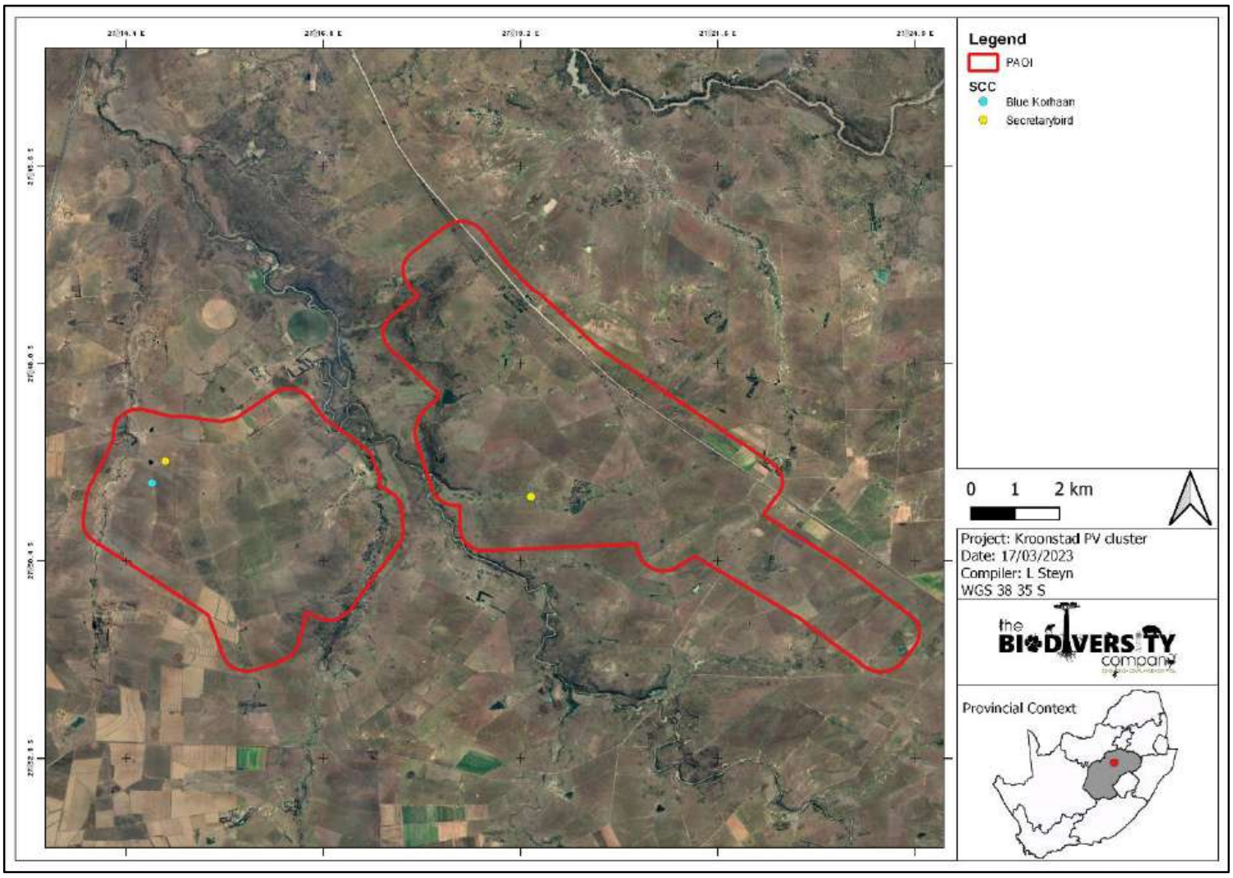


Figure 5-2 Location of the SCC during the first assessment

5.1.2 Priority Species

'Priority Species' are those avifauna that are particularly susceptible to energy developments, and although these priority species were developed for Wind Energy developments (Ralston Paton *et al*, 2017), the type of impact is congruent with Solar Energy Facilities (SEFs), i.e., collision, electrocution, and habitat loss. Even though the panels may not pose an extensive collision risk for larger avifauna species, power lines associated with the infrastructure, guidelines (anchor lines) and connection lines do pose a risk. The fence could also pose a collision risk for various species. Fifteen of the species observed within the PAOI are regarded as priority species (Table 5-2). Photographs of some of the species are shown in Figure 5-3, while Figure 5-4 shows the location of these priority species.

Table 5-2 Summary of Priority Species recorded within and around the proposed PAOI

Common Name	Scientific Name	Collisions	Electrocutions	Habitats Loss
Black-headed Heron	*Ardea melanocephala*	x	x	
Black-winged Kite	*Elanus caeruleus*		x	
Blue Korhaan	*Eupodotis caerulescens*	x		x
Common Ostrich	*Struthio camelus*			x
Egyptian Goose	*Alopochen aegyptiaca*	x		
Greater Kestrel	*Falco rupicoloides*		x	
Grey Heron	*Ardea cinerea*	x	x	
Hamerkop	*Scopus umbretta*	x		
Northern Black Korhaan	*Afrotis afraoides*	x		x

Purple Heron	*Ardea purpurea*	x	x	
Red-billed Teal	*Anas erythrorhyncha*	x		
Secretarybird	*Sagittarius serpentarius*	x		
Spur-winged Goose	*Plectropterus gambensis*	x		
White-faced Whistling Duck	*Dendrocygna viduata*	x		
Yellow-billed Duck	*Anas undulata*	x		

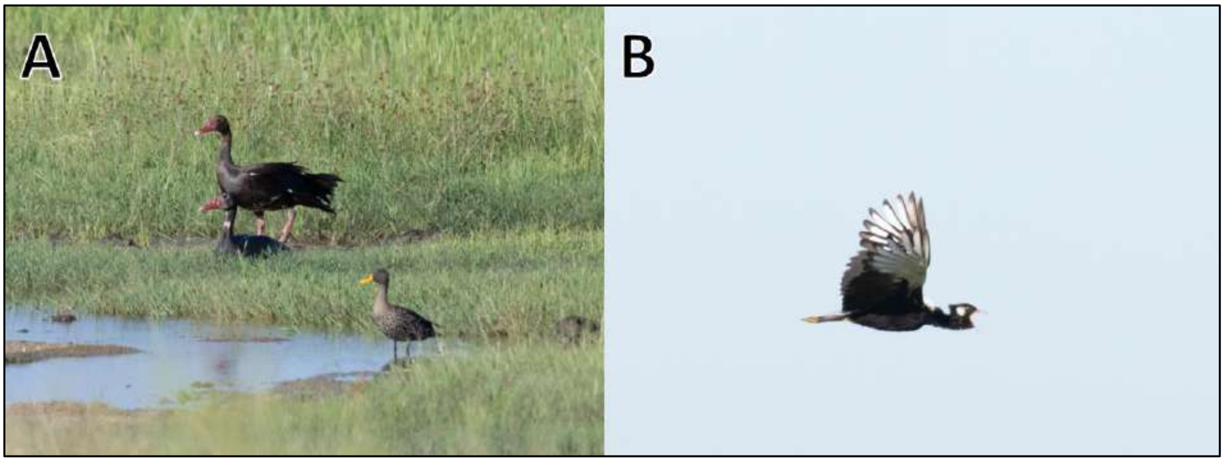


Figure 5-3 Some of the risk species identified; A) Spur-winged Goose and Yellow-billed Duck, and D) Northern Black Korhaan

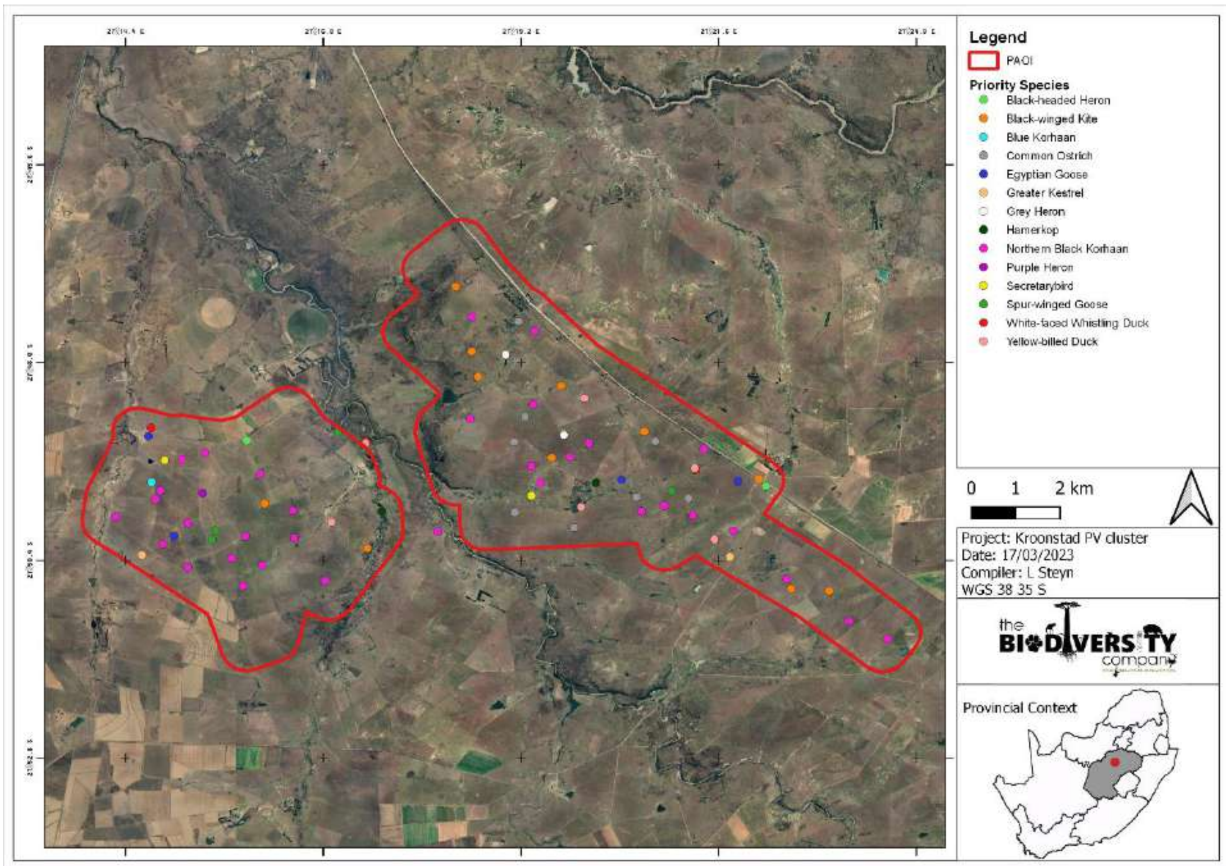


Figure 5-4 The locations of the priority species in the PAOI

5.1.3 Dominant Species

Table 5-3 provides the relative abundance of the dominant species as well as the frequency with which each species appeared in the point count samples. Nineteen of the recorded species accounted for more than 79.9% of the total number of individuals recorded. The species with the highest abundance found was the South African Cliff Swallow (Table 5-3).

Table 5-3 Relative abundance and frequency of occurrence of dominant avifauna species recorded within the PAOI during the field survey. Dominant species cumulatively account for more than 79.9% of the overall abundance. Only data from the standardized point counts were considered.

Common Name	Scientific Name	Guild code	Relative abundance	Frequency (%)
South African Cliff Swallow	*Petrochelidon spilodera*	IAD	0,194	47,761
Red-billed Quelea	*Quelea quelea*	GGD	0,140	13,433
Southern Red Bishop	*Euplectes orix*	GGD	0,097	26,866
Long-tailed Widowbird	*Euplectes progne*	GGD	0,076	67,164
Cloud Cisticola	*Cisticola textrix*	IGD	0,046	76,119
Yellow-crowned Bishop	*Euplectes afer*	GGD	0,028	31,343
Common Quail	*Coturnix coturnix*	OMD	0,024	47,761
Ant-eating Chat	*Myrmecocichla formicivora*	IGD	0,022	26,866
Desert Cisticola	*Cisticola aridulus*	IGD	0,020	50,746
Cape Longclaw	*Macronyx capensis*	IGD	0,019	34,328
Western Cattle Egret	*Bubulcus ibis*	IGD	0,018	19,403
Zitting Cisticola	*Cisticola juncidis*	IGD	0,018	46,269
African Quail-finch	*Ortygospiza atricollis*	GGD	0,018	22,388
Diederik Cuckoo	*Chrysococcyx caprius*	IGD	0,017	46,269
Northern Black Korhaan	*Afrotis afraoides*	IGD	0,015	35,821
Eastern Clapper Lark	*Mirafra fasciolata*	IGD	0,013	25,373
Crowned Lapwing	*Vanellus coronatus*	IGD	0,012	5,970
Rufous-naped Lark	*Mirafra africana*	IGD	0,011	23,881
Black-chested Prinia	*Prinia flavicans*	IGD	0,010	23,881

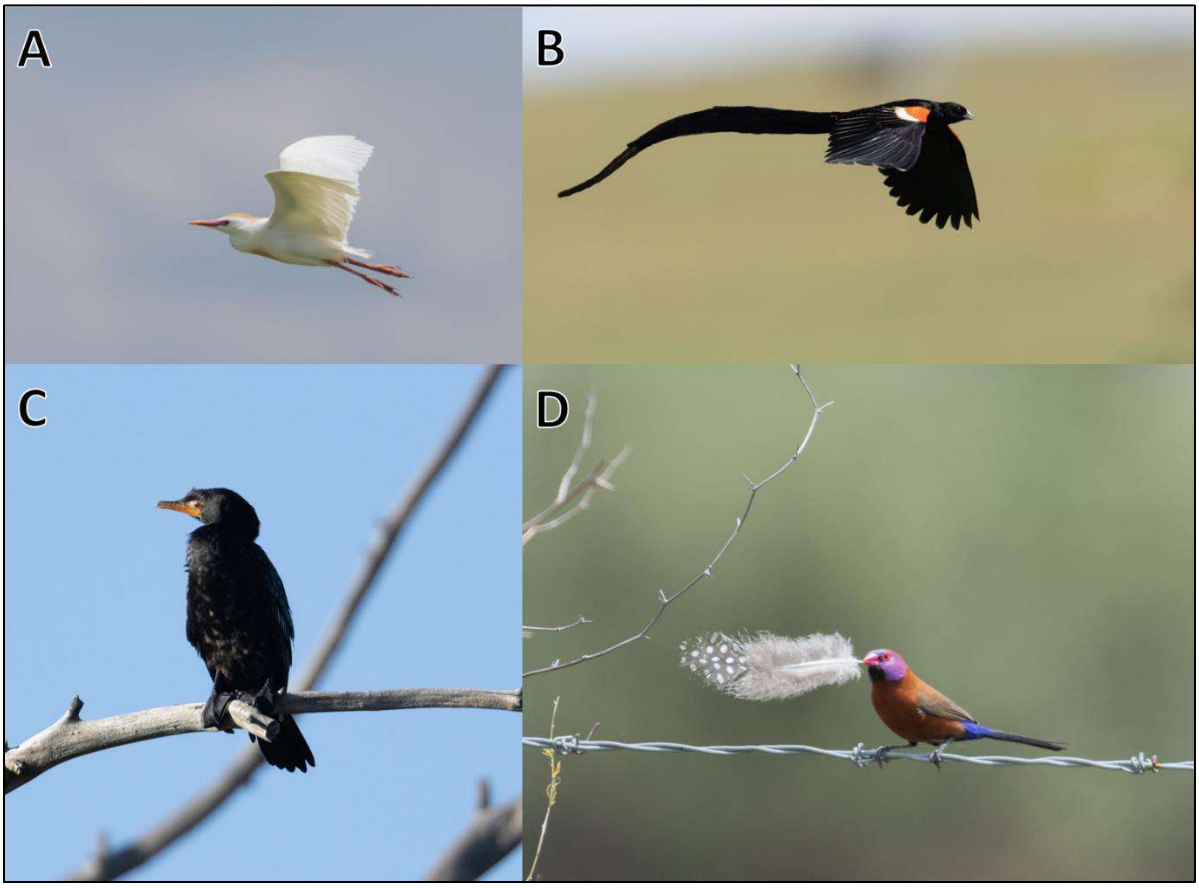


Figure 5-5 Some of the species recorded in the PAOI; A) Cattle Egret, B) Long-tailed Widowbird, C) Reed Cormorant and D) Violet-eared Waxbill

5.1.4 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 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 insectivorous birds that feed on the ground during the day (IGD). Followed by Omnivores (OMD) and Granivores (GGD) (Figure 5-6). The species composition is spread throughout the various groups, nocturnal surveys were not performed due to safety risk and might not represent the infield composition.

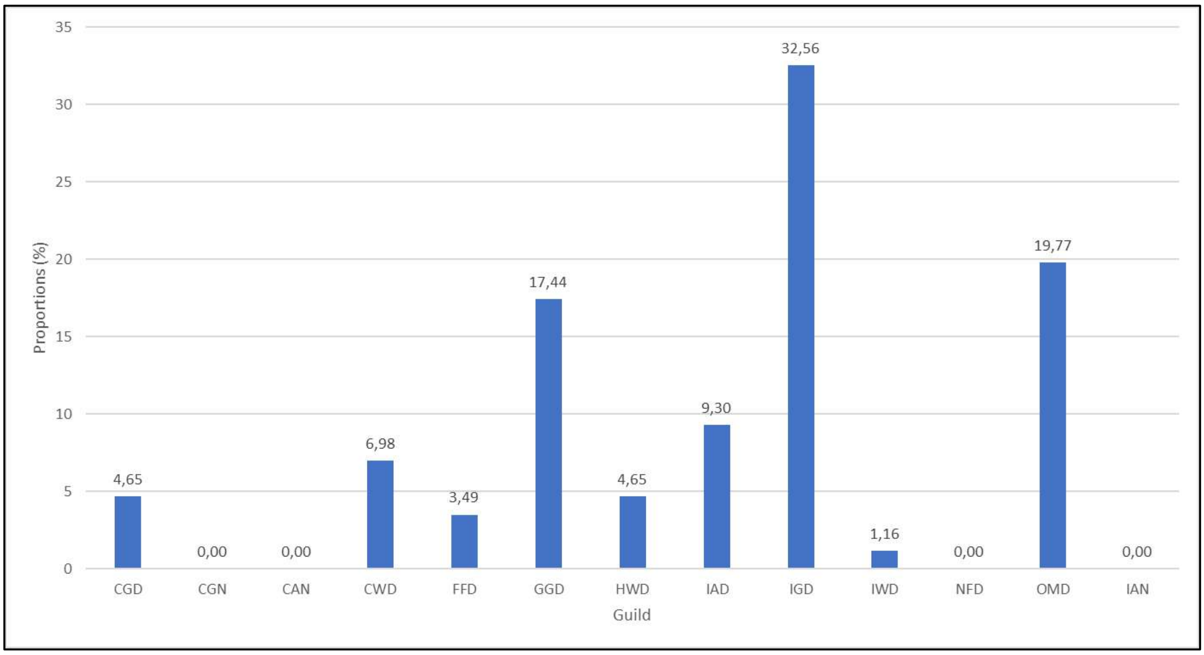


Figure 5-6 ***Column plot illustrating the proportion of each Functional Feeding Guild to the total abundance (Avifaunal trophic guilds. CGD, carnivore ground diurnal; CGN, carnivore ground nocturnal, CAN, carnivore air nocturnal, CWD, carnivore water diurnal; FFD, frugivore foliage diurnal; GGD, granivore ground diurnal; HWD, herbivore water diurnal; IAD, insectivore air diurnal; IGD, insectivore ground diurnal; IWD, insectivore water diurnal; NFD, nectivore foliage diurnal; OMD, omnivore multiple diurnal; IAN, Insectivore air nocturnal).***

5.2 Second Survey

5.2.1 Species List of Second Field Survey

During the second assessment performed in the summer (6th to 10th of March 2023) 109 species were recorded during the point counts (Appendix D) and 34 during the incidental counts (Appendix E).

Black-winged Pratincole (*Glareola nordmanni*) were observed during the second survey. These birds were observed on three occasions and 170 birds were observed. Table 5-4 lists the species recorded, Figure 5-7 are photographic evidence of the species while Figure 5-8 shows the location of the observed species.

Table 5-4 ***Summary of the avifauna species of conservation concern recorded within the proposed PAOI during the second field survey.***

Common Name	Scientific Name	RD (Regional, Global)	Relative abundance	Frequency (%)
Black-winged Pratincole	*Glareola nordmanni*	NT, NT	0,061	2,985

Figure 5-7 Photographs illustrating some of the Black-winged Pratincole recorded within the proposed PAOI during the second field survey

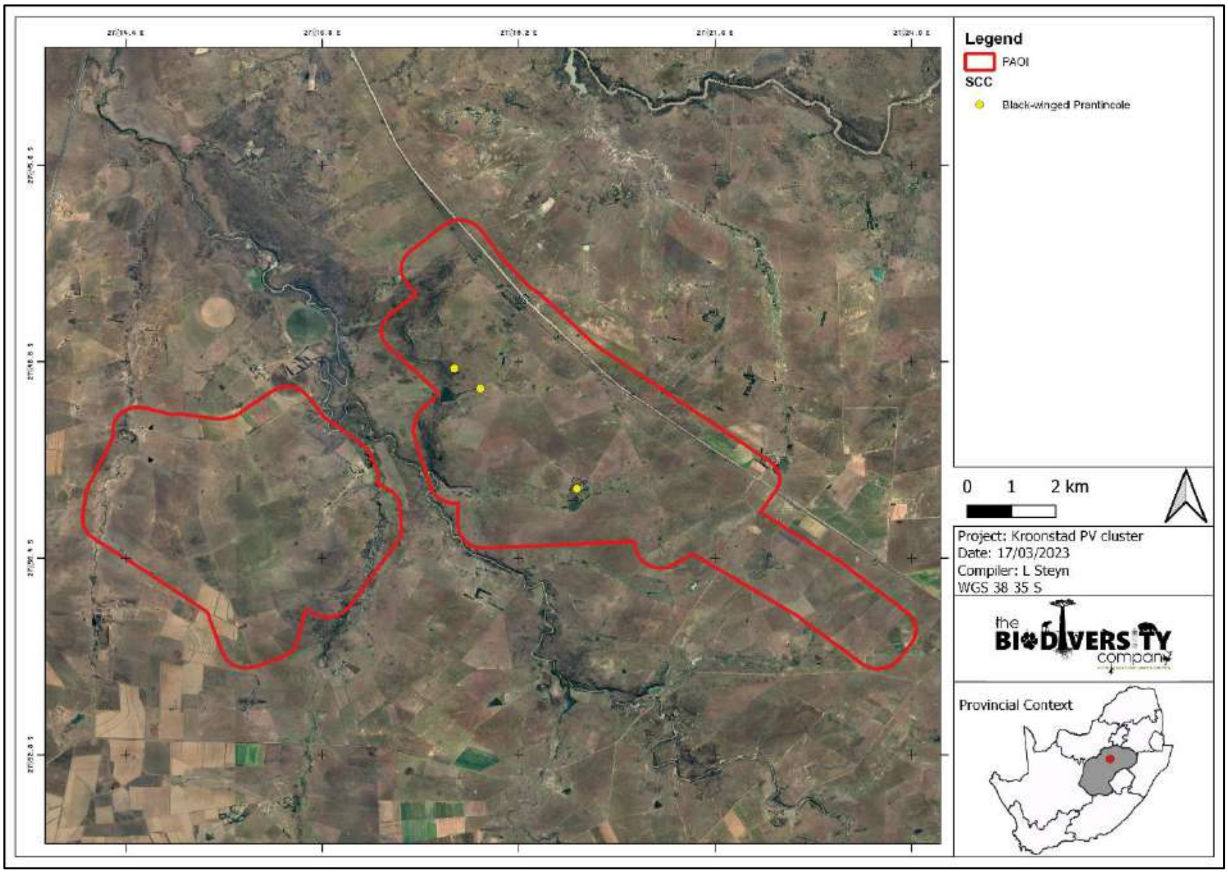


Figure 5-8 Location of the SCC during the second assessment

5.2.2 Priority Species

'Priority Species' are those avifauna that are particularly susceptible to energy developments, and although these priority species were developed for Wind Energy developments (Ralston Paton *et al*, 2017), the type of impact is congruent with SEFs, i.e., collision, electrocution, and habitat loss. Even though the panels may not pose an extensive collision risk for larger avifauna species, power lines associated with the infrastructure, guidelines (anchor lines) and connection lines do pose a risk. The fence could also pose a collision risk for various species. Eighteen of the species observed within the PAOI are regarded as priority species (Table 5-2). Photographs of some of the species are shown in Figure 5-3.

Table 5-5 Summary of Priority Species recorded during the second survey within and around the proposed project.

Common Name	Scientific Name	Collisions	Electrocutions	Habitats Loss
African Sacred Ibis	*Threskiornis aethiopicus*		x	
Amur Falcon	*Falco amurensis*		x	
Black Sparrowhawk	*Accipiter melanoleucus*	x	x	
Black-headed Heron	*Ardea melanocephala*	x	x	
Black-winged Kite	*Elanus caeruleus*		x	
Black-winged Pratincole	*Glareola nordmanni*			x
Common (Steppe) Buzzard	*Buteo buteo*	x	x	
Common Ostrich	*Struthio camelus*			x
Egyptian Goose	*Alopochen aegyptiaca*	x		
Glossy Ibis	*Plegadis falcinellus*		x	
Greater Kestrel	*Falco rupicoloides*		x	
Grey Heron	*Ardea cinerea*	x	x	
Hamerkop	*Scopus umbretta*	x		
Northern Black Korhaan	*Afrotis afraoides*	x		x
Pale Chanting Goshawk	*Melierax canorus*		x	
South African Shelduck	*Tadorna cana*	x		
White-faced Whistling Duck	*Dendrocygna viduata*	x		
Yellow-billed Duck	*Anas undulata*	x		

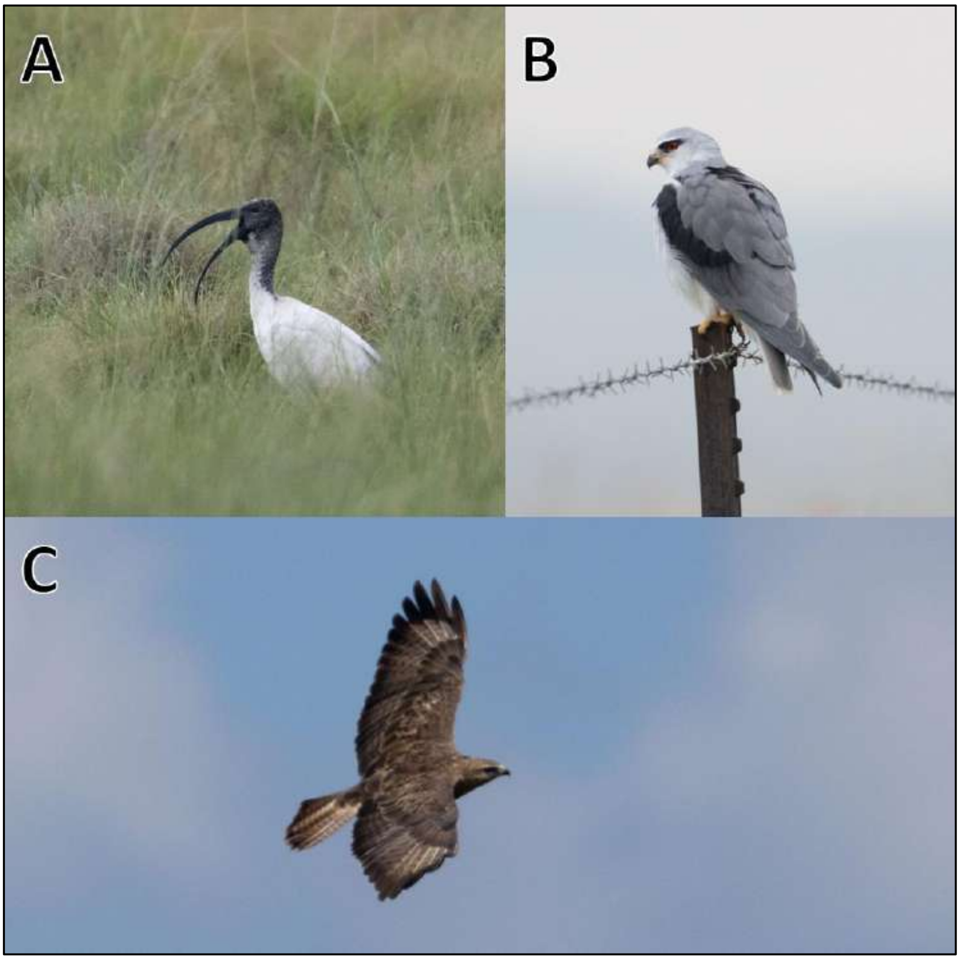


Figure 5-9 Some of the risk species identified; A) African Sacred Ibis, B) Black-winged Kite, and D) Common Buzzard

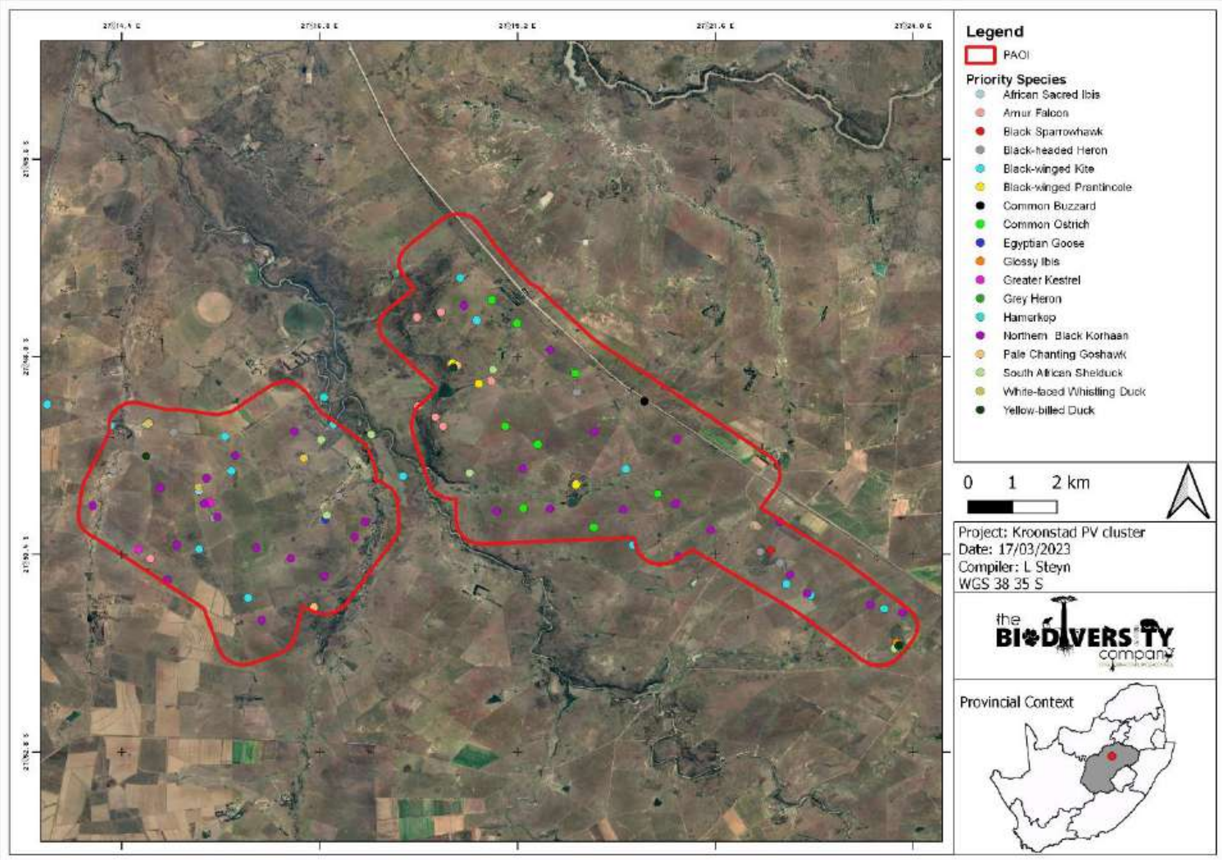


Figure 5-10 Location of the priority species observed.

5.2.3 Dominant Species

Table 5-3 provides the relative abundance of the dominant species as well as the frequency with which each species appeared in the point count samples. Eighteen of the recorded species accounted for more than 79% of the total number of individuals recorded. The most abundant species were *Petrochelidon spilodera* (South African Cliff Swallow) with a relative abundance of 0.213 and a frequency of occurrence of 34.33%. Additional ubiquitous species comprised of *Macronyx capensis* (Cape Longclaw) and *Ortygospiza atricollis* (African Quail-Finch), with a frequency of occurrence of 47.7% and 46.3%, respectively.

Table 5-6 Relative abundance and frequency of occurrence of dominant avifauna species recorded within the PAOI during the field survey. Dominant species cumulatively account for more than 79% of the overall abundance. Only data from the standardized point counts were considered.

Common Name	Scientific Name	Relative abundance	Frequency (%)
South African Cliff Swallow	*Petrochelidon spilodera*	0,213	34,328
Long-tailed Widowbird	*Euplectes progne*	0,089	38,806
Barn Swallow	*Hirundo rustica*	0,081	29,851
Black-winged Pratincole	*Glareola nordmanni*	0,061	2,985
Southern Red Bishop	*Euplectes orix*	0,044	11,940
Red-billed Quelea	*Quelea quelea*	0,043	4,478
African Quail-Finch	*Ortygospiza atricollis*	0,026	46,269
Western Cattle Egret	*Bubulcus ibis*	0,024	10,448

Cape Longclaw	*Macronyx capensis*	0,023	47,761
Speckled Pigeon	*Columba guinea*	0,023	5,970
Bokmakierie	*Telophorus zeylonus*	0,018	35,821
Zitting Cisticola	*Cisticola juncidis*	0,017	38,806
Black-chested Prinia	*Prinia flavicans*	0,014	32,836
Levaillant's Cisticola	*Cisticola tinniens*	0,014	22,388
Ant-eating Chat	*Myrmecocichla formicivora*	0,013	22,388
Desert Cisticola	*Cisticola aridulus*	0,013	29,851
White-rumped Swift	*Apus caffer*	0,013	10,448
Northern Black Korhaan	*Afrotis afraoides*	0,012	28,358
White-browed Sparrow-Weaver	*Plocepasser mahali*	0,012	16,418
Cloud Cisticola	*Cisticola textrix*	0,010	23,881
European Bee-eater	*Merops apiaster*	0,010	7,463
Helmeted Guineafowl	*Numida meleagris*	0,010	4,478
Red-faced Mousebird	*Urocolius indicus*	0,010	13,433

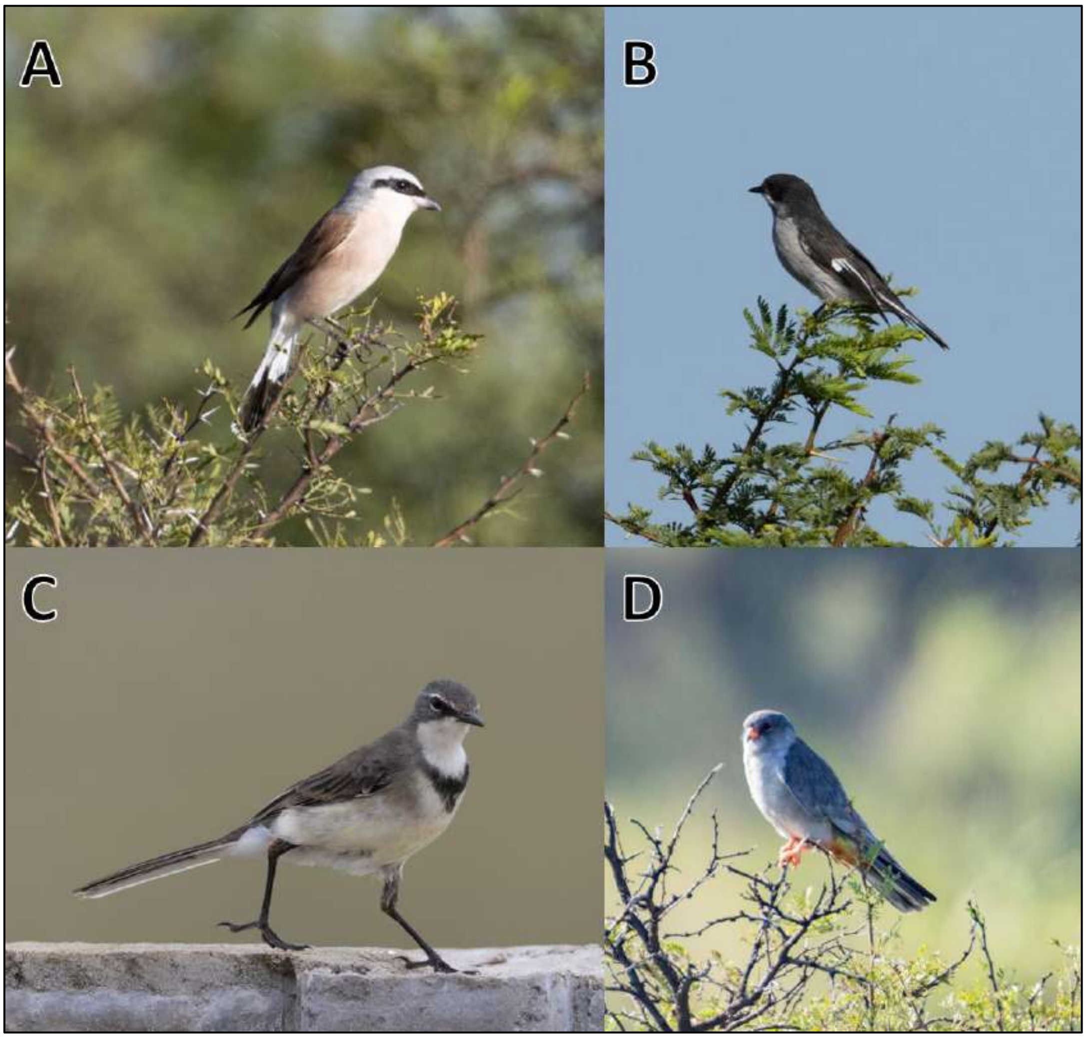


Figure 5-11 Some of the species recorded in the PAOI; A) Red-backed Shrike, B) Fiscal Flycatcher, C) Cape Wagtail, and D) Amur Falcon

5.2.4 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 insectivorous birds that feed on the ground during the day (IGD). Followed by Granivores (GGD) and Omnivores (OMD) (Figure 5-12).

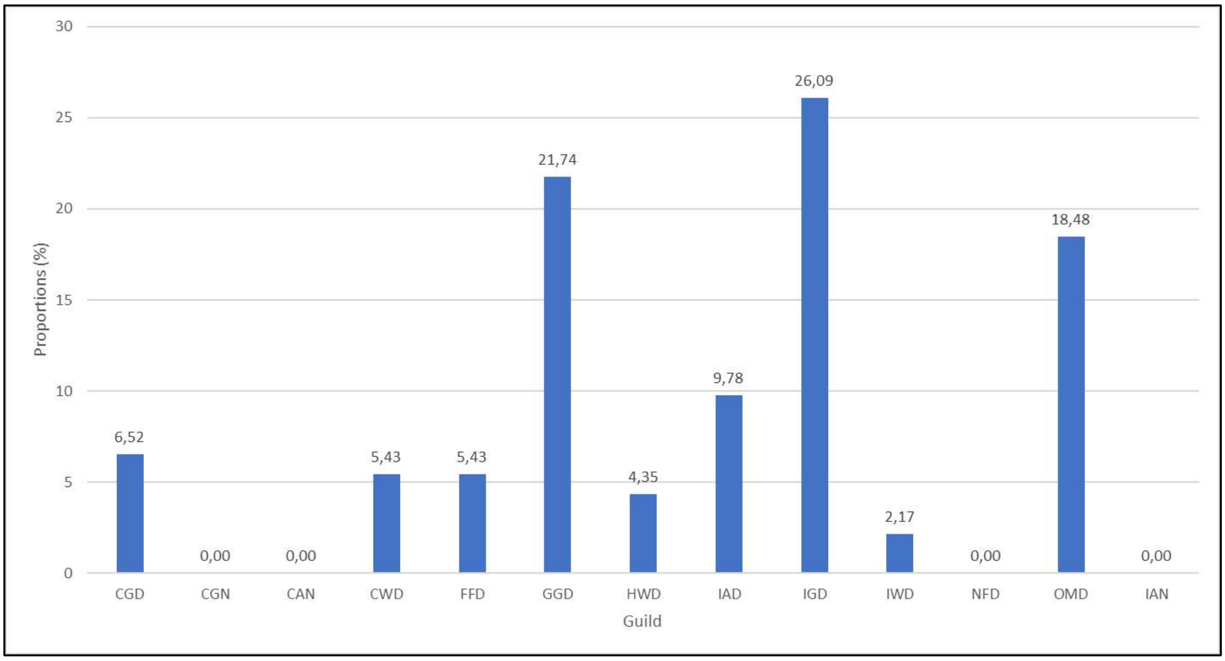


Figure 5-12 Column plot illustrating the proportion of each Functional Feeding Guild to the total abundance (Avifaunal trophic guilds. CGD, carnivore ground diurnal; CGN, carnivore ground nocturnal, CAN, carnivore air nocturnal, CWD, carnivore water diurnal; FFD, frugivore foliage diurnal; GGD, granivore ground diurnal; HWD, herbivore water diurnal; IAD, insectivore air diurnal; IGD, insectivore ground diurnal; IWD, insectivore water diurnal; NFD, nectivore foliage diurnal; OMD, omnivore multiple diurnal; IAN, Insectivore air nocturnal).

5.3 Nests

Nests of seven species were observed of which five are priority species (Figure 5-13 and Figure 5-14). A 100 m buffer was placed around the priority species nests. If the nests are in the development footprint then these nests must be regarded as no go buffers for the duration of the breeding season (January-April), if the nests can be found just outside of the development areas then these nests and their buffers must be treated as long term (for the duration of the development) no go areas.

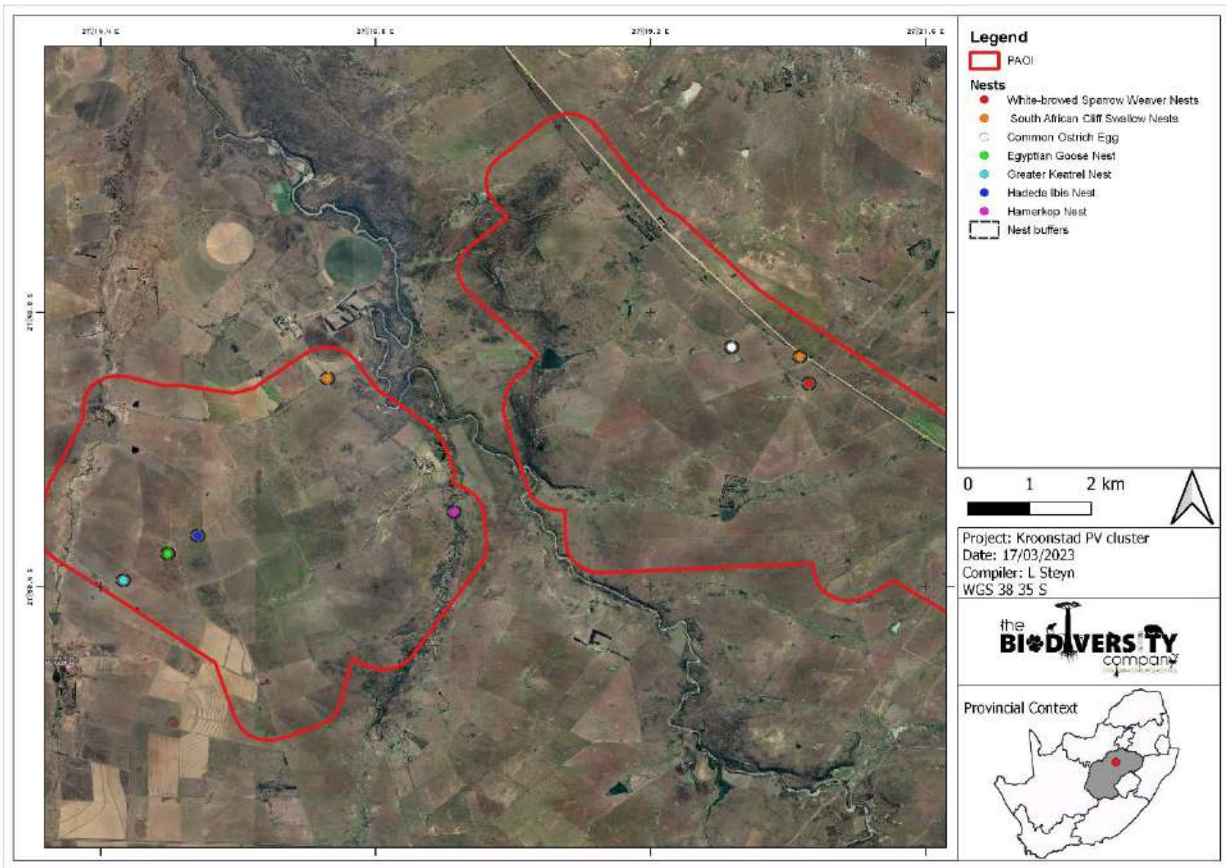


Figure 5-13 ***Locations of the nests in the PAOI***

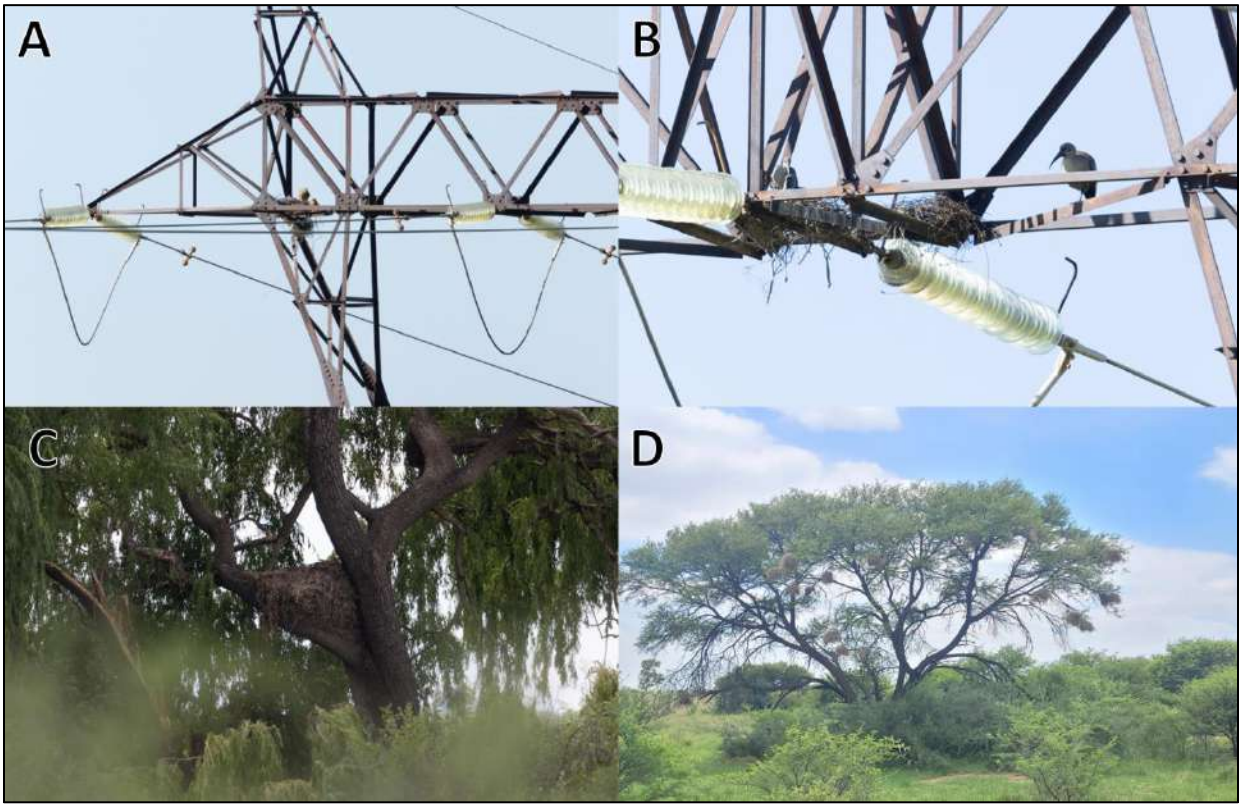


Figure 5-14 ***Photos of some of the nests found, A) Greater Kestrel nest, B) Hadeda Ibis nest, C) Hamerkop nest and D) White-browed Sparrow Weaver nests***

6 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. During the field assessment three habitat units were identified from an avifauna perspective. They were Transformed-Degraded Grassland, Grassland and Water Resource. The delineations of these habitats are shown in Figure 6-4.

Grassland

The majority of the PAOI comprised of grassland which is typically characterised by open grassland areas with scattered medium to large tree/shrubs clustered together. Some portions of this habitat consist of old agricultural fields that have recovered, the avifauna species compositions in these areas were the same resulting in the grouping of these habitats (Figure 6-1). Avifauna species found here included Ant-eating Chats, Northern Black Korhaan, and Zitting Cisticola.

Figure 6-1 Photograph illustrating the grassland habitat associated with the PAOI

Degraded- Transformed Grassland

This habitat is areas associated with housing, agriculture, some main roads where the edge of the road has been degraded, and areas where overgrazing has taken place (Figure 6-2). Some portions of this habitat type is still semi natural while others have been completely transformed. Avifauna species that were found here included Pied Crow, Cape Turtle Dove and Helmeted Guineafowl.

Figure 6-2 Photograph illustrating the degraded-transformed grassland habitat associated with the PAOI

<u>Water resource</u>

The water resources found in the PAOI consisted of wetlands, rivers, farm dams and pans. The habitat adjacent to these features were incorporated into this habitat classification as the avifauna species compositions here differed from that of the adjacent grasslands (Figure 6-4). Avifauna species found here included Yellow-billed Ducks, White-faced Whistling Ducks, Grey Heron and Little Grebe.

Figure 6-3 ***Photograph illustrating the water resource habitat in the nearby vicinity of the PAOI***

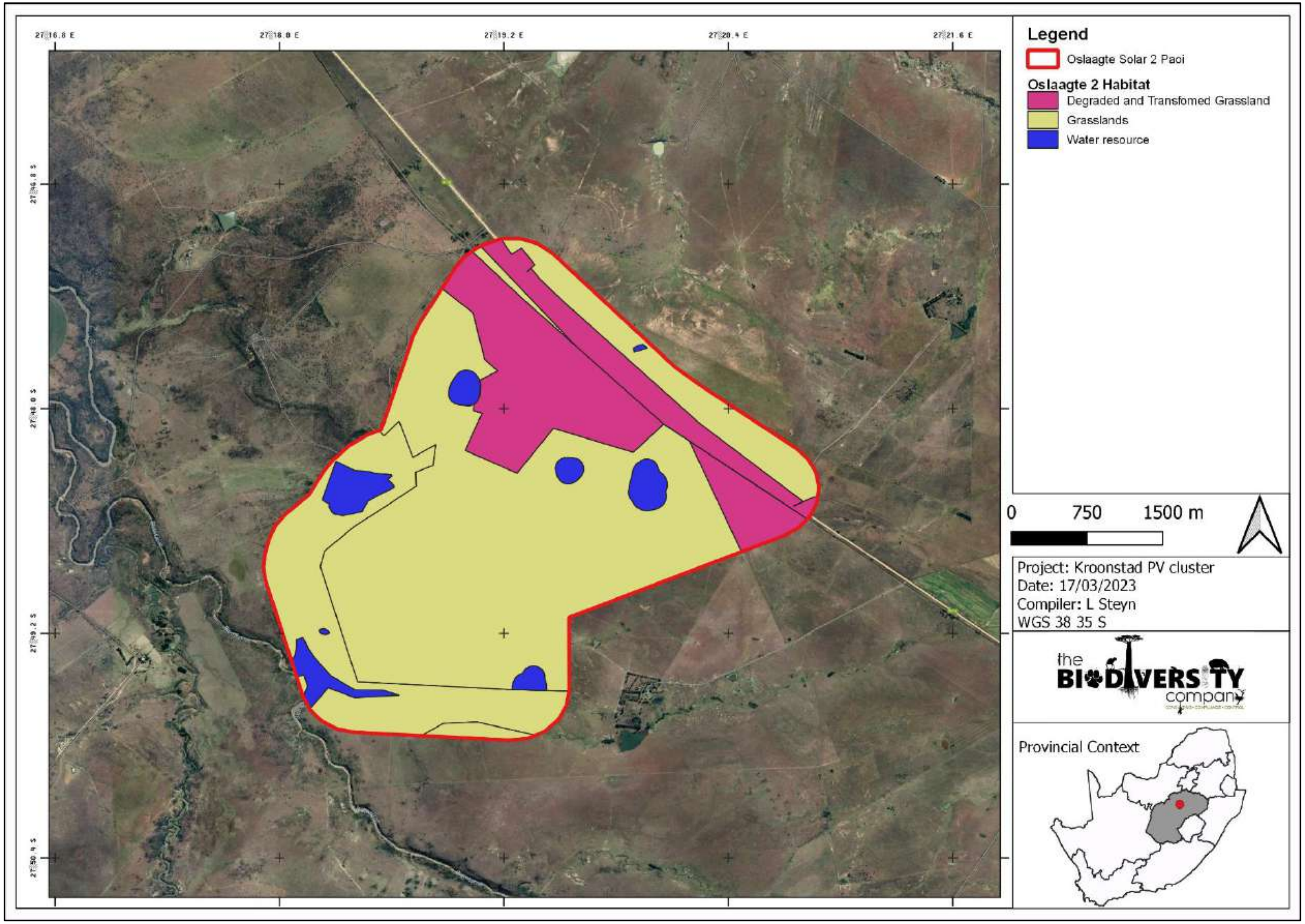
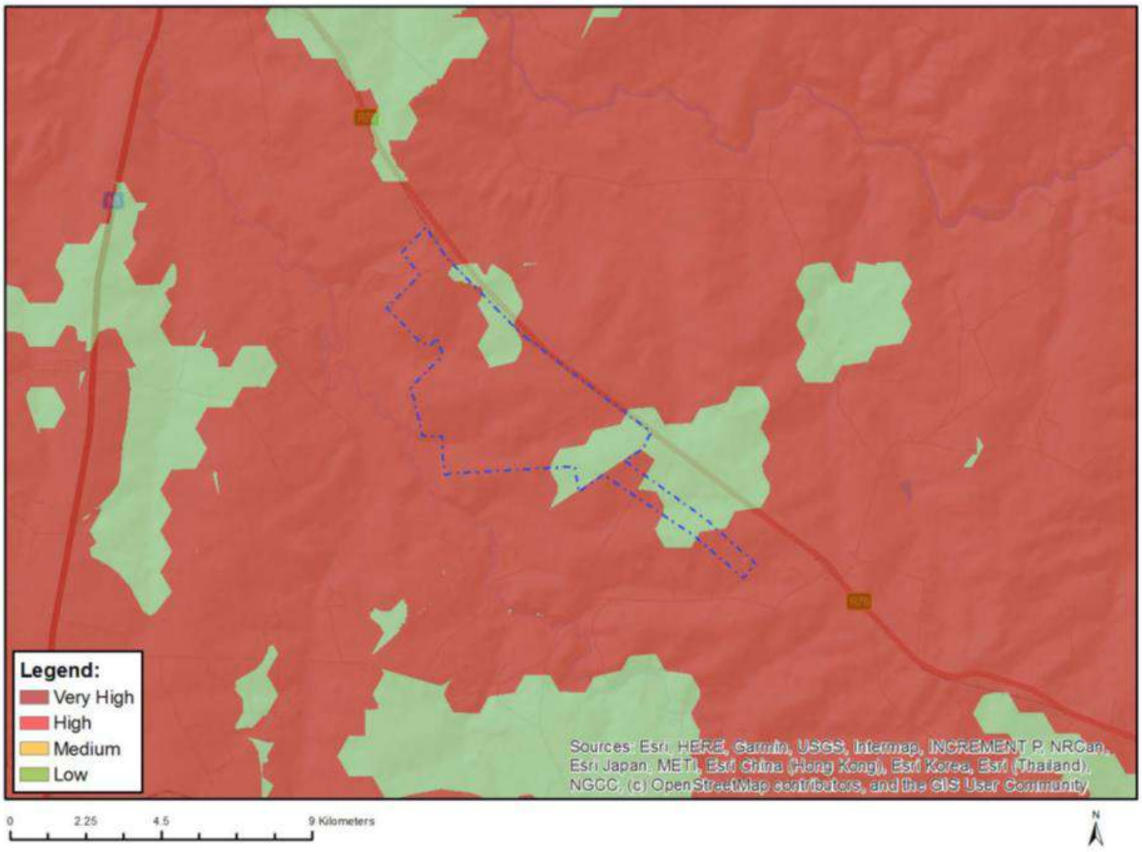


Figure 6-4 ***Map illustrating the habitat types delineated within the proposed PAOI***

7 Site Ecological Importance (SEI)

7.1 Environmental Screening Tool

The terrestrial biodiversity theme sensitivity as indicated by the screening tool report for the PAOI was derived to be 'Very High' (Figure 7-1). The classification is due to the CBA1, CBA2, ESA1, ESA2, NPAES, EN ecosystem and protected area status of the PAOI.



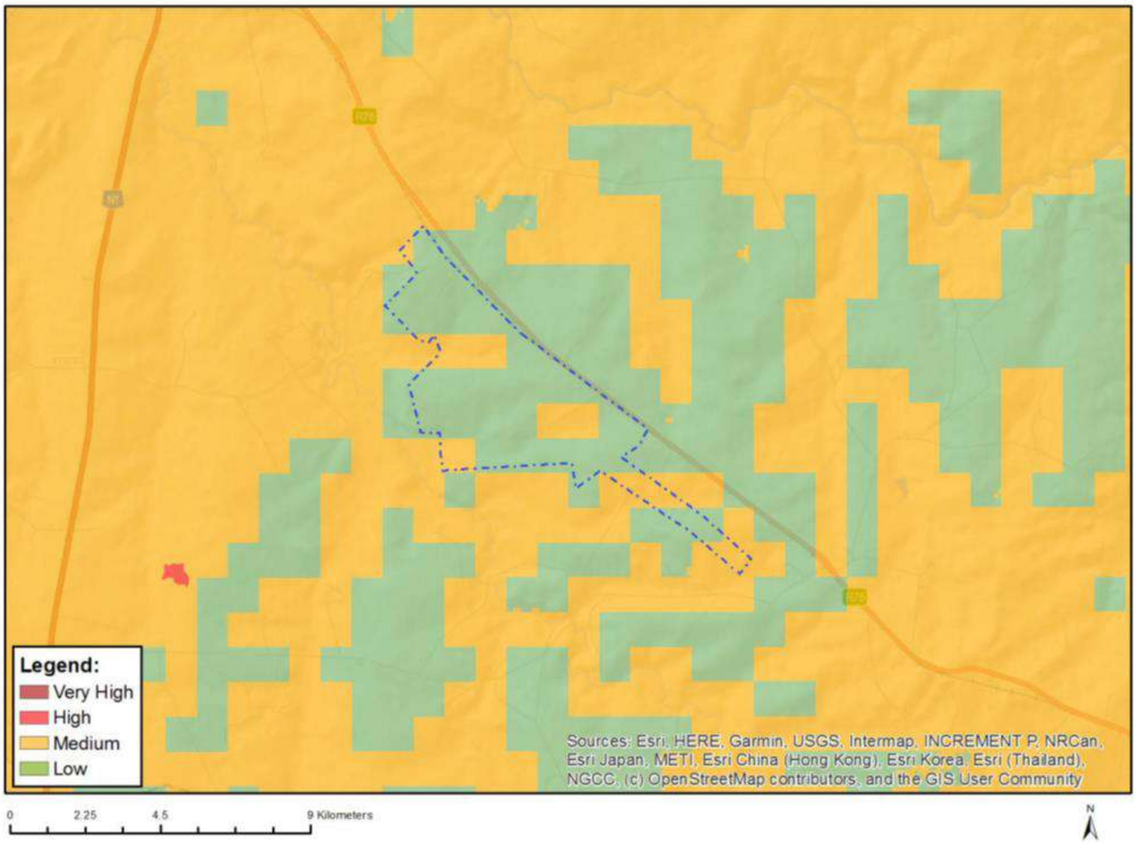
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Very High	Ecological support area 1
Very High	Ecological support area 2
Very High	Protected Areas Expansion Strategy
Very High	Serendipidie Private Nature Reserve

Figure 7-1 Terrestrial Biodiversity Theme Sensitivity, National Web based Environmental Screening Tool

The Animal Species Theme sensitivity, as indicated in the screening report, was derived to be 'Medium' (Figure 7-2). The medium sensitivity was due to the likely presence of mammal and herpetofauna species.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Subject to confirmation
Medium	Mammalia-Hydrictis maculicollis
Medium	Sensitive species 15

Figure 7-2 Fauna Theme Sensitivity, National Web based Environmental Screening Tool

7.2 Site Ecological Importance (SEI)

Based on the criteria provided in Section 3.1.5 of this report, all habitats within the assessment area of the proposed project were allocated a sensitivity or SEI category (Table 7-1).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 are illustrated in Figure 7-3. The water resources are where the Black-winged Pratincoles were observed, while in the grasslands the Secretarybird and Blue Korhaan were found. All the habitats also have a further potential to support additional SCCs.

Table 7-1 SEI Summary of habitat types delineated within field assessment area of PAOI

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Grassland	High Confirmed or highly likely occurrence of CR, EN, VU species. Presence of Rare species	Medium Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity	**Medium**	Medium Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality	**Medium**
Transformed- Degraded Grassland	Low No confirmed or highly likely populations of SCC.	Low Almost no habitat connectivity but migrations still possible	**Low**	High Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition	**Very Low**
Water resources	. High Confirmed or highly likely occurrence of CR, EN, VU species. Presence of Rare species	Medium Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity	**Medium**	Low Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality	**High**

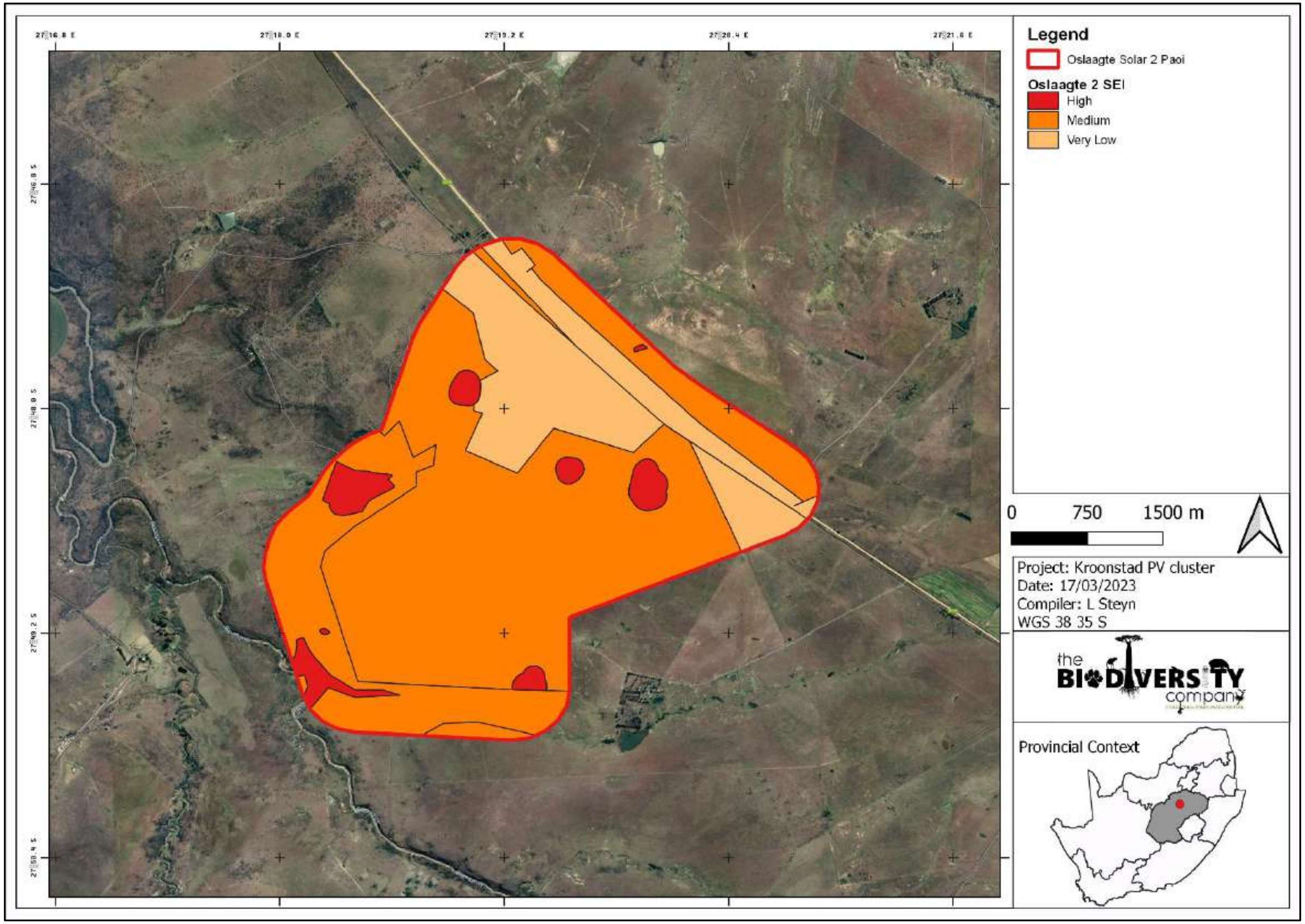


Figure 7-3 ***Map illustrating the Site Ecological Importance of the proposed PAOI within an avifauna context***

Interpretation of the SEI in the context of the proposed project is provided in Table 7-2.

Table 7-2 Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities

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

7.2.1 Site Sensitivity Verification

The allocated sensitivities for each of the relevant themes are either disputed or validated for the overall Project Area in Table 7-3 below. A summative explanation for each result is provided as relevant. The specialist-assigned sensitivity ratings are based largely on the SEI process followed in the previous section, and consideration is given to any observed or likely presence of SCC or protected species.

Table 7-3 Summary of the screening tool vs. specialist assigned sensitivities

Screening Tool Theme	Screening Tool	Specialist	Tool Validated or Disputed by Specialist - Reasoning
Animal Theme	Medium	Medium	Validated – Three SCC were recorded, nests of these species were however not found they therefore utilize the area for foraging alone

8 Impact Assessment

Potential impacts were evaluated against the data captured during the fieldwork and from a desktop perspective to identify relevance to the PAOI. The assessment of the significance of direct, indirect and cumulative impacts was undertaken. The methods used is available on request.

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.

8.1 Present Impacts to Avifauna

In consideration that there are anthropogenic activities and influences present within the landscape, there are currently several negative impacts to biodiversity, including avifauna. These include:

- Historic land modification largely in the form of road and powerline infrastructure, and the associated land clearing and edge effects;
- Livestock grazing;
- Minor and major gravel roads (and associated vehicle traffic and the possibility of wildlife road mortalities);
- Invasive Alien Plant infestations; and
- Fences and the associated infrastructure.

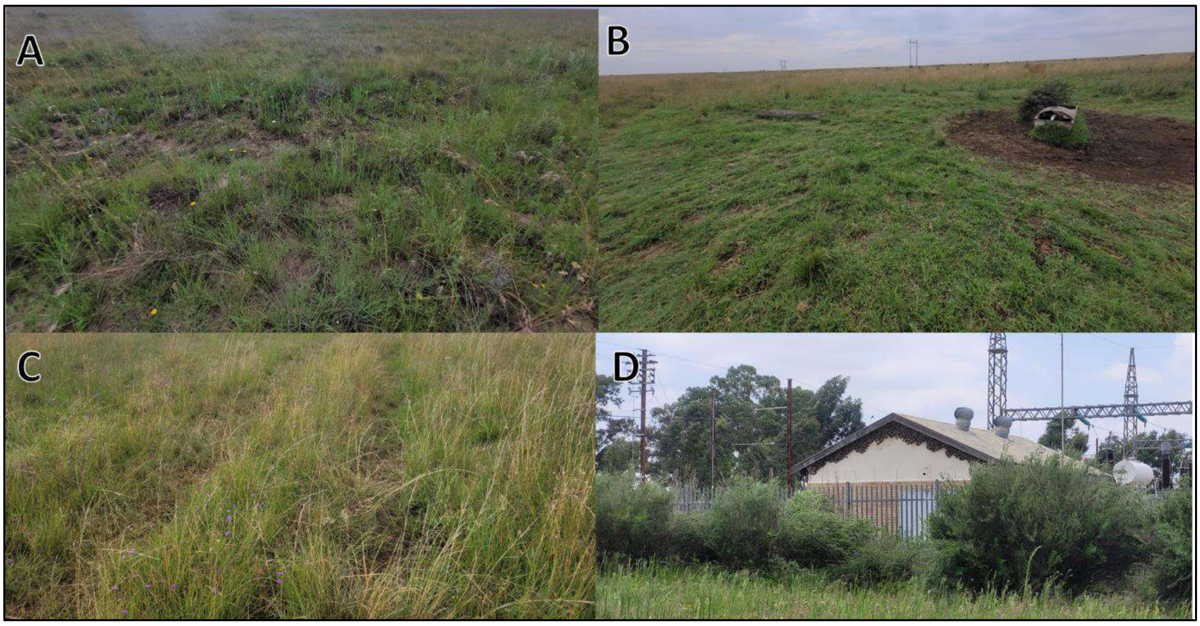


Figure 8-1 Photograph illustrating current negative impacts associated with the PAOI: A) Overgrazed habitat; B) Livestock grazing ad existing powerlines; C) Farm roads; and D) Substation and associated infrastructure.

8.2 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 power lines, 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.

8.3 Alternatives Considered

The design was changed to take into account the sensitive areas (Figure 8-2) as identified by the various studies, this is now considered below as Alternative 2.

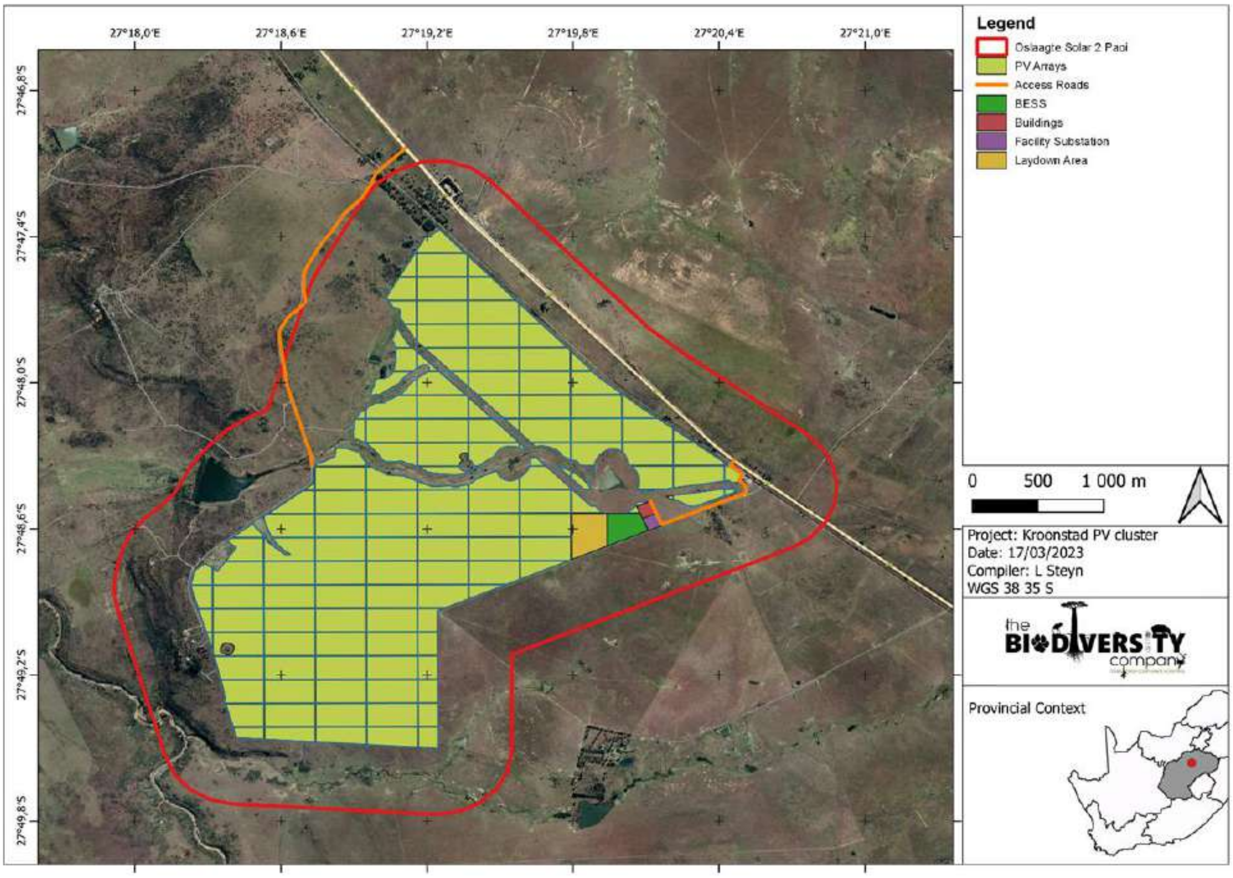


Figure 8-2 Alternative layout provided

8.4 Loss of Irreplaceable Resources

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

- Ecological Support Area; and
- Habitat and possible nesting sites for avifauna SCC.

8.5 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. Except for the habitat destruction, all in the impacts for the original and alternative design will be the same and were assessed simultaneously.

8.5.1 Construction Phase

8.5.1.1 Habitat destruction within the project footprint

Habitat destruction of the proposed development is inevitable. For the original design pre-mitigation the significance of the impact is a Negative High Impact but with the implementation of mitigation measures can be reduced to a Negative Moderately High Impact. With the alternative design, the pre-mitigation impact will be high, but the post mitigation as the sensitive areas are successfully avoided will be lowered to Moderate.

Prior to mitigation (Original design)					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
5	3	4	4	5	
Permanent	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Definite	**High**
Post mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
4	2	4	4	4	
Life of operation or less than 20 years: Long Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Highly likely	**Moderately High**

Prior to mitigation (Alternative Design)					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
5	3	4	4	5	
Permanent	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Definite	**High**
Post mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
4	2	4	3	4	
Life of operation or less than 20 years: Long Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Great / harmful/ ecosystem structure and function largely altered	Significant / ecosystem structure and function moderately altered	Highly likely	**Moderate**

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

8.5.1.2 Destruction, degradation and fragmentation of surrounding habitats

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

Prior to mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
4	3	3	4	4	
Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Highly likely	**Moderately High**
Post mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance

3	2	2	2	3	
One year to five years: Medium Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Likely	**Low**

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 should 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;
- Cement mixed on site must be mixed in a bunded area or on a removable surface such as thick plastic sheeting at least 50 m away from any wetlands or water resources; and
- 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.

8.5.1.3 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. Pre-mitigation this impact has a Negative Moderately High significance, but with the implementation of mitigation measures the significance can be reduced to a Negative Low impact.

Prior to mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
4	3	3	4	4	
Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Highly likely	**Moderately High**
Post mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
3	2	2	2	3	
One year to five years: Medium Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Likely	**Low**

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.

8.5.1.4 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 Moderately High Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Prior to mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
4	3	3	4	4	
Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Highly likely	**Moderately High**
Post mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
2	2	2	4	3	
One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology highly sensitive /important	Likely	**Low**

Mitigation Actions:

- All personnel should 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.

8.5.1.5 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 Moderately High Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Prior to mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
4	3	4	4	4	
Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Highly likely	**Moderately High**
Post mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
2	2	2	2	1	
One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Highly unlikely	**Absent**

Mitigation Actions:

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

8.5.2 Operational Phase

8.5.2.1 Collisions with infrastructure associated with the PV Facility and powerlines

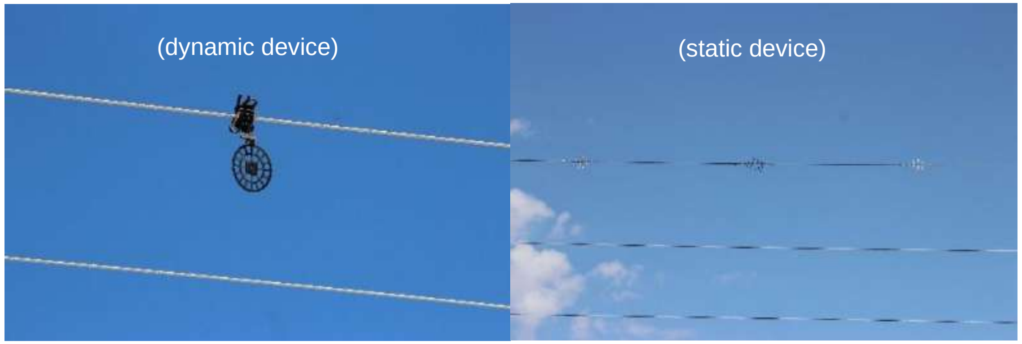
The proposed project comprises of components that pose a collision risk to avifauna species. This includes collisions with PV panels, connection infrastructure, powerlines and fences. This impact was determined to have a Negative High significance but can be reduced to a Negative Moderate significance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

Prior to mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
5	4	4	4	4	
Permanent	Regional within 5 km of the site boundary / < 2000ha impacted / Linear features affected < 3000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Highly likely	**High**
Post mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
4	3	3	4	4	

Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Highly likely	**Moderately High**

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 must be minimised by burying them;
- Overhead cables/lines across water resource areas must be fitted with industry standard bird flight diverters in order to make the lines as visible as possible to collision-susceptible species. Shaw et al (2021) demonstrated that large avifauna species mortality was reduced by 51% (95% CI: 23–68%). Recommended bird diverters such as flapping devices (dynamic device) and thickened wire spirals (static device) that increase the visibility of the lines should be fitted 5 m apart. The Inotec BFD88 bird diverter is highly recommended due to its visibility under low light conditions when most species move from roosting to feeding sites;



Inotec BFD800 (source: https://migratorysoaringbirds.birdlife.org/)

- 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.

8.5.2.2 Electrocution due to infrastructure associated with the PV Facility

This impact was determined to have a Negative Moderately High significance but can be reduced to a Negative Moderate significance with the implementation of appropriate mitigation measures.

Prior to mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
4	3	3	4	4	
Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Highly likely	**Moderately High**

Post mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
4	3	3	4	2	
Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Possible	**Moderate**

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).

8.5.2.3 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 Moderate Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Prior to mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance

4	3	3	4	3	
Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Likely	**Moderate**
Post mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
3	2	2	2	2	
One year to five years: Medium Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Possible	**Low**

Mitigation Actions:

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

8.5.2.4 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 Moderate Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Prior to mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
4	3	3	4	3	
Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Likely	**Moderate**
Post mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
2	2	2	2	3	
One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Likely	**Low**

Mitigation Actions:

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

8.5.2.5 Heat radiation from the BESS and PV panels

Heat radiation from 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 Moderate Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Prior to mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
4	3	3	4	3	
Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Likely	**Moderate**
Post mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
2	2	2	2	3	
One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Likely	**Low**

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.

8.5.2.6 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 Moderate significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Prior to mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
4	3	3	4	3	
Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Likely	**Moderate**
Post mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
2	2	2	2	3	
			Ecology with limited sensitivity/importance	Likely	**Low**

One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged			

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.

8.5.3 Decommissioning Phase

8.5.3.1 Direct mortality due to earthworks, vehicle collisions and persecution

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

Prior to mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
4	3	3	4	3	
Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Likely	**Moderate**
Post mitigation					

Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
2	2	3	4	3	
One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Likely	**Low**

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 should be removed safely by an appropriately qualified environmental officer or removal specialist;
- All construction vehicles should 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, this includes the powerlines; and
- The PAOI must be rehabilitated, and a management plan must be in place to ensure that it is done successfully.

8.5.3.2 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. Pre-mitigation this impact has a Negative Moderately-High significance, but with the implementation of mitigation measures the significance can be reduced to a Negative Low impact.

Prior to mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
4	3	3	4	4	
Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Highly likely	**Moderately High**
Post mitigation					
Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
2	2	2	4	3	
One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology highly sensitive /important	Likely	**Low**

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 should 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.

8.6 Unplanned Events

The planned activities will have anticipated impacts as discussed above; however, unplanned events may occur on any project, and these could lead to potential impacts which will require appropriate management.

Table 8-1 is a summary of the findings of an unplanned event assessment conducted from an avifaunal 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 8-1 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.

8.7 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.

A total area of 30 km surrounding the PAOI were used to assess the total habitat loss in the area and subsequently the cumulative impact. To determine the intact remnant habitat the NBA (2018) remnant spatial data was utilised. The future renewable energy projects were also considered by utilising the REEA Q4 (2022) spatial dataset. In order to remove any duplication, only the areas that overlap with the remanence areas were considered. The total cumulative loss was found to be 41.97% (Table 8-2), a visual representation of this is shown in Figure 8-3.

Table 8-2 The cumulative impacts considered for avifauna

Total Area of 30 km^2	Intact Remnant Habitat	REEA area that does not overlap with disturbed areas	Total Disturbed/Transformed habitat	Percentage area lost
415292.42 Ha	239001.68 Ha	1970.48 Ha	174320 Ha	41.97%

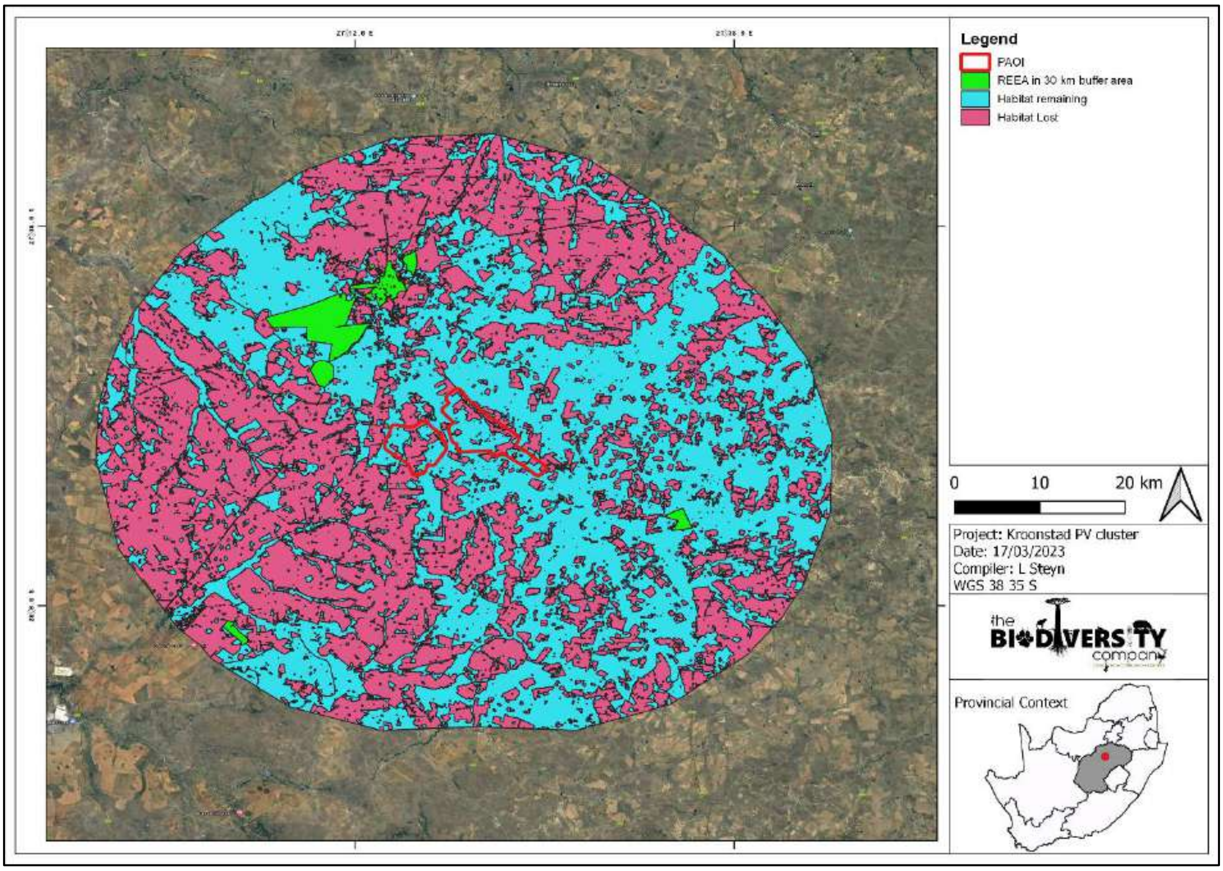


Figure 8-3 Map illustrating the additional renewable energy developments within the landscape overlaid onto the remnant vegetation types

The proposed Solar PV facility in isolation has a Negative Low impact significance (Table 8-3). In consideration of the aforementioned information, the cumulative impact was determined to be of a Negative Medium significance (Table 8-4).

Table 8-3 Cumulative Impacts to avifauna associated with the proposed project – Project in Isolation

Impact	Project in Isolation							
	Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
Loss of habitat	1	4	2	2	3	2	2	
	Site: The impact will only affect the site.	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.	Significant loss of resources: The impact will result in significant 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**

Table 8-4 Cumulative Impacts to avifauna associated with the proposed project – Cumulative Effect

Impact	Cumulative Effect							
	Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
Loss of habitat, and disruption of surrounding ecological corridors.	3	4	3	3	3	4	2	
	Province/region: Will affect the entire province or region.	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).	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.	High cumulative impact: The impact would result in significant 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**

9 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 9-1 presents the recommended mitigation measures and the respective timeframes, targets, and performance indicators pertaining to the avifaunal component.

Table 9-1 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
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 area must be re-vegetated with plant and grass species which are indigenous to this vegetation type.	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 likelihood of encroachment by alien invasive plant species. Topsoil must also be utilised, and any disturbed	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.	
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
Cement mixed on site must be mixed in a bunded area or on a removable surface such as thick plastic sheeting at least 50 m away from any wetlands or water resources	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 PAOI 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 must 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
Outside lighting must be designed and limited to minimize impacts on fauna. All outside lighting should be directed away from highly sensitive areas. Fluorescent and mercury vapor	Construction/Operational Phase	Project Manager Environmental Officer Design Engineer	Light pollution and period of light.	Ongoing

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
lighting should be avoided, and sodium vapor (red/green) 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 limit (20 km/h), to respect all forms of wildlife. Speed limits must 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
Powerlines must be fitted with bird diverters in the high sensitivity areas	Planning and Construction	Project Manager Environmental Officer Contractor Engineer	Presence of electrocuted birds or bird strikes	During Phase
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 must 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
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
Fencing mitigations: • Top 2 strands must be smooth wire; • Routinely retention loose wires; • Minimum 300 mm between wires; and	Life of Operation	Project Manager Environmental Officer Contractor Design Engineer	Presence of birds stuck /dead in fences Monitor fences for slack wires	During phase

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
• Place markers on fences.				
As far as possible power cables within the PAOI 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 can 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) and body parts should also be collected.	During phase. The monitoring frequency is based on the collision rate.
All infrastructure, must be removed if the facility is decommissioned.	Closure/Rehabilitation	Project Manager Environmental Officer	Infrastructure removal	During Process

10 Monitoring

Nest monitoring must be performed for two years post development to determine the effect the development is having on these priority species outside of the direct footprint.

11 Conclusion and Impact Statement

11.1 Conclusion

The aim of this Avifauna Impact Assessment was to provide information to guide the risk of the proposed Solar PV facility to the avifauna community likely affected by its development.

During the assessment three SCCs were observed, the Blue Korhaan (*Eupodotis caerulescens*; LC (Regional), NT (Global)) ; Secretarybird (*Sagittarius serpentarius;* VU, EN) and Black-winged Pratincole (*Glareola nordmanni;* NT, NT). The Black-winged Pratincoles were observed on three occasions and a total of 150 birds were recorded. Two Blue Korhaans and two Secretarybirds were observed. Fifteen and eighteen priority species respectively were recorded in the first and second survey. These species are at risk of either habitat loss, collisions or electrocutions. If the mitigations and recommendations are implemented these risks can be reduced to moderate. Nests of seven species were observed of which five are priority species. A 100 m buffer were placed around the priority species nests. If the nests are in the development footprint then these nests must be regarded as no go buffers for the duration of the breeding season (January- April), if the nests can be found just outside of the development areas then these nests and their buffers must be treated as long term (for the lifetime of the development) no go areas. Three habitats were delineated in the assessment namely, Grassland, Degraded-transformed grassland and Water Resources. All these habitats support a number of avifauna species with the grasslands being the most species rich. The Water Resources were given a high SEI rating based on the SCCs that are dependent on this habitat for both water and habitation. The overall impact of the project is regarded as acceptable should the mitigations and recommendations be implemented. The alternative design is the preferred layout.

11.2 Impact Statement

The main expected impacts of the proposed PV facility 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, monitoring and recommendations provided in this report and other specialist reports are implemented.

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13 Appendix Items

13.1 Appendix A: Summary of Expected species

Common Name	Scientific Name	RD (Regional, Global)
Abdim's Stork	*Ciconia abdimii*	NT, LC
Acacia Pied Barbet	*Tricholaema leucomelas*	
African Black Duck	*Anas sparsa*	
African Black Swift	*Apus barbatus*	
African Darter	*Anhinga rufa*	
African Fish Eagle	*Haliaeetus vocifer*	
African Harrier-Hawk	*Polyboroides typus*	
African Hoopoe	*Upupa africana*	
African Openbill	*Anastomus lamelligerus*	
African Palm Swift	*Cypsiurus parvus*	
African Paradise Flycatcher	*Terpsiphone viridis*	
African Pipit	*Anthus cinnamomeus*	
African Quail-finch	*Ortygospiza atricollis*	
African Red-eyed Bulbul	*Pycnonotus nigricans*	
African Reed Warbler	*Acrocephalus baeticatus*	
African Rock Pipit	*Anthus crenatus*	NT, LC
African Sacred Ibis	*Threskiornis aethiopicus*	
African Snipe	*Gallinago nigripennis*	
African Spoonbill	*Platalea alba*	
African Stonechat	*Saxicola torquatus*	
African Wattled Lapwing	*Vanellus senegallus*	
Alpine Swift	*Tachymarptis melba*	
Amethyst Sunbird	*Chalcomitra amethystina*	
Amur Falcon	*Falco amurensis*	
Ant-eating Chat	*Myrmecocichla formicivora*	
Ashy Tit	*Melaniparus cinerascens*	
Banded Martin	*Riparia cincta*	
Barn Swallow	*Hirundo rustica*	
Barred Wren-Warbler	*Calamonastes fasciolatus*	
Black Crake	*Zapornia flavirostra*	
Black Cuckoo	*Cuculus clamosus*	
Black Harrier	*Circus maurus*	EN, EN
Black Sparrowhawk	*Accipiter melanoleucus*	
Black-chested Prinia	*Prinia flavicans*	
Black-chested Snake Eagle	*Circaetus pectoralis*	
Black-collared Barbet	*Lybius torquatus*	

Black-crowned Night Heron	*Nycticorax nycticorax*	
Black-faced Waxbill	*Brunhilda erythronotos*	
Black-headed Heron	*Ardea melanocephala*	
Black-necked Grebe	*Podiceps nigricollis*	
Blacksmith Lapwing	*Vanellus armatus*	
Black-throated Canary	*Crithagra atrogularis*	
Black-winged Kite	*Elanus caeruleus*	
Black-winged Pratincole	*Glareola nordmanni*	NT, NT
Black-winged Stilt	*Himantopus himantopus*	
Blue Korhaan	*Eupodotis caerulescens*	LC, NT
Blue Waxbill	*Uraeginthus angolensis*	
Bokmakierie	*Telophorus zeylonus*	
Booted Eagle	*Hieraaetus pennatus*	
Bronze-winged Courser	*Rhinoptilus chalcopterus*	
Brown Snake Eagle	*Circaetus cinereus*	
Brown-crowned Tchagra	*Tchagra australis*	
Brown-hooded Kingfisher	*Halcyon albiventris*	
Brown-throated Martin	*Riparia paludicola*	
Brubru	*Nilaus afer*	
Buffy Pipit	*Anthus vaalensis*	
Burchell's Coucal	*Centropus burchellii*	
Cape Bunting	*Emberiza capensis*	
Cape Canary	*Serinus canicollis*	
Cape Glossy (Cape) Starling	*Lamprotornis nitens*	
Cape Longclaw	*Macronyx capensis*	
Cape Penduline-tit	*Anthoscopus minutus*	
Cape Robin-chat	*Cossypha caffra*	
Cape Shoveler	*Spatula smithii*	
Cape Sparrow	*Passer melanurus*	
Cape Teal	*Anas capensis*	
Cape Turtle (Ring-necked) Dove	*Streptopelia capicola*	
Cape Wagtail	*Motacilla capensis*	
Cape Weaver	*Ploceus capensis*	
Cape White-eye	*Zosterops virens*	
Capped Wheatear	*Oenanthe pileata*	
Cardinal Woodpecker	*Dendropicos fuscescens*	
Caspian Tern	*Hydropogne caspia*	VU, LC
Chestnut-backed Sparrow-lark	*Eremopterix leucotis*	
Chestnut-vented Tit-Babbler (Warbler)	*Curruca subcoerulea*	

Cinnamon-breasted Bunting	*Emberiza tahapisi*	
Cloud Cisticola	*Cisticola textrix*	
Common (Kurrichane) Buttonquail	*Turnix sylvaticus*	
Common (Steppe) Buzzard	*Buteo buteo*	
Common Cuckoo	*Cuculus canorus*	
Common Greenshank	*Tringa nebularia*	
Common House Martin	*Delichon urbicum*	
Common Moorhen	*Gallinula chloropus*	
Common Myna	*Acridotheres tristis*	
Common Ostrich	*Struthio camelus*	
Common Quail	*Coturnix coturnix*	
Common Ringed Plover	*Charadrius hiaticula*	
Common Sandpiper	*Actitis hypoleucos*	
Common Scimitarbill	*Rhinopomastus cyanomelas*	
Common Starling	*Sturnus vulgaris*	
Common Swift	*Apus apus*	
Common Waxbill	*Estrilda astrild*	
Common Whitethroat	*Curruca communis*	
Crested Barbet	*Trachyphonus vaillantii*	
Crimson-breasted Shrike	*Laniarius atrococcineus*	
Crowned Lapwing	*Vanellus coronatus*	
Curlew Sandpiper	*Calidris ferruginea*	LC, NT
Desert Cisticola	*Cisticola aridulus*	
Diederik Cuckoo	*Chrysococcyx caprius*	
Double-banded Courser	*Rhinoptilus africanus*	
Dwarf Bittern	*Ixobrychus sturmii*	
Eastern Clapper Lark	*Mirafra fasciolata*	
Eastern Long-billed Lark	*Certhilauda semitorquata*	
Egyptian Goose	*Alopochen aegyptiaca*	
Eurasian Golden Oriole	*Oriolus oriolus*	
European Bee-eater	*Merops apiaster*	
European Honey Buzzard	*Pernis apivorus*	
European Roller	*Coracias garrulus*	NT, LC
Fairy Flycatcher	*Stenostira scita*	
Familiar Chat	*Oenanthe familiaris*	
Fiscal Flycatcher	*Melaenornis silens*	
Fork-tailed Drongo	*Dicrurus adsimilis*	
Fulvous Whistling Duck	*Dendrocygna bicolor*	
Gabar Goshawk	*Micronisus gabar*	

Garden Warbler	*Sylvia borin*	
Giant Kingfisher	*Megaceryle maxima*	
Glossy Ibis	*Plegadis falcinellus*	
Golden-breasted Bunting	*Emberiza flaviventris*	
Goliath Heron	*Ardea goliath*	
Great Crested Grebe	*Podiceps cristatus*	
Great Egret	*Ardea alba*	
Great Reed Warbler	*Acrocephalus arundinaceus*	
Greater Flamingo	*Phoenicopterus roseus*	NT, LC
Greater Honeyguide	*Indicator indicator*	
Greater Kestrel	*Falco rupicoloides*	
Greater Striped Swallow	*Cecropis cucullata*	
Green Wood-hoopoe	*Phoeniculus purpureus*	
Green-winged Pytilia	*Pytilia melba*	
Grey Heron	*Ardea cinerea*	
Grey-headed Gull	*Chroicocephalus cirrocephalus*	
Hadeda (Hadada) Ibis	*Bostrychia hagedash*	
Hamerkop	*Scopus umbretta*	
Helmeted Guineafowl	*Numida meleagris*	
Horus Swift	*Apus horus*	
House Sparrow	*Passer domesticus*	
Icterine Warbler	*Hippolais icterina*	
Jackal Buzzard	*Buteo rufofuscus*	
Jacobin Cuckoo	*Clamator jacobinus*	
Jameson's Firefinch	*Lagonosticta rhodopareia*	
Kalahari Scrub Robin	*Cercotrichas paena*	
Karoo Prinia	*Prinia maculosa*	
Karoo Scrub Robin	*Cercotrichas coryphoeus*	
Karoo Thrush	*Turdus smithi*	
Kittlitz’s Plover	*Charadrius pecuarius*	
Klaas's Cuckoo	*Chrysococcyx klaas*	
Knob-billed Duck	*Sarkidiornis melanotos*	
Lanner Falcon	*Falco biarmicus*	VU, LC
Lark-like Bunting	*Emberiza impetuani*	
Laughing Dove	*Spilopelia senegalensis*	
Lesser Black-backed Gull	*Larus fuscus*	
Lesser Flamingo	*Phoeniconaias minor*	NT, NT
Lesser Grey Shrike	*Lanius minor*	
Lesser Honeyguide	*Indicator minor*	

Lesser Kestrel	*Falco naumanni*	
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	
Levaillant's Cisticola	*Cisticola tinniens*	
Lilac-breasted Roller	*Coracias caudatus*	
Little Bee-eater	*Merops pusillus*	
Little Egret	*Egretta garzetta*	
Little Grebe	*Tachybaptus ruficollis*	
Little Stint	*Calidris minuta*	
Little Swift	*Apus affinis*	
Long-billed crombec	*Sylvietta rufescens*	
Long-tailed Paradise Whydah	*Vidua paradisaea*	
Long-tailed Widowbird	*Euplectes progne*	
Maccoa Duck	*Oxyura maccoa*	NT, EN
Magpie Shrike	*Urolestes melanoleucus*	
Malachite Kingfisher	*Corythornis cristatus*	
Malachite Sunbird	*Nectarinia famosa*	
Marsh Owl	*Asio capensis*	
Marsh Sandpiper	*Tringa stagnatilis*	
Marsh Warbler	*Acrocephalus palustris*	
Martial Eagle	*Polemaetus bellicosus*	EN, EN
Melodious Lark	*Mirafra cheniana*	
Mocking Cliff Chat	*Thamnolaea cinnamomeiventris*	
Mountain Wheatear	*Myrmecocichla monticola*	
Namaqua Dove	*Oena capensis*	
Namaqua Sandgrouse	*Pterocles namaqua*	
Natal Spurfowl	*Pternistis natalensis*	
Neddicky	*Cisticola fulvicapilla*	
Nicholson's Pipit	*Anthus nicholsoni*	
Northern Black Korhaan	*Afrotis afraoides*	
Orange River Francolin	*Scleroptila gutturalis*	
Orange River White-eye	*Zosterops pallidus*	
Pale Chanting Goshawk	*Melierax canorus*	
Pearl-breasted Swallow	*Hirundo dimidiata*	
Pied Avocet	*Recurvirostra avosetta*	
Pied Crow	*Corvus albus*	
Pied Kingfisher	*Ceryle rudis*	
Pied Starling	*Lamprotornis bicolor*	
Pink-billed Lark	*Spizocorys conirostris*	
Pin-tailed Whydah	*Vidua macroura*	

Plain-backed Pipit	*Anthus leucophrys*	
Pririt Batis	*Batis pririt*	
Purple Heron	*Ardea purpurea*	
Rattling Cisticola	*Cisticola chiniana*	
Red-backed Shrike	*Lanius collurio*	
Red-billed Firefinch	*Lagonosticta senegala*	
Red-billed Quelea	*Quelea quelea*	
Red-billed Teal	*Anas erythrorhyncha*	
Red-breasted Swallow	*Cecropis semirufa*	
Red-capped Lark	*Calandrella cinerea*	
Red-chested Cuckoo	*Cuculus solitarius*	
Red-collared Widowbird	*Euplectes ardens*	
Red-eyed Dove	*Streptopelia semitorquata*	
Red-faced Mousebird	*Urocolius indicus*	
Red-footed Falcon	*Falco vespertinus*	NT, VU
Red-headed Finch	*Amadina erythrocephala*	
Red-knobbed coot	*Fulica cristata*	
Red-throated Wryneck	*Jynx ruficollis*	
Red-winged Starling	*Onychognathus morio*	
Reed Cormorant	*Microcarbo africanus*	
Rock Dove	*Columba livia*	
Rock Kestrel	*Falco rupicolus*	
Rock Martin	*Ptyonoprogne fuligula*	
Ruff	*Calidris pugnax*	
Rufous-cheeked Nightjar	*Caprimulgus rufigena*	
Rufous-eared Warbler	*Malcorus pectoralis*	
Rufous-naped Lark	*Mirafra africana*	
Sabota Lark	*Calendulauda sabota*	
Scaly-feathered Finch (Weaver)	*Sporopipes squamifrons*	
Secretarybird	*Sagittarius serpentarius*	VU, EN
Shaft-tailed Whydah	*Vidua regia*	
Sickle-winged Chat	*Emarginata sinuata*	
South African Cliff Swallow	*Petrochelidon spilodera*	
South African Shelduck	*Tadorna cana*	
South African Shelduck	*Tadorna cana*	
Southern (Common) Fiscal	*Lanius collaris*	
Southern Boubou	*Laniarius ferrugineus*	
Southern Grey-headed Sparrow	*Passer diffusus*	
Southern Masked Weaver	*Ploceus velatus*	

Southern Pochard	*Netta erythrophthalma*	
Southern Red Bishop	*Euplectes orix*	
Speckled Mousebird	*Colius striatus*	
Speckled Pigeon	*Columba guinea*	
Spike-heeled Lark	*Chersomanes albofasciata*	
Spotted Eagle-Owl	*Bubo africanus*	
Spotted flycatcher	*Muscicapa striata*	
Spotted Thick-knee	*Burhinus capensis*	
Spur-winged Goose	*Plectropterus gambensis*	
Squacco Heron	*Ardeola ralloides*	
Streaky-headed Seedeater	*Crithagra gularis*	
Swainson’s Spurfowl	*Pternistis swainsonii*	
Swallow-tailed Bee-eater	*Merops hirundineus*	
Three-banded Plover	*Charadrius tricollaris*	
Verreaux's Eagle	*Aquila verreauxii*	VU, LC
Village Indigobird	*Vidua chalybeata*	
Violet-backed Starling	*Cinnyricinclus leucogaster*	
Violet-eared Waxbill	*Granatina granatina*	
Wailing Cisticola	*Cisticola lais*	
Wattled Starling	*Creatophora cinerea*	
Western Barn Owl	*Tyto alba*	
Western Cattle Egret	*Bubulcus ibis*	
Western Osprey	*Pandion haliaetus*	
Whiskered Tern	*Chlidonias hybrida*	
White Stork	*Ciconia ciconia*	
White-backed Duck	*Thalassornis leuconotus*	
White-backed Mousebird	*Colius colius*	
White-bellied Sunbird	*Cinnyris talatala*	
White-breasted Cormorant	*Phalacrocorax lucidus*	
White-browed Sparrow-Weaver	*Plocepasser mahali*	
White-faced Whistling Duck	*Dendrocygna viduata*	
White-fronted Bee-eater	*Merops bullockoides*	
White-rumped Swift	*Apus caffer*	
White-throated Canary	*Crithagra albogularis*	
White-throated Swallow	*Hirundo albigularis*	
White-winged Tern	*Chlidonias leucopterus*	
White-winged Widowbird	*Euplectes albonotatus*	
Willow Warbler	*Phylloscopus trochilus*	
Wing-snapping Cisticola	*Cisticola ayresii*	

Wood Sandpiper	*Tringa glareola*	
Yellow Canary	*Crithagra flaviventris*	
Yellow-bellied Eremomela	*Eremomela icteropygialis*	
Yellow-billed (Intermediate) Egret	*Ardea intermedia*	
Yellow-billed Duck	*Anas undulata*	
Yellow-billed Kite	*Milvus aegyptius*	
Yellow-billed Stork	*Mycteria ibis*	EN, LC
Yellow-crowned Bishop	*Euplectes afer*	
Yellow-fronted Canary	*Crithagra mozambica*	
Zitting Cisticola	*Cisticola juncidis*	

13.2 Appendix A: Point count data of the first assessment

Common Name	Scientific Name	RD (Regional, Global)	Endemism in South Africa (E)	Guild code	Relative abundance	Frequency (%)
Acacia Pied Barbet	*Tricholaema leucomelas*			OMD	0,004	10,448
African Pipit	*Anthus cinnamomeus*			IGD	0,007	17,910
African Quail-finch	*Ortygospiza atricollis*			GGD	0,018	22,388
African Red-eyed Bulbul	*Pycnonotus nigricans*			OMD	0,001	1,493
African Stonechat	*Saxicola torquatus*			IGD	0,003	5,970
Ant-eating Chat	*Myrmecocichla formicivora*			IGD	0,022	26,866
Barn Swallow	*Hirundo rustica*			IAD	0,002	2,985
Black-chested Prinia	*Prinia flavicans*			IGD	0,010	23,881
Black-headed Heron	*Ardea melanocephala*			CGD	0,001	2,985
Blacksmith Lapwing	*Vanellus armatus*			IGD	0,001	1,493
Black-winged Kite	*Elanus caeruleus*			CGD	0,002	5,970
Blue Korhaan	*Eupodotis caerulescens*	LC, NT	SLS	OMD	0,001	1,493
Bokmakierie	*Telophorus zeylonus*			OMD	0,009	17,910
Brown-crowned Tchagra	*Tchagra australis*			OMD	0,001	1,493
Cape Glossy (Cape) Starling	*Lamprotornis nitens*			IGD	0,004	5,970
Cape Longclaw	*Macronyx capensis*			IGD	0,019	34,328
Cape Robin-Chat	*Cossypha caffra*			OMD	0,001	1,493
Cape Sparrow	*Passer melanurus*			GGD	0,002	2,985
Cape Turtle (Ring-necked) Dove	*Streptopelia capicola*			GGD	0,006	13,433
Cape Wagtail	*Motacilla capensis*			IGD	0,003	4,478
Cardinal Woodpecker	*Dendropicos fuscescens*			IGD	0,001	1,493
Chestnut-vented Tit-Babbler (Warbler)	*Curruca subcoerulea*			IGD	0,003	8,955
Cloud Cisticola	*Cisticola textrix*		NE	IGD	0,046	76,119
common Ostrich	*Struthio camelus*			OMD	0,005	7,463
Common Quail	*Coturnix coturnix*			OMD	0,024	47,761
Common Scimitarbill	*Rhinopomastus cyanomelas*			IGD	0,001	1,493
Crowned Lapwing	*Vanellus coronatus*			IGD	0,012	5,970
Desert Cisticola	*Cisticola aridulus*			IGD	0,020	50,746
Diederik Cuckoo	*Chrysococcyx caprius*			IGD	0,017	46,269
Double-banded Courser	*Rhinoptilus africanus*			IGD	0,001	1,493
Eastern Clapper Lark	*Mirafra fasciolata*			IGD	0,013	25,373
Egyptian Goose	*Alopochen aegyptiaca*			HWD	0,004	5,970
European Bee-eater	*Merops apiaster*			IAD	0,005	7,463

Fiscal Flycatcher	*Melaenornis silens*		NE	OMD	0,002	2,985
Greater Kestrel	*Falco rupicoloides*			CGD	0,002	1,493
Greater Striped Swallow	*Cecropis cucullata*			IAD	0,001	1,493
Grey Heron	*Ardea cinerea*			CWD	0,001	2,985
Hadeda (Hadada) Ibis	*Bostrychia hagedash*			OMD	0,007	14,925
Hamerkop	*Scopus umbretta*			CWD	0,001	1,493
Helmeted Guineafowl	*Numida meleagris*			OMD	0,006	5,970
Jacobin Cuckoo	*Clamator jacobinus*			IGD	0,001	1,493
Kalahari Scrub Robin	*Cercotrichas paena*			IGD	0,002	5,970
Laughing Dove	*Spilopelia senegalensis*			GGD	0,001	1,493
Levaillant's Cisticola	*Cisticola tinniens*			IGD	0,006	16,418
Little Grebe	*Tachybaptus ruficollis*			CWD	0,009	11,940
Little Swift	*Apus affinis*			IAD	0,005	2,985
Long-tailed Widowbird	*Euplectes progne*			GGD	0,076	67,164
Malachite Kingfisher	*Corythornis cristatus*			CWD	0,001	1,493
Namaqua Dove	*Oena capensis*			GGD	0,001	1,493
Northern Black Korhaan	*Afrotis afraoides*			IGD	0,015	35,821
Orange River Francolin	*Scleroptila gutturalis*			GGD	0,003	4,478
Orange River White-eye	*Zosterops pallidus*			OMD	0,002	2,985
Pied Crow	*Corvus albus*			OMD	0,005	7,463
Pin-tailed Whydah	*Vidua macroura*			GGD	0,005	5,970
Purple Heron	*Ardea purpurea*			CWD	0,001	1,493
Red-billed Firefinch	*Lagonosticta senegala*			GGD	0,001	2,985
Red-billed Quelea	*Quelea quelea*			GGD	0,140	13,433
Red-billed Teal	*Anas erythrorhyncha*			OMD	0,001	1,493
Red-chested Cuckoo	*Cuculus solitarius*			IGD	0,001	2,985
Red-faced Mousebird	*Urocolius indicus*			FFD	0,003	2,985
Red-knobbed Coot	*Fulica cristata*			HWD	0,005	8,955
Red-throated Wryneck	*Jynx ruficollis*			IGD	0,002	4,478
Reed Cormorant	*Microcarbo africanus*			CWD	0,002	4,478
Rufous-naped Lark	*Mirafra africana*			IGD	0,011	23,881
Secretarybird	*Sagittarius serpentarius*	VU, EN		CGD	0,001	1,493
South African Cliff Swallow	*Petrochelidon spilodera*		BNE	IAD	0,194	47,761
Southern (Common) Fiscal	*Lanius collaris*			IAD	0,005	13,433
Southern Masked Weaver	*Ploceus velatus*			GGD	0,008	14,925
Southern Red Bishop	*Euplectes orix*			GGD	0,097	26,866

Speckled Pigeon	*Columba guinea*			FFD	0,005	2,985
Spike-heeled Lark	*Chersomanes albofasciata*			IGD	0,009	13,433
Spur-winged Goose	*Plectropterus gambensis*			OMD	0,003	5,970
Swainson's Spurfowl	*Pternistis swainsonii*			OMD	0,005	11,940
Three-banded Plover	*Charadrius tricollaris*			IWD	0,001	2,985
Violet-eared Waxbill	*Granatina granatina*			IGD	0,001	1,493
Western Cattle Egret	*Bubulcus ibis*			IGD	0,018	19,403
White-backed Mousebird	*Colius colius*			FFD	0,001	1,493
White-browed Sparrow-Weaver	*Plocepasser mahali*			OMD	0,008	11,940
White-faced Whistling Duck	*Dendrocygna viduata*			HWD	0,002	2,985
White-fronted Bee-eater	*Merops bullockoides*			IAD	0,004	4,478
White-throated Swallow	*Hirundo albigularis*			IAD	0,001	1,493
White-winged Widowbird	*Euplectes albonotatus*			GGD	0,002	2,985
Yellow-billed Duck	*Anas undulata*			HWD	0,007	10,448
Yellow-crowned Bishop	*Euplectes afer*			GGD	0,028	31,343
Yellow-fronted Canary	*Crithagra mozambica*			GGD	0,001	1,493
Zitting Cisticola	*Cisticola juncidis*			IGD	0,018	46,269

13.3 Appendix C: Incidental records during the first assessment

Common Name	Scientific Name
African Pipit	*Anthus cinnamomeus*
African Red-eyed Bulbul	*Pycnonotus nigricans*
Black-winged Kite	*Elanus caeruleus*
Buffy Pipit	*Anthus vaalensis*
Chestnut-vented Tit-Babbler (Warbler)	*Curruca subcoerulea*
Karoo Thrush	*Turdus smithi*
Little Swift	*Apus affinis*
Mountain Wheatear	*Myrmecocichla monticola*
Pink-billed Lark	*Spizocorys conirostris*
Red-billed Firefinch	*Lagonosticta senegala*
Sabota Lark	*Calendulauda sabota*
Scaly-feathered Finch (Weaver)	*Sporopipes squamifrons*
Spike-heeled Lark	*Chersomanes albofasciata*
Swainson's Spurfowl	*Pternistis swainsonii*
Violet-eared Waxbill	*Granatina granatina*
Whiskered Tern	*Chlidonias hybrida*
White-winged Widowbird	*Euplectes albonotatus*

13.4 Appendix D: Point count data of the second assessment

Common Name	Scientific Name	RD (Regional, Global)	Endemism in South Africa (E)	Guild code	Relative abundance	Frequency (%)
Acacia Pied Barbet	*Tricholaema leucomelas*		0	OMD	0,005	13,433
African Pipit	*Anthus cinnamomeus*		0	IGD	0,007	16,418
African Quail-Finch	*Ortygospiza atricollis*		0	GGD	0,026	46,269
African Red-eyed Bulbul	*Pycnonotus nigricans*		0	OMD	0,003	5,970
African Sacred Ibis	*Threskiornis aethiopicus*		0	CGD	0,001	1,493
African Stonechat	*Saxicola torquatus*		0	IGD	0,005	8,955
Amur Falcon	*Falco amurensis*		0	CGD	0,006	5,970
Ant-eating Chat	*Myrmecocichla formicivora*		0	IGD	0,013	22,388
Barn Swallow	*Hirundo rustica*		0	IAD	0,081	29,851
Black-chested Prinia	*Prinia flavicans*		0	IGD	0,014	32,836
Black-collared Barbet	*Lybius torquatus*		0	FFD	0,001	1,493
Black-headed Heron	*Ardea melanocephala*		0	CGD	0,002	5,970
Blacksmith Lapwing	*Vanellus armatus*		0	IGD	0,004	2,985
Black-winged Kite	*Elanus caeruleus*		0	CGD	0,004	10,448
Black-winged Pratincole	*Glareola nordmanni*	NT, NT	0	IAD	0,061	2,985
Bokmakierie	*Telophorus zeylonus*		0	OMD	0,018	35,821
Brown-crowned Tchagra	*Tchagra australis*		0	OMD	0,001	2,985
Cape Longclaw	*Macronyx capensis*		0	IGD	0,023	47,761
Cape Robin-Chat	*Cossypha caffra*		0	OMD	0,001	1,493
Cape Sparrow	*Passer melanurus*		0	GGD	0,001	1,493
Cape Turtle (Ring-necked) Dove	*Streptopelia capicola*		0	GGD	0,009	22,388
Cape Wagtail	*Motacilla capensis*		0	IGD	0,002	4,478
Cape White-eye	*Zosterops virens*		NE	OMD	0,001	1,493
Chestnut-vented Tit-Babbler (Warbler)	*Curruca subcoerulea*		0	IGD	0,004	10,448
Cloud Cisticola	*Cisticola textrix*		NE	IGD	0,010	23,881
Common Ostrich	*Struthio camelus*		0	OMD	0,008	10,448
Common Quail	*Coturnix coturnix*		0	OMD	0,009	22,388
Common Scimitarbill	*Rhinopomastus cyanomelas*		0	IGD	0,001	1,493
Common Waxbill	*Estrilda astrild*		0	GGD	0,006	4,478
Crested Barbet	*Trachyphonus vaillantii*		0	FFD	0,002	2,985
Crowned Lapwing	*Vanellus coronatus*		0	IGD	0,006	8,955
Desert Cisticola	*Cisticola aridulus*		0	IGD	0,013	29,851
Diederik Cuckoo	*Chrysococcyx caprius*		0	IGD	0,004	10,448
Eastern Clapper Lark	*Mirafra fasciolata*		0	IGD	0,001	1,493
Egyptian Goose	*Alopochen aegyptiaca*		0	HWD	0,001	1,493

European Bee-eater	*Merops apiaster*		0	IAD	0,010	7,463
Fiscal Flycatcher	*Melaenornis silens*		NE	OMD	0,002	2,985
Glossy Ibis	*Plegadis falcinellus*		0	IWD	0,001	1,493
Greater Kestrel	*Falco rupicoloides*		0	CGD	0,001	1,493
Greater Striped Swallow	*Cecropis cucullata*		0	IAD	0,003	4,478
Grey Heron	*Ardea cinerea*		0	CWD	0,001	1,493
Hadeda (Hadada) Ibis	*Bostrychia hagedash*		0	OMD	0,003	4,478
Hamerkop	*Scopus umbretta*		0	CWD	0,001	1,493
Helmeted Guineafowl	*Numida meleagris*		0	OMD	0,010	4,478
Laughing Dove	*Spilopelia senegalensis*		0	GGD	0,002	2,985
Levaillant's Cisticola	*Cisticola tinniens*		0	IGD	0,014	22,388
Little Grebe	*Tachybaptus ruficollis*		0	CWD	0,006	7,463
Little Swift	*Apus affinis*		0	IAD	0,002	1,493
Long-billed Crombec	*Sylvietta rufescens*		0	IGD	0,001	1,493
Long-tailed Widowbird	*Euplectes progne*		0	GGD	0,089	38,806
Malachite Kingfisher	*Corythornis cristatus*		0	CWD	0,001	1,493
Namaqua Dove	*Oena capensis*		0	GGD	0,002	4,478
Northern Black Korhaan	*Afrotis afraoides*		0	IGD	0,012	28,358
Orange River Francolin	*Scleroptila gutturalis*		0	GGD	0,003	4,478
Orange River White-eye	*Zosterops pallidus*		0	OMD	0,002	4,478
Pale Chanting Goshawk	*Melierax canorus*		0	CGD	0,001	1,493
Pied Crow	*Corvus albus*		0	OMD	0,002	1,493
Pink-billed Lark	*Spizocorys conirostris*		0	GGD	0,002	4,478
Pin-tailed Whydah	*Vidua macroura*		0	GGD	0,005	8,955
Red-billed Quelea	*Quelea quelea*		0	GGD	0,043	4,478
Red-billed Teal	*Anas erythrorhyncha*		0	OMD	0,003	4,478
Red-capped Lark	*Calandrella cinerea*		0	GGD	0,003	1,493
Red-eyed Dove	*Streptopelia semitorquata*		0	GGD	0,002	1,493
Red-faced Mousebird	*Urocolius indicus*		0	FFD	0,010	13,433
Red-knobbed Coot	*Fulica cristata*		0	HWD	0,001	2,985
Red-throated Wryneck	*Jynx ruficollis*		0	IGD	0,001	1,493
Reed Cormorant	*Microcarbo africanus*		0	CWD	0,003	7,463
Rufous-naped Lark	*Mirafra africana*		0	IGD	0,005	11,940
Scaly-feathered Finch (Weaver)	*Sporopipes squamifrons*		0	GGD	0,008	5,970
Shaft-tailed Whydah	*Vidua regia*		0	GGD	0,001	1,493
South African Cliff Swallow	*Petrochelidon spilodera*		BNE	IAD	0,213	34,328
South African Shelduck	*Tadorna cana*		0	OMD	0,006	7,463
Southern (Common) Fiscal	*Lanius collaris*		0	IAD	0,009	20,896
Southern Grey-headed Sparrow	*Passer diffusus*		0	GGD	0,002	2,985

Southern Masked Weaver	*Ploceus velatus*		0	GGD	0,005	10,448
Southern Red Bishop	*Euplectes orix*		0	GGD	0,044	11,940
Speckled Pigeon	*Columba guinea*		0	FFD	0,023	5,970
Spike-heeled Lark	*Chersomanes albofasciata*		0	IGD	0,006	11,940
Spotted Thick-knee	*Burhinus capensis*		0	IGD	0,001	1,493
Swainson's Spurfowl	*Pternistis swainsonii*		0	OMD	0,007	19,403
Three-banded Plover	*Charadrius tricollaris*		0	IWD	0,001	1,493
Western Cattle Egret	*Bubulcus ibis*		0	IGD	0,024	10,448
White-backed Mousebird	*Colius colius*		0	FFD	0,007	8,955
White-browed Sparrow-Weaver	*Plocepasser mahali*		0	OMD	0,012	16,418
White-faced Whistling Duck	*Dendrocygna viduata*		0	HWD	0,002	4,478
White-rumped Swift	*Apus caffer*		0	IAD	0,013	10,448
White-throated Swallow	*Hirundo albigularis*		0	IAD	0,001	1,493
Yellow Canary	*Crithagra flaviventris*		0	GGD	0,002	2,985
Yellow-billed (Intermediate) Egret	*Ardea intermedia*		0	IGD	0,001	1,493
Yellow-billed Duck	*Anas undulata*		0	HWD	0,006	4,478
Yellow-crowned Bishop	*Euplectes afer*		0	GGD	0,006	2,985
Zitting Cisticola	*Cisticola juncidis*		0	IGD	0,017	38,806

13.5 Appendix E: Incidental records during the second survey

Common Name	Scientific Name
Acacia Pied Barbet	*Tricholaema leucomelas*
African Paradise Flycatcher	*Terpsiphone viridis*
Bokmakierie	*Telophorus zeylonus*
Cape Glossy (Cape) Starling	*Lamprotornis nitens*
Cape Sparrow	*Passer melanurus*
Cape Turtle (Ring-necked) Dove	*Streptopelia capicola*
Cinnamon-breasted Bunting	*Emberiza tahapisi*
Common Waxbill	*Estrilda astrild*
Crowned Lapwing	*Vanellus coronatus*
Fawn-coloured Lark	*Calendulauda africanoides*
Fiscal Flycatcher	*Melaenornis silens*
Great Spotted Cuckoo	*Clamator glandarius*
Greater Striped Swallow	*Cecropis cucullata*
Jacobin Cuckoo	*Clamator jacobinus*
Kalahari Scrub Robin	*Cercotrichas paena*
Karoo Thrush	*Turdus smithi*
Namaqua Dove	*Oena capensis*

Neddicky	*Cisticola fulvicapilla*
Orange River Francolin	*Scleroptila gutturalis*
Red-backed Shrike	*Lanius collurio*
Red-billed Firefinch	*Lagonosticta senegala*
Red-capped Lark	*Calandrella cinerea*
Red-eyed Dove	*Streptopelia semitorquata*
Sabota Lark	*Calendulauda sabota*
Scaly-feathered Finch (Weaver)	*Sporopipes squamifrons*
Southern (Common) Fiscal	*Lanius collaris*
Southern Grey-headed Sparrow	*Passer diffusus*
Southern Masked Weaver	*Ploceus velatus*
Speckled Pigeon	*Columba guinea*
Spotted Thick-knee	*Burhinus capensis*
Violet-eared Waxbill	*Granatina granatina*
White-browed Sparrow-Weaver	*Plocepasser mahali*
White-fronted Bee-eater	*Merops bullockoides*
Yellow Canary	*Crithagra flaviventris*

13.6 Appendix F: Specialist Declaration of Independence

I, Lindi Steyn, 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.

Lindi Steyn

Biodiversity Specialist

The Biodiversity Company

April 2023

APPENDIX E4: Agricultural Compliance Statement

AGRICULTURAL ASSESSMENT:

COMPLIANCE STATEMENT (Rev 3)

Oslaagte Solar 2: Kroonstad South Cluster - Free State Province

Compiled for:

Nemai Consulting

Compiled by

Dr Andries Gouws Index

April 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 not 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.

April 2023

CONTENTS

SUMMARY

The site is located Southeast of Kroonstad in Free State Province.

The Department of Forestry, Fisheries and Environment published Notice 320 in 2020 that describes the minimum criteria when applying for environmental authorisation, which was followed for this investigation.

SENSITIVITY ACCORDING TO THE SCREENING TOOL

1) Field crop boundary: The sensitivity tool incorrectly indicates cultivated land. There is no land that is cultivated on the site.
2) The sensitivity screening tool indicates land with a medium sensitivity. In our professional view this grading is correct.

SITE INVESTIGATION

The outcome of the site sensitivity verification found the following:

1) The survey disagrees with the screening tool that there is no cultivated land on the proposed site. It is used for cattle farming.
2) The environmental sensitivity according to the tool is indicated as moderately to highly sensitive. This was found as correct by the site investigation. Using the same guidelines as DALRRD, the land has low/moderate arable potential.

In line with the provisions of the Protocol, a compliance statement is required for the EIA scoping report.

LOSS OF HIGH POTENTIAL LAND

No high potential or sensitive soils were found; therefore, there will not be a loss of high potential land if Oslaagte Solar 2 is implemented. The impact is low, temporary and totally reversable.

LOSS OF AGRICULTURAL PRODUCTION

The site is used for cattle farming. These cattle can be moved to another part of the farm. It is also possible to introduce sheep to replace the cattle.

The grazing opportunity that the farm provides cannot be replaced.

- The impact is low on a regional or national scale.
- The loss is temporary and will be for the medium term or life of the project.
- There will be no loss of labour opportunities. The labourer that tends the cattle can be employed elsewhere on the farm or on the PV project.

LOSS OF AGRICULTURAL INFRASTRUCTURE

There is little farming infrastructure on the site. The kraals and watering facilities can be moved or used for other animals.

LOSS OF SOIL DUE TO EROSION

The soil is very erodible because of the strongly developed structure in the subsoil.

Runoff from hard surfaces should be dealt with by a Stormwater Management Plan (SWMP). This is an engineering function and is normally addressed as part of the project design.

RECOMMENDATION

No key issues or triggers were identified that should be addressed in the Scoping Report.

The conclusion is that there will be no permanent loss of high potential land and only limited loss of agricultural production from cattle. It is still possible to farm with sheep below the PV panels if the panels

are raised.

There were no gaps found in knowledge in the investigation. The recommendations made in this report is based on the findings during the investigation.

The PV site development takes place on medium/low potential land with low fertility. It has a medium sensitivity related to agriculture.

It is the author's opinion that there is no reason to prevent the project from being implemented.

Further, any measures or projects that can help to relieve the country's electricity problems should be encouraged.

1 SPECIALIST DECLARATION

COMPLIANCE STATEMENT

Main findings of the study are as follows:

SENSITIVITY SCREENING TOOL

- Field crop boundary. The sensitivity tool incorrectly indicates cultivated land.
- Land sensitivity to agriculture. The tool indicates the sensitivity of the site as moderate.

SITE INVESTIGATION

The outcome of the site sensitivity verification found the following:

1. The survey disagrees with the screening tool. No cultivation takes place on the proposed site. It is used for cattle farming.
2. The environmental sensitivity according to the tool is indicated as moderately sensitive. This was confirmed by the site investigation. Using the same guidelines as DALRRD, the land has low/moderate arable potential. This is because of slope as well as the shallow and highly erodible nature of the soils.

In line with the provisions of the Protocol, a compliance statement is required for the EIA scoping report.

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 Section 10.
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), overlaid on the agricultural sensitivity map generated by the national environmental screening tool;	The entire PV site will be developed. See Figure 4 for the development footprint. Although the screening tool indicate highly sensitive land, the detailed assessment found that the climatic conditions and crop yield are such that profitable crop farming is not possible.
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 was confined to the land of 659ha which will be under PV and support infrastructure.
3.3.5. Confirmation that the development footprint is in line with the allowable development limits contained in Table 1 above;	No detail at this stage

3.3.6. confirmation from the specialist that all reasonable measures have been taken through micro-siting to avoid or minimize fragmentation and disturbance of agricultural activities;	659ha will be developed. The PV project will not disturb any adjacent farming activities. The site will be leased to the developer and will not be subdivided in terms of Act 70. It will, therefore 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/medium potential land that has a medium sensitivity related to agriculture. It consists of moderately deep and shallow and rocky soils. It is the author's opinion that there is no reason 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 PV site is not a linear activity. An OHL will be installed and the land that will be cleared from grass during installation will take time to recover. However, only the transmission line footprint will be disturbed and by planting locally occurring grass species, the line will have no negative impact of cattle grazing.
3.3.10. Where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr; and	The only recommendation is that the EMP includes erosion control measures and that the SWMP be implemented.
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 was appointed for a number of solar projects at Kroonstad. They are located south west of the town in the Free state Province. INDEX was then appointed as agricultural specialist to do the agricultural impact statement in terms of Notice 320 of the National Environmental Management Act in May 2020 of the Department of Environmental Affairs.

This report will describe the findings of the initial site verification and then assess the agricultural potential of the site in terms of the guidelines of Notice 320.

The location is indicated in Figure 1.

The Kroonstad South Cluster consists of the following five PV units.

1) Leeuwspruit Solar 1.
2) Leeuwspruit Solar 2.
3) Oslaagte Solar 1.
4) Oslaagte Solar 2.
5) Oslaagte Solar 3.

The survey was done for all three the projects on Oslaagte. The area was then split into the three different PV projects.

This report deals with Oslaagte Solar 2 (referred to as OL2 in this report).

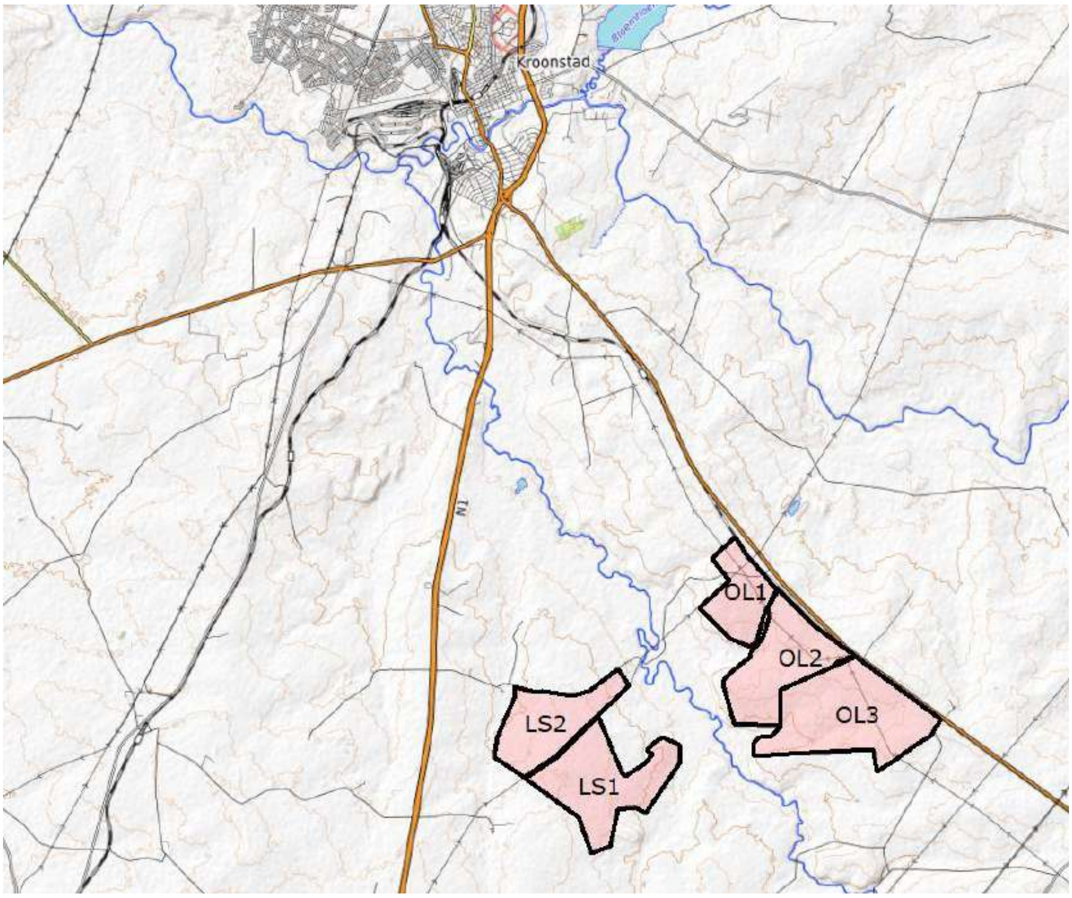


Figure 1. Locality of the project

The details of the site are as follows:

SITE DESCRIPTION

The total Oslaagte is 3077ha. Of this approximately 2017ha is proposed for the three PV projects. 600ha will be OL2.

	Farm names	Footprint size	Total Size
OL2	Oslaagte 2654	600ha	3077ha

REVISED LAYOUT – ALTERNATIVE 2

A layout of the infrastructure was provided to the sectoral specialist to evaluate in terms of Notice 320 of NEMA. This layout was evaluated. Some sensitivities were highlighted be specialist that led to a revised layout that incorporated all their findings.

The new layout is minor as far as agriculture is concerned because their placement is not on highly sensitive land; all supporting infrastructure is on low/moderate or moderately sensitive land. The two layouts are indicated below:

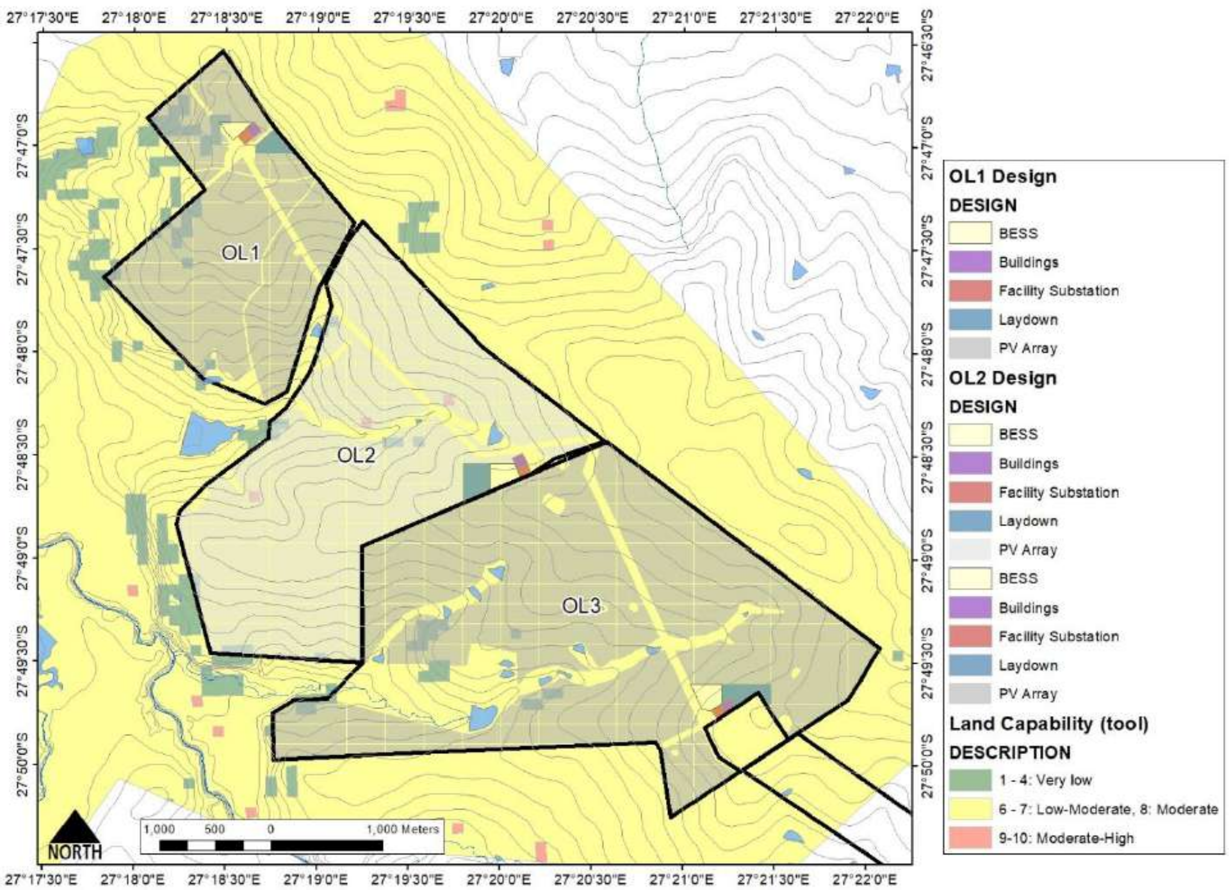


Figure 2. Original layout – Alternative 1

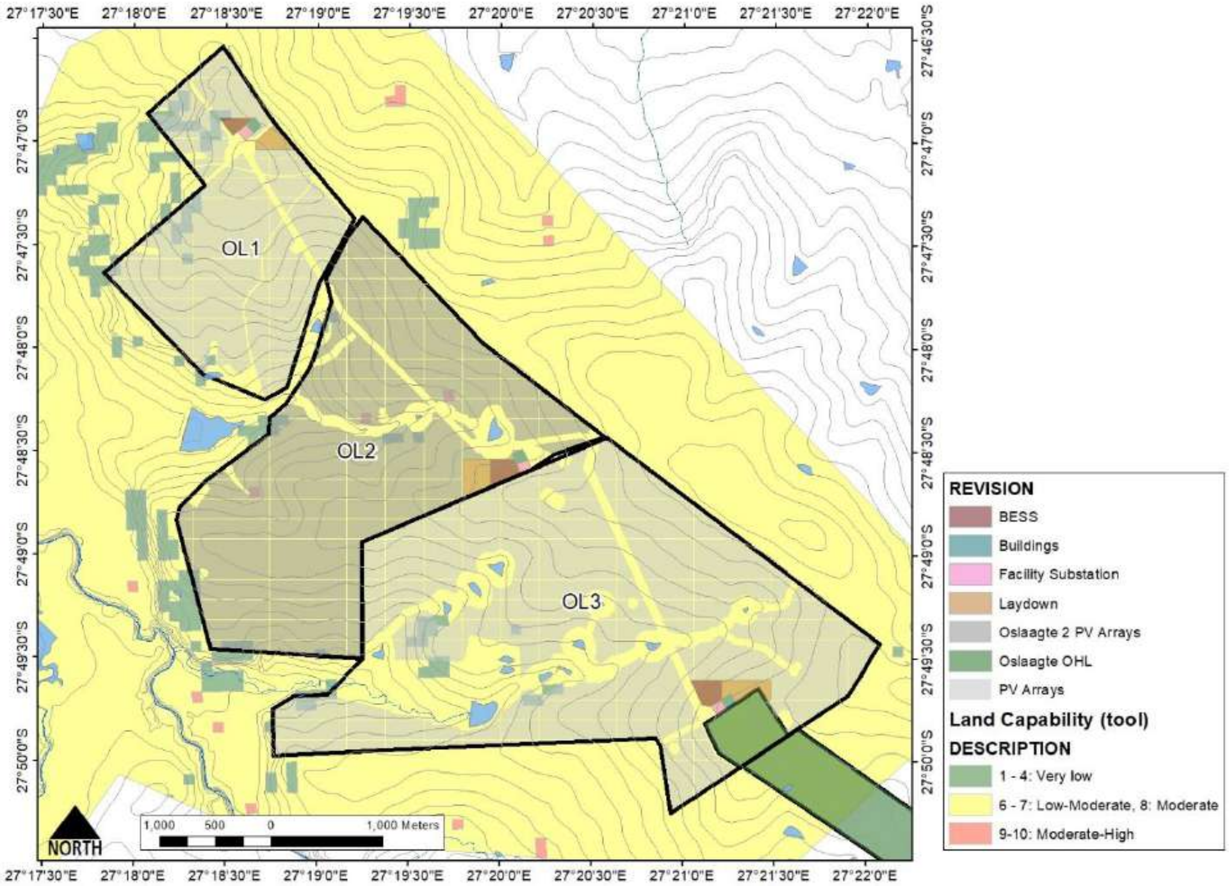


Figure 3. Revised layout - Alternative 2

Because there is no difference on the two option's impact on agriculture, the figures and description will be done based on the layout of Alternative 1.

3 TERMS OF REFERENCE

Nemai Consulting was appointed for this solar project located at Oslaagte No 2564. It consists of a solar PV plant, BESS and support infrastructure. In turn, they appointed Index to do a specialist assessment for agriculture.

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. No
- Indicate loss of agricultural land with high capability due to direct occupation by the development footprint.
- Indicate loss of fertile soil (high potential land).
- Soil erosion due to inadequate stormwater management.

4 PROPOSED DEVELOPMENT

The project consists of a PV site and the associated infrastructure (refer to Figure 4 for the location for the different projects in the Oslaagte section of of the Kroonstad South Cluster.. Refer to 'OL2' on the map below.

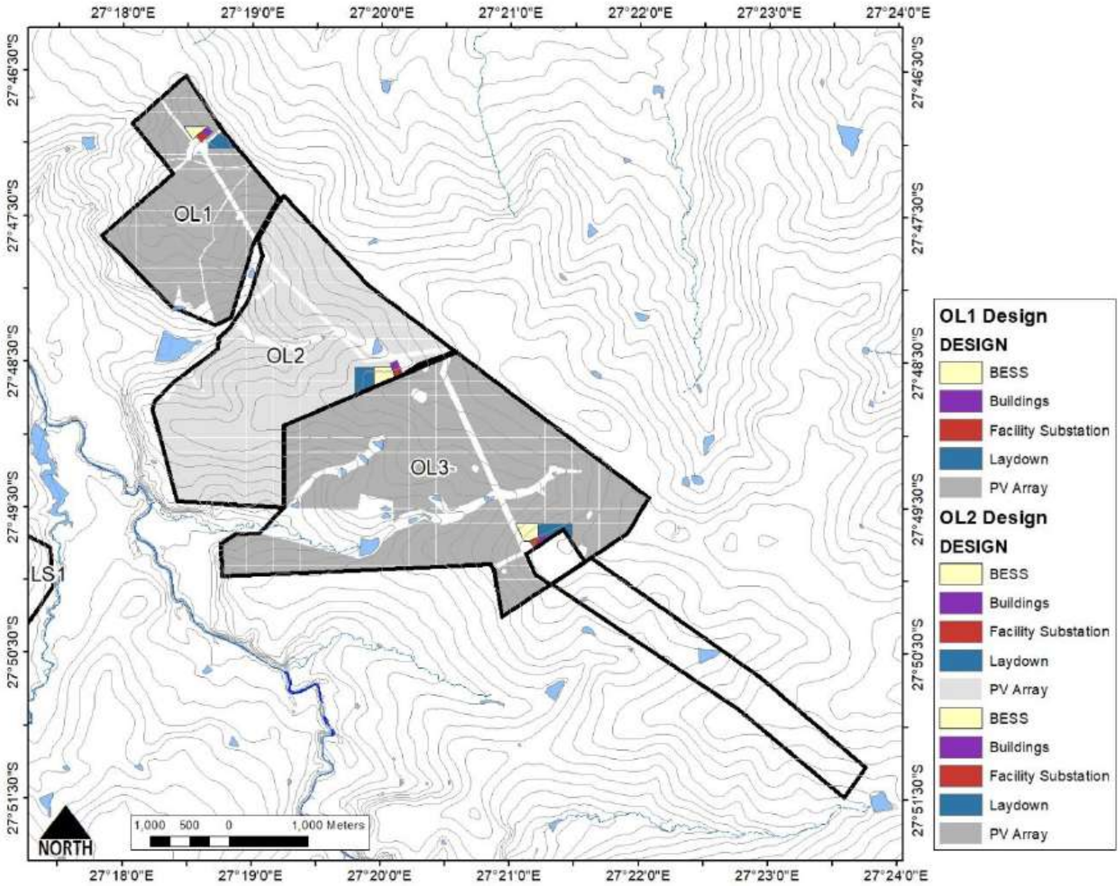


Figure 4. Main components of the development

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 published in May 2020 of the Department of Environmental Affairs.

Theme layers and the crop boundaries were downloaded from the screening tool and incorporated in the GIS as layer. These varies somewhat from the map generated by the tool.
Theme layers of crop boundaries as well as the environmental sensitivities were downloaded from the screening tool and incorporated in the GIS as layer. These varies somewhat from the map generated by the tool.
Because the downloaded date is more specific and descriptive, it was used for analyses.

The current use of the land and the environmental sensitivity of the site as indicated in the screening tool, is indicated below.

- The desktop verification was done through use of satellite imagery and a site visit took place on 25 April 2023.

- The aim of the site servery 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 7.

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 estimated by hand and to determine 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 ECOLOGICAL SENSITIVITY

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 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 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.

6.1 Sensitivity Screening Tool findings

- Field crop boundary

  The sensitivity tool indicates cultivated land on the north western portion of the property (refer to Figure 5).

- Land sensitivity to agriculture

  The tool indicates the sensitivity of the site as moderately (Category 6 and 7).

  See Figure 6 for the results of the Sensitivity Screening Tool.

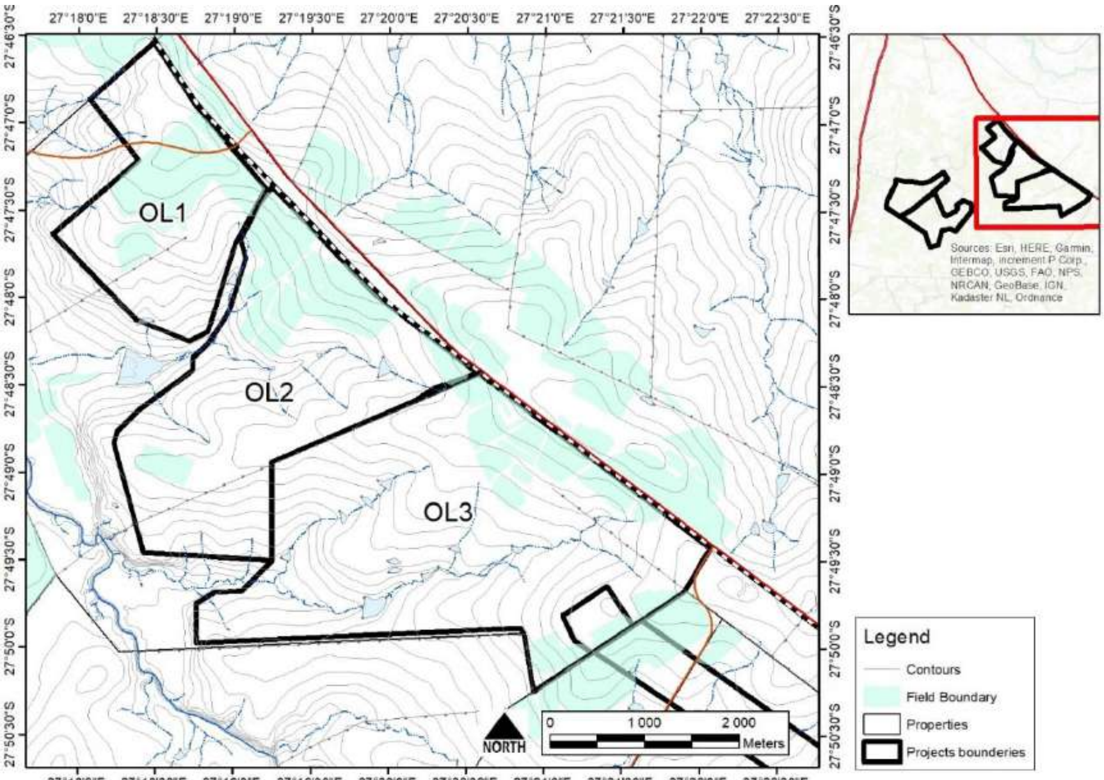


Figure 5. Cultivated land boundary according to the Screening Tool (see OL1)

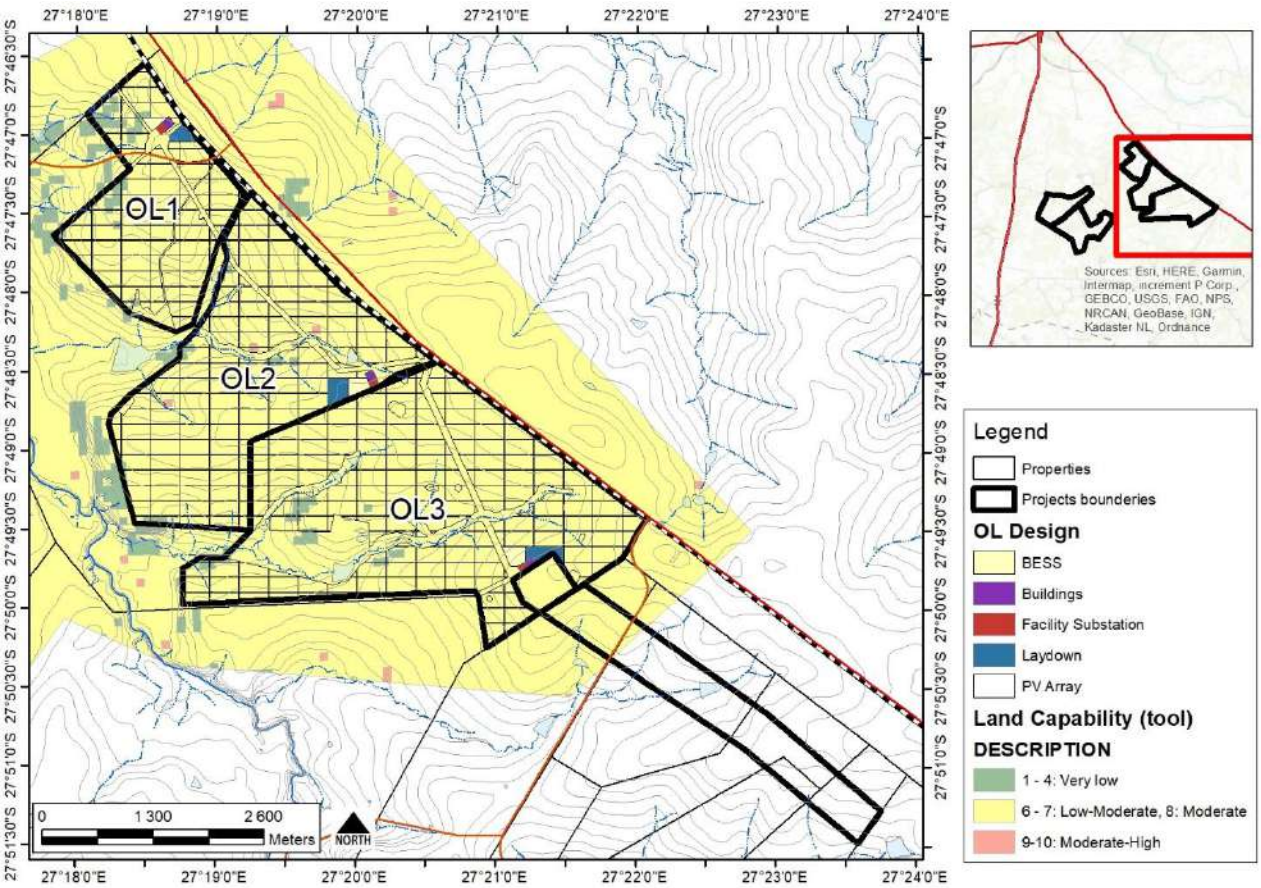


Figure 6. Sensitivity (screening tool)

6.2 FINDINGS OF THE SITE SENSITIVITY INVESTIGATION

The verification was done by desk top analysis, using satellite imagery and then a site inspection. The outcome of the site sensitivity verification found the following:

6.2.1 FIELD CROP BOUNDARY

The survey disagrees with the screening tool. There is no cultivated land on the proposed PV site. The entire site is used for cattle farming.

6.2.2 LAND SENSITIVITY (CAPABILITY)

- The environmental sensitivity of nearly all land, according to the tool is indicated as moderately sensitive. This was confirmed by the site investigation.
- Using the same guidelines as in AGIS (DALRRD), the land has low/moderate arable potential. There is a small portion of land that was not recognized as highly sensitive, but it is too small to be used for commercial crop production. A map of the soil and land capability was compiled of the site and is shown in Figure 7. See Section 7.5 for a detailed description and results of the site visit related to soil and agricultural potential.
- In line with the provisions of the Protocol, a compliance statement is required for the EIA Scoping Report.

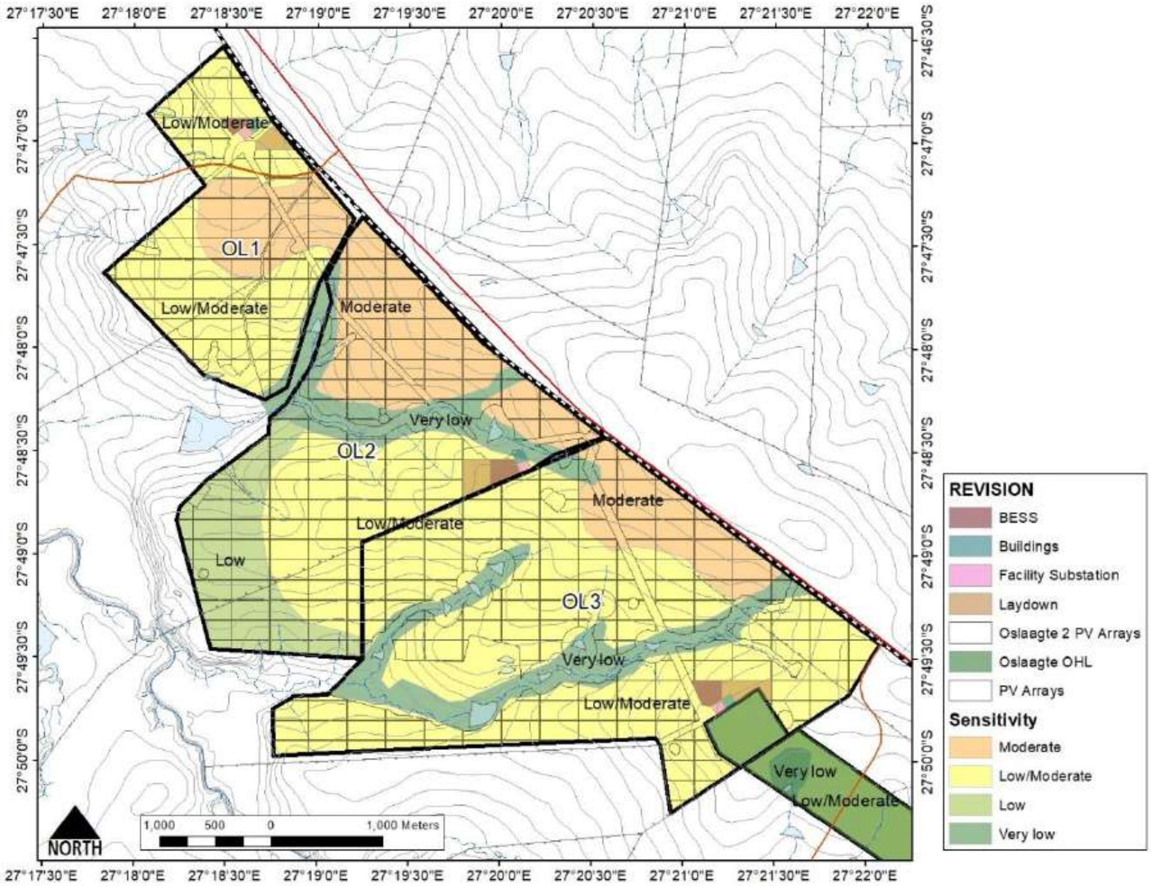


Figure 7. Site sensitivity following the site visit (refer to OL2)

7 SITE EVALUATION

7.1 PRESENT LAND USES

The entire site is used for cattle farming. The veld is in relatively good condition with a large percentage of palatable grass species.

Photo 1. Grazing on the Oslaagte indicated by the screening tool as lands

7.2 CLIMATE

RAINFALL

The average annual rainfall varies between 515mm and 560mm for the different stations around the site. Rain occurs mainly during the summer months, commencing in October lasting to March. This is typical of the summer rainfall pattern of the Highveld region of South Africa.

The rainfall is sufficient for crop production provided that the soils are suitable.

WIND

The predominant wind direction is north, varying between north-easterly and north-westerly. Wind damage is not normally expected to be a deciding factor in crop selection.

TEMPERATURE

The average daily temperature varies from 18,5°C in July to 27,9°C in January. The lowest daily minimum temperature is below freezing for June and July, with frost risk from as early as March and as late as September.

Kroonstad can be classified as a high frost risk area. It has, however, 500 to 750 accumulated chill units for the winter months.

The temperature is suitable for crop production.

7.3 WATER

There is no surface runoff on the property that can be used for irrigation. The irrigated lands south of the site was excluded from the development.

7.4 VEGETATION

The land in its natural state is grassland with *Themeda triandra* the dominant species. Annual *Aristida* occurs in the lower laying portions and where the soils are shallow.

The grazing capacity according to DALRRD is estimated at 5-6 ha/large livestock unit (LSU). The carrying capacity for the PV site is approximately 110 LSU.

7.5 SOIL AND LAND SENSITIVITY CAPABILITY

SOIL TYPES

The PV site is located on mudstone of the Beaufort formations. These are notorious for their high erodibility as can be seen, among other places, in the Eastern Cape at East London and in the former Transkei and Ciskei where deep gullies are common.

Clay migrates to above the bedrock where cutanic structures are formed. These seem to dissolve or fall apart when the protective topsoil is eroded. Dongas are often the result.

The Gs/R is shallow greyish brown soils with scattered rock outcrops. These soils are sometimes cultivated but is low potential cropping land. The dominant soil forms that occur on this unit is Glenrosa.

Sw/Oa and Duplex 300 soils are moderately deep greyish brown soils. The Swartland soils are highly erodible, but where the structured layer is deeper than 500mm, it is sometimes ploughed. The soil has a medium potential for crop production.

There are already gullies that have formed due to erosion. The farmer attempted to slow down flow speeds during high intensity rains by placing car tyres in gullies. High erosion susceptibility is one of the main reasons why the land use potential is low or that the ecological sensitivity is high.

As indicated earlier, erosion is a major concern on soil that derived from Beaufort sediments. Erosion control measures should receive special attention in the design of the stormwater plan.

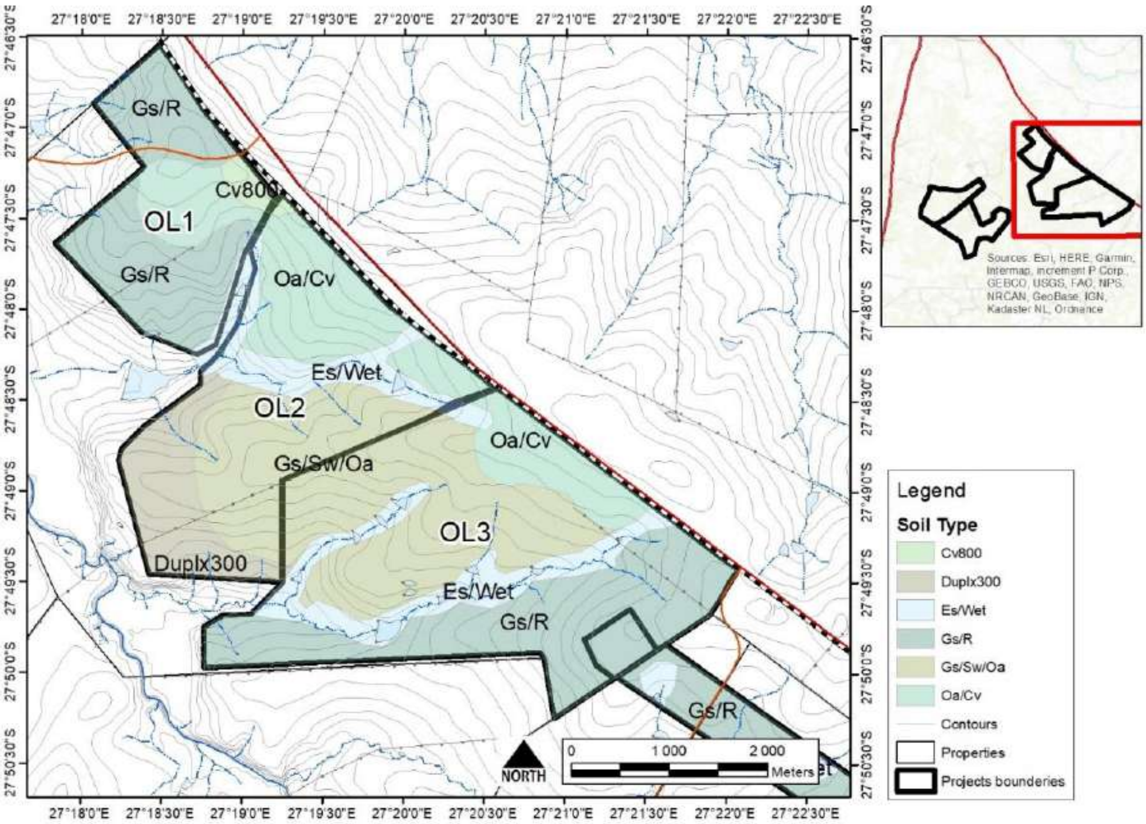


Figure 8. Soil map

Erosion is a major concern on soil that derived from Beaufort sediments. Erosion control measures should receive special attention in the design of the stormwater plan.

LAND CAPABILITY DETERMINATION

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 Sensitivity 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 1. Relationship between grading of the Sensitivity 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).

Table 2 indicates the dominant soils in each soil unit as well as the grading used by Montgomery et al to determine soil potential or sensitivity towards agriculture.

Together with the climate and topography it will indicate sensitivity as per guidelines used by the Screening tool. The land use criteria are indicated in the addenda (Section **Error! Reference source not found.**).

Table 2. Capability description according to Montgomery *et al*.

Soil Type	Soil description	Capability (Montgomery)	Sensitivity	Flood hazard	Erosion susceptibility	Depth restriction	Texture restriction	Drainage restriction	Restriction to cultivation
Duplx300	Escourt, Swartland dominant. Shallow highly erodible soils.	v	Low	1	5	4	2	4	3
Es/Wet	Structured soils in watercourses and their headlands.	v	Very low	1	5	4	2	5	3
Gs/R	Glenrosa soils. Shallow and moderately deep soils on semi-weathered mudstone or shale.	iv	Moderate	1	3	3	2	4	2
Gs/Sw/Oa	Glenrosa, Swartland and Oakleaf are dominant. Shallow and moderately deep soils on semi-weathered mudstone or shale. Some deep yellowish brown high potential soils are present	iv	Moderate	1	3	3	2	4	2
Oa/Cv Cv800	Oakleaf and Clovelly soils are dominant. Shallow and moderately deep soils on semi-weathered mudstone or shale. Some portions have concretions at 400 – 600mm These soils are arable but has a moderate potential for crop production.	iv	Moderate	1	4	3	2	3	2

- According to Klingebiel *et al*, the soil capability is Class v and lower, mainly because of soil properties.
- Using the same criteria as AGIS, the farm is Class 7 (or Class iv or v according to Montgomery *et al*) or poorer, which has *moderate/low* sensitivity.
- A small portion of land in the north eastern corner consists of deep yellowish-brown soils (classified as Clovelly). This is arable but is too small to cultivate and is, therefore, low or medium sensitivity.
- In general, the site is grazing land with little potential for cultivation.
- According to the land capability classification, the soils have medium capability (or sensitivity as related to the Sensitivity Screening Tool).

8 IMPACT ASSESSMENT

8.1 LOSS OF HIGH POTENTIAL LAND

Only small pieces of high potential or sensitive soils were found; therefore, there will not be a loss of high potential land. According to the guidelines of various publications of DALRRD that deals with land capability and crop yield, the land is not high potential.

These soils are also not fertile because they have not been cultivated during which fertilised would have been added. Their change in land use will, therefore, also not lead to the loss of fertile soils.

Further, the PV infrastructure does not alter the soil properties or land conditions, and once removed after the project life, it can be utilised for grazing once again.

- The impact is low, temporary and totally reversable.

8.2 LOSS OF AGRICULTURAL PRODUCTION

The site is used for cattle farming. These animals can be moved to another part of the farm without any impact on farming income. It is also possible to utilise the grazing with sheep.

The grazing opportunity that the farm provides cannot be replaced or mitigated on a national level.

Our national electricity problems far outweigh the loss of income that the farm will sacrifice.

- The impact is low on a regional or national scale.
- The loss is temporary and will be for the medium term.
- There will be no loss of labour opportunities. The labourer that tends the livestock can be employed elsewhere on the farm or by the PV project.

8.3 LOSS OF AGRICULTURAL INFRASTRUCTURE

There is little farming infrastructure on the site but for watering facilities and fences.

- In conclusion, no agricultural infrastructure will be lost.
- There is no impact.

8.4 LOSS OF SOIL DUE TO EROSION

The soil is very erodible (see section 6.2.2) because of the strongly developed structure of the B2 horizon.

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 SWMP. This is an engineering function and is normally addressed as part of the project design.

- Severe erosion can be expected if the topsoil is removed, especially where the slope is high. It is essential that the stormwater management plan includes orderly runoff and that there are no or little bare surfaces that can be subject to erosion.
- Mitigation is achieved by allowing grass to re-establish after construction and by guidelines in the SWMP.
- All stormwater runoff structures should be grassed and flow retarding structures should be placed where runoff speeds become too high.
- Wetlands areas should not be disturbed and where eroded areas should be repaired.

8.5 CUMULATIVE IMPACTS

Because of land ownership and individual land use or farming enterprise preference, the impact of any development rarely transcend farm boundaries. In the case of Oslaagte, the development is a cluster of three projects; Oslaagte 1, 2 and 3 which can introduce increased runoff and erosion if the stormwater management is not carefully designed. The fear is that rivers and streams may silt up or due to increased runoff speed may damage wetlands of dam structures.

As discussed in the soils section of this report, the Beaufort geological formation is extremely erodible and could lead to precious farming land to become derelict and unproductive if the topsoil is not protected. It is critical that the soil is not stripped of vegetation

The proposed development will not have impacts on farming land due to fragmentation or subdivisions of land that can lead to unsustainable farming units. This is also the fear expressed in the Subdivision of Land Act no 70 of 1970.

There is no subdivision proposed and the land will as is return to farming after the life of the project.

9 CONCLUSIONS AND RECOMMENDATIONS

- The Screening Tool incorrectly indicates that there is cultivated land.
- It indicates no highly sensitive land that needs to be protected. This is correct.

According to the Protocols for agricultural impact assessment in terms of Notice No. 320 Government Gazette 43110 20 March 2020 of the proposed PV site, a compliance statement is required for inclusion into the Project Scoping Report.

The impacts of the development are as follows:

- Loss of high potential land

There will not be permanent loss of high potential land. According to the guidelines of various publications of DALRRD that deals with land capability, the land is not high potential.

- Loss of agricultural production

The impact of the project on agricultural production is low.

- Loss of Agricultural infrastructure

There is no agricultural infrastructure on the site.

- Loss of soil due to erosion

Severe erosion can be expected if the topsoil is removed. It is essential that the SWMP includes orderly runoff and that there are no or little bare surfaces that can be subject to erosion.

Mitigation is achieved by allowing grass to re-establish after construction.

Wetlands areas should not be disturbed and where eroded areas should be repaired.

Runoff from hard surfaces should be dealt with by a SWMP.

RECOMMENDATIONS

The conclusion is that there will be no permanent loss of high potential land and only limited loss of agricultural production from the cattle farming.

There were no gaps found in knowledge in the investigation. The recommendations made in this report is based on the findings during the investigation.

The PV site development takes place on low potential land that has a low sensitivity related to agriculture.

It is the author’s opinion that there is no reason to prevent the project from being implemented.

Further, any measures or projects that can help to relieve the country’s electricity problems should be encouraged.

10 ADDENDA

10.1 SOURCES OF INFORMATION

a) Criteria for high potential agricultural land in South Africa, Department of Agriculture, Directorate Land Use and Soil Management, 2002.

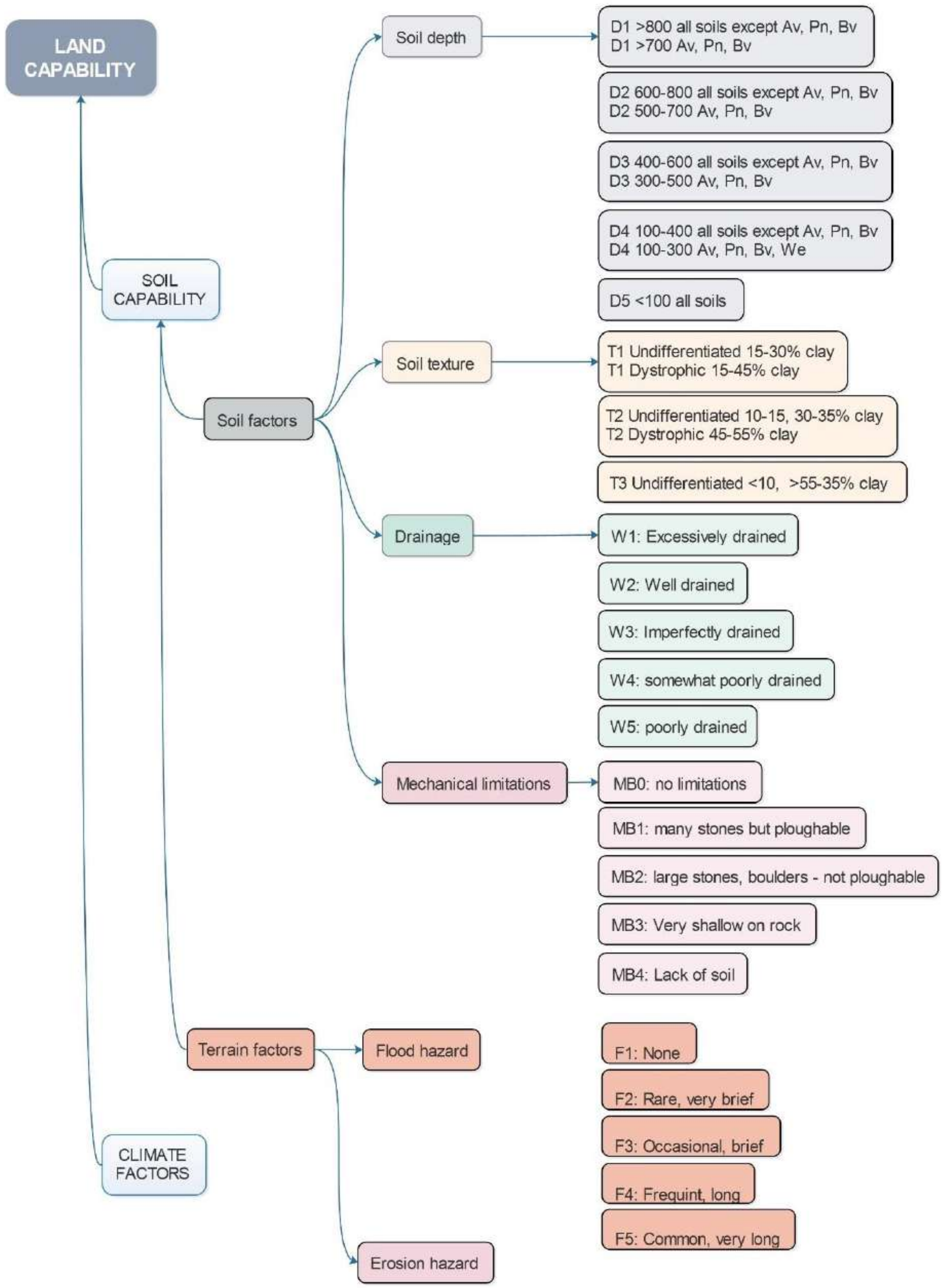
b) Grondklassifikasie Werkgroep, 1991. Grondklassifikasie, 'n Taksonomiese sisteem vir Suid Afrika, Departement van Landbou-ontwikkeling, Pretoria.

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.

10.2 LAND USE CAPABILITY CRITERIA



10.3 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

10.4 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

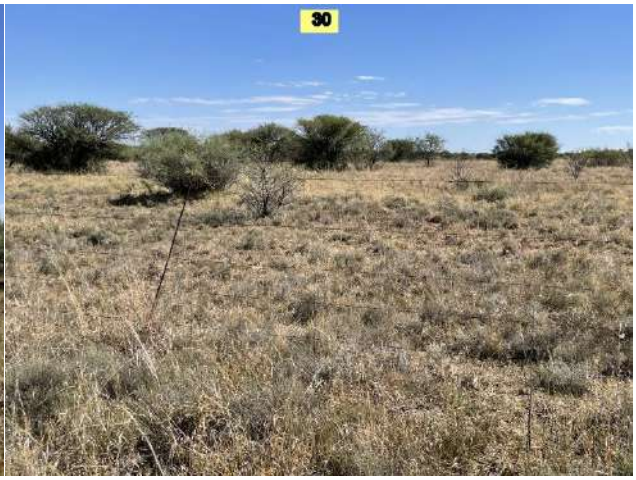
Phone: +27 (0) 82 807 6717

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		April 2023
Name of Expert	Signature	Date

10.5 OBSERVATIONS



APPENDIX E5: Phase 1 Cultural Heritage Impact Assessment

OSLAAGTE SOLAR 2 (PTY) LTD

PROPOSED 460MW OSLAAGTE SOLAR 2 PHOTOVOLTAIC PROJECT, SOUTHEAST OF KROONSTAD, FREE STATE PROVINCE

HERITAGE IMPACT ASSESMENT

26 MAY 2023

Submitted to: Nemai Consulting

Prepared by:

Jennifer Kitto

Nitai Consulting (PTY) Ltd

147 Bram Fischer Drive

Ferndale

2194

NITAI CONSULTING

SPECIALIST ENVIRONMENTAL CONSULTING

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 Consulting for the Proposed 460MW Oslaagte Solar 2 Photovoltaic Project Southeast of Kroonstad, Free State Province. The views contained in this report are purely objective and no other interests are displayed during 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, Regulations and all other applicable legislation, including 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 project 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 NEMA 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 Regulations;

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SIGNATURE - ______________________________

Executive Summary

The applicant, Oslaagte Solar 2 (Pty) Ltd, proposes the development of a 460MW solar photovoltaic (PV) facility, as well as associated infrastructure, on a site located near the town of Kroonstad in the Free State Province. The solar PV facility will be known as Oslaagte Solar 2 PV.

The Oslaagte Solar 2 (up to 460MW) Solar PV Project will be located approximately 17,5 km to the southeast of Kroonstad's central business district (CBD) and falls within Ward 1 of the Moqhaka Local Municipality (MLM). The electricity generated by the Project will be transmitted through a 132kV power line between facility substation and the Eskom Collector Switching Station/Main Transmission Substation (MTS). At this stage it is envisaged for the project to be bid into the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

Methodology/ Significance Assessment

The Site Survey fieldwork provided confirmation of the existence of heritage resources occurring within and close to the solar PV project area footprint. The inspection identified a total of four heritage resources situated within the project area footprint. Two of these sites are recent/modern structures (Os2-01 and Os2-03), one is a graveyard depicted on the 1960 topographic map (Os2-04) and one comprises several clusters of rocks likely to be the remains of an African homestead (Os2-02).

Identification of Activities, Aspect, and Impacts

The project area that will be impacted by the proposed Oslaagte Solar 2 PV project contains some areas that are currently disturbed by grazing activities and other animal activity (e.g., burrows and termite mounds). The impact significance of the project on graves and cemeteries is high before mitigation as the graveyard site (Os2-04) and site with potential infant burials (Os2-02) are both located inside the proposed PV array area of the project footprint. Site Os2-04 is protected by section 36 of the NHRA and must be avoided in the design planning (as a "no go" area). There is also a possibility that potential infant burials could be located at Site Os2-02. However, implementation of the mitigation measures required will reduce the impact to low.

The impact significance of the proposed project on protected historical structures is low as only one potential historical structure site was identified (Os2-02) which contained the collapsed remains of several structures of a homestead.

Alternatives

The project applicant adopted a comprehensive iterative design process to inform the Oslaagte Solar 2 PV layout/design. By integrating the screening and assessment of environmental (including heritage) and social constraints alongside the technical components of the project, allowed for the reduction in risks to the project.

All the identified heritage resources have been avoided by the Alternative 2 layout, however there may be some indirect impacts associated with the construction related activities such as site clearance, etc. Therefore, the mitigation measures set out below remain applicable.

Mitigation Measures

The proposed Oslaagte Solar 2 PV project (Alternative 1 and Alternative 2) could impact on heritage resources identified within and adjacent to the project footprint. Heritage resources that were verified by the field survey to occur within the project footprint include a total of four heritage resources situated within the project area footprint and one situated just north of the north-eastern boundary (within the Oslaagte Solar 1 PV footprint). Two of these sites are recent/modern structures (Os2-01 and Os2-03), one is the graveyard depicted on the 1960 topographic map (Os2-04) and one comprises several clusters of rocks likely to be the remains of an African homestead (Os2-02).

In terms of the impact on the identified heritage resources, the Alternative 2 layout which has been revised to exclude certain environmentally and heritage sensitive areas is the preferred alternative. However, the graveyard site (Os2-04) and homestead site with potential infant graves (Os2-02) could still be subject to indirect impact, specifically during site clearance or construction activities. Consequently, the mitigation measures set out above and below will still apply.

The recommendations below are provided to mitigate the potential impact of the grid connection on the identified heritage resources:

- The heritage sites Os2-02 and Os2-04 must be protected with at least a 30m buffer;
- The formal graves at Site Os2-04 are protected by section 36 of the NHRA and must be demarcated and avoided as a “no go” area. There is also a possibility that potential infant burials could be located at Site Os2-02. This site should also be demarcated and avoided as a “no go” area.;
- The remains of Historical structures at Os2-02 are protected by section 34 of the NHRA and should be fenced and avoided as “no go” areas to prevent any indirect impact;
- A separate desktop palaeontological assessment is being undertaken by a palaeontologist as the project area falls into an area of Very High fossil sensitivity. The desktop assessment will indicate if significant/sensitive fossils will be impacted by the proposed project and provide mitigation measures and the way forward in this regard.

No fatal flaws were identified during this study, therefore, it is the considered opinion of the heritage specialist that the construction of the proposed Oslaagte Solar 2 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 palaeontological assessment are implemented before any site clearance or construction activities commences. In terms of the impact on the identified heritage resources, Alternative 2 is preferred as the layout has been revised to avoid the two sites containing historical graves and structure remains (Os2-04 and Os2-02).

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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 Environment, Fisheries and Forestry
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
PHRA	Provincial Heritage Resources Authority
PV	Photo Voltaic
FSHRA	Free State Heritage Resources Authority
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SAHRA	South African Heritage Resources Agency

1 INTRODUCTION

The Applicant, Oslaagte Solar 2 (Pty) Ltd, proposes the development of a 460MW solar photovoltaic (PV) facility, as well as associated infrastructure, to be located approximately 17,5 km southeast of Kroonstad. The Oslaagte Solar 2 (up to 460MW) Solar PV Project will be located on the Farm Oslaagte 2564, within Ward 1 of the Moqhaka Local Municipality (MLM). The project will cover up to approximately 600 ha and is intended to generate up to 460MW. The electricity generated by the Project will be transmitted through a 132kV power line between facility substation and the Eskom Collector Switching Station/Main Transmission Substation (MTS). At this stage it is envisaged for the project to be bid into the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

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 FSHRA 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

The Oslaagte Solar 2 120MW Solar Photo Voltaic (PV) Project will be located on the Farm Oslaagte 2564, within Ward 1 of the Moqhaka Local Municipality (MLM). The project will cover up to approximately 480 ha and is intended to generate up to 240MW. The electricity generated by the Project will be transmitted through a 132kV power line from the new facility substation to a new 400/132 kV Main Transmission Substation (MTS). The 132kV powerline is approximately3.45 kilometres (km) long, with a 100 meter (m) wide assessment corridor.

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 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 (DFFE).

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 is larger than 5000m^2, 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 associated 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, 2017), 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 repots (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 Applicant 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 often restricted by localised flooding due to the rainy (summer) season and extremely dense vegetation (grass and acacia thicket), as well as the occurrence of animal burrows and large termite mounds in some areas. In addition, some gates to fields were locked and therefore not all areas were accessible.

The large area of the project footprint 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, graves or burial sites.

4 PROJECT DESCRIPTION

4.1 Location

The Oslaagte Solar 2 project is located on the Farm Oslaagte 2564, and will cover up to approximately 600haa. The solar PV facility has a contracted capacity of up to 460 MW. The 132kV power line will exit the new facility substation, which is located near the south eastern boundary, to a new 400/132kV Main Transmission Substation (MTS) that is located 3.45km south of the Project PV site.

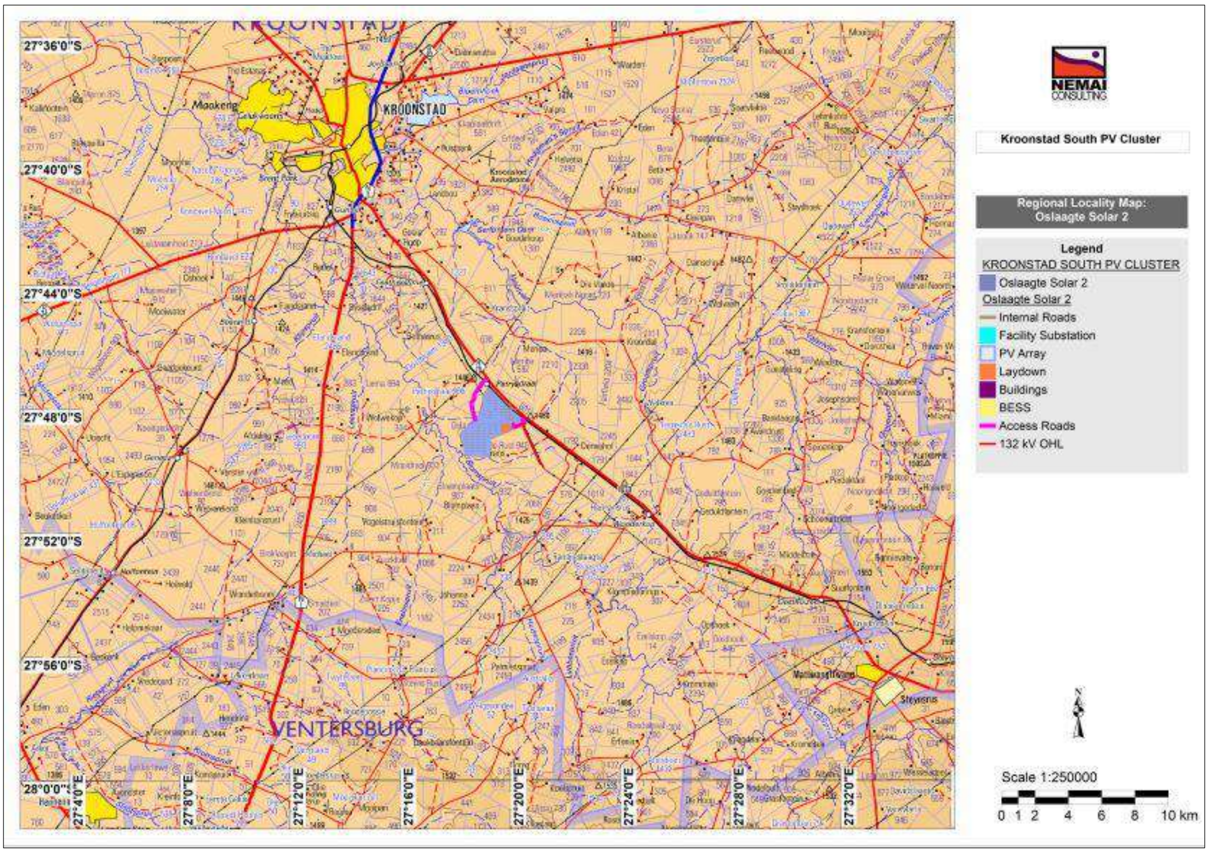

Figure 1: Oslaagte Solar 2 Project Locality south of Kroonstad (Nemai 2023)

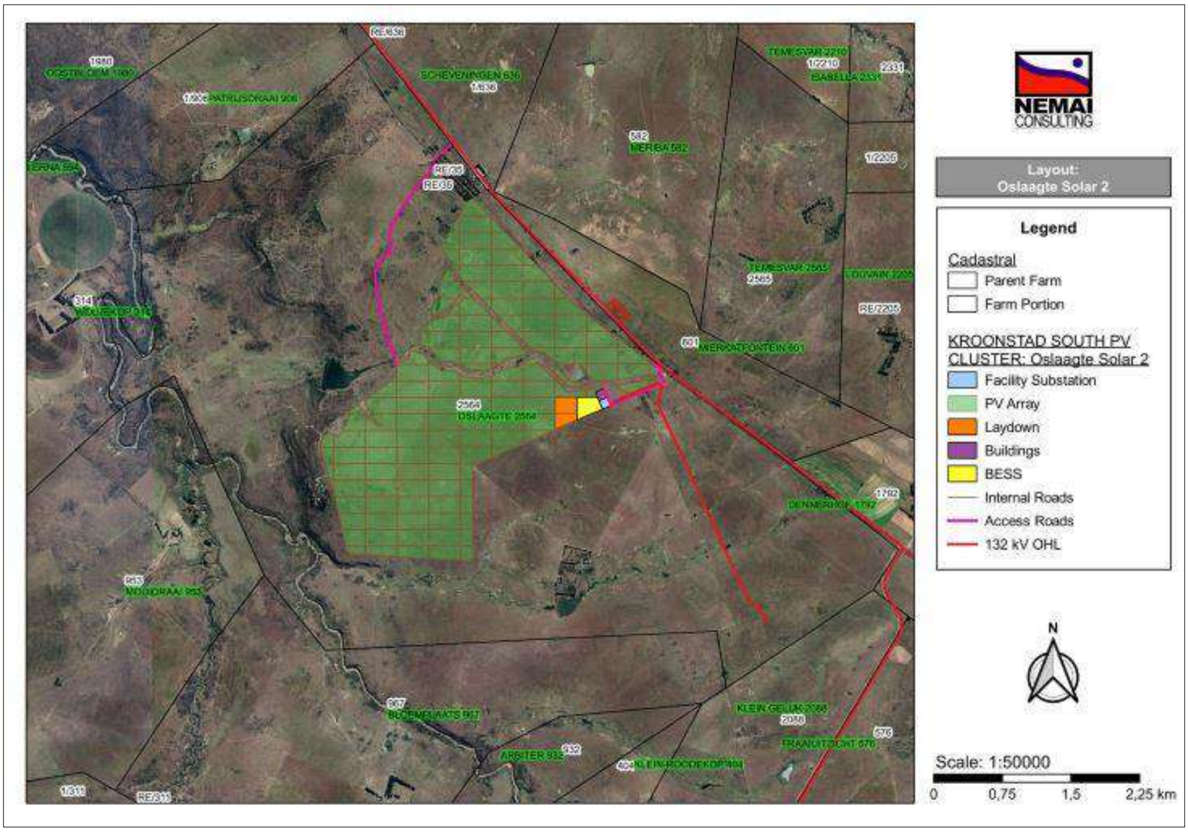

Figure 2: Oslaagte Solar 2 PV Project - Layout Alternative 1 (Nemai 2023)

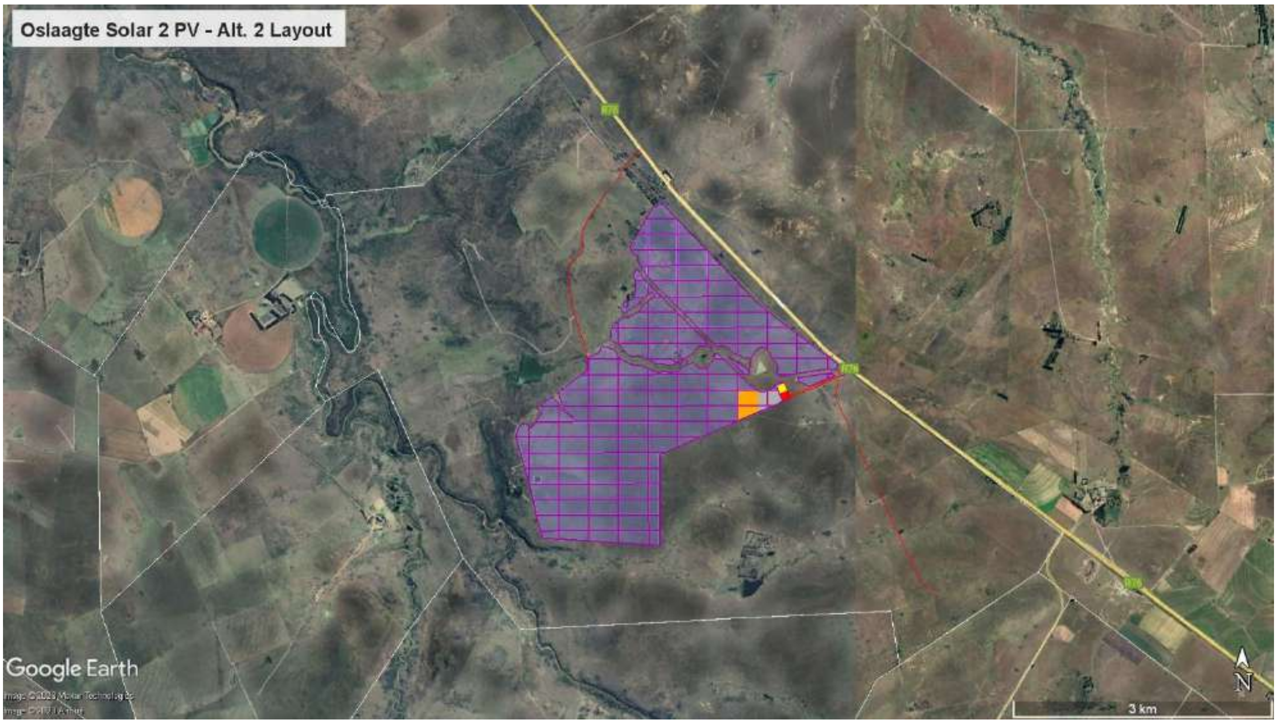

Figure 3: Oslaagte Solar 2 PV Project - Layout Alternative 2

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 PV Technology Overview

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 4** below, provides an overview of a typical Solar PV Power Plant.

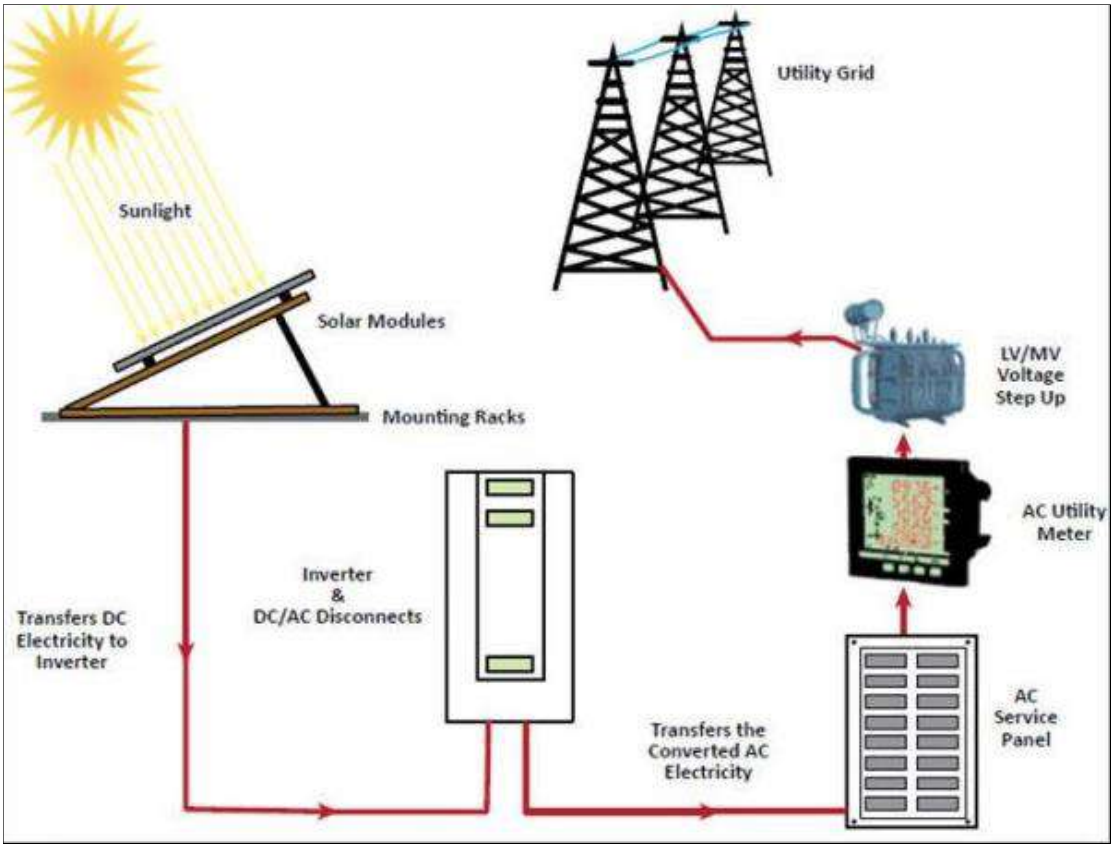

Figure 4: Overview of Solar PV Power Plant (International Finance Corporation, 2015. Utility-Scale Solar Photovoltaic Power Plan.)

4.2.3 Overview of Technical Details: Oslaagte 2 Solar PV project

The technical details of the proposed Solar PV Plant are captured in Table 1 below.

Table 1: Technical details of the proposed PV Plant

No.	Component	Alternative 1 - Description / Dimensions	Alternative 2 - Description / Dimensions
1.	Height of PV panels	Up to 5 m	Up to 5.5 m
2.	Facility generation capacity (MW)	120 MW	Up to 240 MW
3.	Area of PV Array	Up to approximately 218,8 ha	Monofacial or Bifacial PV panels, mounted on either fixed-tilt, single-axis tracking, and/or double-axis tracking systems. Up to 325 ha
4.	Area occupied by substations	Up to 1 ha	Up to 1 ha
5.	Capacity of on-site substation	High voltage (132 kV)	The facility substation will collect the power from the facility and transform it from medium voltage (up to 33kV) to high voltage (132 kV).
6.	BESS	Area up to ± 4ha	Area up to ± 4ha
7.	Area occupied by both permanent and construction laydown areas	Temporary: Up to 5ha Permanent: Up to 1 ha (located within the area demarcated for temporary construction laydown)	Temporary: Up to 5ha Permanent: Up to 1 ha (located within the area demarcated for temporary construction laydown)
8.	Area occupied by buildings	Up to 1 ha	Up to 1 ha
9.	Length of internal roads	Up to 17 km	Up to 17 km
10.	Width of internal roads	The internal roads will be up to 6 m wide. The access roads will be up to 8 m wide.	The internal roads will be up to 6 m wide. The access roads will be up to 8 m wide.
11.	Proximity to grid connection	±7.30 km	±7.30 km
12.	Height of fencing	Up to 3.5m	Up to 3.5m
13.	Type of fencing	Type will vary around the site, welded mesh, palisade and electric fencing	Type will vary around the site, welded mesh, palisade and electric fencing

4.2.4 Project Layout

The layout alternatives for the Solar PV Plant are shown in **Figure 2** (Alternative 1) and **Figure 3** (Alternative 2), above. The desirability of the earmarked site for the development of the proposed Solar PV 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 connection: The electricity generated by the Project will be transmitted through a 132kV power line from the new facility substation to a new 400/132 kV Main Transmission Substation (MTS).
- Extent of site: The overall extent of the site is sufficient for the installation of the PV facility.
- Site access: The site can be accessed via the R76, which runs along the eastern boundary of the site.

4.2.5 Components of the Proposed Solar PV Plant

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

- PV modules and mounting structures which will consist of either Monofacial or Bifacial PV panels, mounted on either fixed-tilt, single-axis tracking, and/or double-axis tracking systems.
- 132kV power line that is 3.45km in length.
- Inverter stations, transformers, switchgear and internal electrical reticulation (underground cabling).
- Battery Energy Storage System (BESS), potentially Lithium Battery Technologies, with an area up to 5ha.
- Facility grid connection infrastructure, including:
  - 33kV cabling between the project components and the facility substation;
  - A 132kV facility substation. The maximum size of the facility substation will not exceed 1 ha. The facility substation will collect the power from the facility and transform it from medium voltage (up to 33 kV) to high voltage (132 kV).
  - 33kV or 132kV cabling or powerline between the facility substation and the proposed Main Transmission Substation or the Kroonstad Switching Station.
- Temporary construction laydown area up to seven (7) ha and permanent laydown area up to 1 ha (to be located within the area demarcated for the temporary construction laydown).
- Internal roads will be up to 6 m wide, to allow access to the Solar PV modules for operations and maintenance activities.
- Main access road is up to 8 m wide. The site is accessible via the R76.
- Operation and Maintenance buildings including a gate house and security building, control centre, offices, warehouses and workshops for storage and maintenance. The buildings will occupy an area of 1.5ha.
- Fencing around the PV site to a height of 3.5m.

5 STATUS QUO ANALYSIS

5.1 General Existing Condition of Receiving Environment

The Oslaagte Solar 2 PV project area is situated on the middle portion of the farm Oslaagte 2564. A railway line runs along the eastern boundary of the site, adjacent to the R76 road. The general area is covered with a combination of acacia thickets and grassland which varies from shorter to long dense grass. Several farm dams occur and there are several outcrops of sandstone. There are also many termite mounds as well as animal burrows occurring on the property. The topography varies from relatively flat to gently undulating. 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 property is currently used for cattle grazing with some game (gemsbok and springbok) present as well. The south-eastern section of the project area contains a small electricity substation situated adjacent to the eastern boundary.

Figure 5: View of the vegetation and terrain in the north-central section of the project footprint area

Figure 6: General view of the grassland and shrubs, with a termite mound in the lower left-hand corner

Figure 7: View of the long dense grass vegetation on the south-central section of the project footprint,

Figure 8: View showing the mixed grassland and acacia vegetation over large portions of the project footprint

Figure 9: View of existing powerline and grassland vegetation in the south-eastern section of the project footprint

5.2 Cultural-Heritage Receiving Environment

5.2.1 DFFE Environmental Screening Tool

The DFFE Environmental Screening Tool was accessed for information on the cultural-heritage sensitivity as well as the palaeontological sensitivity of the general region. This tool indicated that the Archaeological and Cultural Heritage Sensitivity of the general region is Low (**Figure 10**). However, the palaeontological sensitivity of the geology of the surrounding area is indicated as Very High (**Figure 11**).

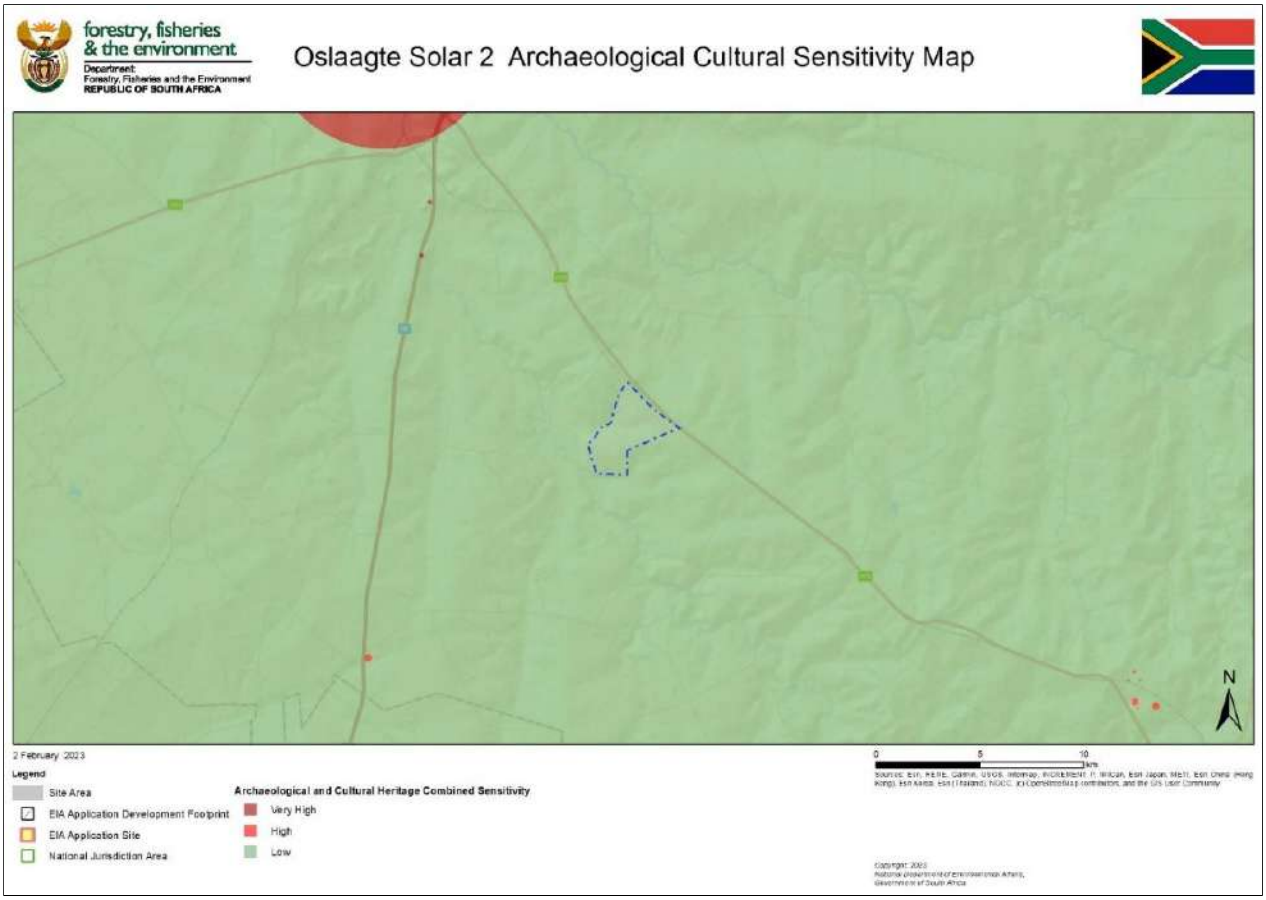

Figure 10: Archaeological Cultural Sensitivity map indicating that the project footprint is located within a region of low heritage sensitivity (DFFE Screening Tool).

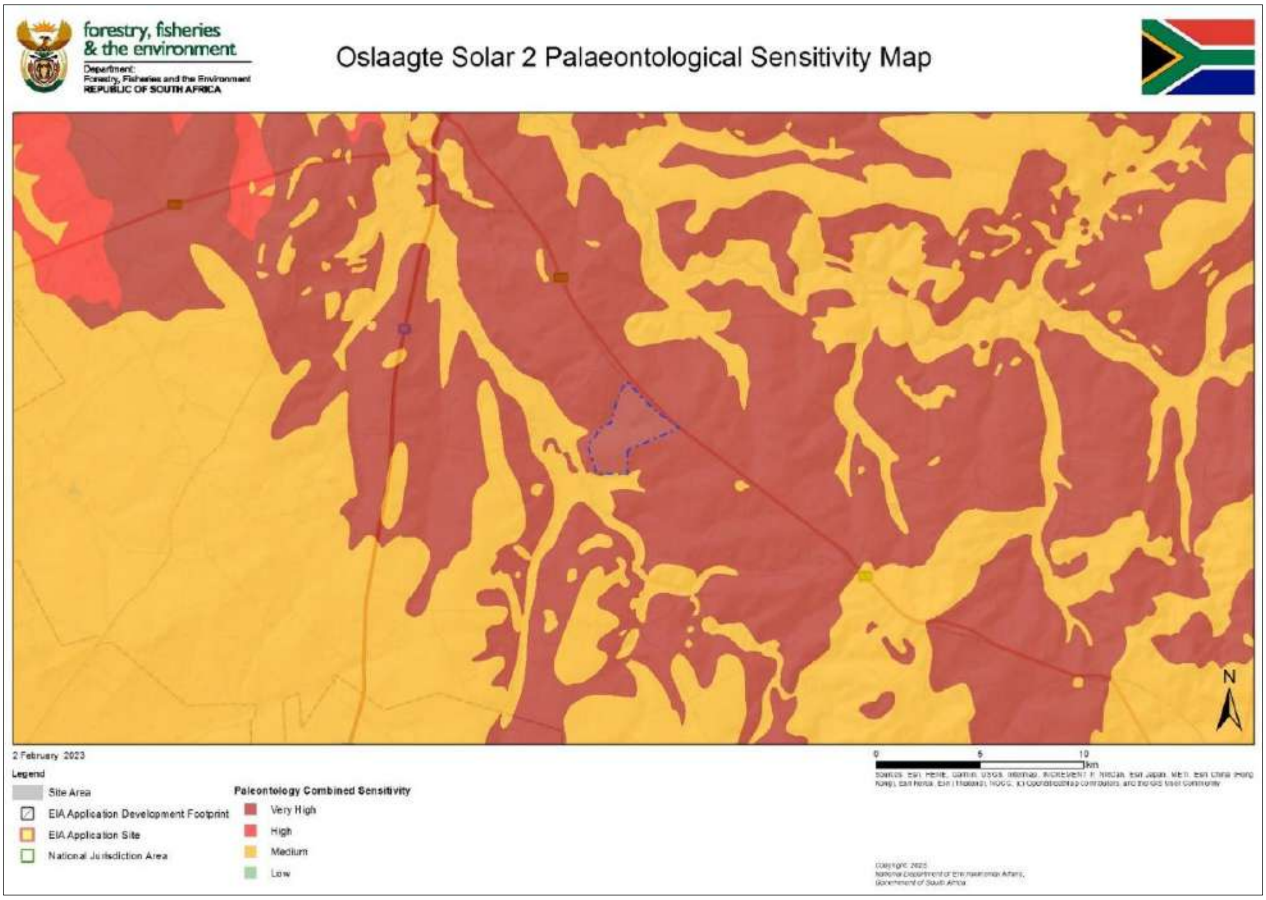

Figure 11: Palaeontological Sensitivity map indicating that the project footprint is located within a region with Very High sensitivity (DFFE Screening Tool)

5.2.2 Historical Background of Surrounding Region (archaeological and historical literature survey)

The Free State is rich in archaeological and historical resources and includes significant aspects such as Later Stone Age rock art, Battlefields and Iron Age stonewalled enclosures. Historically, the general region of the project area was a frontier region where San hunter-gatherers, Nguni and Sotho-Tswana agro-pastoralists, Dutch Voortrekkers and British Colonists all interacted.

The archaeological history of the area can be divided into a Stone Age, Iron Age and Historic or Colonial Period. An overview of the general region is presented below.

The Stone Age

The Earlier Stone Age (ESA) is the first and oldest phase identified in South Africa's archaeological history and the material culture of the earliest people comprises two technological phases. The earliest of these is known as Oldowan and is associated with crude flakes and hammer stones. It dates to approximately two million years ago. The second technological phase is the Acheulian which is comprised of more refined stone artefacts such as the cleaver and bifacial hand axe. The Acheulian dates to approximately 1.5 million years ago. No ESA sites are known from the study area and surrounding region (Fourie 2021; Angel and Kitto 2018).

The Middle Stone Age (MSA) material culture is associated with flakes, points and blades manufactured by means of a technique known as the "prepared core" technique. This phase is furthermore associated with modern humans and complex cognition (Wadley, 2013). research fieldwork by the National Museum in Bloemfontein, recorded ten sites where MSA and/or Later Stone Age artefacts were identified in association with mammal fossil remains from erosion channels along the Sand, Vet and Doring Rivers (De Ruiter *et. al*. 2011, Fourie 2021; Angel and Kitto 2018).

The Later Stone Age (LSA) is the third archaeological phase and is characterised by very small stone tools known as microliths. 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 (in some areas, for a considerable period). Apart from the occurrence of LSA stone tools along the Sand, Vet and Doring Rivers (see above), no other LSA are known from the surroundings of the study area.

The Later Stone Age is also associated with the production of rock engravings and rock paintings. Rock engravings are known from the wider vicinity of the study area (Bergh, 1999). The closest rock art site in the general area is Spitskop. Spitskop is located 12 km west of Verkeerdevlei on the link road to the N1 in the Brandfort District. The Spitskop site consists of three San or 'Bushman', as well as Khoe or 'Khoi' rock-engraving sites located on adjacent farms, which are all relatively close to a sandstone mountain known as Spitskop. There are images of eland, geometric forms, human figures, and ostrich (Ouzman, S. 2001); http://www.nasmus.co.za/departments/rock-art/public-rock-art-sites).

The Iron Age

The Iron Age in South Africa (c.AD 1600 – c.AD 1840) is associated with pre-colonial farming communities and includes both agricultural and pastoralist farming activities, metal working, and the occurrence of stone-walled settlements known as the 'Central Cattle Pattern' (Huffman, 2007) as well as cultural customs such as lobola . According to the distribution map for Iron Age settlements on the Southern Highveld as published in Maggs (1976:38-39), the project area is located within the western boundary of the known distribution of such Late Iron Age sites. The distribution maps as published by Huffman (2007) also indicate that the project area is located very close to the periphery of two Iron Age ceramic typological sub-groups known as facies. These two Iron Age facies are known as Thabeng and Makgwareng.

The Thabeng facies of the Moloko Branch of the Urewe Tradition is one of the sub-groups identified within the study area. The decoration on the ceramics associated with this facies is characterised by incised triangles, coloured chevrons and arcades. The Tlhaping at Dithakong, Rolong at Platberg and the Kubung from the Free State form a Southwestern Sotho-Tswana cluster that is associated with this Thabeng facies pottery and so-called 'Type Z' settlement layouts (Huffman, 2007). The Type Z settlements are one of the Late Iron Age stonewalled settlement types identified initially by Tim Maggs during his extensive archaeological research project on the Iron Age of the southern Highveld (Maggs, 1976), which includes the current project area. These Type Z sites are characterised by large primary enclosures surrounded by dwellings which are comprised of two sections or lobes, one being larger than the other. Each of these 'bilobial' dwellings comprises a hut at the front with a semi-circular courtyard at the back. While several Type Z sites are located within the general region of the project area, one of the more well-known ones is OXF1, situated a short distance north-west of the town of Ventersburg. Ventersburg is located approx.45km south of Kroonstad. This site was excavated by Tim Maggs during the 1970s as part of his overall research project (Maggs, 1976).

The next known Iron Age period within the surroundings of the study area is represented by the Makgwareng facies of the Blackburn Branch of the Urewe Ceramic Tradition (Huffman 2007). The decoration on the ceramics from this sub-group is characterised by finely stamped triangles, rim notching and appliqué (Huffman, 2007). This sub-group developed from Ntsuanatsatsi south of the Vaal River and can be associated with the so-called 'Type V' stone walling settlement type (Huffman, 2007). Dreyer (1990) also conducted excavations on Type V Late Iron Age stonewalled settlements which are located a short distance south-west of Winburg, which is approx. 100km south of Kroonstad. The Type V settlements comprise a central core of cattle enclosures surrounded by beehive type huts. Corbelled stone huts are also associated with this walling type. They are low stone huts located at the edge of the cattle enclosures (Huffman 2007).

The best-known site of this type found within the surroundings of the study area, is a site known as "Early Sotho Settlement, Waterval, Sandrivierhoogte" that was originally declared a National Monument and which is now registered as a Provincial Heritage Site in terms of the National Heritage Resources Act (No 25 of 1999). The site is located roughly 42km south-east of the current study area. The original declaration as a national monument was on 17 December 1982. In the declaration, the site is described as a "Leghoya Village", comprising corbelled huts and stonewalls (Govt. Gazette No. 8481, 1982).

Historical/Colonial Period

From roughly the 1820s there was a period characterised by conflict across the Southern Highveld. This resulted from the migration of three Nguni groups from the current Kwazulu-Natal province into the present-day Free State province which was a result of the expansion of the Zulu kingdom under King Shaka. The three Nguni groups were the Hlubi of Mpangazitha, the Ngwane of Matiwane and the Khumalo Ndebele (Matabele) of Mzilikazi. The migrations of all three groups would have had a definite impact on the northern Free State (Fourie 2021).

During the early Colonial Period (early 1800s) the study area and surroundings became known as Transorangia. The people called the Griqua had moved into the area in the years prior to 1804. Then a few white Trekboers started moving across the Orange River from the Cape Colony in search of better grazing for their livestock during times of drought. At first the farmers requested permission from the Cape authorities before crossing the river. However, later groups moved into the Transorangia region without permission (Fourie 2021, citing Schoeman, 1980). During the 1830s, this occasional movement developed into a mass migration of Afrikaner families from the Cape Colony to the interior. This mass migration became known as the 'Great Trek' and the families were known as Voortrekkers (Fourie 2021, citing Visagie, 2011). The first Voortrekker party of some 70 wagons crossed over the Orange River during early 1836. More groups followed and established themselves along the Vet River (Fourie 2018, citing Schoeman, 1980).

In 1841 the town of Winburg was established on the banks of the Vet River. It was laid out on the farm Waaifontein in 1841 and became a municipality in 1872. Raper (2014) notes that the name was originally spelt 'Wenburg', which means 'town of winning'. He considers that this original spelling may refer to a military victory over the Matabele at Mosega on 17 January 1837, or to the triumph of those residents of the town who were in favour of Waaifontein as the site of the town (Raper 2014). After the annexation of Natal by the British in 1843 and the subsequent dissolution of the Voortrekker Republic of Natalia, Winburg became the capital of the Voortrekkers in what is today known as the Free State (Erasmus, 2014). Winburg is located nearly 83km south-west of the project area.

In 1846, Major H.D. Warden was appointed British Resident of the area between the Orange and the Vaal rivers, to maintain peace between the various population groups. In 1848, General Harry Smith annexed the area between the Orange and Vaal rivers as British territory and named it the Orange River Sovereignty. However, due to ongoing conflict between the Boers, the Griqua and the Basotho people, the British government subsequently withdrew from the Orange River Sovereignty in 1854 and the area became an Afrikaner republic, the Orange Free State, with J.P. Hoffman as first Afrikaner State President and Bloemfontein as the state capital (Afrikaans community 1820-1899 | South African History Online (sahistory.org.za)).

On 16 January 1852, the Sand River Convention was signed between the British Government and the Transvaal Boers. This convention formally recognised the existence and independence of a Boer Republic north of the Vaal River by the British Government, namely the Zuid-Afrikaansche Republiek (South African Republic). The site where the signing of the convention took place, was declared a monument and for many years was marked by a stone cairn and plaque (Fourie 2021, citing Oberholster, 1972). The site is located near the bridge where the N1 highway passes over the Sand River and is located approximately 53.36 km south- west of the present project area.

The Town of Kroonstad was laid out on the farm Klipplaatsdrift in 1855. It is generally accepted to have been named after Kroondrift, a ford on the Vals /Valsch River, so called because a horse named Kroon broke its leg there (Raper 2014).

After the end of the Anglo-Transvaal War (also referred to the First South African War) which ended the two-year British annexation of the Zuid-Afrikaansche Republiek (ZAR), the Pretoria Convention of 1881 redefined the western boundary of the ZAR which was moved from the Makwassie Spruit to roughly the Harts River. In 1884, the western boundary of the ZAR was again moved further west following the recommendations of the London Convention (Bergh, 1999).

The railway line between Bloemfontein and Johannesburg was built during the early 1890s, and eventually reached Johannesburg during September 1891 and Pretoria in January 1892 (Fourie 2021, citing Schoeman, 1980).

The Second South African War (1899 – 1902) was fought between the Boer Republics of the Transvaal and Free State against Great Britain, but the victims and participants of the war were not excluded to British or Boer citizens alone.

During this war, a concentration camp was located at Kroonstad, somewhere in the vicinity of the Valsch Rivier. This was at first divided into two sections, with people from the Lindley district on the south side of the river and those from other districts on the north side. However, flooding of the river cut off the Lindley people completely and made it impossible to provide them with rations, so the Lindley people were transferred to the main section on the south of the river. The camp at Kroonstad seems to have been formed between September and November 1900. Quite a few farms had been burnt by 1900, resulting in a substantial influx of homeless families into the town. A camp for black people was also established but information on the location and other details is lacking (British Concentration Camps of the South African War 1900-1902 (uct.ac.za).

At the beginning of the First World War (1914-1918), when the South African Government of General Louis Botha notified Great Britain of their willingness to support that country against Germany, several former Boer Generals who disagreed strongly with this decision, such as Christiaan de Wet, J.C.G. Kemp and General Christiaan Frederik Beyers, led an armed rebellion. An incident which occurred close to Kroonstad was an attempt by De Wet with about 1500 or more men to capture the railway station at Virginia, roughly 55km southwest of Kroonstad, which was held by about 250 government troops. The troops held off the rebels until government reinforcements and a train arrived (The-Boer-Rebellion-in-South-Africa-pdf.pdf (moltenofamily.net). Several casualties of the Rebellion are buried in the old Kroonstad Cemetery (SJ de Klerk 2021, Battlefields Route – Koppies to Kroonstad | The Heritage Portal).

In 1975, Winnie Mandela was incarcerated at the Kroonstad Prison. In February 1975, her husband, the late Nelson Mandela, wrote her a letter where he was encouraging her not to let Prison break her down (Kroonstad | South African History Online (sahistory.org.za)).

In 2014 the Kroonstad Correctional Centre was officially renamed to the 'Bizzah Makhate Correctional Centre". This name pays tribute to the late Comrade; Wilfred Sefularo 'Bizzah' Makhate who was incarcerated at this facility in the eighties (https://www.gov.za/kroonstad-correctional-centre-officially-renamed-bizzah-makhate-correctional-centre).

Reverend Zaccheus Richard "ZR" Mahabane, lived and worked in Kroonstad for most of his lengthy career, and is buried in Seeisoville Cemetery in Maokeng, although he was born in Thaba Nchu. Rev. Mahabane was one of the Founding Fathers of the ANC and was elected ANC President in 1924. He constantly strove for black unity and together with Mr A Abdurahman established the non-European Unity Movement (NEUM) between 1927 and 1934. In 1935 he served as an executive committee member of the All Africa Convention (AAC), a federal body that gave expression to the aspirations of black people and fought against the Native trust and Land Act promulgated in 1936. He was elected as ANC President for the second time from 1936 – 1940. He also played a prominent role in the development of the Methodist Church in South Africa and helped draft the church's constitution and define the equal status of all in the church (Verwey 1995, SA History Online). His grave in Seeisoville Cemetery was recently declared as a National Heritage Site (Govt. Gazette Notice No.380 2019).

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 sheet for this area dates to 1960, therefore, it was not considered necessary to examine the later edition map sheets. Any heritage resources that are 60 years or older would be depicted on the 1960 edition sheet.

The topographical map was 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 Oslaagte Solar 2 footprint: 2727CD Wonderhoek Edition 1 1960. The map was surveyed in 1960 and drawn in 1962 by the Trigonometrical Survey Office of the Republic of South Africa from aerial photographs taken in 1951.

As can be seen in **Figure 12** and **Figure 13** below, the 1960s edition map depicts one heritage feature within the Oslaagte Solar 2 footprint, which is a graveyard. Two features are located adjacent to the project footprint. One is a group of homesteads and the other is a group of four structures marked adjacent to the railway line, outside the north-west corner of the footprint. Two homesteads are depicted at the south end of the powerline (not shown in the figures). The features depicted will be at least 63 years old.

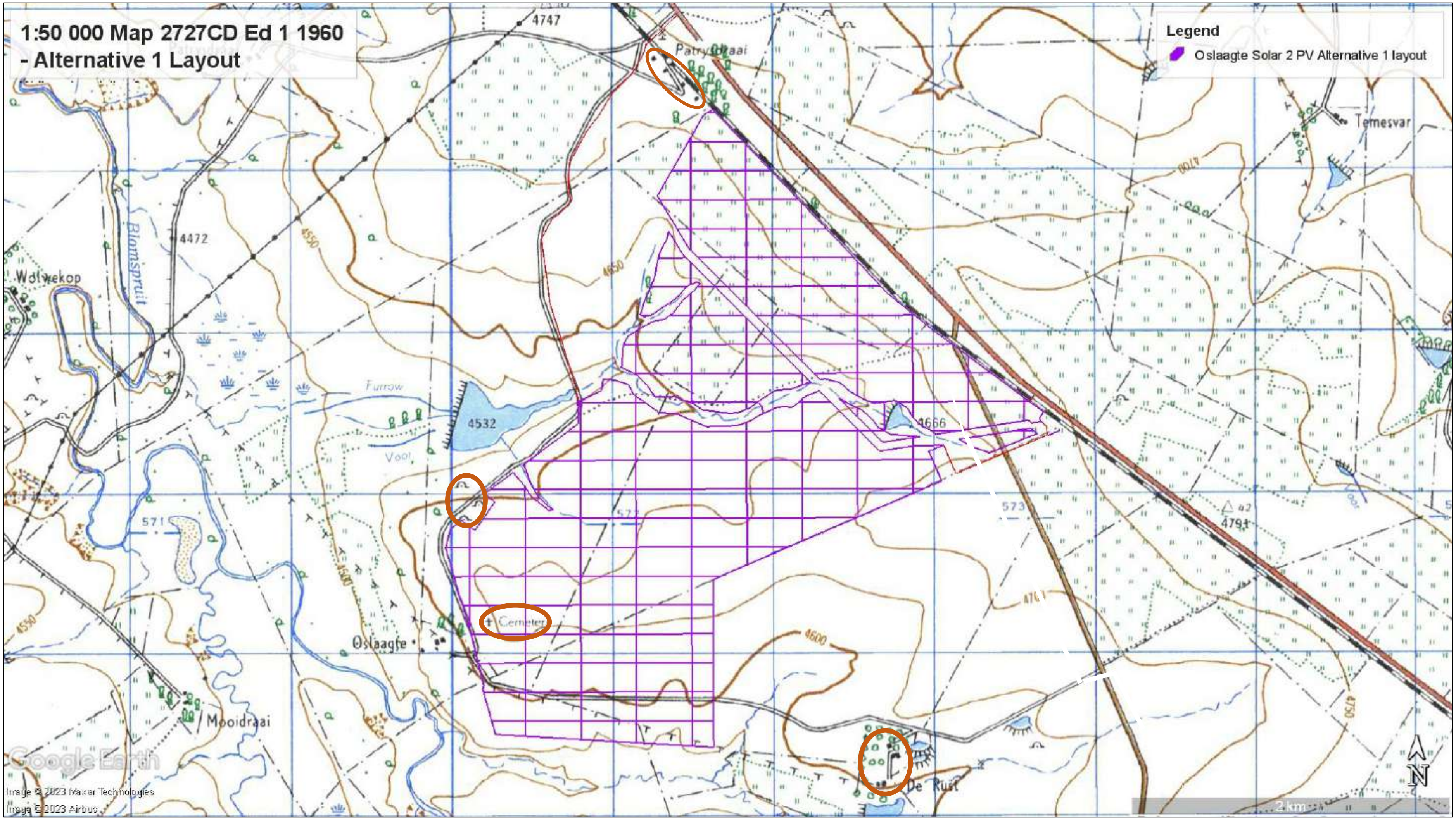

Figure 12: Enlarged view of topographic map 2727CD Ed 1 1960, depicting one heritage feature which is a graveyard within the Oslaagte Solar 2 PV footprint – Alternative 1. Two features are located adjacent to the project footprint. One is a group of homesteads. The other is a group of four structures in the area adjacent to the railway line, outside the north-west corner of the footprint. All features are marked by orange polygons.

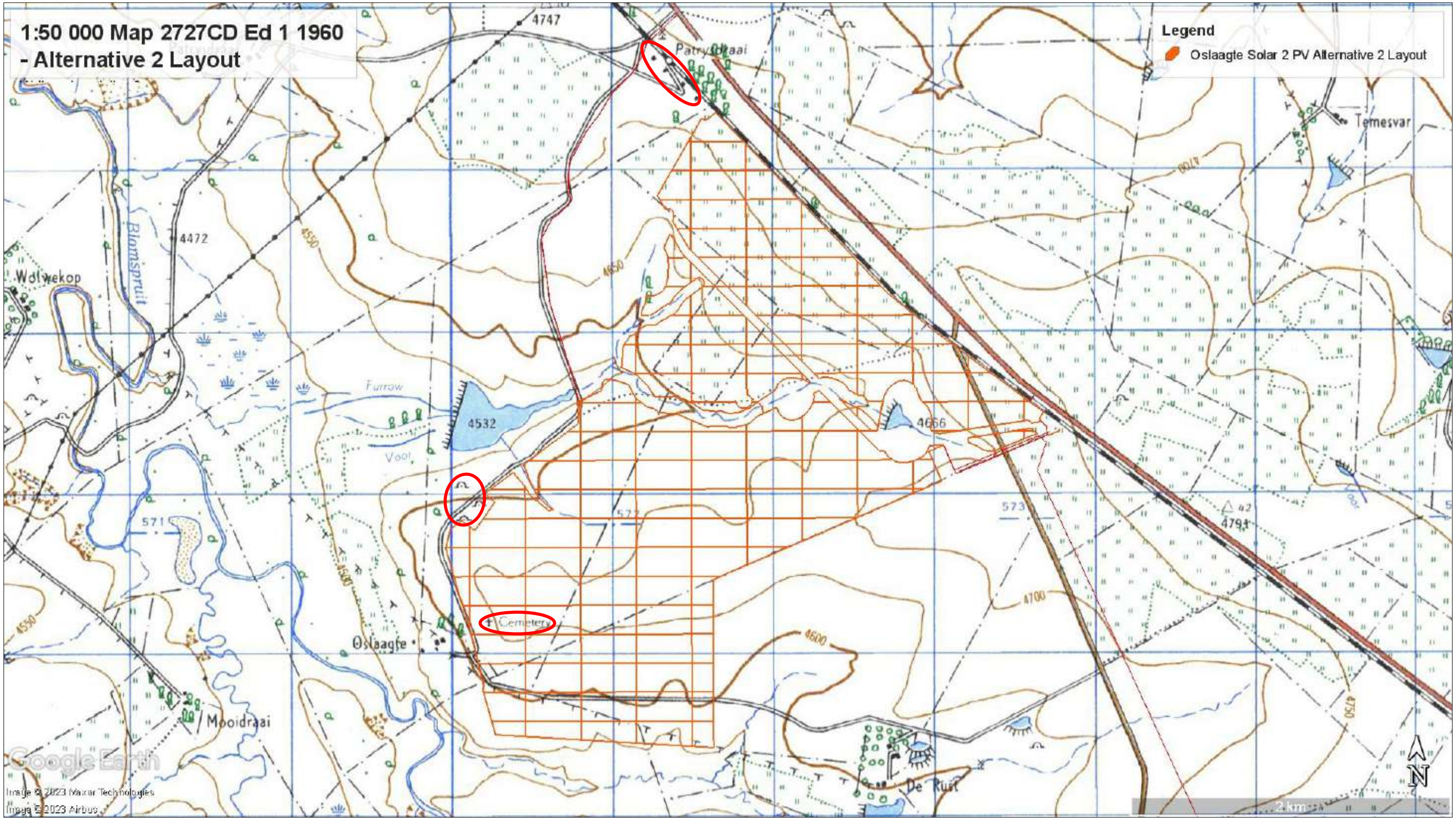

Figure 13: Enlarged view of topographic map 2727CD Ed 1 1960, depicting one heritage feature (a cemetery) within the Oslaagte Solar 2 PV footprint – Alternative 2. Two features are depicted just outside the boundary of the footprint: one is a group of homesteads, the other is a group of four structures located adjacent to the railway line, immediately outside the north-east corner of the footprint. The powerline is not included in this view. All features are marked by red polygons

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.

Fourie, W. 2021. HIA for *The Proposed Harmony Fss6 Reclamation Pipeline, Welkom, Free State Province.* During the survey, no heritage sites were identified.

Lavin, J. 2020. *Archaeological Specialist Study In terms of Section 38(8) of the NHRA for a Proposed development of the Vrede and Rondavel Solar Energy Facilities near Kroonstad, Free State Province*. Two Later Stone Age scatters and one isolated flake were identified within the area proposed for the Rondavel SEF. A series of four stone cairns were also identified, as possible graves.

Van der Walt, J. 2019. *Heritage Desktop Report Lengana Health SA Prospecting Application, Koppies, Free State Province.* The proposed prospecting activities were located on Felix 318, Goedgunst 315, Kronenbloem 51, Ventersbloem 163, Oceaan 64, Oceaan 99, Broodkop 304, Enkelsbosch 31, Hooge Bult 542, Geluk 237, Verdeel 278, Goudlaagte 238, Ongegund 507. The desktop study noted that structures of unknown age occur within the prospecting right area, no stone walled settlements were visible on aerial images consulted and no known graves occur in the study area, although informal graves could be expected in the study area.

Angel, J and J Kitto. 2018. *Kophia Diamonds (Pty) Ltd Catherine's Fancy 831, which forms part of the Blaauwbosch Mine, Boshof District, Free State Province Heritage Impact Assessment.* The HIA was necessitated by the discovery of skeletal material during mining activities on the farm Catherine's Fancy. Seven heritage resources were located, not including the accidentally discovered burial ground. These included three Middle Stone Age sites and four historical structures.

De Bruyn, C. 2018. *Basic Assessment Report for the Prospecting Right and Environmental Authorisation Application for Kroonstad South Situated in the Free State Province*. A graveyard with several marked and unmarked graves as well as two historical farmhouses were found within the project area.

De Jong, RC. 2011. *Specialist Study: Heritage Impact Assessment for the Installation of the Sirius Fibre Optic Cable between Johannesburg and Yzerfontein, Gauteng, Free State, Eastern and Western Cape Provinces.* The cable corridor included the section of the N1 roads between northern Johannesburg and Bloemfontein via Kroonstad, Ventersburg and Winburg. No significant heritage resources were identified along the N1 in the Kroonstad area.

5.4 Desktop 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 South African Palaeontological Sensitivity Map (http://www.sahra.org.za/sahris/map/palaeo). This map indicates that the Oslaagte Solar 2 PV project footprint falls within an area of Very High (red colour) fossil sensitivity (see **Figure 14** below). The different palaeontological sensitivities that are defined on the SAHRIS Palaeontological Sensitivity Map, are outlined in the table below. A separate desktop palaeontological assessment has been undertaken by a professional palaeontologist.

Figure 14: SAHRIS Palaeo-sensitivity map overlain on the Oslaagte Solar 2 PV project footprint (purple polygon). The underlying geology is shown as having 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 (1960) of the 1:50 000 topographical maps overlain with the project footprint has shown that at least two specific heritage features, one being a graveyard. could be present within the project area footprint.

The Site Survey fieldwork provided confirmation of some of the heritage resources occurring within and close to the project area footprint, specifically the graveyard.

6 SITE SURVEY/FIELDWORK RESULTS

The survey of the Oslaagte Solar 2 project footprint took place over one day (07 January 2023) by the author (heritage specialist) and an assistant. A vehicle was used to access the project footprint area and the survey was conducted both by 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 acacia thicket in several areas, as well as certain sections which contained many animal burrows and termite mounds, which limited accessibility. Some areas could not be accessed due to the gates being locked.

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 structures or remains and landscape features of cultural heritage significance. The inspection identified a total of four heritage resources situated within or adjacent to the project area footprint. Two of these sites are recent/modern structures (Os2-01 and Os2-03), one is the graveyard depicted on the 1960 topographic map (Os2-04) and one comprises several clusters of rocks likely to be the remains of an African homestead (Os2-02). A fourth site was identified a short distance to the north of the project footprint, which is the demolished remains of several railway houses.

Identified Heritage Sites

Site Name	Os2-01_Structure
GPS Coordinates	- 27°48'18.22"S, 27°19'21.27"E
Site Description	A redbrick and concrete structure, which seems to be a water tank support is located here.
Approximate Age	Recent/modern structure
NHRA, No. 25	N/A
Field Grading and Ratings	
Site context and description	The structure is situated in the central area of both the proposed Alternative 1 and Alternative 2 footprints (within the PV solar area layout). However, the impact will not be significant.
Site Density	One brick and concrete structure
Uniqueness	Low
Heritage Significance	Low - GP.C/ NCW
Mitigation	No mitigation is required.

Figure 15: View of support structure for water tank (Site Os2-01)

Site Name	Os2-02_Homestead
GPS Coordinates	27°48'20.36"S, 27°19'22.24"E
Site Description	The site comprises a scattered group of sandstone rocks/stones that form the collapsed remains of several structures, possibly a homestead. The remains are located on a sandstone outcrop. Extent approx. 31mx15m.
Approximate Age	Unclear if the site is more than 60 years old as nothing is depicted on the 1960s map
NHRA, No. 25	Section 34 of the Act (Section 36, potential infant graves).
Field Grading and Ratings	
Site context and description	The structure remains are situated in the central area of the proposed Alternative 1 and Alternative 2 footprints (within the PV array layout). If this is the remains of a homestead, then infant burials could be present. Nothing is depicted in this location on the 1960 topographic map 2727CD.
Site Density	The number of the collapsed structures could not be identified. More building remains could be present.
Uniqueness	Low
Heritage Significance	IIIC / GP.C- Low (demolished structures); IIIB / GP.A - High (possible infant graves – to be confirmed)
Mitigation	The site should be avoided with at least a 30m buffer as a “no go” area. The Alternative 2 Layout has been designed to avoid this area. No additional mitigation is required unless the site will be impacted.

Figure 16: View of Os2-02, looking north

Figure 17: Another view of the rock clusters, looking south

Site Name	Os2-03_Structure
GPS Coordinates	-27°48'24.26"S, 27°20'29.49"E
Site Description	The site is a building constructed of yellow/tan bricks, comprising part of an electrical substation.
Approximate Age	It is probably younger than 60 years (not depicted on the 1960 map)
NHRA, No. 25	N/A
Field Grading and Ratings	
Site context	The site is situated outside of the PV layout area for both Alternative 1 and Alternative 2 footprints.
Site Density	One modern/recent substation building
Uniqueness	Low
Heritage Significance	IIIC / GP. C - Low/ NCW
Mitigation	No mitigation is required.

Figure 18: View of western elevation of the substation building, Os2-03

Figure 19: View of northern end of the substation building, showing swallow/ swift colony nests

Site Name	Os2-04_Graveyard
GPS Coordinates	27°49'5.46"S, 27°18'22.89"E
Site Description	The site is a formal graveyard containing six graves of the Botha family. The graves date from 1925 (oldest) to 1983 (youngest). Extent approx. 555m^2/0.5ha.
Approximate Age	Oder than 60 years. A graveyard is depicted in this location on the 1960 topographic map.
NHRA, No. 25	Section 36 of the Act
Field Grading and Ratings	
Site context	The graves all belong to the Botha family, the oldest date of death inscription is 1925, the youngest is 1983. The graveyard is fenced, with no gate. It is situated within the western boundary of the Oslaagte Solar 2 PV footprint and within the PV array area for both Alternative 1 and Alternative 2 (however the Alt. 2 layout does avoid this site).
Site Density	The graveyard comprises six formal graves.
Uniqueness	Low
Heritage Significance	IIIA/ GP.A - High
Mitigation	The site should be avoided with a buffer of at least 30-50m and demarcated clearly as a "no go" area. Provision should be made for visitation access by the family. Social consultation should be undertaken to identify any surviving family members and determine their wishes regarding the graves. The graves can be relocated subject to the family's consent. This will require a permit from the responsible Heritage Authority (SAHRA) as well as the responsible Health authorities and should be undertaken by an archaeologist experienced in grave relocations.

Figure 20: View of the Botha family graveyard, showing the fence and dense vegetation

Figure 21: View of the Botha family graves, from inside the fenced area

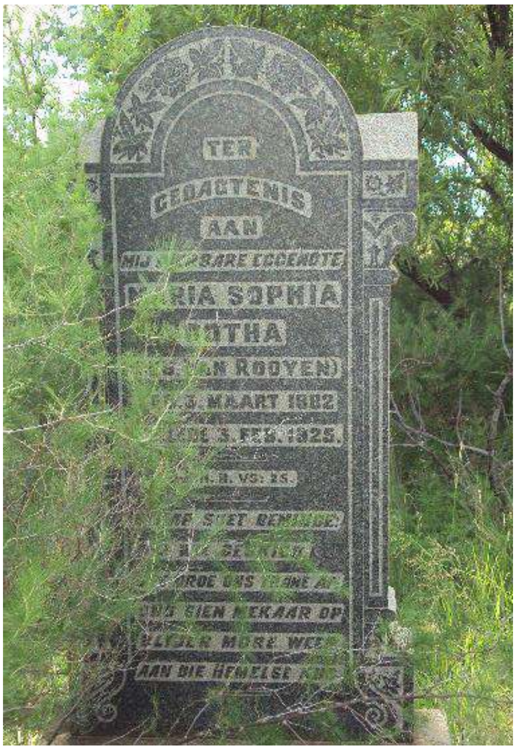

Figure 22: View of the oldest Botha grave in the graveyard (date of death 1925)

Figure 23: View of the second oldest grave, (date of death 1930)

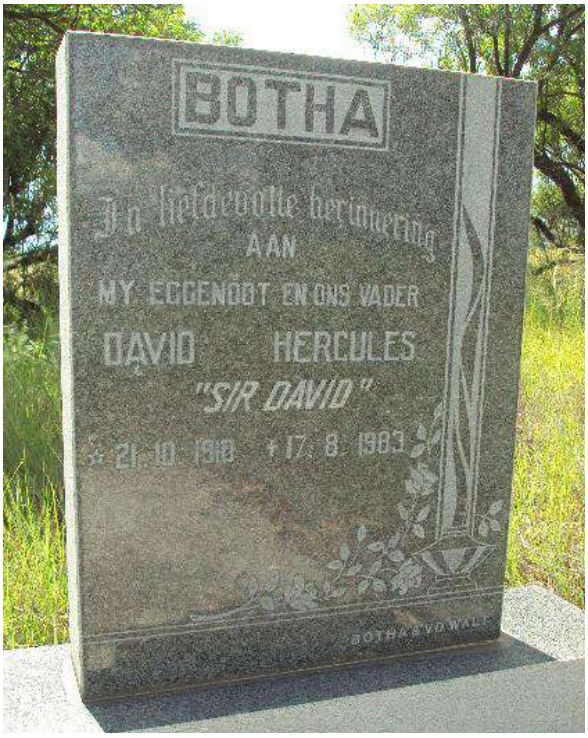

Figure 24: View of the most recent grave in the graveyard (date of death 1983)

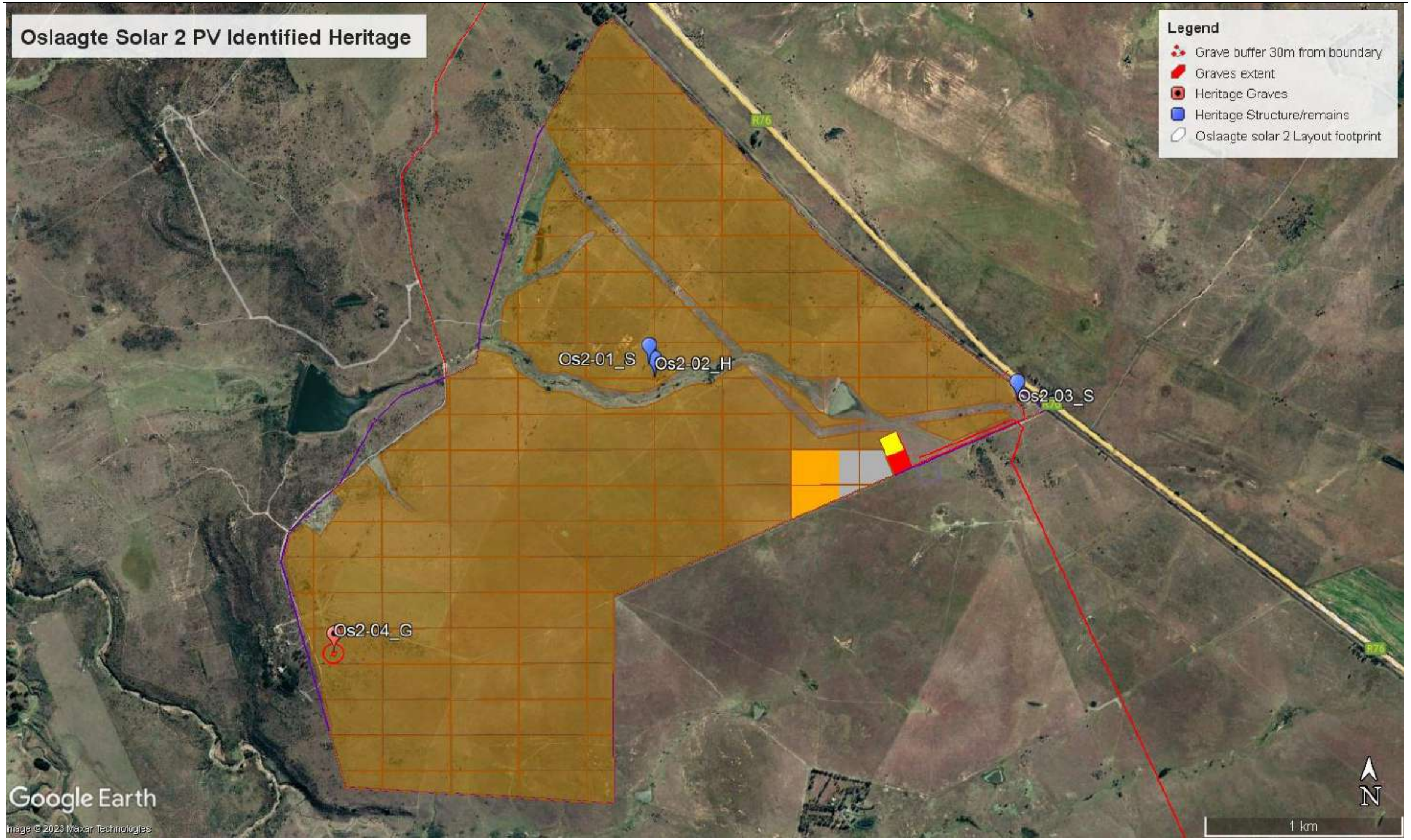

Figure 25: Heritage resources identified during the site survey and overlain on the project layout – Alternative 1 (blue icon = Structure or Homestead, red icon = grave)

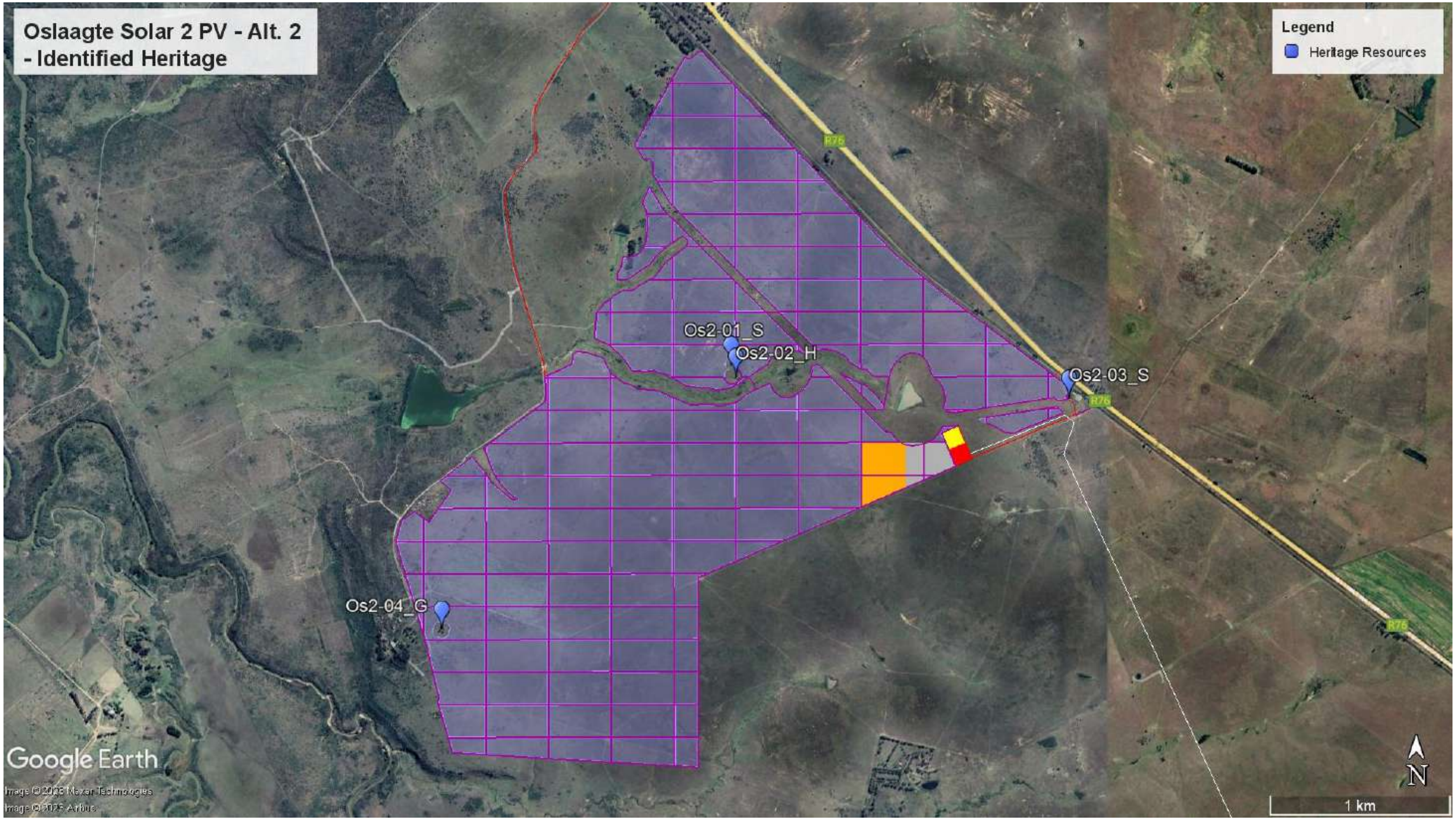

Figure 26: Heritage resources identified during the site survey and overlain on the project layout – Alternative 2 (blue icon =heritage resource)

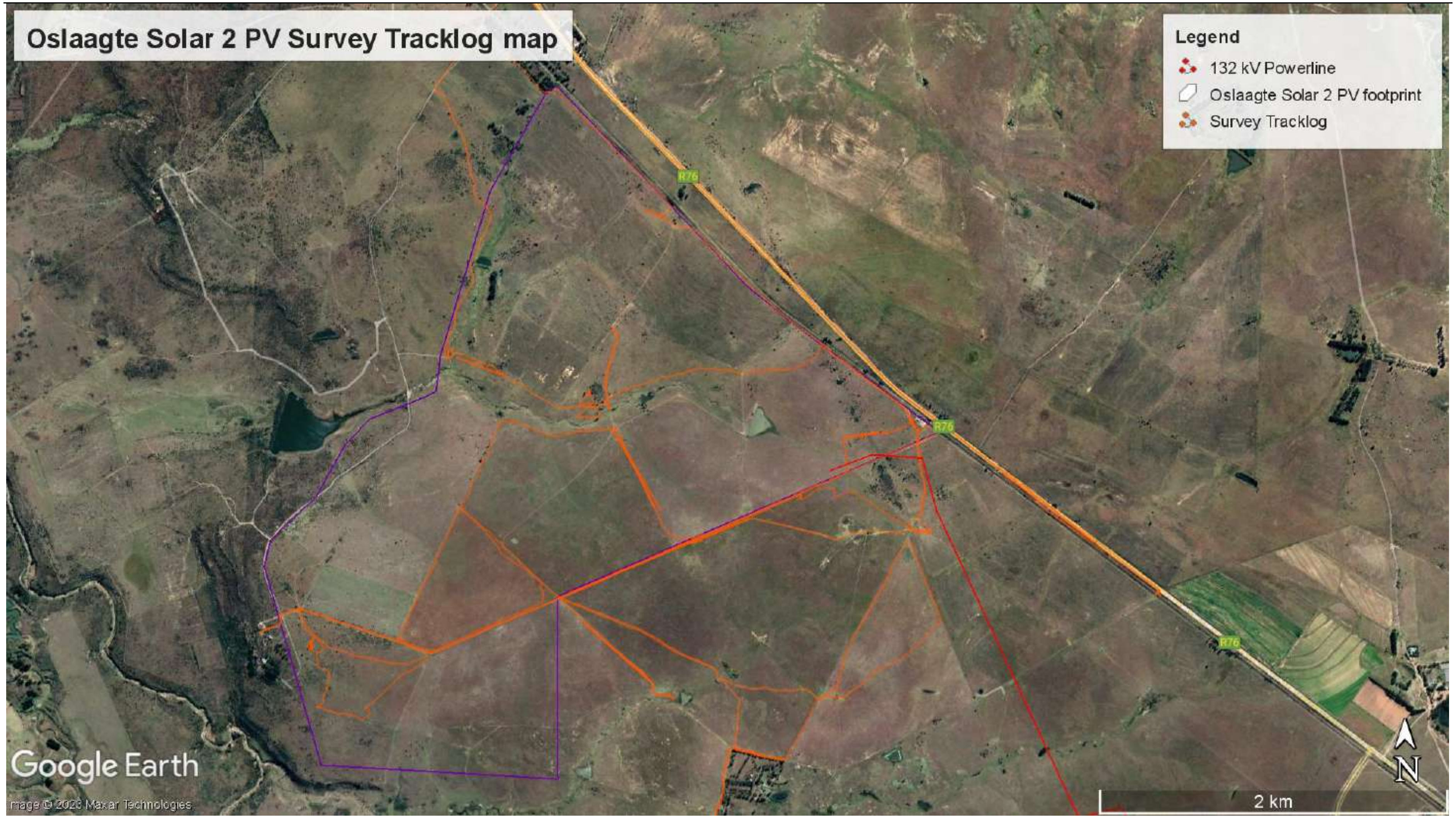

Figure 27: Site Survey Tracklog (orange lines) overlain on the general project footprint area (purple polygon)

7 SIGNIFICANCE ASSESSMENT

7.1 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 the relevant historical 1:50 000 topographical map 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.

Several internet sites were also accessed for information including ,amongst others, the website of SA History Online (https://www.sahistory.org.za), and the concentration camp database website of the University of Cape Town (British Concentration Camps of the South African War 1900-1902 (uct.ac.za)

Literature resources accessed are listed in Table 3.

Table 3: Literature sources accessed

Source	Information
Background Information Document - Nemai	Project location and description details
Published and unpublished sources and Past HIAs	Historical and archaeological background on Kroonstad and surrounding region
Directorate: National Geo-spatial Information of the Department of Rural Development & Land Reform, Cape Town	Historical topographic map 1:50 000, 2727CD Wonderhoek Edition 1 1960.

Field Survey

A physical Site Inspection or Field Survey was then conducted predominantly by vehicle and on foot through the project area by an experienced heritage specialist and an assistant. This focussed on identifying and documenting heritage resources situated within and immediately adjacent to the proposed project area footprint.

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 Guidelines (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 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

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage 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. Current examples: St George's Cathedral, Community House	May be declared as a Provincial Heritage Site managed by Provincial Heritage Authority.	Exceptionally High Significance
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.		

Grading	**Description of Resource**	**Examples of Possible Management Strategies**	**Heritage Significance**
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 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.	Low Significance

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage 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 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.C)		Low Significance	Destruction

8 Identification of Impacts

8.1 Impacts and Mitigation Framework

All impacts are analysed in the section to follow regarding 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	

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.

In order to capture the impacts associated with the proposed infrastructure, an activity – aspect – impact table was created, refer to Table 9 below.

Table 9: Activity, Aspects and Impacts of the Project

Activity	Aspect	Potential Impact – Positive	Potential Impact – Negative
Site clearance/ construction camp	Heritage		Damage to existing historical structures and/or graves
Construction	Heritage	Positive - if historical structures are reused	Damage to existing historical structures and/or graves
Operation	Heritage	Positive – if historical structures are reused	Damage to existing historical structures and/or graves

8.3 Impact and Mitigation Assessment

The project area that will be impacted by the proposed Oslaagte Solar 2 PV project contains some areas that are currently disturbed by grazing activities and other animal activity (e.g., burrows and termite mounds).

The impact significance of the project on graves and cemeteries is high before mitigation as the graveyard site (Os2-04) and site with potential infant burials (Os2-02) are both located inside the proposed PV array area of the project footprint (for both Alternative 1 and Alternative 2). Site Os2-04 is protected by section 36 of the NHRA and must be avoided in the design planning. There is also a possibility that potential infant burials could be located at Site Os2-02. However, implementation of the mitigation measures required (set out in **Table 10**, below) will reduce the impact to low.

The impact significance of the proposed project on protected historical structures is low as only one potential historical structures site was identified (Os2-02) which contained the collapsed remains of several structures of a homestead.

8.4 Impacts During the Planning, Construction and Operation Phase

As a result of the analysis above,**Error! Reference source not found.** the following impact/mitigation table has been generated.

Table 10: Heritage Resources – Historical Graves Mitigation Table

Environmental Feature	Heritage resources – Graves and burial grounds
Project life cycle	Planning, Construction and Operation
Potential Impact	Proposed Management Objectives / Mitigation Measures
Possible damage to or destruction of identified historical graves (Os2-04)	• A buffer of at least 30m must be placed around the graveyard at Os2-04 to ensure that during construction, the graves are not damaged • The materials demarcating the 30m buffer must be highly visible and made of durable material to ensure that they are still in place during the operation of the PV site so that work crews are aware of the site. • If, for any reason, the graves cannot be avoided, then a Phase 2 mitigation process will need to be undertaken. During this process, the family and relevant communities will have to be engaged with regarding their wishes on the possibility of relocating the graves (permission and to discuss where the remains are to be moved to). In addition, application will have to be made to SAHRA for the necessary permits. • Sub-sections (4) and (5) of section 36 of the NHRA regarding the removal of graves must be adhered to. The exhumation and removal of graves is strongly discouraged as graves are highly significant to many people and there are many traditional, cultural and personal sensitivities concerning the removal of graves.
Potential infant burials (Site Os2-02) and unidentified graves	• A buffer of at least 30m must be placed around the site Os2-02 to ensure that during construction, the site is not damaged

	• If any impact is anticipated to this site, then social consultation with the local community is required to confirm the presence or absence of infant burials • If infant burials are confirmed then a Phase 2 mitigation process for grave removal will be required, as above • If any significant changes are made to the general project footprint prior to construction, monitoring of site clearance activities must be undertaken by a heritage specialist to identify any additional unidentified grave sites or burials					
Alternative 1	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	High	Permanent	Almost Certain	3
After Mitigation	Negative	Local	Medium	Long- term	Unlikely	1
Significance of Impact and Preferred Alternatives	The graveyard site (Os2-04) and site with potential infant burials (Os2-02) are both located inside the proposed PV array area of the project footprint (Alternative 1), therefore, the above mitigation measures must be followed for both sites. It is recommended that specifically site Os2-04 be avoided and demarcated as a "no go" area.					
Alternative 2	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	High	Permanent	Moderate	2
After Mitigation	Negative	Local	Medium	Long- term	Unlikely	1
Significance of Impact and Preferred Alternatives	The graveyard site (Os2-04) and site with potential infant burials (Os2-02) are both avoided by the Alternative 2 layout. However, there is still a possibility of indirect impact. It is recommended that specifically site Os2-04 be avoided and demarcated as a "no go" area.					

Table 11: Heritage Resources – Historical Structures Mitigation Table

Environmental Feature	Heritage resources – Historical structures (Os2-02)
Project life cycle	Planning, Construction and Operation
Potential Impact	Proposed Management Objectives / Mitigation Measures
Possible damage to or destruction of extant historical structures	Not applicable, none identified.
Possible destruction of demolished remains of historical structures (Site Os2-02)	• A buffer of at least 30m must be placed around this site to ensure that during construction, no historical-archaeological material is damaged • The materials demarcating the 30 m buffer must be highly visible and made of durable material to ensure that they are still in place during the construction of the PV site so that work crews are aware of the site. • If any destruction/clearance of the area is anticipated, a permit will be required from FS PHRA or SAHRA • NB: the above will apply in addition to the mitigation measures set out in the table above for the potential infant graves

Alternative 1	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Medium	Permanent	Almost certain	2
After Mitigation	Positive	Local	Low	Short-term	Unlikely	1
Significance of Impact and Preferred Alternatives	Site Os2-02 has low significance as the buildings are all demolished. However, the potential for infant graves increases the significance to medium-high without mitigation. This site is located within the Alternative 1 layout and should be avoided with a 30m buffer.					
Alternative 2	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Medium	Permanent	Moderate	2
After Mitigation	Positive	Local	Low	Short-term	Unlikely	1
Significance of Impact and Preferred Alternatives	Site Os2-02 has low significance as the buildings are all demolished. However, the potential for infant graves increases the significance to medium-high without mitigation. This site is avoided by the Alternative 2 layout.					

8.5 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 Oslaagte Solar 2 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 other solar PV projects, prospecting and mining projects, pipeline and fibre optic cable construction and the construction of the N1 national road and R76 regional road, in addition to historical farming activities around Kroonstad and the development of Kroonstad town.

Current impacts: the immediate area of the Oslaagte Solar 2 PV footprint is affected by farming activities (cattle and game) and the R76 regional road is currently being upgraded with roadworks in progress along the eastern boundary of the project area.

The baseline impacts are considered to be moderate for Heritage resources, and additional project impacts (if no mitigation measures are implemented) will increase the significance of the existing baseline impacts, where the cumulative unmitigated impact will probably be of a moderate to high significance. The impact is going to happen and will be long-term in nature, therefore the impact risk class will be Moderate to High. However, with the implementation of the recommended management and mitigation measures this risk class can be minimized to a Low rating.

9 Analysis of Alternatives

9.1 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.

9.2 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.

9.3 Layout / Design Alternatives

The project applicant adopted a comprehensive iterative design process to inform the Oslaagte Solar 2 PV layout/design. By integrating the screening and assessment of environmental (including heritage) and social constraints alongside the technical components of the project, allowed for the reduction in risks to the project.

In terms of the impact on the identified heritage resources, the original layout (Alternative 1) has been revised to exclude certain environmentally and heritage sensitive areas (Alternative 2). The Alternative 2 layout avoids the graveyard site (Os2-04) and also avoids the homestead structure remains site (Os2-02) with potential infant graves. Therefore, from a heritage perspective, Alternative 2 is the preferred layout. However, these two heritage resources 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.

9.4 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.

10 STATEMENT OF IMPACT SIGNIFICANCE

The project area that will be impacted by the proposed Oslaagte Solar 2 PV project contains some areas that are currently disturbed by cattle and game farming activities and other animal activity (e.g., burrows and termite mounds).

The impact significance of the project on graves and cemeteries is high before mitigation as the graveyard site (Os2-04) and site with potential infant burials (Os2-02) are both located inside the proposed PV panel area of the project footprint (both Alternative 1 and Alternative 2 layouts). Site Os2-04 is protected by section 36 of the NHRA and must be avoided in the design planning. There is also a possibility that potential infant burials could be located at Site Os2-02. However, implementation of the mitigation measures required (set out in **Table 10**, above) will reduce the impact to low.

The impact significance of the proposed project on protected historical structures is low before mitigation as only one potential historical structure site was identified (Os2-02) which contained the collapsed remains of several structures of a homestead.

11 HERITAGE MANAGEMENT GUIDELINES

11.1 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. Unidentified graves or burials;

   b. Historical-archaeological material, including middens;
   c. Historical structure remains;
   d. Palaeontological deposits such as bones and teeth or plant fossils.

3. If a possible find is discovered during construction, all activities must be halted around 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. If human remains are uncovered, or previously unknown graves are discovered, a qualified archaeologist needs to be contacted and an evaluation made of the finds.
9. If the remains or grave/s are to be exhumed and relocated, the relocation procedures as accepted by SAHRA need to be followed. This includes an extensive social consultation process.

12 Recommendations and Conclusion

The proposed Oslaagte Solar 2 PV project (Alternative 1 and Alternative 2) could impact on heritage resources identified within and adjacent to the project footprint. Heritage resources that were verified by the field survey to occur within the project footprint include a total of four heritage resources situated within the project area footprint and one situated just north of the north-eastern boundary (within the Oslaagte Solar 1 PV footprint). Two of these sites are recent/modern structures (Os2-01 and Os2-03), one is the graveyard depicted on the 1960 topographic map (Os2-04) and one comprises several clusters of rocks likely to be the remains of an African homestead (Os2-02).

In terms of the impact on the identified heritage resources, the Alternative 2 layout which has been revised to exclude certain environmentally and heritage sensitive areas is the preferred alternative. However, the graveyard site (Os2-04) and homestead site with potential infant graves (Os2-02) could still be subject to indirect impact, specifically during site clearance or construction activities. Consequently, the mitigation measures set out above and below will still apply.

The recommendations below are provided to mitigate the potential impact of the grid connection on the identified heritage resources:

- The heritage sites Os2-02 and Os2-04 must be protected with at least a 30m buffer;
- The formal graves at Site Os2-04 are protected by section 36 of the NHRA and must be demarcated and avoided as a "no go" area. There is also a possibility that potential infant burials could be located at Site Os2-02. This site should also be demarcated and avoided as a "no go" area.;
- The remains of Historical structures at Os2-02 are protected by section 34 of the NHRA and should be fenced and avoided as "no go" areas to prevent any indirect impact;
- A separate desktop palaeontological assessment is being undertaken by a palaeontologist as the project area falls into an area of Very High fossil sensitivity. The desktop assessment will indicate if significant/sensitive fossils will be impacted by the proposed project and provide mitigation measures and the way forward in this regard.

No fatal flaws were identified during this study, therefore, it is the considered opinion of the heritage specialist that the construction of the proposed Oslaagte Solar 2 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 palaeontological assessment are implemented before any site clearance or construction activities commences. In terms of the impact on the identified heritage resources, Alternative 2 is preferred as the layout has been revised to avoid the two sites containing historical graves and structure remains (Os2-04 and Os2-02).

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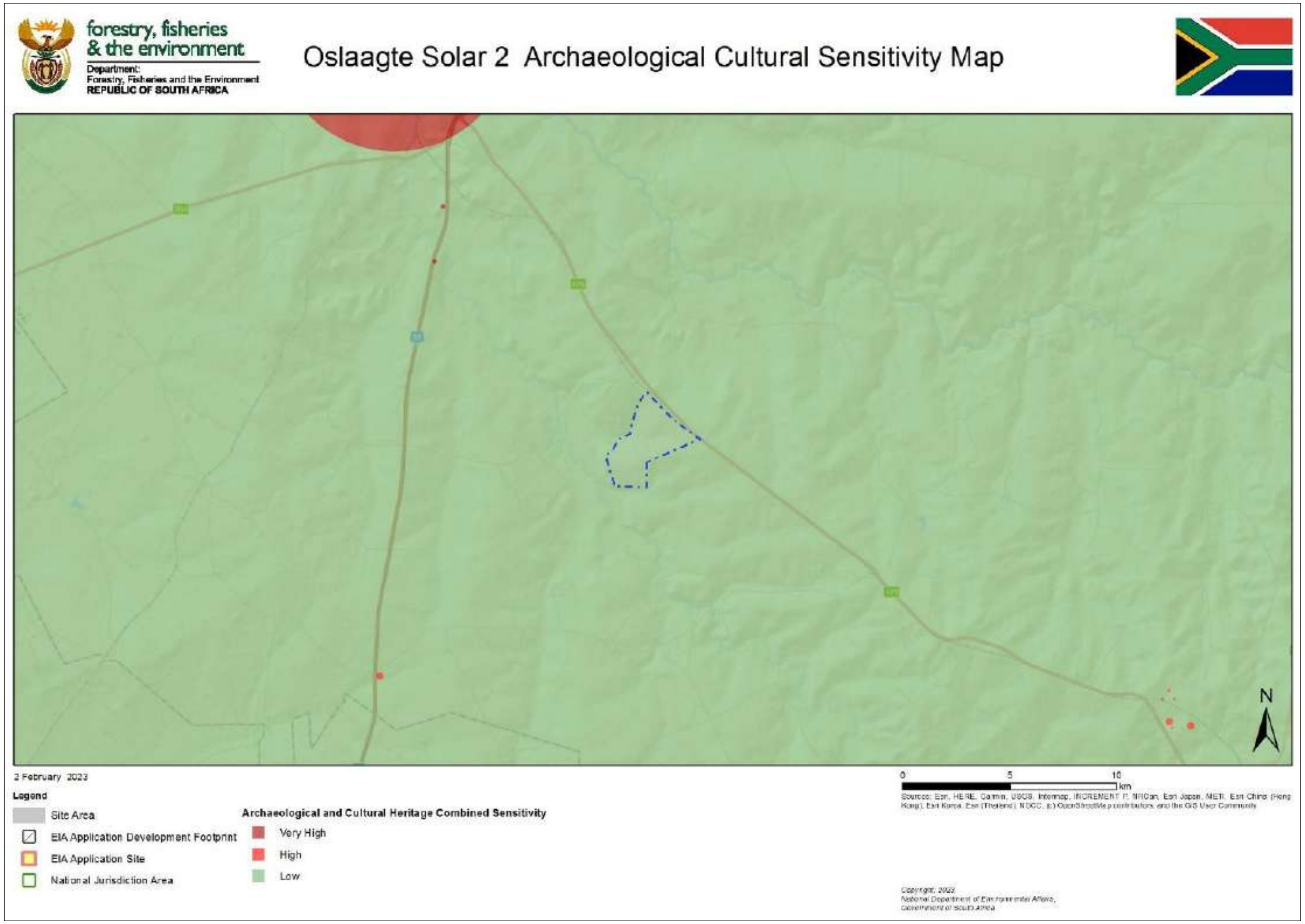
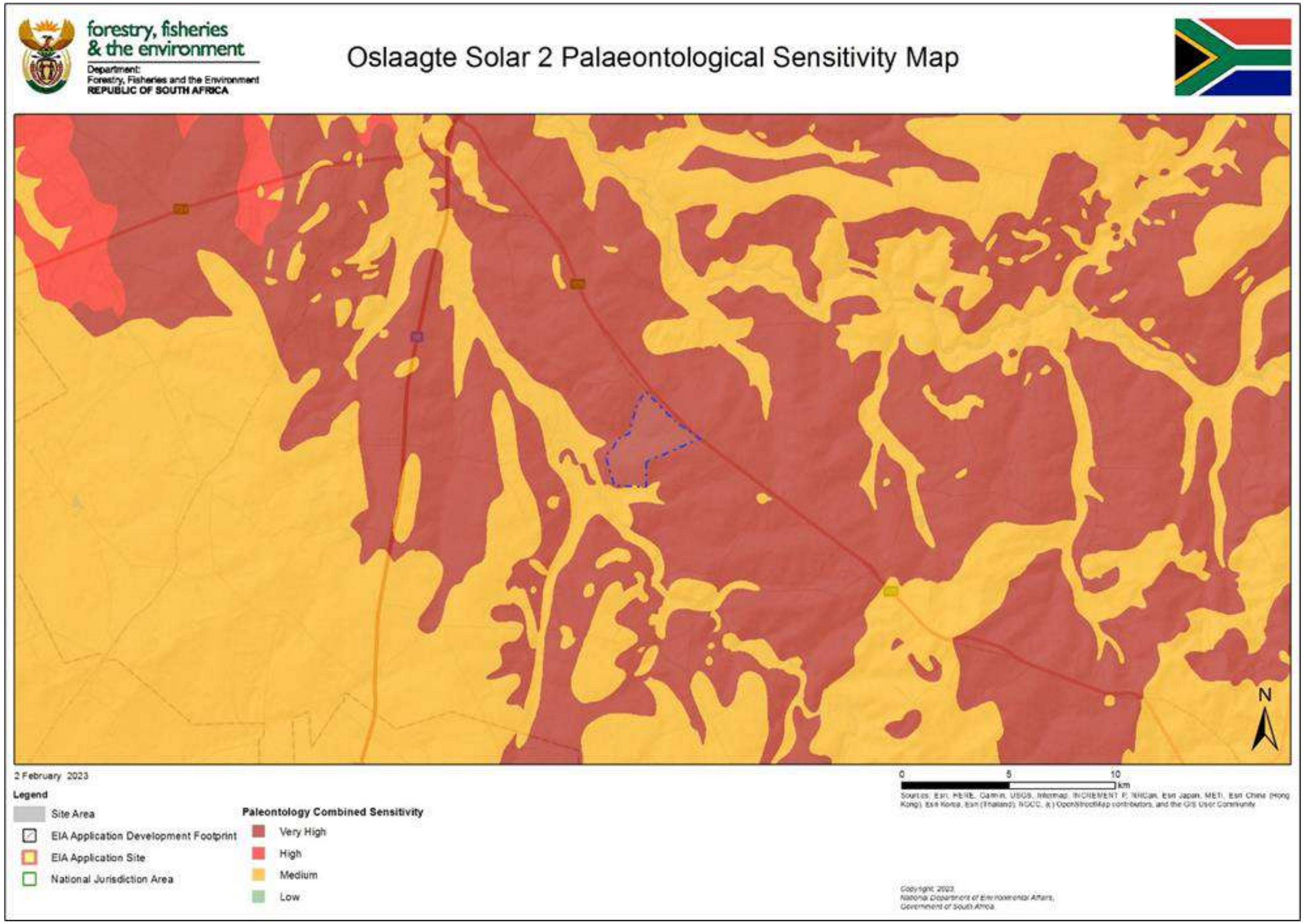
APPENDIX 1: HERITAGE SENSITIVITY MAP/S

1. Archaeological Cultural Heritage Sensitivity map from Environmental Screening Tool



2. Palaeontological Sensitivity map from Environmental Screening Tool



3. Heritage Sensitivity Maps based on the Site Inspection / Field survey .

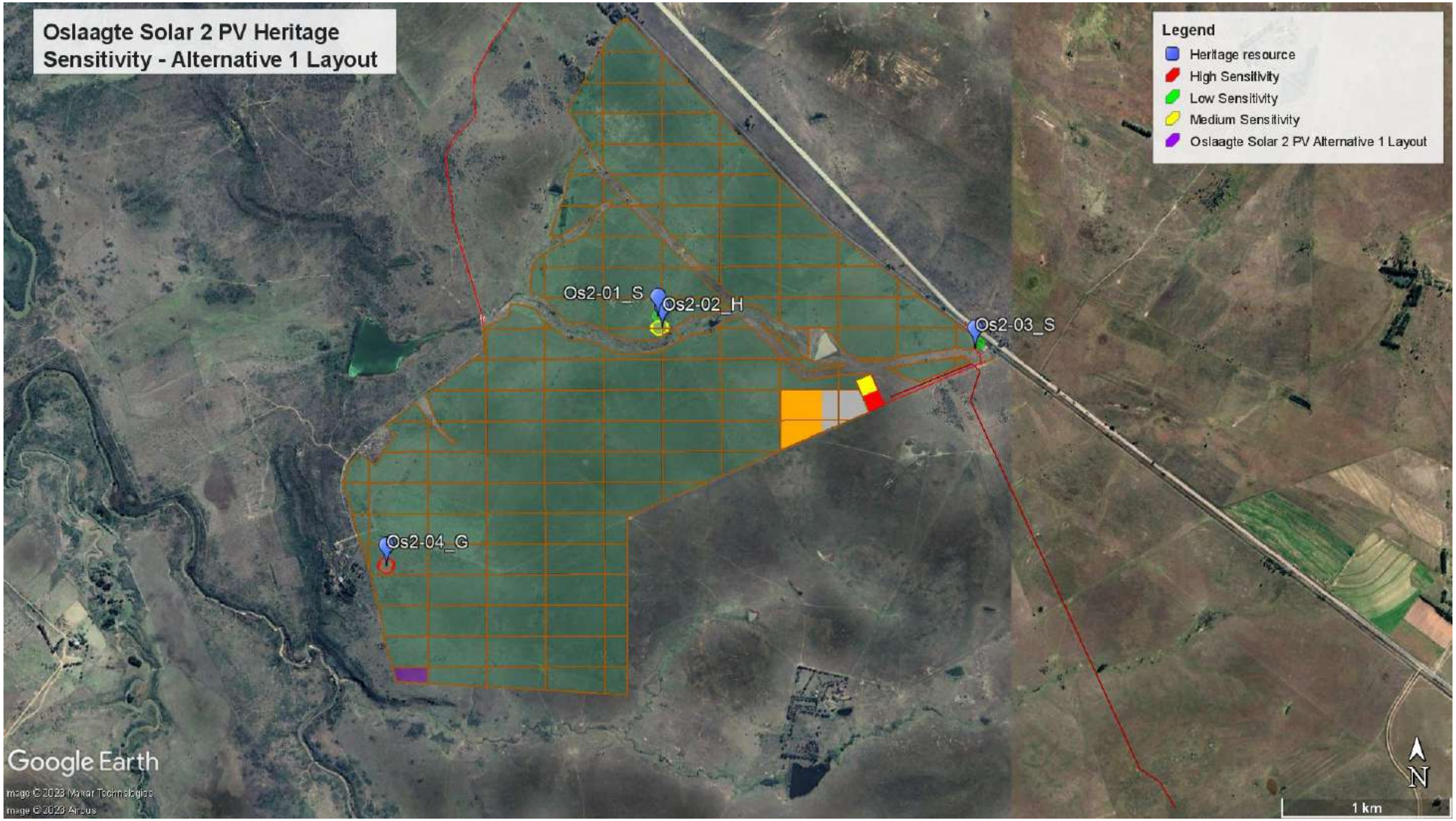


Figure 28: Heritage Sensitivity for Oslaagte Solar 2 PV – Layout Alternative 1

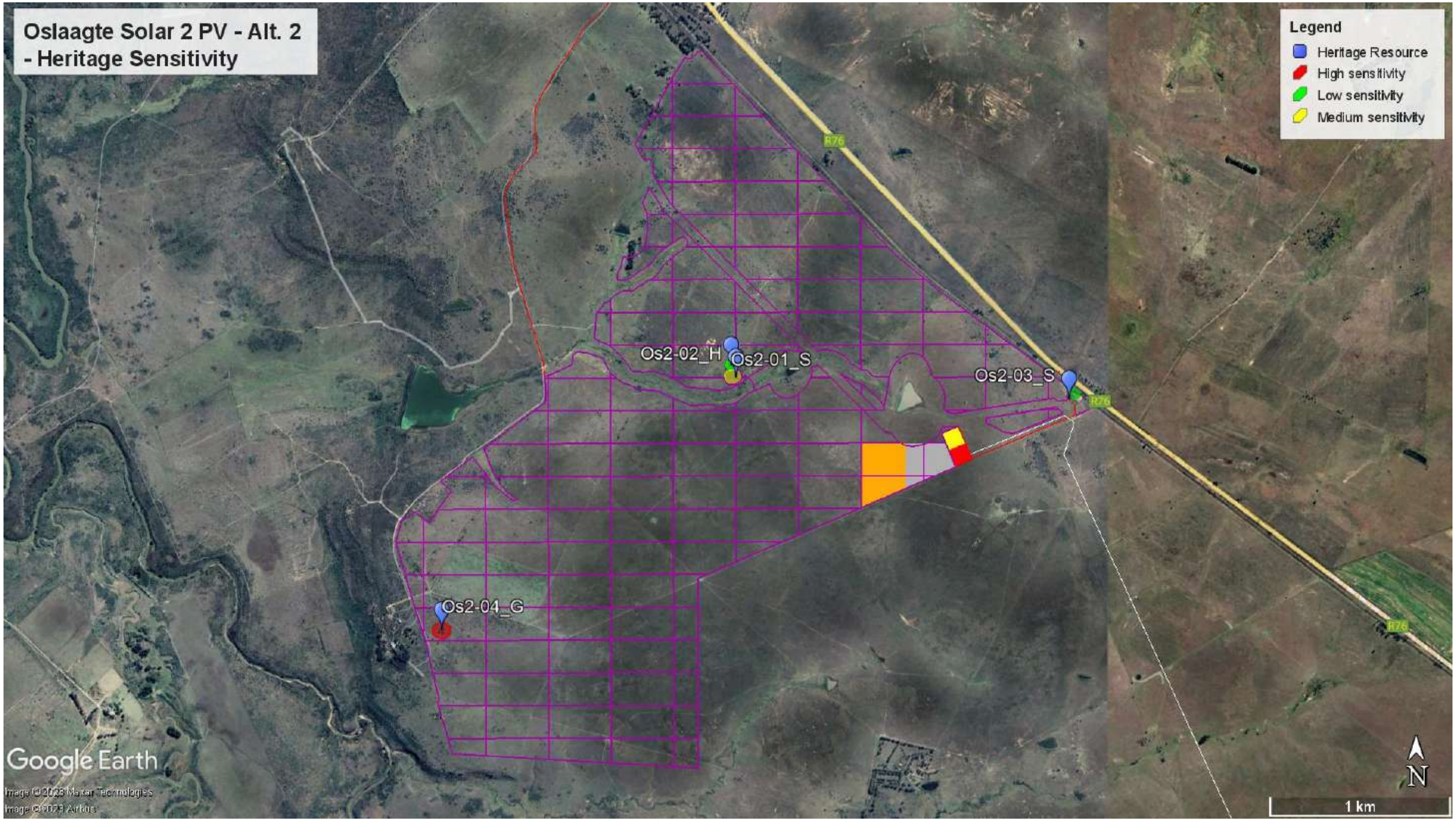


Figure 29: Heritage Sensitivity for Oslaagte Solar 2 PV – Layout Alternative 2

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 Raisimone, 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 E6: Paleontological Impact Assessment

BANZAI ENVIRONMENTAL

PALAEONTOLOGICAL IMPACT ASSESSMENT

PROPOSED 460 MW OSLAAGTE SOLAR 2 PHOTOVOLTAIC RENEWABLE ENERGY FACILITY

NEAR KROONSTAD, FREE STATE PROVINCE

2023

COMPILED for: Nemai Consulting CC

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:

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 Consulting CC to conduct the Palaeontological Impact Assessment (PIA) to assess the proposed 460 MW Oslaagte Solar 2 Photovoltaic (PV) Project south east of Kroonstad, Free State Province. This project forms part of the Kroonstad South PV Cluster. 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 Oslaagte Solar 2 PV Facility is largely underlain by the Adelaide Subgroup of the Beaufort Group (Karoo Supergroup), with a very small portion of Jurassic dolerite in the south of the development. According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) and the DFFE (Department of Forestry, Fisheries and the Environment) Screening Tool the Palaeontological Sensitivity of the Adelaide Subgroup is Very High (Almond and Pether, 2009; Almond *et al*., 2013). Updated Geology (Council of Geosciences) refines the geology and indicates that the proposed development is underlain by the Balfour Formation of the Adelaide Subgroup with a small portion in the west underlain by alluvium, colluvium, eluvium and gravel. Two Layout alternatives have been considered for this project. The first alternative is the original layout of the proposed development while the second alternative was determined after input of the different specialist studies. 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 the weekend of 13 May 2023. No fossiliferous outcrop was detected in the proposed development. This could be attributed to the lack of outcrops as well as the lush grassy vegetation in the area. Based on the site investigation as well as desktop research 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 Kroonstad 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.

Impact Summary

Environmental parameter	**Issues**	**Rating prior to mitigation**	**Average**	**Rating post mitigation**	**Average**
Planning Phase Alternative 1 Oslaagte Solar 2 PV Facility	No Impact	0	No Impact	0	No Impact
Construction Stage Alternative 1 Oslaagte Solar 2 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 Oslaagte Solar 2 PV Facility	No Impact	0	No Impact	0	No Impact
Decommissioning Phase Alternative 1 Oslaagte Solar 2 1 PV Facility	No Impact	0	No Impact	0	No Impact
Planning Phase Alternative 2 Oslaagte Solar 2 PV Facility	No Impact	0	No Impact	0	No Impact
Construction Stage Alternative 2 Oslaagte Solar 2 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 2 Oslaagte Solar 2 PV Facility	No Impact	0	No Impact	0	No Impact
Decommissioning Phase Alternative 2 Oslaagte Solar 2 1 PV Facility	No Impact	0	No Impact	0	No Impact

It is therefore considered that the proposed Oslaagte Solar 2 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. Oslaagte Solar 2 (Pty) Ltd (the "Applicant") has proposed the development of up to 460MW Oslaagte Solar 2 Photovoltaic (PV) Project near Kroonstad, in the Free State Province (the "Project"). The electricity generated by the Project will be transmitted through a 132kV power line from the new facility substation to a new 400/132 kV Main Transmission Substation (MTS).

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.

Nemai Consulting CC (Nemai) was appointed by Oslaagte Solar 2 (Pty) Ltd (the "Applicant") to conduct the Environmental Impact Assessment (EIA) for the proposed 460 MW Solar Photovoltaic (PV) Project south east of Kroonstad, in the Free State Province (the "Project") (Figure 1-2).

1.1 Technical details

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

- PV modules and mounting structures which will consist of either Monofacial or Bifacial PV panels, mounted on either fixed-tilt, single-axis tracking, and/or double-axis tracking systems.
- 132kV power line that is approximately 3.45km in length.
- Inverter stations, transformers, switchgear and internal electrical reticulation (underground cabling).
- Battery Energy Storage System (BESS), potentially Lithium Battery Technologies, with an area up to 5ha.
- Facility grid connection infrastructure, including:
    - 33kV cabling between the project components and the facility substation;
    - A 132kV facility substation. The maximum size of the facility substation will not exceed 1 ha. The facility substation will collect the power from the facility and transform it from medium voltage (up to 33 kV) to high voltage (132 kV).
    - 33kV or 132kV cabling or powerline between the facility substation and the proposed Main Transmission Substation or the Kroonstad Switching Station.
- Temporary construction laydown area up to ten (10) ha and permanent laydown area up to 1 ha (to be located within the area demarcated for the temporary construction laydown).
- Internal roads will be up to 6 m wide, to allow access to the Solar PV modules for operations and maintenance activities.
- Main access road is up to 8 m wide. The site is accessible via the R76.

- Operation and Maintenance buildings including a gate house and security building, control centre, offices, warehouses and workshops for storage and maintenance. The buildings will occupy an area of 1.5ha.
- Fencing around the PV site to a height of 3.5m.
- Main access road is up to 8 m wide.
- The site is accessible via the R76.

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.

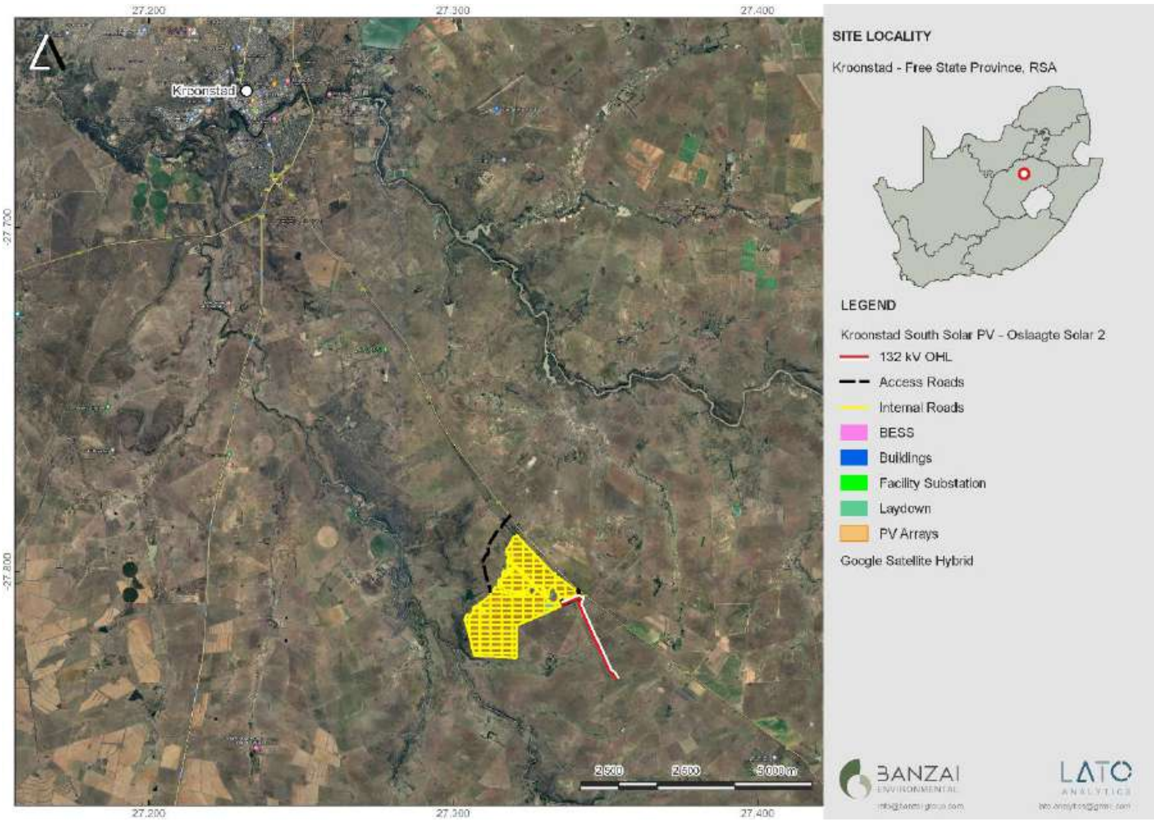


***Figure 1:** Regional locality of the proposed Oslaagte Solar 2 PV Project near Kroonstad, in the Free State Province.*

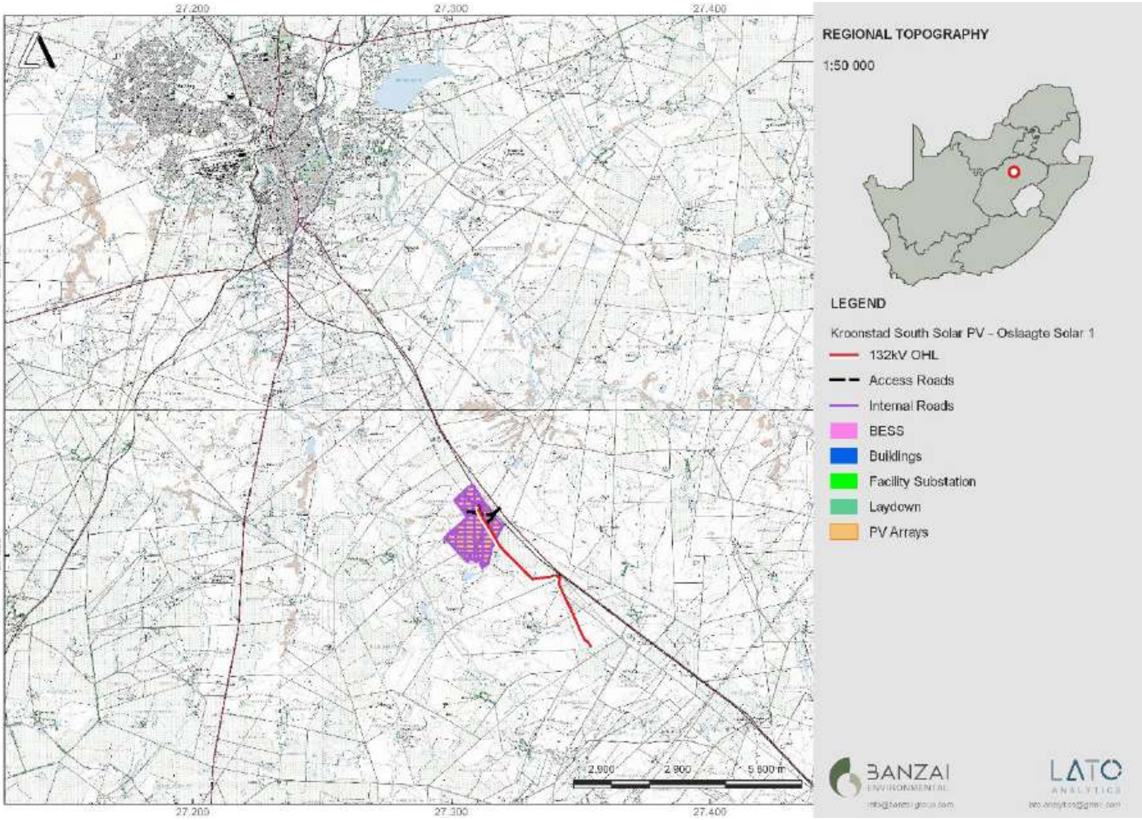


***Figure 2**: Locality map of the the proposed Oslaagte Solar 2 PV Project near Kroonstad, in the Free State.*

Table 2: Technical Details of the PV plant

No.	Component	Alternative 1 - Description / Dimensions	Alternative 2 - Description / Dimensions
1.	Height of PV panels	Up to 5.5 m	Up to 5.5 m
2.	Facility generation capacity (MW)	240 MW	Up to 460 MW
3.	Area of PV Array	Up to 610 ha	Monofacial or Bifacial PV panels, mounted on either fixed-tilt, single-axis tracking, and/or double-axis tracking systems. Area: Up to 585 ha
4.	Area occupied by inverter / transformer stations / substations	Up to 1ha	It is estimated that the maximum size of the facility substation will not exceed 2 ha. Each facility will require inverter-stations, transformers, switchgear and internal electrical reticulation (underground cabling).
5.	Capacity of on-site substation	The facility substation will collect the power from the facility and transform it from medium voltage (up to 33 kV) to high voltage (132 kV).	The facility substation will collect the power from the facility and transform it from medium voltage (up to 33 kV) to high voltage (132 kV).
6.	BESS	Area up to ± 5ha	Area: up to ± 5 ha
7.	Area occupied by both permanent and construction laydown areas	Temporary: Up to 7ha Permanent: Up to 1 ha (located within the area demarcated for temporary construction laydown)	Temporary construction laydown area up to 10 ha. Permanent laydown area up to 1 ha (to be located within the area demarcated for the temporary construction laydown).
8.	Area occupied by buildings	Up to 1.5 ha	Up to 1.5 ha
9.	Length of internal roads	Up to 33km	Up to 33 km
10.	Width of internal roads	The internal roads will be up to 6 m wide. The access roads will be up to 8 m wide.	The internal roads will be up to 6 m wide. The access roads will be up to 8 m wide.
11.	Proximity to grid connection	±7.30 km	Approximately 6 - 8 km
12.	Height of fencing	Up to 3.5m	Up to 3.5m
13.	Type of fencing	Type will vary around the site, welded mesh, palisade and electric 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 PV 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. For this reason, two Layout alternatives have been considered for this project. The first alternative was the original layout of the proposed development while the second alternative was determined after input of the different specialist studies.

1.2.3 Technology Alternatives

Solar PV technology consists of either monofacial or bifacial solar panels used on either a fixed mounting system or tracking mounting system. The following is noted in this regard:

- Single axis tracker system – this is preferred as it optimises the yield output and is the standard for utility scale solar PV installation. Some additional benefits associated with this technology include its robustness, long lifetime, the equipment prices have drastically decreased the past 10 years, it is easy to maintain, it does not cause any emissions and no waste is generated.

  The selected tracker type is the single axis E-W tracker system which specifically has its collector move from east to west tracking the suns movement throughout the day. A side view of proposed tracker mounting structure.

- Fixed mounted system – This is not preferred in utility scale solar PV plants as it is not able to generate as much energy as a solar PV system using a tracker system. This option will not be considered further.

A bifacial solar panel receives irradiation on both sides of the panel, which increases the yield. This is preferred over monofacial solar panels that only receive power on one of its sides.

1.2.1 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.

1.2.1 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).

1.2.2 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 Oslaagte Solar 2 PV Project near Kroonstad in the Free State is depicted on the 1: 250 000 Kroonstad 2726 (2000) Geological Map (Council for Geosciences, Pretoria) (Figure 3, Table 2). Two layout alternatives have been considered for this project. The first alternative is the original layout of the proposed development while the second alternative was determined after input of the different specialist studies. A small area in the south-east of the development is underlain by the Karoo Dolerite Suite (Jd, red) while the largest portion of the development is underlain by the Adelaide Subgroup (Pa, green) of the Beaufort Group (Karoo Supergroup). According to the PalaeoMap (Figure 4) of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the dolerite is Zero as it is igneous in origin and thus unfossiliferous, while the Adelaide Subgroup has a Very High (red) Palaeontological Sensitivity (Almond and Pether, 2009; Almond *et al*., 2013). The Environmental Screening Tool is depicted in Figure 5-6 and indicates that the development has a very High Palaeontological Sensitivity. Updated Geology (Council of Geosciences) indicates that the proposed development is underlain by alluvium, colluvium, eluvium and gravel as well as the Balfour Formation of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) (Figure 7, Groenewald *et al.,* 2014).

The Cenozoic superficial deposits (updated geology, Figure 7) are the youngest geological deposits formed during the most recent geological period (approximately 2.6 million years ago to present). Most of the superficial deposits are unconsolidated sediments and consist of clay, gravel, sand, silt, that form relatively thin, discontinuous patches of sediments. These sediments comprise of channel, floodplain, and stream deposits.

The Cenozoic deposits are very important because palaeoclimatic changes are reflected in the different geological formations (Hunter *et al*., 2006). During the climate fluctuations in the Cenozoic Era most geomorphologic features in southern Africa where formed (Maud, 2012). Barnosky (2005) indicated that various warming and cooling events occurred in the Cenozoic but states that climatic changes during the Quaternary Period, specifically the last 1.8 Ma, were the most drastic climate changes relative to all climate variations in the past. Climate variations that occurred in the Quaternary Period were both drier and wetter than the present and resulted in changes in river flow patterns, sedimentation processes and vegetation variation (Tooth *et al*., 2004).

Cenozoic fossil assemblages are generally rare and low in diversity and occur over a wide-ranging geographic area. These fossil assemblages may in some cases occur in extensive alluvial and colluvial deposits. In the past palaeontologists did not focus on Caenozoic superficial deposits although they sometimes comprise of significant fossil deposits. These fossil assemblages resemble modern animals and may comprise of mammalian teeth, bones and horn corns, reptile skeletons and fragments of ostrich eggs. Microfossils, non-marine mollusc shells are also known from Quaternary deposits. Plant material such as foliage, wood, pollens, and peats are recovered as well as trace fossils like vertebrate tracks, burrows, termitaria (termite heaps/ mounds) and rhizoliths (root casts).

Partially calcretised older alluvium deposits often overlies dolerite. Gravelly colluvial and eluvial deposits are dominated by hornfels, sandstone, and dolerite rubble that mantles most hillslopes and plateaus. The topographically relief of the Beaufort Group in the development footprint is low as can be seen in the Site Visit Section (Section 8).

The Karoo igneous province is one of the worlds classic continental basalt (CFB) provinces. This province consists of intrusive and extrusive rocks that occur over a large area (Duncan et al, 2006). Generally, the flood basalts do not contribute to prominent volcanic structures, but instead are formed by successive eruptions from a set of fissures that form sub-horizontal lava flows (sills and dykes) varying in thickness. This lava caps the landscape on which they erupted. As the Karoo is an old flood basalt province it is today preserved as erosional fragments of a more extensive lava cap that covered much of southern Africa in the geological past. It is estimated that the Karoo lava outcrop currently covered at least 140 000 km^2 while it was larger in the past [~2 000 000 km^2 (Cox 1970, 1972)].

The Karoo Igneous Province contains a large volume of flood basalts as well as silicic volcanic rocks. These units are comprised of rhyodacite and rhyolitic magma and crops out along the Lebombo monocline. Individual units span up to 60 km and sometimes show massive pyroclastic structures and are thus classified as rheoignimbrites. The basal lavas lie conformable on the Clarens Formation but in specific localities sandstone erosion occurred before the volcanic eruptions took place. Lock *et al* (1974) found evidence in the Eastern Cape that in the early stages of volcanism magma interacted with ground water to produce volcaniclastic deposits as well as phreatic and phreatomagmatic diatremes. Eales *et al* (1984) also found evidence of aqueous environments during early volcanism by the existence of pillow lavas and associated hyaloclastite breccias and thin lenses of fluviatile sandstones interbedded with the lowermost magmas.

The Adelaide Subgroup (Beaufort Group). Comprise of Karoo sandstones, mudstones, and shales, that was deposited under fluvial environments. The Beaufort Group is the third of the main subdivisions of the Karoo Supergroup. The Beaufort group overlays the Ecca Group and consists essentially of sandstones and shales, deposited in the Karoo Basin from the Middle Permian to the early part of the Middle Triassic periods and was deposited on land through alluvial processes. The Beaufort Group covers a total land surface area of approximately 200 000 km^2 in South Africa and is the first fully continental sequence in the Karoo Supergroup and is divided into the Adelaide subgroup and the overlying Tarkastad subgroup (Figure 8). The Adelaide subgroup rocks are deposited under a humid climate that allowed for the establishment of wet floodplains with high water tables and are interpreted to be fluvio-lacustrine sediments. The Adelaide Subgroup is approximately 5 000m thick in the southeast, but this decreases to about 800m in the centre of the basin which decreases to about 100 to 200m in the north.

The Adelaide Subgroup contains alternating greyish-red, bluish-grey, or greenish grey mudrocks in the southern and central parts of the Karoo Basin with very fine to medium-grained, grey lithofeldspathic sandstones. Thicker sandstones of the Adelaide are usually multi-storey and usually have cut-and-fill features. The sandstones are characterized internally by horizontal lamination together with parting lineation and less frequent trough crossbedding as well as current ripple lamination. The bases of the sandstone units are extensive beds, while ripple lamination is usually confined to thin sandstones towards the top of the thicker units. The mudrocks of the Adelaide Subgroup usually have massive and blocky weathering. Sometimes desiccation cracks and impressions of raindrops are present. In the mudstones of the Beaufort Group calcareous nodules and concretions occur throughout.

The flood plains of the Beaufort Group (Karoo Supergroup) are internationally renowned for the early diversification of land vertebrates and provide the worlds' most complete transition from early "reptiles" to mammals. The Beaufort Group is subdivided into a series of biostratigraphic units based on its faunal content (Kitching1977, 1978; Keyser *et al*, 1977, Rubidge 1995, Smith *et al,* 2020; Viglietti 2020) (Figure 8). The development is underlain by the Balfour Formation (Figure 7) which is divided in the *Daptocephalus* (DAZ) which in turn is divided in the upper (younger) *Lystrosaurus maccaigi* - *Moschorhinus* and lower (older) *Dicynodon-Theriognathus Subzones* (Figure 8-13; Viglietti, 2020).

The dicynodont, *Daptocephalus leoniceps* is the main biozone defining fossil of the D*aptocephalus* Assemblage Zone (Figure 8). The *Daptocephalus* Assemblage Zone (DaAZ) is characterised by the co-occurrence of the dicynodontoid *Daptocephalus leoniceps*, the therocephalian *Theriognathus* microps, and the cynodont *Procynosuchus delaharpeae*. The DaAZ comprise of two subzones representing the two distinct faunal assemblages in this assemblage zone. The Dicynodon - Theriognathus Subzone (Figure 9) (in co-occurrence with *Daptocephalus*) is present in the lower *Daptocephalus* Assemblage Zone while the *Lystrosaurus maccaigi* – Moschorhinus kitchingi Subzone (Figure 10) is present in the upper DaAZ. The defining taxa of the latter subzone is *L. maccaigi, Daptocephalus* and *Moschorhinus*. This Zone is characterized by the co-occurrence of the two therapsids namely *Dicynodon* and *Theriognathus (Figure 9)*. The *Daptocephalus* Assemblage Zone of the Beaufort Group shows the greatest vertebrate diversity and includes numerous well-preserved genera and species of dicynodonts, biarmosuchians, gorgonopsian, therocephalian and cynodont therapsid Synapsida. Captorhinid Reptilia are also present while eosuchian Reptilia, Amphibia and Pisces are rarer in occurrence. Trace fossils of vertebrates and invertebrates as well as *Glossopteris* flora plants have also been described.

The *Daptocephalus Assemblage Zone* (AZ) expands into the lower Palingkloof of the Upper Balfour Formation. The lower Palingkloof Member is of special importance as it precedes the Permo-Triassic Extinction Event which destroyed the vertebrate fauna and extinguished the diverse glossopterid plants. The lower *Lystrosaurus* declivis AZ forms part of the Katberg Formation. Fauna and flora from this assemblage zone is rare as few genera survived the Permo-Triassic Extinction Event. The *Lystrosaurus* declivis AZ is characterized by the dicynodont, *Lystrosaurus* (Figure 13) and captorhinid reptile, *Procolophon,* biarmosuchian and gorgonopsian Therapsida that did not survive into the *Lystrosaurus* Assemblage Zone although the therocephalian and cynodont Therapsida are present in moderate quantities. Captorhinid Reptilia is reduced, but this interval is characterised by a unique diversity of oversize amphibians while fossil fish, millipedes and diverse trace fossils have also been recorded.

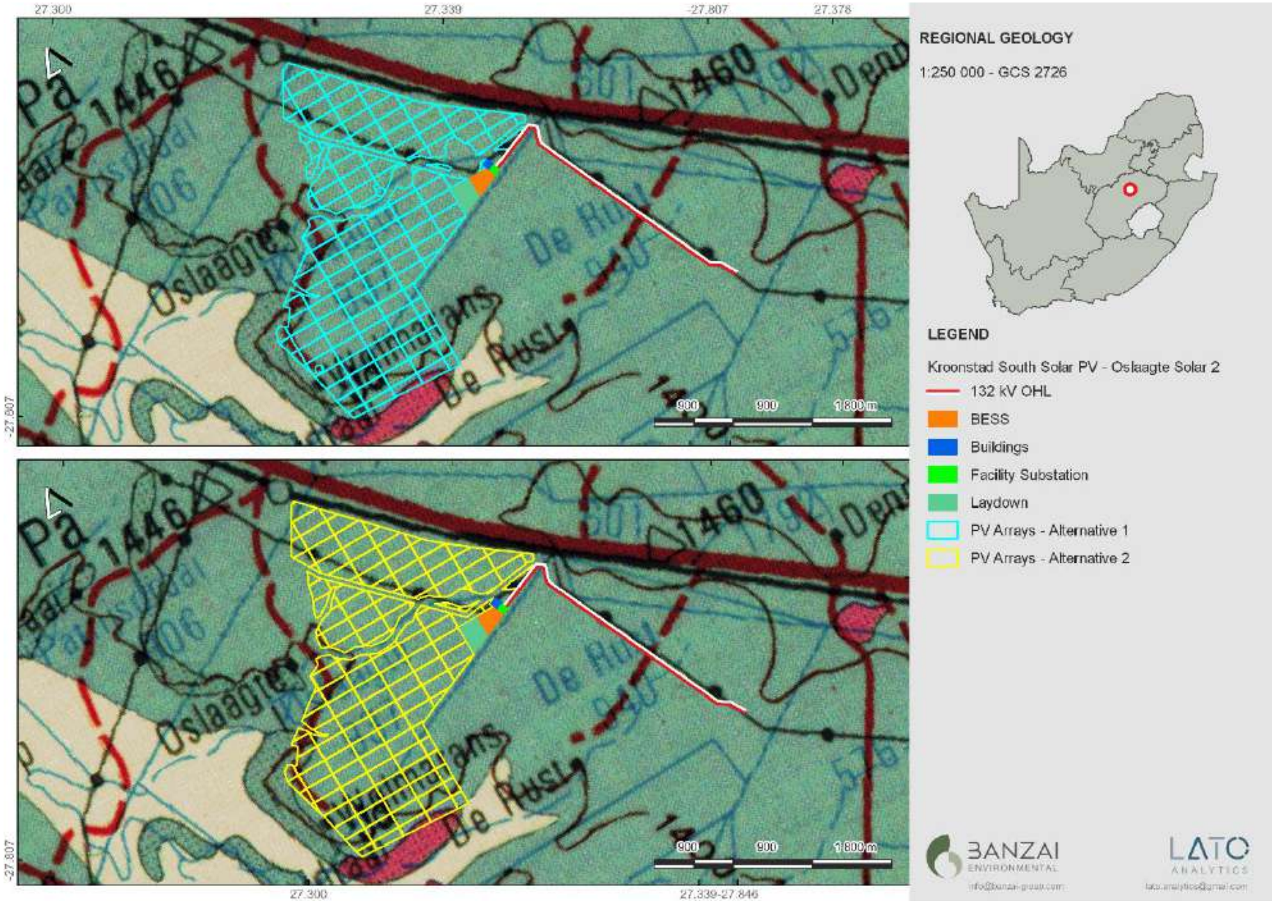
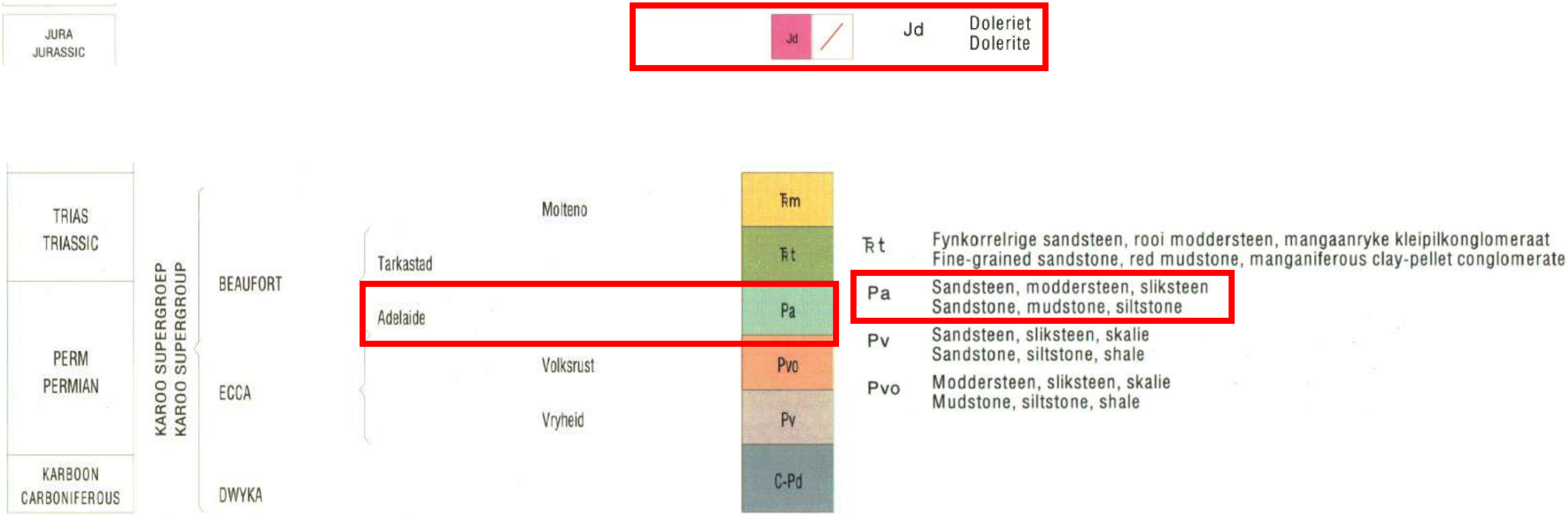


***Figure 3**: Extract of the 1:250 000 Kroonstad 2726 (2000) Geological Map (Council for Geosciences, Pretoria) indicating the Oslaagte Solar 2 PV and grid connection Project near Kroonstad in the Free State. The proposed development is underlain by the Dolerite (Jd, red) and Adelaide Subgroup (Pa, green) of the Beaufort Group (Karoo Supergroup).*

Table 3: Legend to the Kroonstad 2726 (2000) Geological Map (Council for Geosciences, Pretoria).

Relevant sediments are indicated in a red square.



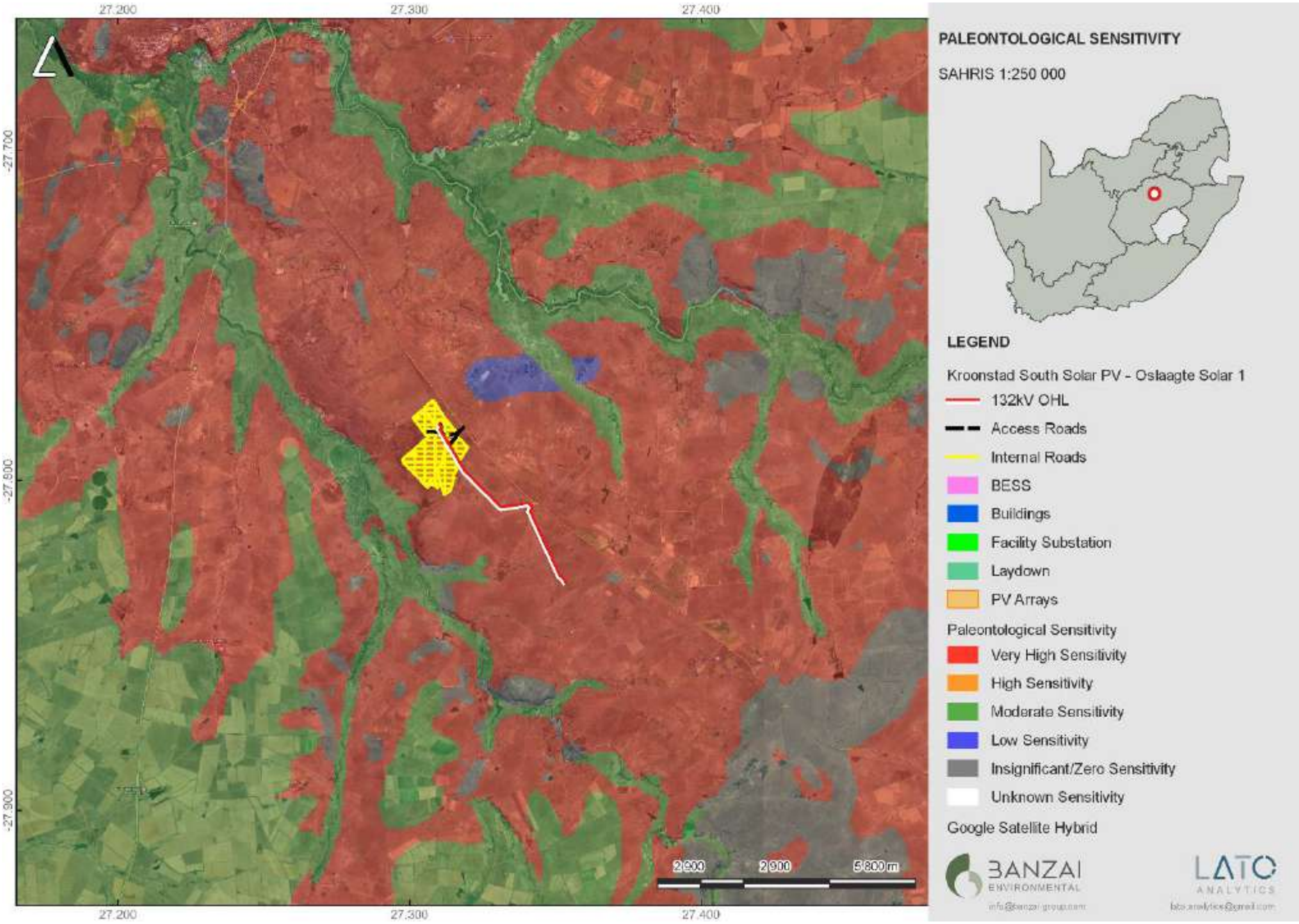


Figure 4*: Extract of the 1 in 250 000 SAHRIS PalaeoMap (Council of Geosciences) indicating the proposed Oslaagte Solar 2 PV and power line near Kroonstad in the Free State.*

Table 4: 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 4) the proposed development is underlain by sediments with a Very High (red) and Zero (grey) Palaeontological Significance.

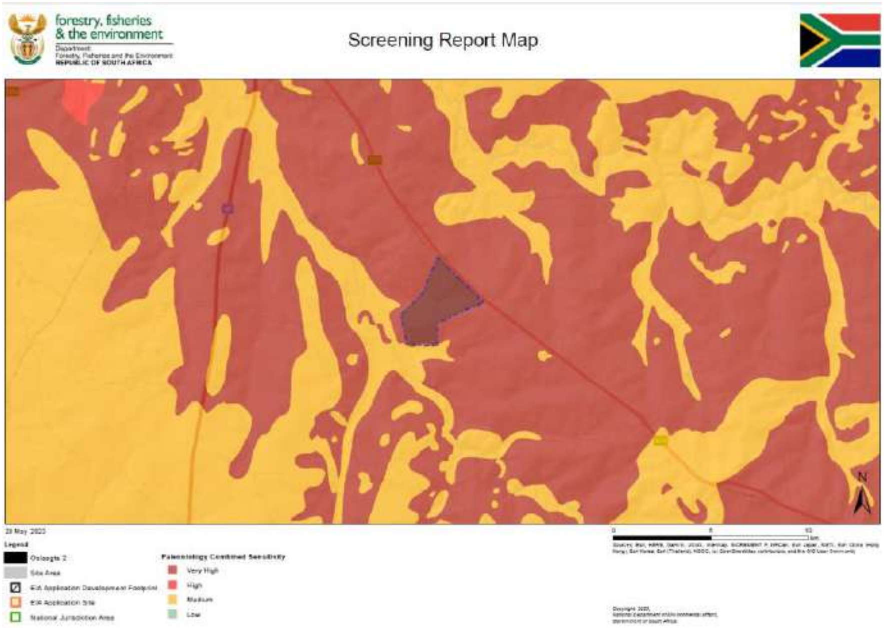


***Figure 5**: Palaeontological Sensitivity of the* Oslaagte Solar PV 2 facility *by the National Environmental Web-bases Screening Tool indicates a Very High Palaeontological Sensitivity.*

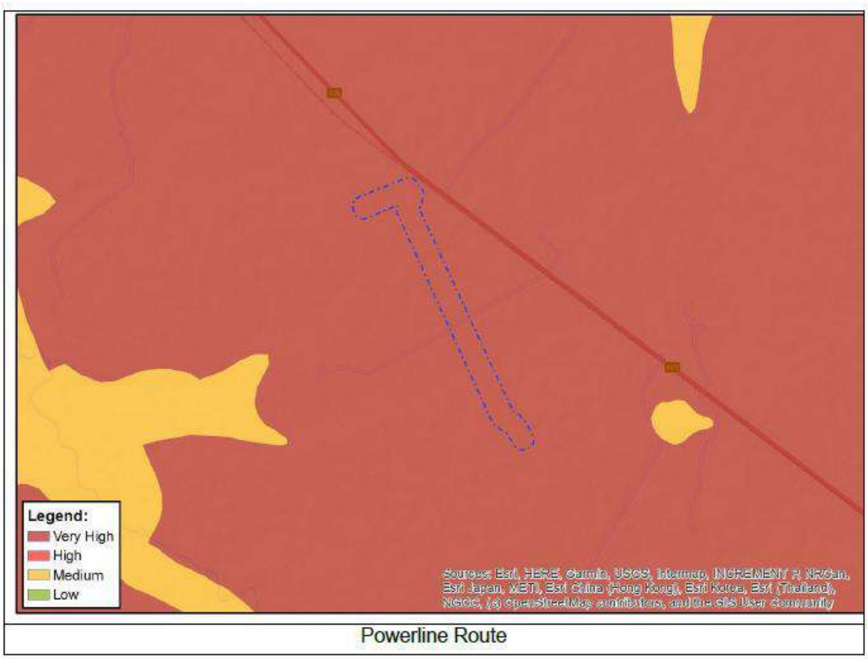


***Figure 6**: Palaeontological Sensitivity of the* Oslaagte Solar PV 2 *grid connection by the National Environmental Web-bases Screening Tool indicates a Very High Palaeontological Sensitivity.*

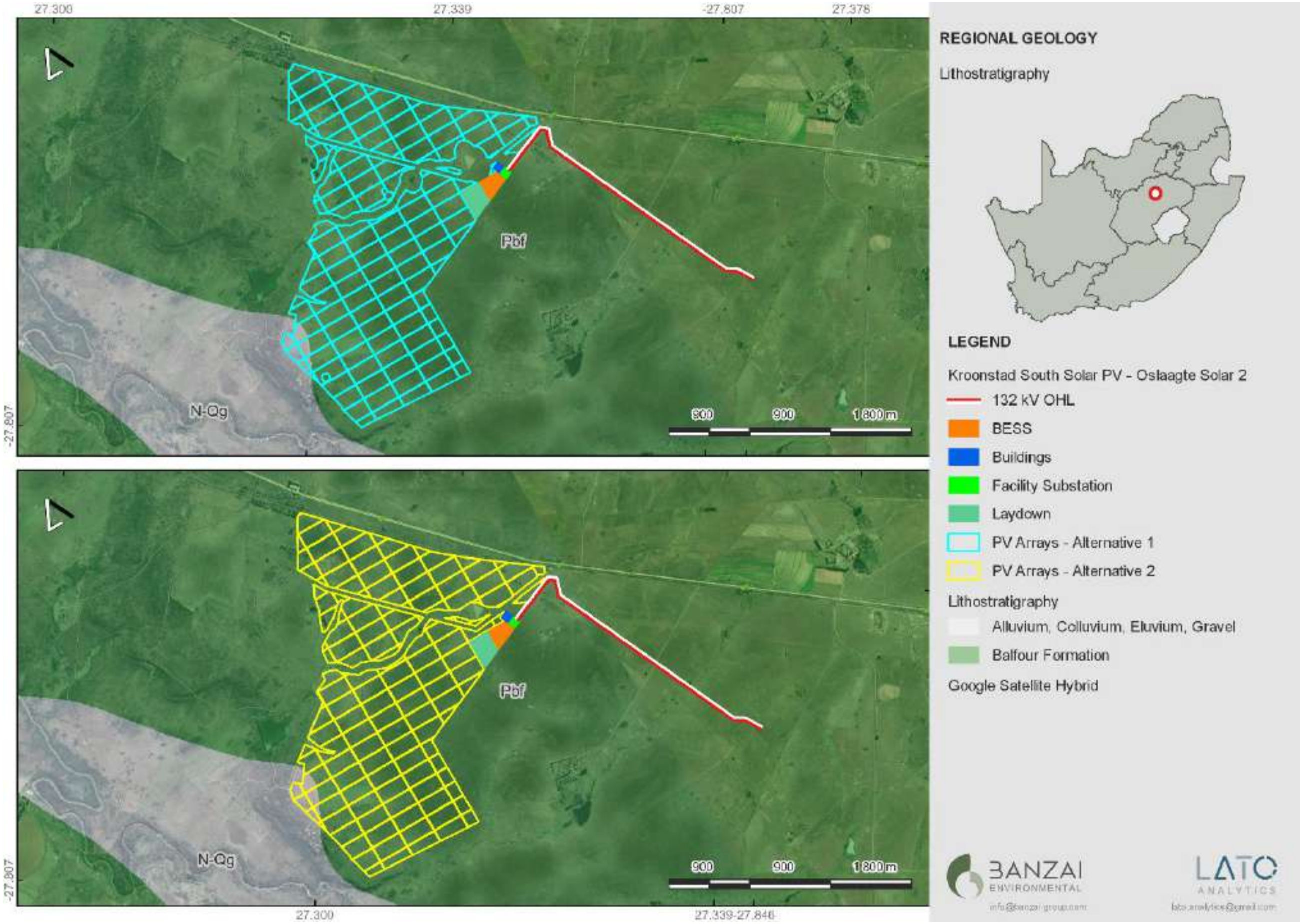


Figure 7: *Updated Geology (Council of Geosciences, Pretoria) of the study area indicates that the development is underlain by alluvium, colluvium, eluvium and gravel as well as the Balfour Formation of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup).*

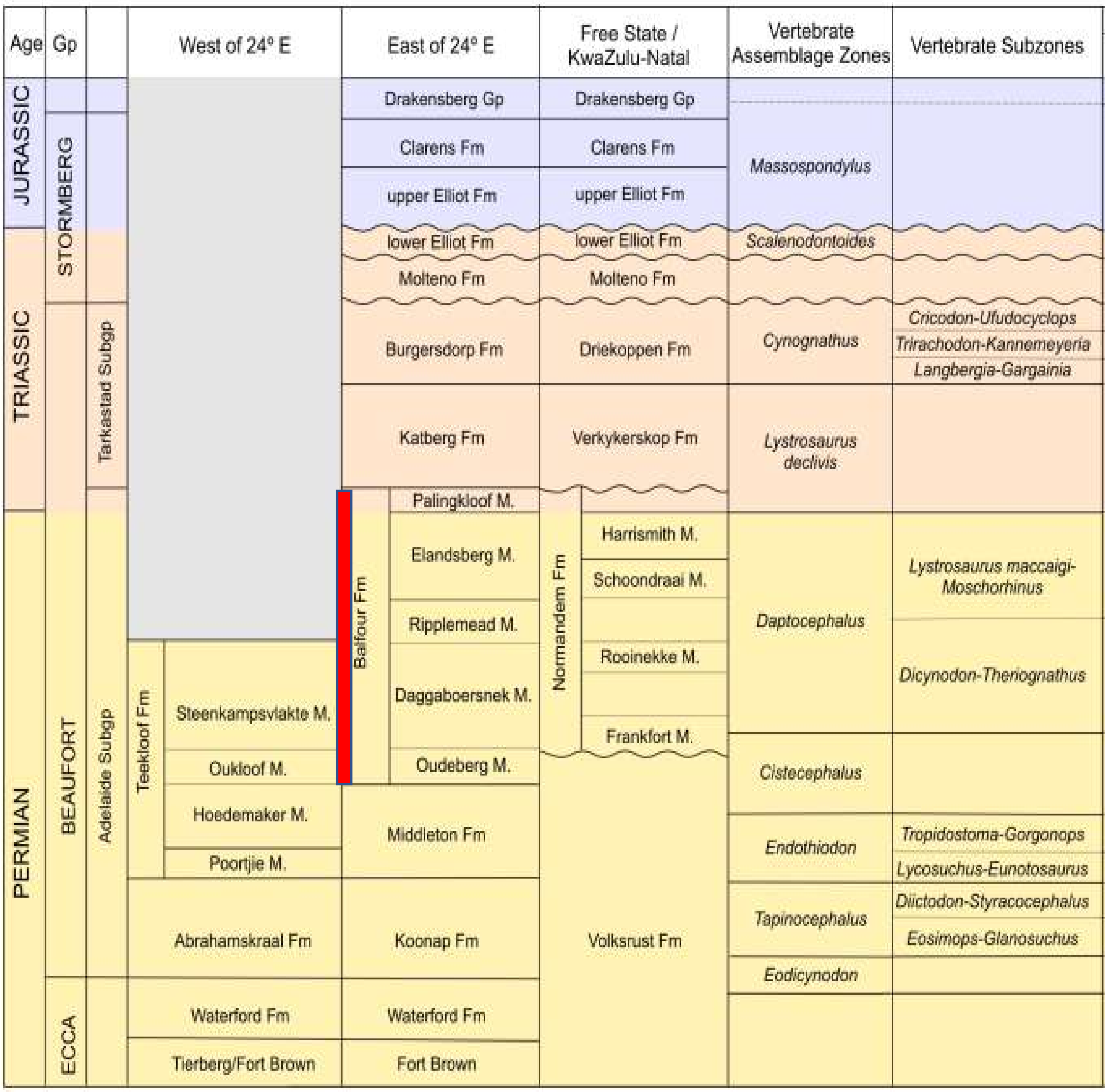


***Figure 8**: Vertebrate biozonation range chart for the Main Karoo Basin of South Africa.*
Solid lines indicate known ranges, dotted lines indicate suspected but not confirmed ranges, single dot represents the stratigraphic position of the taxa that have only been recovered from a single bed. Wavy lines indicate unconformities. (PLYCSR=Pelycosauria and MAMMFMES+Mammaliaformes. Gp=group, Subgp-Supbroup, Fm=Formation, M=Member
The geology of the proposed development is indication by the red line.

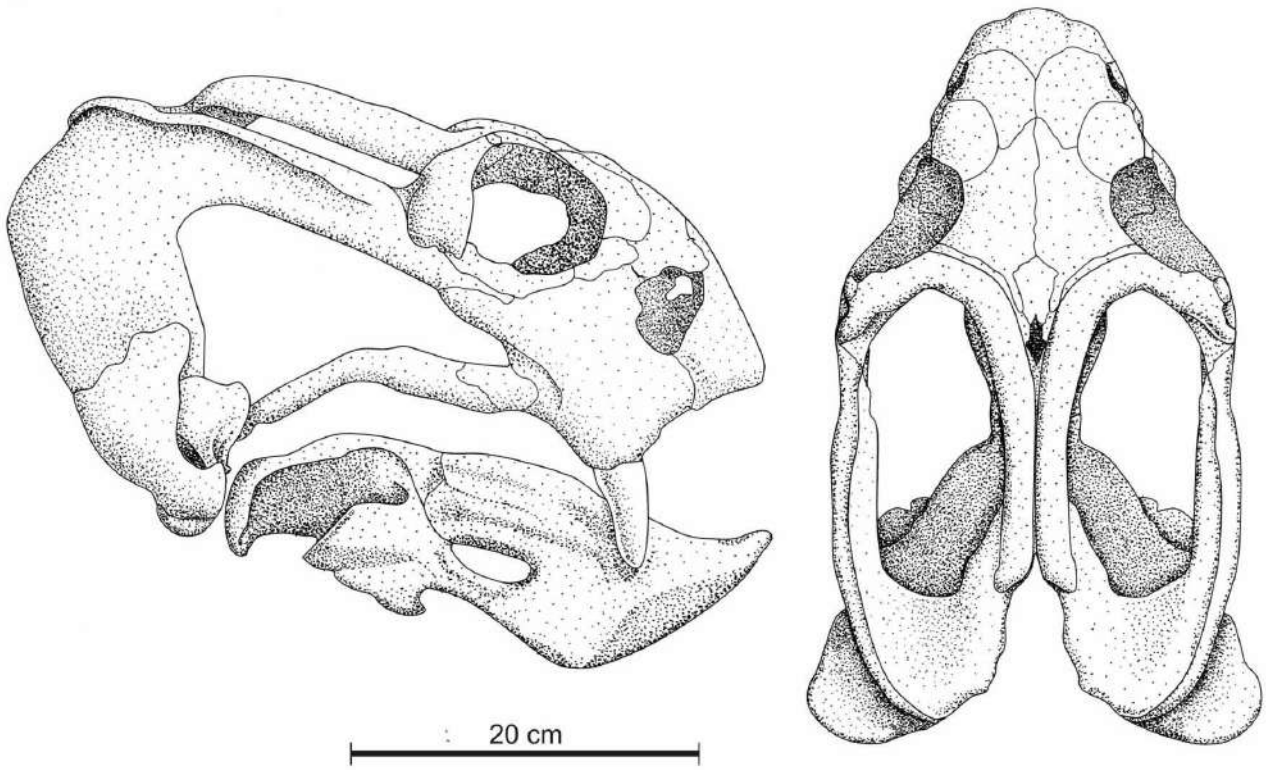


***Figure 9**: Lateral and dorsal views of skull of the dicynodont Daptocephalus leoniceps, the main biozone defining fossil (Image taken from Viglietti, 2020) and dorsal views (Image taken from Viglietti, 2020).*

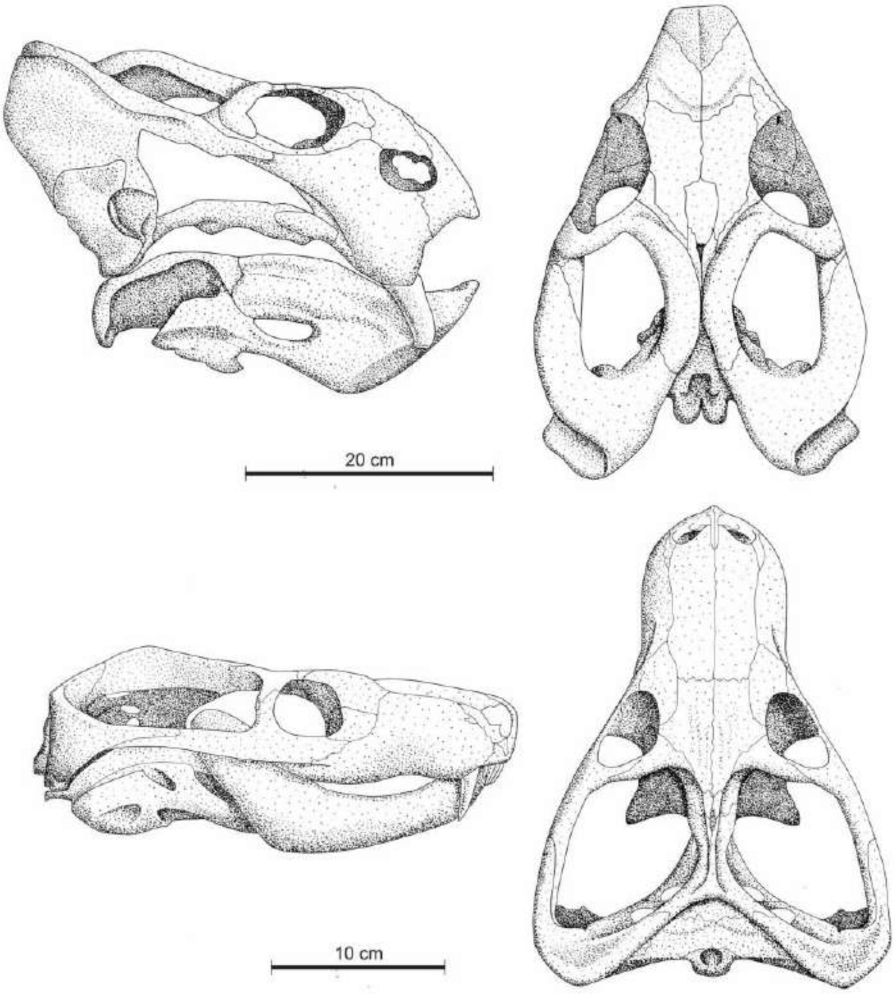


Figure 10:*Skulls of the biozone defining fossils of the Dicynodon-Theriognathus Subzone in lateral and dorsal views. Dicynodon lacerticeps (top), Theriognathus microps (bottom) (Image taken from Viglietti, 2020).*

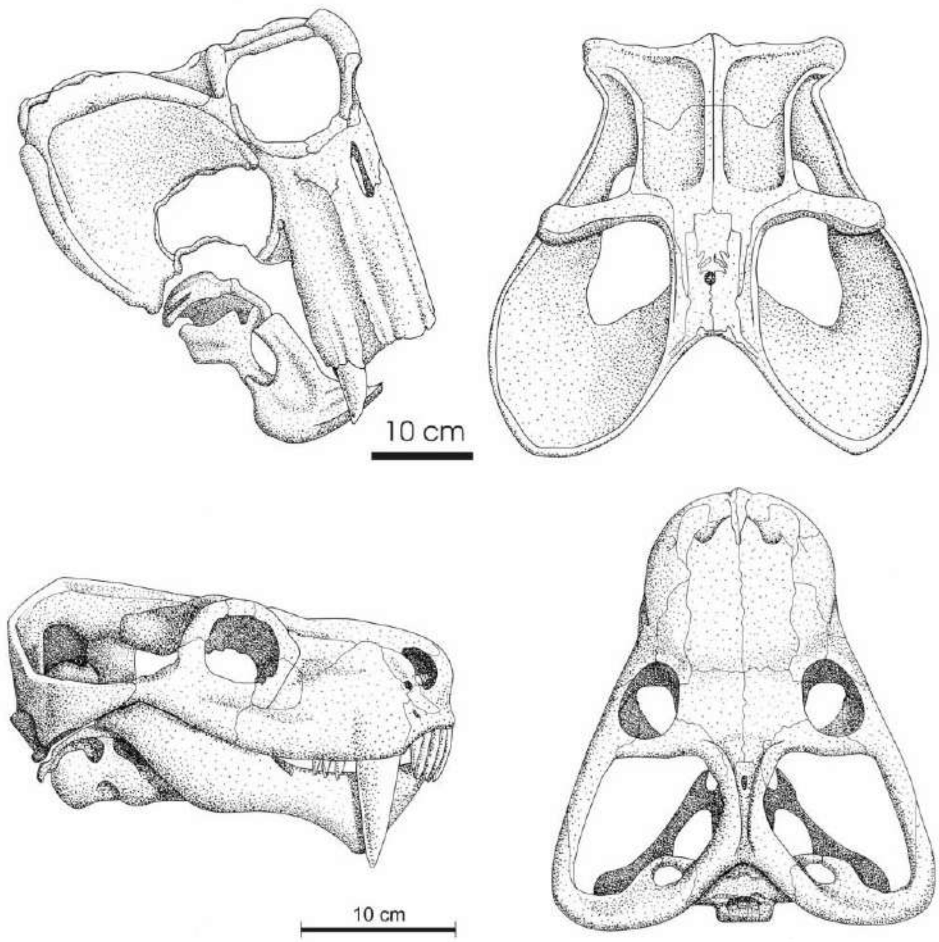


***Figure 11**: Biozone defining fossils of the Lystrosaurus maccaigi- Moschorhinus Subzone. The skulls of the Lystrosaurus maccaigi (top) and Moschorhinus kitchingi (bottom) in lateral (Image taken from Viglietti, 2020).*

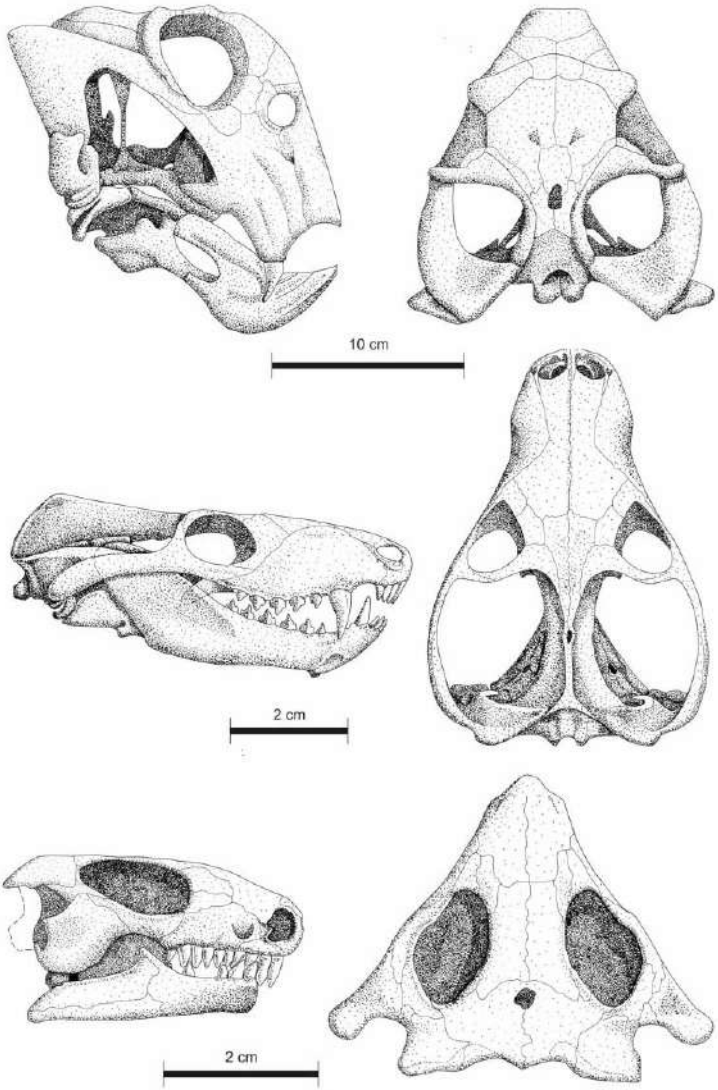


Figure 12: *Lateral and dorsal views of the index taxa defining the Lystrosaurus declivis Assemblage Zone. (top) Lystrosaurus declivis, (centre) Thrinaxodon liorhinus, (bottom) Procolophon trigoniceps (Image taken from Botha and Smith, 2020). Image taken from Viglietti, 2020.*

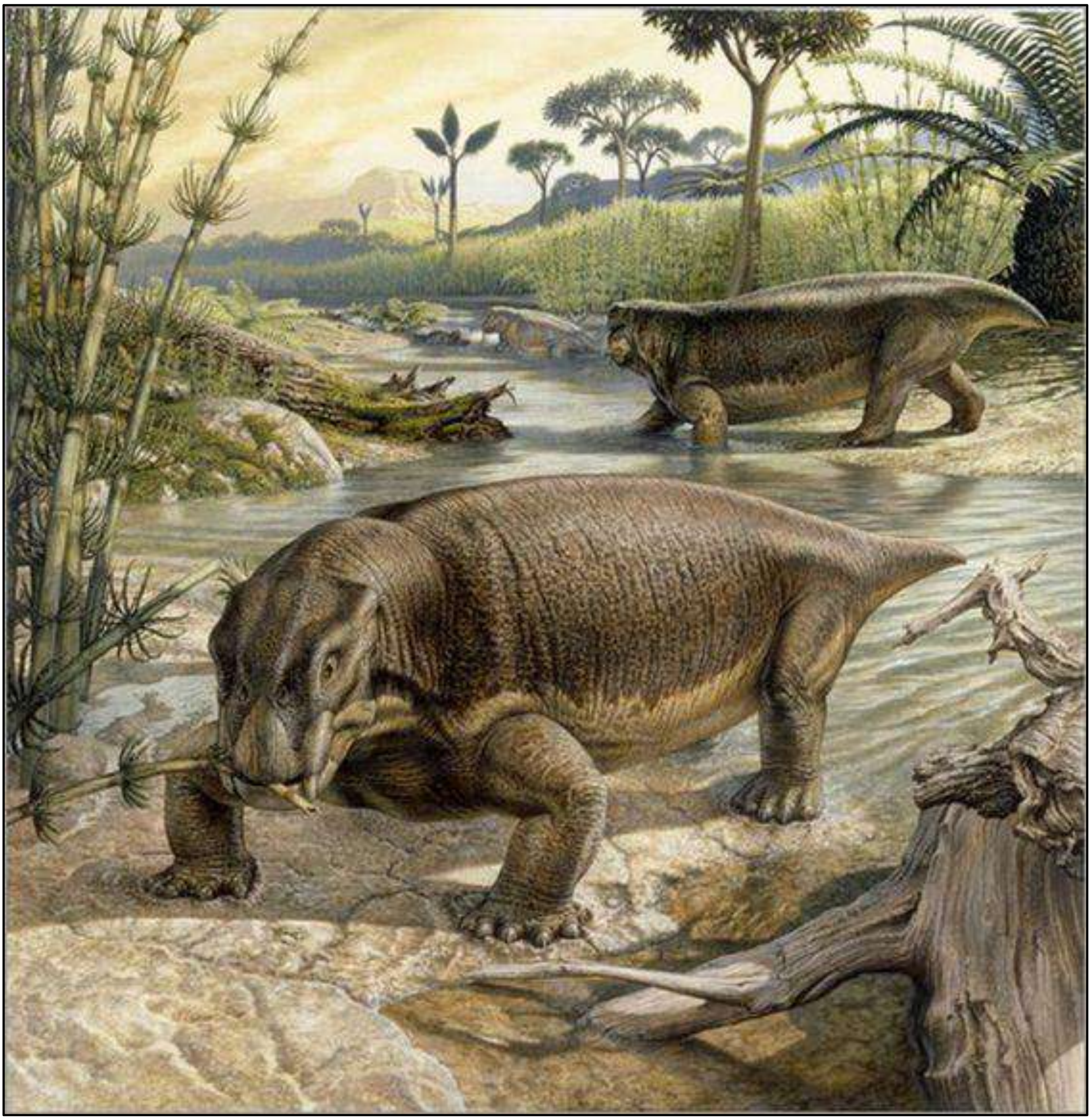


***Figure 13**: Reconstruction of Lystrosaurus sp.*

https://i.pinimg.com/564x/ac/7b/13/ac7b132d1d9882e6d9f9af804820a21e.jpg

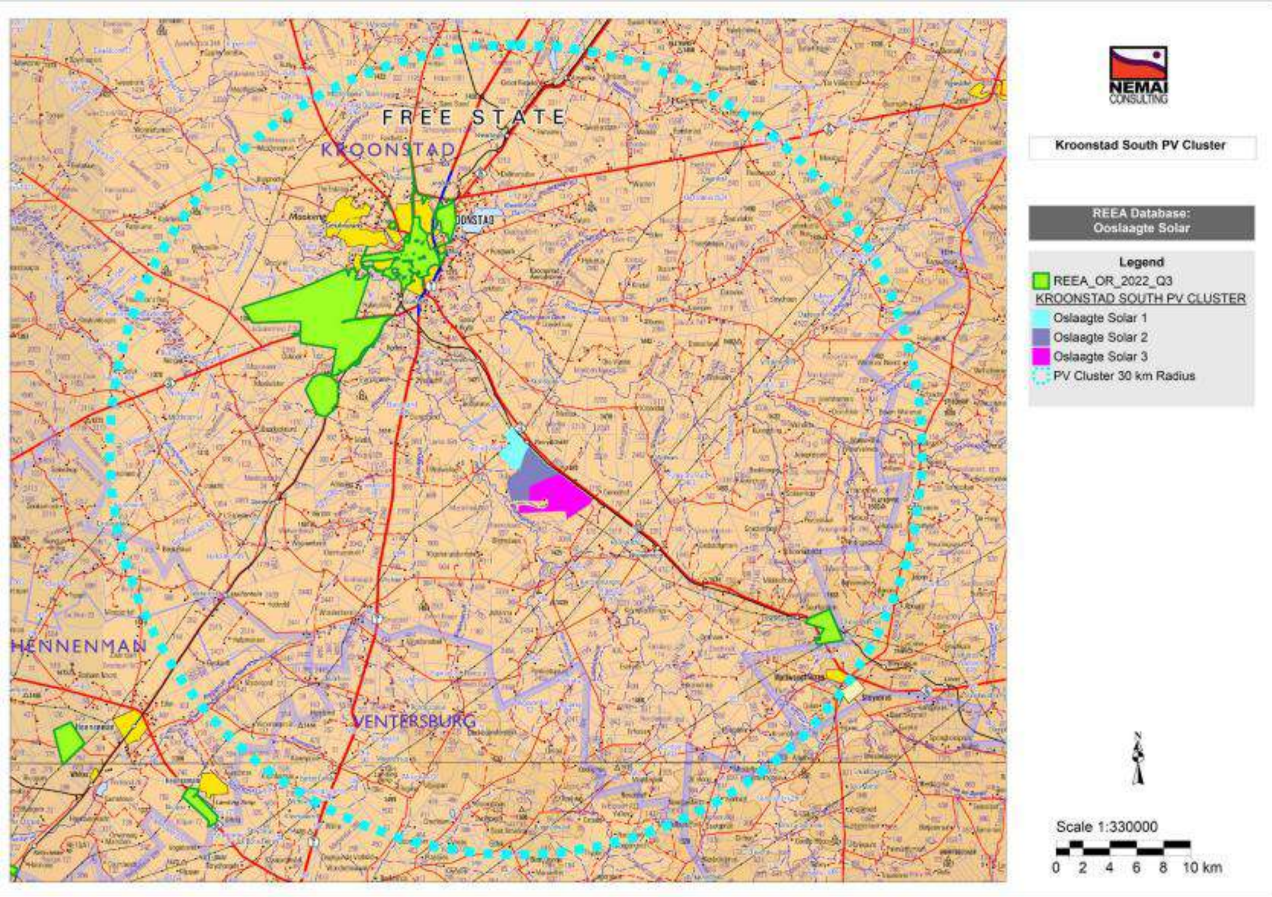


Figure 14:*Renewable energy applications in relation to the Project (within a 30km radius)*

Solar Facilities to the north, and west of the proposed development will have a Low to Very High Palaeontological Sensitivity (Figure 4). However, it is important to note that the quality of preservation of these 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 17.5km to the south east of Kroonstad central business district (CBD) and falls within Ward 1 of the Moqhaka Local Municipality, in the Free State Province. The R76 runs along the eastern boundary of the site. (Figure 1-2).

The property footprint covers a combined area of approximately 600ha. The electricity generated by the Project will be transmitted through a 132kV power line from the new facility substation to a new 400/132 kV Main Transmission Substation (MTS). The 132kV powerline is approximately 3.45 kilometres (km) long, with a 100 meter (m) wide assessment corridor.

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 Consulting
- 1:250 000 2726 Kroonstad (2000) 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 that includes that of (Almond 2020a-c, 2021)
- 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 13 May 2023. No fossiliferous outcrops were identified during the site visit.

***Figure 15**:General view of the proposed development indicates a low topography with grassveld vegetation.*

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 5: 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 6: Impacts on 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 7: Impacts on (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

Impact Summary

Environmental parameter	**Issues**	**Rating prior to mitigation**	**Average**	**Rating post mitigation**	**Average**
Planning Phase Alternative 1 Oslaagte Solar 2 PV Facility	No Impact	0	No Impact	0	No Impact
Construction Stage Alternative 1 Oslaagte Solar 2 PV Facility Loss of fossil heritage	Destroy or permanently seal-in fossils at or below the surface that are then no longer	45	Negative Medium impact	16	Negative Low impact

	available for scientific study				
Operational Phase Alternative 1 Oslaagte Solar 2 PV Facility	No Impact	0	No Impact	0	No Impact
Decommissioning Phase Alternative 1 Oslaagte Solar 2 1 PV Facility	No Impact	0	No Impact	0	No Impact
Planning Phase Alternative 2 Oslaagte Solar 2 PV Facility	No Impact	0	No Impact	0	No Impact
Construction Stage Alternative 2 Oslaagte Solar 2 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 Oslaagte Solar 2 PV Facility	No Impact	0	No Impact	0	No Impact
Decommissioning Phase Alternative 2 Oslaagte Solar 2 1 PV Facility	No Impact	0	No Impact	0	No Impact

11. FINDINGS AND RECOMMENDATIONS

The proposed Oslaagte Solar 2 PV Facility is largely underlain by the Adelaide Subgroup of the Beaufort Group (Karoo Supergroup), with a very small portion of Jurassic dolerite in the south of the development. According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) and the DFFE (Department of Forestry, Fisheries and the Environment) Screening Tool the Palaeontological Sensitivity of the Adelaide Subgroup is Very High (Almond and Pether, 2009; Almond *et al*., 2013) and that of the Dolerite is Zero. Updated Geology (Council of Geosciences) indicates that the proposed development is underlain by the Balfour Formation of the Adelaide Subgroup with a small portion in the west underlain by alluvium, colluvium, elluvium and gravel. Two Layout alternatives have been considered for this project. The first alternative was the original layout of the proposed development while the second alternative was determined after input of the different specialist studies. 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 the weekend of 13 May 2023. No fossiliferous outcrop was detected in the proposed development. This could be attributed to the lack of outcrops as well as the lush grassy vegetation in the area. Based on the site investigation as well as desktop research 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 Kroonstad 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

TECHNICAL REPORTS

Butler, E. 2014. Palaeontological Impact Assessment of the proposed development of private dwellings on portion 5 of farm 304 Matjesfontein Keurboomstrand, Knysna District, Western Cape Province. Bloemfontein.
Butler, E. 2014. Palaeontological Impact Assessment for the proposed upgrade of existing water supply infrastructure at Noupoort, Northern Cape Province. 2014. Bloemfontein.
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Butler, E. 2015. Palaeontological impact assessment of the proposed mixed land developments at Rooikraal 454, Vrede, Free State. Bloemfontein.
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Butler, E. 2015. Palaeontological Impact Assessment of the proposed Ficksburg raw water pipeline. Bloemfontein.
Butler, E. 2015. Palaeontological Heritage Impact Assessment report on the establishment of the 65 mw Majuba Solar Photovoltaic facility and associated infrastructure on portion 1, 2 and 6 of the farm Witkoppies 81 HS, Mpumalanga Province. Bloemfontein.
Butler, E. 2015. Palaeontological Impact Assessment of the proposed township establishment on the remainder of portion 6 and 7 of the farm Sunnyside 2620, Bloemfontein, Mangaung metropolitan municipality, Free State, Bloemfontein.
Butler, E. 2015 . Palaeontological Impact Assessment of the proposed Woodhouse 1 photovoltaic solar energy facilities and associated infrastructure on the farm Woodhouse729, near Vryburg, North West Province. Bloemfontein.
Butler, E. 2015. Palaeontological Impact Assessment of the proposed Woodhouse 2 photovoltaic solar energy facilities and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.
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Butler. E., 2022Palaeontological Desktop Assessment to assess the proposed Dominion 1 Solar Park, located on the Remaining Extent of Portion 18 of Farm 425, near Klerksdorp within the North-West Province.
Butler. E., 2022. Palaeontological Desktop Assessment to assess the proposed Dominion 2 Solar Park, located on the Remaining Extent of Portion 8 of Farm 425, near Klerksdorp within the North-West Province.
Butler. E., 2022. on the Remaining Extent of Portion 11 of Farm 425, and Remaining Extent of Portion 31 of Farm 425 near Klerksdorp within the North-West Province
Butler. E., 2022. Palaeontological Impact Assessment to assess the Delta Solar Power Plant on the remaining extent of the farm Kareefontein No. 340, Dr Ruth Segomotsi Mompati District Municipality, Lekwa-Teemane Local Municipality near Bloemhof in the North West Province
Butler. E., 2022. Palaeontological Impact Assessment to assess the Sonneblom Solar Power Plant (SPP) on Portion 1 of the farm Blydschap No. 504 within the Mangaung Metropolitan Municipality, southeast of Bloemfontein in the Free State.
Butler. E., 2022. Palaeontological Impact Assessment for the proposed Naos Solar PV One Project near Viljoenskroon in the Free State.
Butler. E., 2022. Palaeontological Impact Assessment for the proposed Naos Solar PV Two Project near Viljoenskroon in the Free State.
Butler. E., 2022. Palaeontological Impact Assessment for the proposed Naos Solar PV Two Project near Viljoenskroon in the Free State
Butler. E., 2022. Palaeontological Impact Assessment for the Ngwedi Solar Power near Viljoenskroon in the Free State.
Butler. E., 2022. Palaeontological Impact Assessment for the Noko Solar Power Plant and power line near Orkney in the North West.
Butler. E., 2022. Palaeontological Impact Assessment for the Proposed Power Line as part of the Paleso Solar Power Plant near Viljoenskroon in the Free State
Butler. E., 2022. Palaeontological Impact Assessment for the Thakadu Solar Plant which near Viljoenskroon in the Free State
Butler. E., 2022. Palaeontological Impact Assessment of the Kentani, Braklaagte, Klipfontein, Klipfontein 2, Leliehoek and Sonoblomo PV Facilities located near Dealsville in the Free State Province
Butler. E., 2022. Palaeontological Impact Assessment for the proposed Harvard 1 Solar Photovoltaic (PV) facility on Portion 5 of Farm Spes Bona no 2355, Mangaung Metropolitan Municipality in the Free State.
Butler. E., 2022. Palaeontological Impact Assessment for proposed Harvard 2 Solar Photovoltaic (PV) facility on Portion 8 of Farm Spes Bona No 2355, Mangaung Metropolitan Municipality in the Free State.
Butler. E., 2022. Palaeontological Impact Assessment for the proposed Doornrivier Solar 1, southwest of Matjhabeng (formerly Virginia) in the Free State
Butler. E., 2022. Palaeontological Desktop Assessment for the proposed Leeuwbosch PV solar photovoltaic (PV) plant and associated infrastructure on Portion 37 of the Farm Leeuwbosch No. 44 near Leeudoringstad within the Maquassi Hills Local Municipality in the Dr Kenneth Kaunda District Municipality in the North West Province.

APPENDIX 2

PALAEONTOLOGICAL SITE VERIVICATION REPORT

Oslaagte2 Solar PV Project

(Part of the Kroonstad South PV Cluster)

CONTENTS

1. INTRODUCTION

Nemai Consulting CC (Nemai) was appointed by Oslaagte Solar 2 (Pty) Ltd (the "Applicant") to conduct the Environmental Impact Assessment (EIA) for the proposed 460 MW Solar Photovoltaic (PV) Project west of Kroonstad, in the Free State Province (the "Project").

The electricity generated by the Project will be transmitted through a 132kV power line from the new facility substation to a new 400/132 kV Main Transmission Substation (MTS). 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.

Table S1: Details of the affected properties

Farm Name	21-digit Surveyor General (SG) Code
Oslaagte 2564	F02000000000256400000

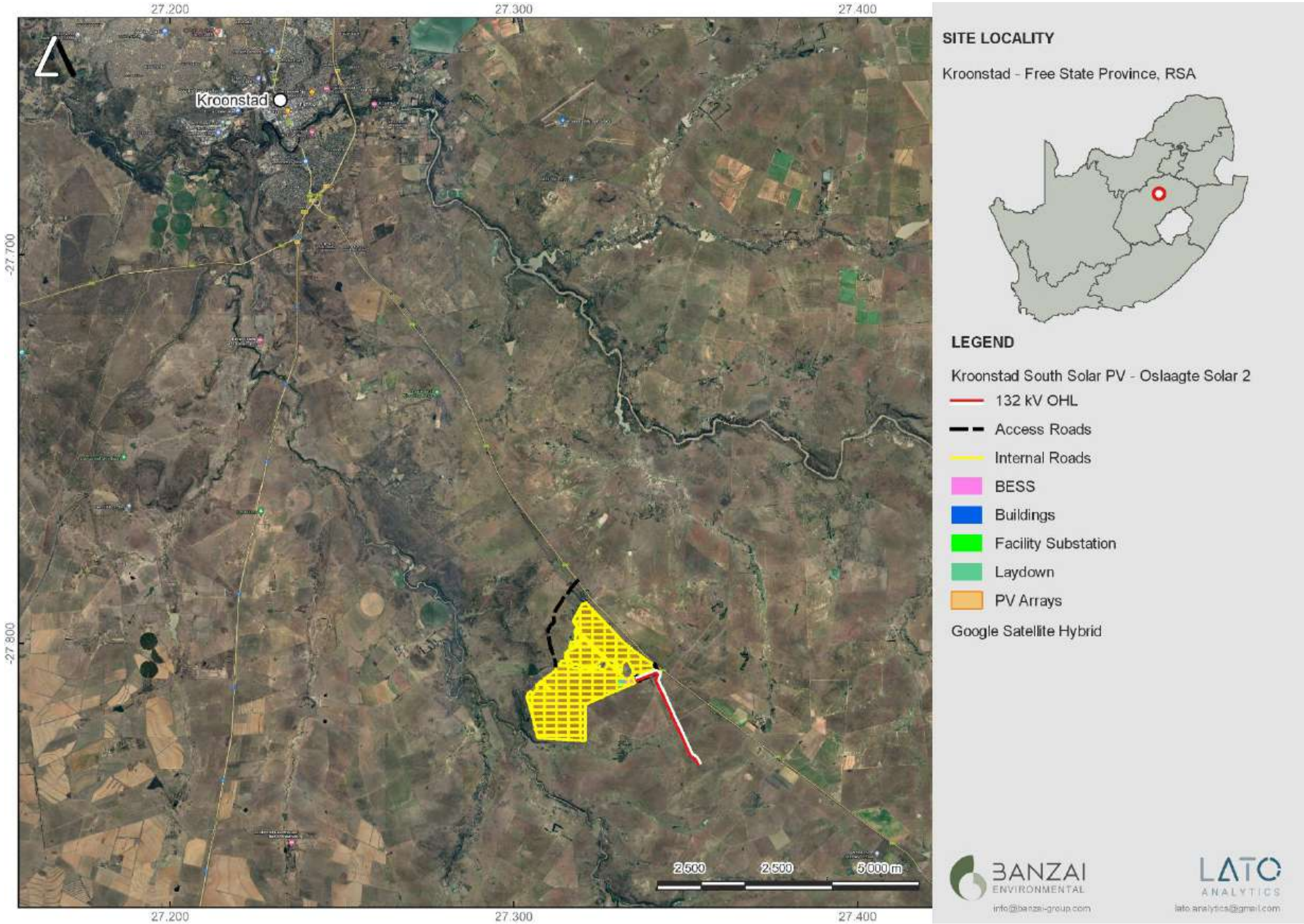


Figure S1: Regional locality Map of the proposed Oslaagte Solar 2 PV Facility near Kroonstad in the Free State Province.

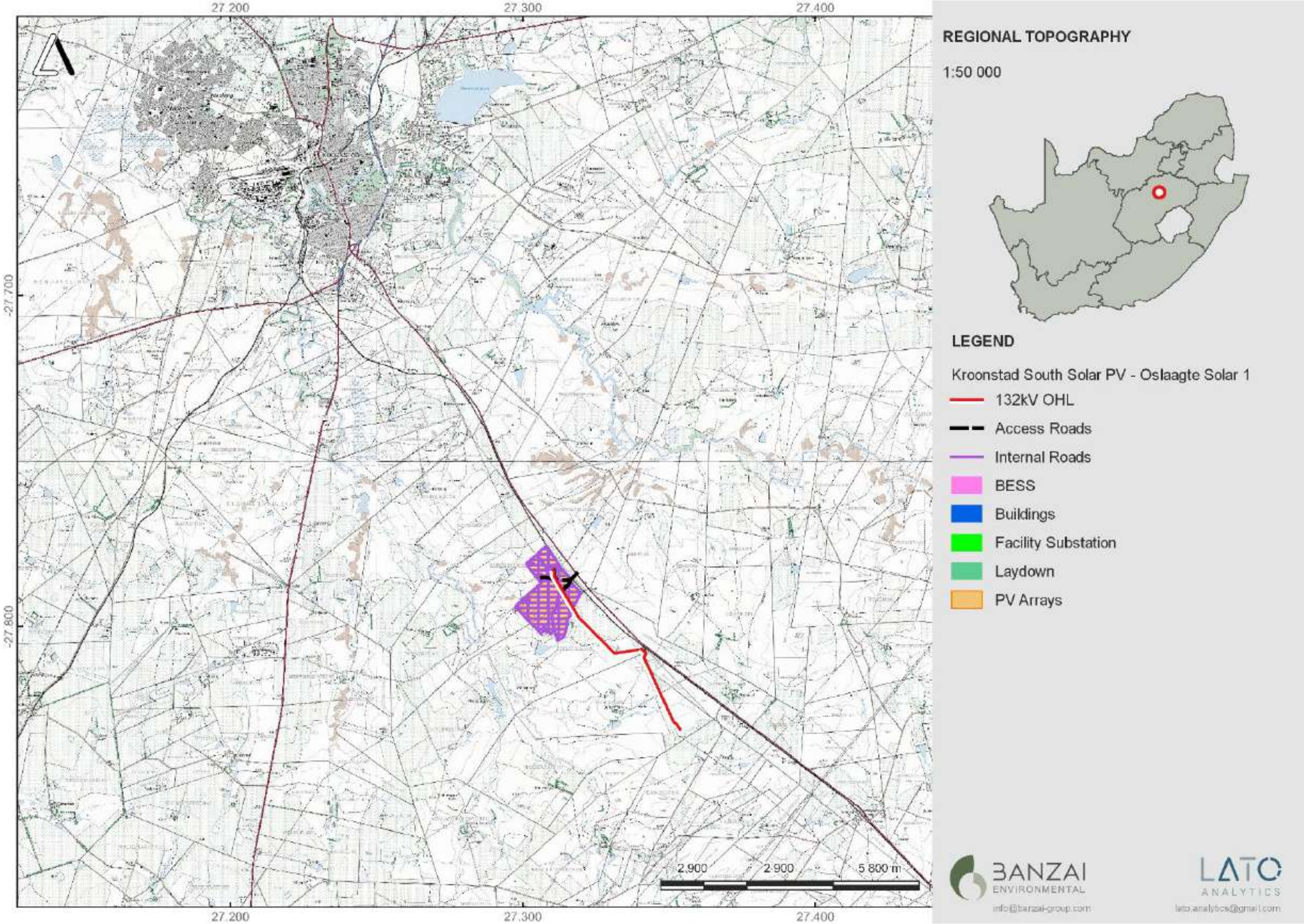


Figure S2: Locality map of the proposed Oslaagte Solar 2 PV Facility near Kroonstad in the Free State Province.

2. TECHNICAL DETAILS FOR THE PROPOSED DEVELOPMENT

No.	Component	Alternative 1 - Description / Dimensions	Alternative 2 - Description / Dimensions
14.	Height of PV panels	Up to 5.5 m	Up to 5.5 m
15.	Facility generation capacity (MW)	240 MW	Up to 460 MW
16.	Area of PV Array	Up to 610 ha	Monofacial or Bifacial PV panels, mounted on either fixed-tilt, single-axis tracking, and/or double-axis tracking systems. Area: Up to 585 ha
17.	Area occupied by inverter / transformer stations / substations	Up to 1ha	It is estimated that the maximum size of the facility substation will not exceed 2 ha. Each facility will require inverter-stations, transformers, switchgear and internal electrical reticulation (underground cabling).
18.	Capacity of on-site substation	The facility substation will collect the power from the facility and transform it from medium voltage (up to 33 kV) to high voltage (132 kV).	The facility substation will collect the power from the facility and transform it from medium voltage (up to 33 kV) to high voltage (132 kV).
19.	BESS	Area up to ± 5ha	Area: up to ± 5 ha
20.	Area occupied by both permanent and construction laydown areas	Temporary: Up to 7ha Permanent: Up to 1 ha (located within the area demarcated for temporary construction laydown)	Temporary construction laydown area up to 10 ha. Permanent laydown area up to 1 ha (to be located within the area demarcated for the temporary construction laydown).
21.	Area occupied by buildings	Up to 1.5 ha	Up to 1.5 ha
22.	Length of internal roads	Up to 33km	Up to 33 km
23.	Width of internal roads	The internal roads will be up to 6 m wide. The access roads will be up to 8 m wide.	The internal roads will be up to 6 m wide. The access roads will be up to 8 m wide.
24.	Proximity to grid connection	±7.30 km	Approximately 6 - 8 km
25.	Height of fencing	Up to 3.5m	Up to 3.5m
26.	Type of fencing	Type will vary around the site, welded mesh, palisade and electric fencing	Type will vary around the site, welded mesh, palisade and electric fencing

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

The geology of the proposed Oslaagte Solar 2 PV near Kroonstad in the Free State is depicted on the 1: 250 000 Kroonstad 2726 (2000) Geological Map (Council for Geosciences, Pretoria) (Figure S3, Table

[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

S2). This map indicates that the study area is mainly underlain by the Adelaide Subgroup (Pa, green) (Beaufort Group, Karoo Supergroup) while a very small portion in the south is underlain by dolerite.

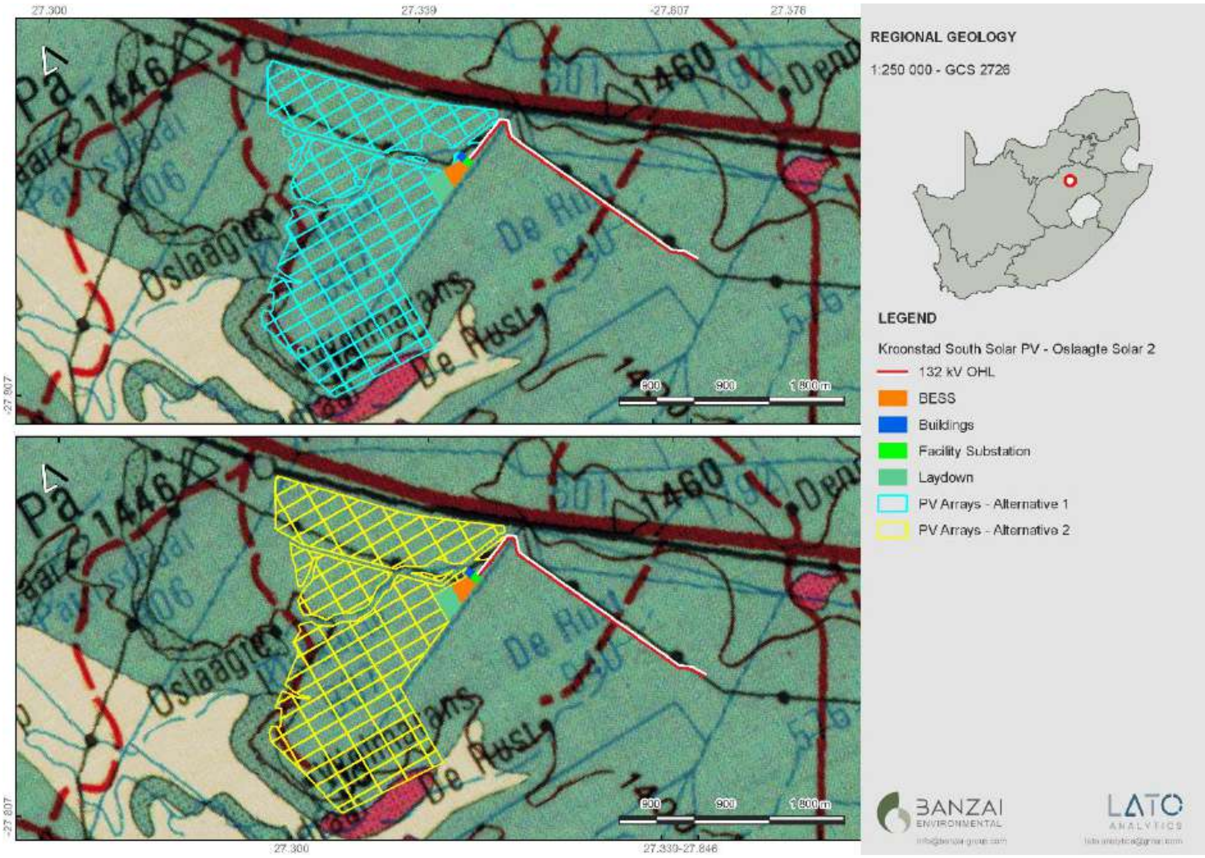
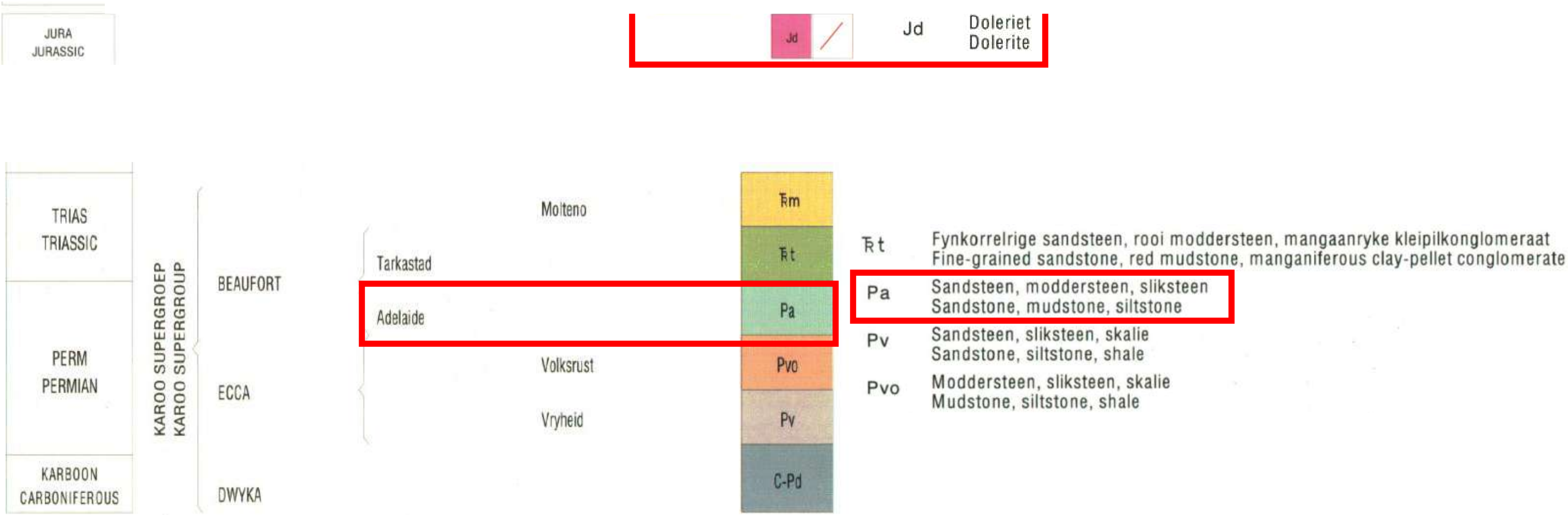


Figure S3: Extract of the 1: 250 000 Kroonstad 2726 (2000) Geological Map (Council of Geoscience, Pretoria) indicating that the Oslaagte Solar 2 PV development and associated infrastructure is underlain by the Adelaide Subgroup (Balfour Group, Karoo Supergroup with a very small portion of Dolerite in the south).

Table S3: Legend to the Kroonstad 2726 (2000) Geological Map (Council for Geosciences, Pretoria).

Relevant sediments are indicated in a red square



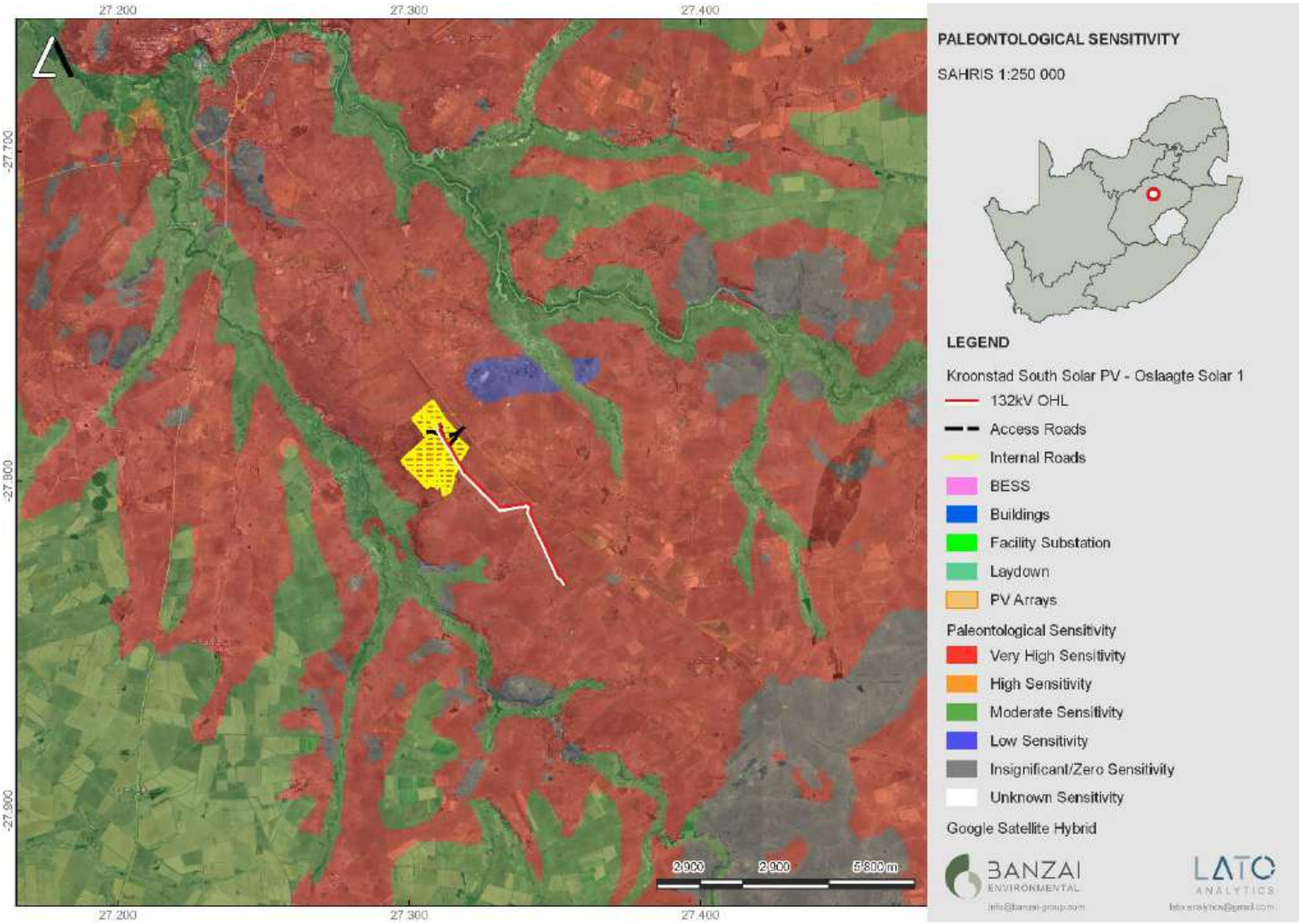


Figure S4: Extract of the 1: 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the proposed Oslaagte Solar 2 PV development and associated infrastructure.

Table S4: 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 S3, Table S3) indicates that the Palaeontological Sensitivity of the Oslaagte Solar 2 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 and power line by the National Environmental Web-bases Screening Tool.

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 Oslaagte Solar PV 2 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 Oslaagte Solar PV 2 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 E7: Social Impact Assessment

PROPOSED 460MW OSLAAGTE SOLAR 2 PHOTOVOLTAIC PROJECT SOUTH OF KROONSTAD, FREE STATE PROVINCE

Social Impact Assessment Report

March 2023

Prepared for: Oslaagte Solar 2 (Pty) Ltd

Title and Approval Page

Project Name:	Proposed 460MW Oslaagte Solar 2 Photovoltaic Project South of Kroonstad, Free State Province
Report Title:	Social Impact Assessment Report
Report Status:	Draft EIA

Client	Oslaagte Solar 2 (Pty) Ltd

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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
BID	Background information document
CBD	Central Business District
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
FDDM	Fezile Dabi District Municipality
GCCA	Generation Connection Capacity Assessment
GDP	Gross Domestic Product
GIS	Geographic Information System
GVA	Gross Value Added
HIV	Human Immunodeficiency Virus
IAP	Interested and Affected Party
IEP	Integrated energy plan
IFC	International Finance Corporation
ILO	International Labour Organisation
IRP	Integrated Resource Plan
ISO	International Organisation for Standardization
LDM	Lejweleputswa District Municipality
MLM	Moqhaka Local Municipality
MTS	Main transmission substation
NDP	National Development Plan
NEMA	National Environmental Management Act (No. 107 of 1998)
PV	Photovoltaic
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SIA	Social Impact Assessment
SMME	Small Medium and Micro Enterprises
TMDM	Thabo Mofutsanyana District
XDM	Xhariep District Municipality

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 Oslaagte 2 460MW Solar Photovoltaic Project.

This solar PV generator aims to provide 460MW 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 south-east of the city of Kroonstad in the northern Free State 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 Components

Oslaagte Solar 2 (Pty) Ltd has proposed the development of the 460MW Oslaagte Solar 2 Photovoltaic (PV) Project near Kroonstad, in the Free State Province .The electricity generated by the Project will be injected into the Eskom National Grid system via 132 kV powerlines from the facility substation to a new 132/400 kV Main Transmission Substation (MTS).Oslaagte Solar 2 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 1 below provides an overview of a typical Solar PV Power Plant project.

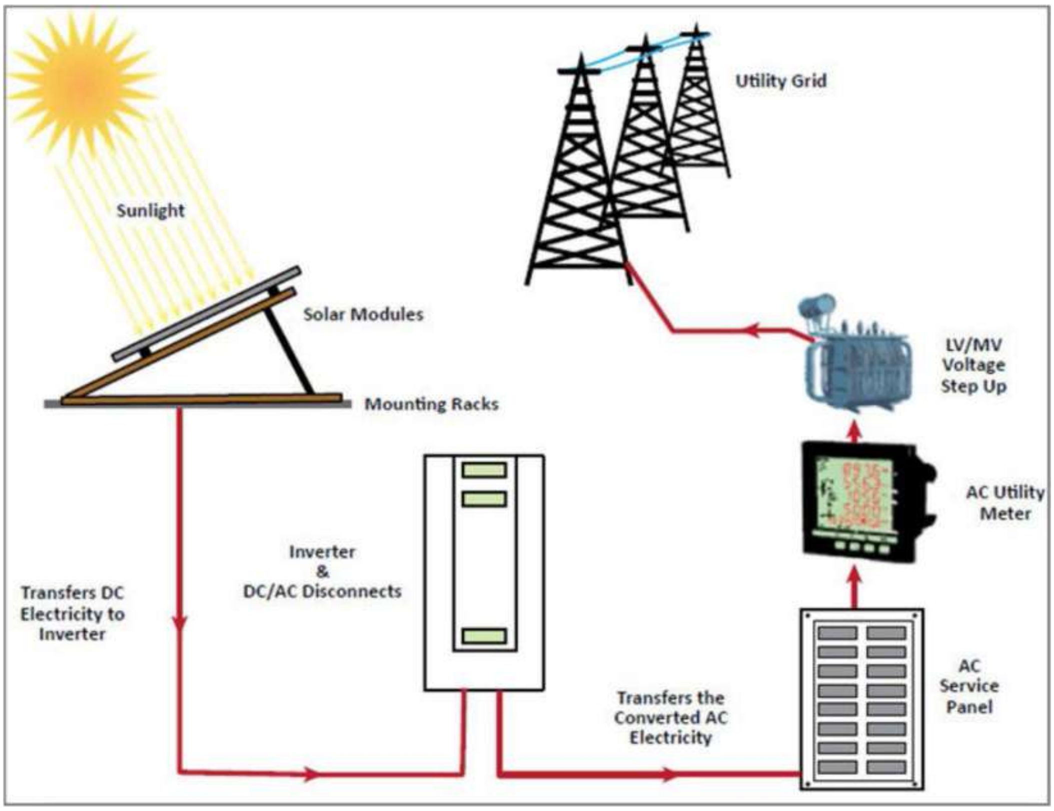


Figure 1:Overview of the solar power plant

(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 project part of the cluster of three facilities, all located in close proximity to one another and using the same electricity transmission infrastructure. The three projects in the cluster are shown in Figure 2 below.

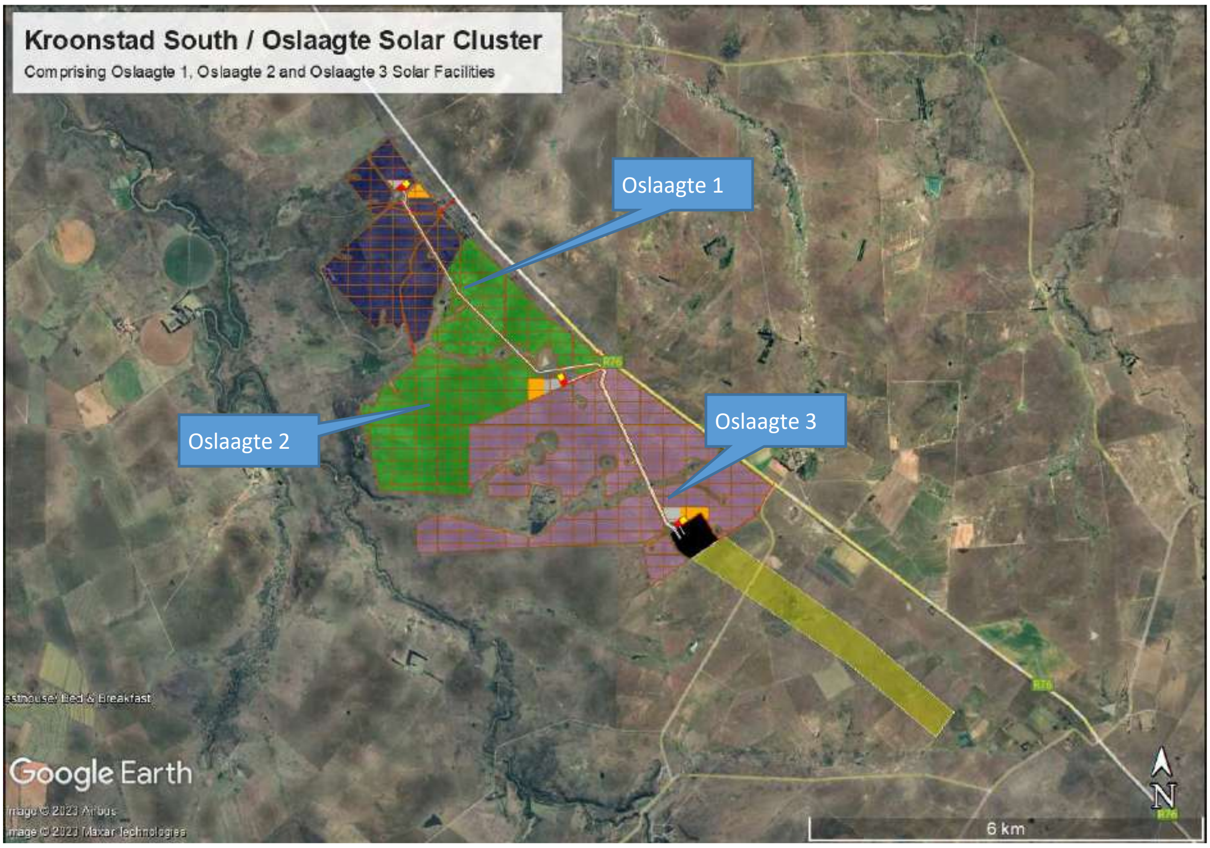


Figure 2: Kroonstad / Oslaagte Solar Cluster

The proposed Oslaatge Solar 2 will cover approximately 600 ha and will include the following infrastructure:

- PV modules and mounting structures which will consist of either Monofacial or Bifacial PV panels, mounted on either fixed-tilt, single-axis tracking, and/or double-axis tracking systems;
- Inverters and transformers;
- Battery Energy Storage System (BESS) area up to five hectares;
- Operation and Maintenance buildings including a gate house and security building, control centre, offices, warehouses and workshops for storage and maintenance;
- Facility grid connection infrastructure, including: 33kV cabling between the project components and the facility substation; a 132kV facility substation; 33kV or 132kV cabling or powerline between the facility substation and the proposed Main Transmission Substation or the Kroonstad Switching Station;
- Temporary construction laydown area up to five hectares;

- Permanent laydown area up to one hectare (to be located within the area demarcated for the temporary construction laydown);
- Internal roads will be up to six metres wide, to allow access to the Solar PV modules for operations and maintenance activities.
- Main Access Road is up to eight metres wide. The site is accessible via the R76.

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.

The subject of this report is the Oslaagte Solar 2 PV Facility, which is shown in Figure 3 below.

The project area is considered to have favorable solar irradiation levels (Global Horizontal Irradiation of 2094.7 kWh per m2 per annum) which makes it ideal to generate solar energy using PV Panels (World Bank, 2019). Based on the latest Generation Connection Capacity Assessment (GCCA) that was released by Eskom in March 2022, the GCCA confirms that the Free State Cluster currently has 4 113 MW generation connection capacity available.

2.2 Project Locality

Oslaagte Solar 2 Photovoltaic (PV) Project is located approximately 16.5km to the southeast of Kroonstad Central Business District (CBD) and falls within Ward 2 of the Moqhaka Local Municipality, in the Free State Province. The R76 runs along the eastern boundary of the site.

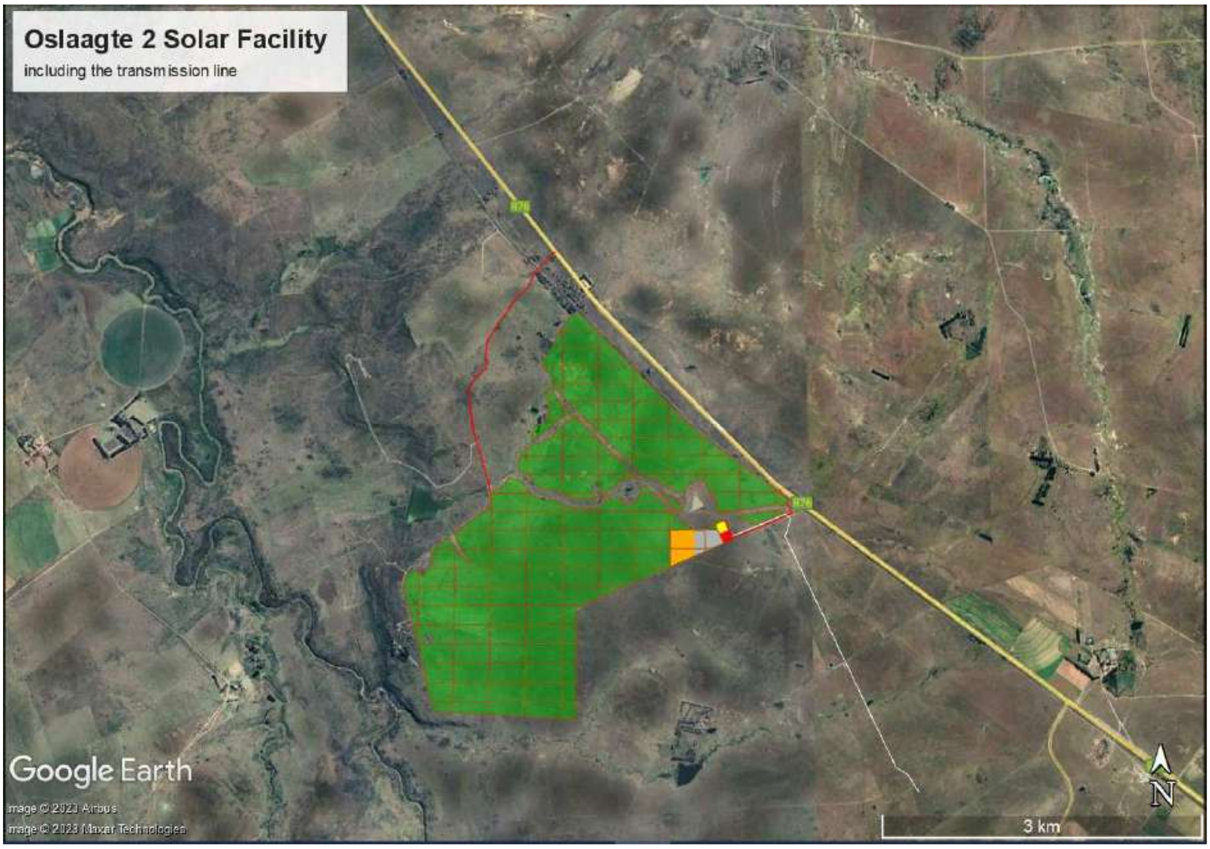


Figure 3: Oslaagte Solar 2

The facility is located at the north of the cluster with access being provided through an access road on the R76.

The project is located on the farm Oslaagte 2564.

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 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 Free State 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 32 122 during construction, and 88 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 of 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 16 205, made up of 11 371 job years for operations and maintenance and a construction phase job phase year estimate of 4 834. 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 1: Job Creation Estimate

Description	Total No.	Local No.
Total Jobs Created (durations above one month)	32 122	17 667
Planning and Construction Phase	31 786	17 482
Operation and Maintenance Phase, 20 years	336	185

Table 2: Estimated Job Years Created

Description	Total No.	Local No.
Total Job Years Created	16 205	8 913
Planning and Construction Phase	4 834	2 659
Operation and Maintenance Phase, 20 years	11 371	6 254

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 R14 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 R14 billion, a local value chain addition of R7 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, a distance of 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 Moqhaka Local Municipality within Free State Province, the regional study area most likely to have direct positive or negative impacts. These impacts include economic pull (job creation), in-migration of workers and multiplier effects in the local and regional economy due to the proximity of the Project footprint. Figure 4 shows the regional study area of Oslaagte Solar 2 PV situated in Moqhaka Local Municipality.

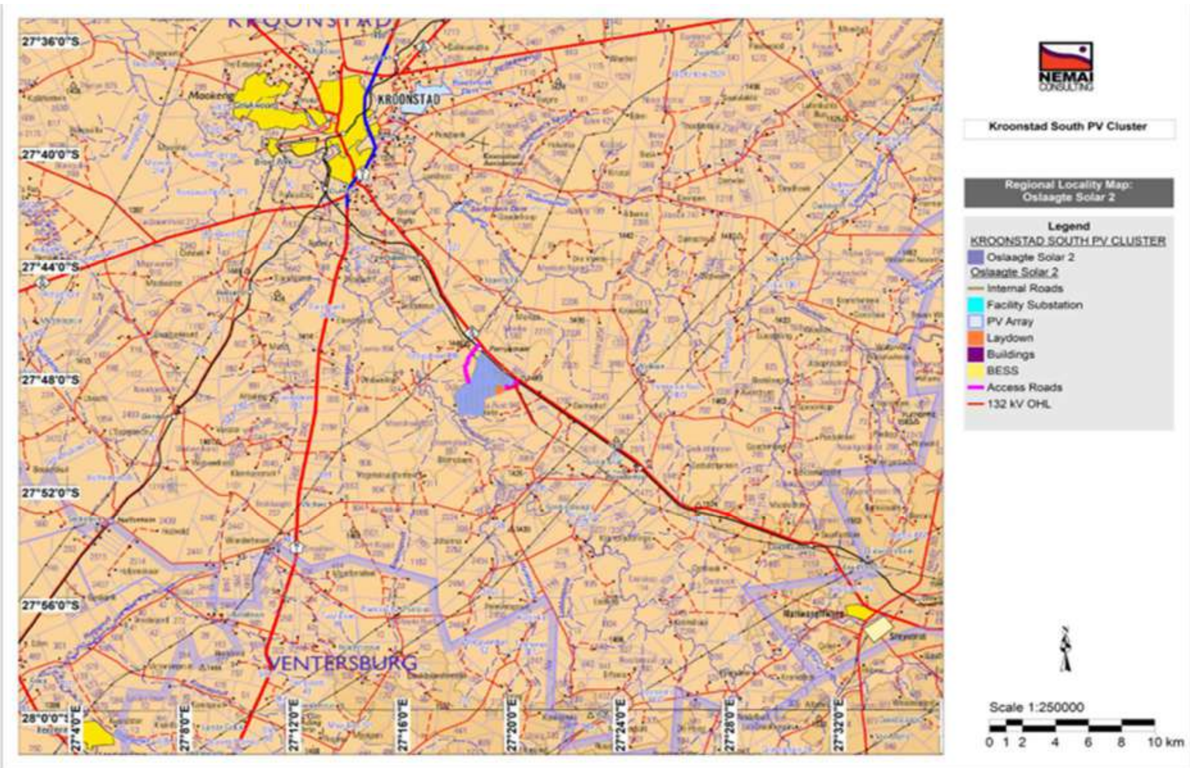


Figure 4: Oslaagte Solar 2 in Moqhaka Local Municipality

For the purposes of the regional analysis, the precise layout of the panels will not have any consequence for the social impact assessment.

4.2 Local Study Area

The local study area is in Ward 2 of the Moqhaka Municipality. The areas are shown in Figure 5 below, shaded in green.

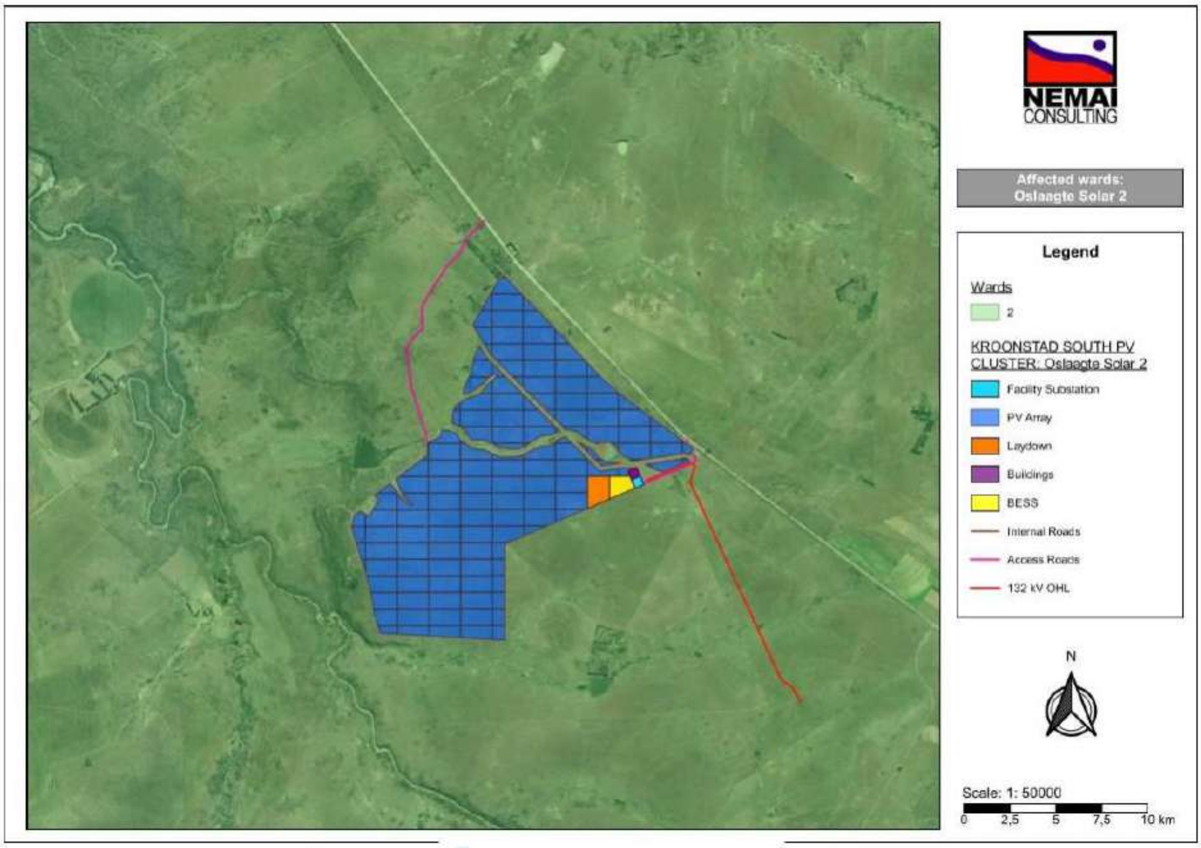


Figure 5: Oslaagte Solar 2 PV in Moqhaka Local Municipality

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 map below.

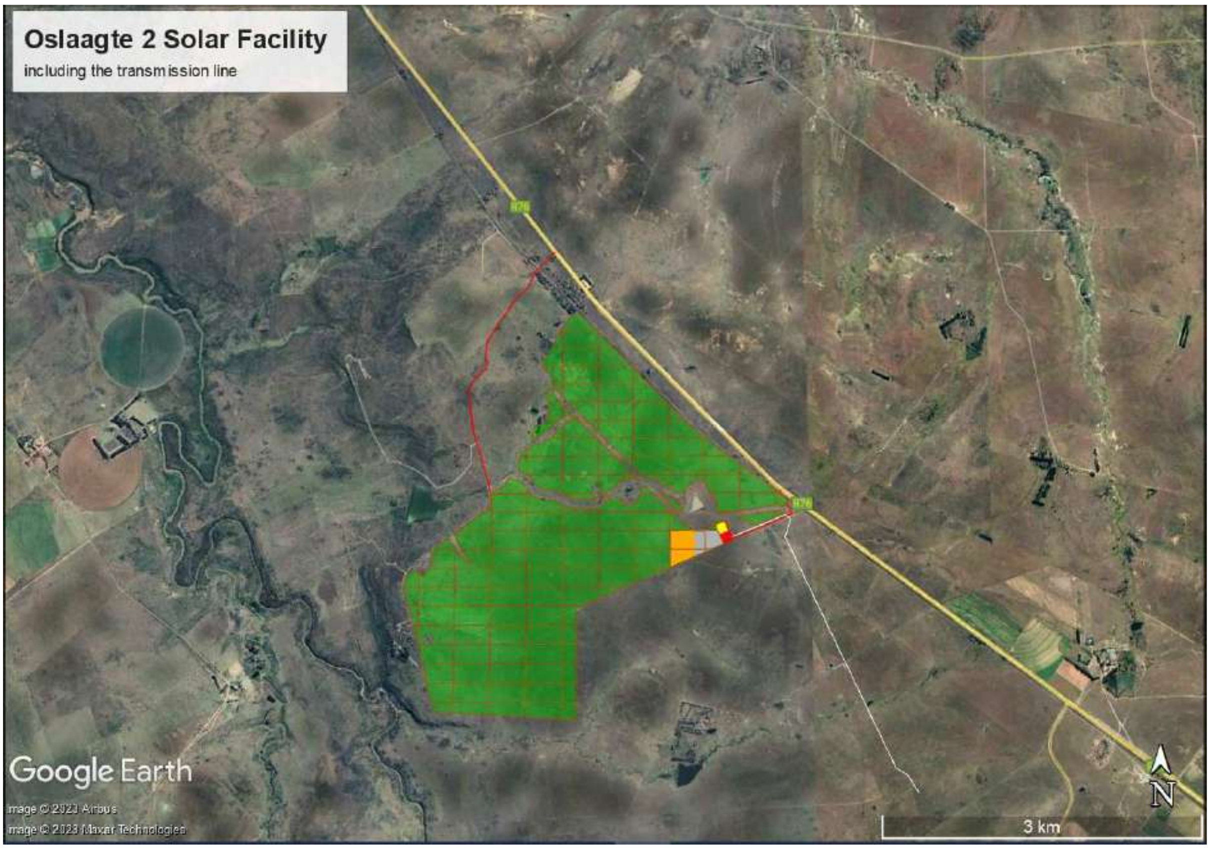


Figure 6: Oslaagte Solar 2 Direct Study Area

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.

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 a number of 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 basis 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 Moqhaka Local Municipality (MLM) and the Fezile Dabi District Municipality (FDDM) IDP documents giving broad background information on the project area and surrounding municipality. 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 Free State Province is the third largest province in the country; but has the second smallest population and the second lowest population density. The province is situated on the center of South Africa and borders other provinces which are inclusive of Mpumalanga; Gauteng; Eastern Cape; North West; Kwazulu-Natal and the Northern Cape; the exceptions being Limpopo and the Western Cape Province.

Free State covers an area of 130 011 square kilometers and in the year 2016 it was recorded to have a population size of 2.8 million people and comprises of four district municipalities, the Fezile Dabi District Municipality (FDDM); Lejweleputswa District Municipality (LDM); Thabo Mofutsanyana District Municipality (TMDM) and Xhariep District Municipality (XDM) (FS IDP, 2020).

Fezile Dabi District Municipality is a Category C municipality, which was established in the year 2000. The municipality is located in the northern part of the Free State Province and covers an area of 20 830 square kilometers. The municipality is the smallest district in the province, making up 16% of its geographical area. The district consists of four local municipalities, the Moqhaka Local Municipality; Metsimaholo Local Municipality; Ngwathe Local Municipality and Mafube Local Municipality. The district has a population size of 527 788; with an annual population growth rate of 1.6 %. In 2019 the district had a total of 166 004 households with a population density of 23.8 people per square kilometers (Fezile Dabi IDP, 2020).

6.2 Moqhaka Local Municipality

Moqhaka is a Sesotho word meaning “crown” and the Moqhaka Local Municipality is one of the four municipalities located in the southern part of the Fezile Dabi District; in the Free State province. It neighbors the N1 national road as well as the most important four-way railway junction in the country. The municipality has a geographical area of 7 925 square kilometers; which makes it the biggest municipality of the four. Cities and towns found in the municipality are Kroonstad, Renovaal, Steynsrus, Vierfontein, and Viljoenskroon. Kroonstad is the major town in the municipality and is the seat of local government. The town plays a crucial role in the district’s economy through its large agricultural community. In addition, industrial activities such as transport; business services and mining are important contributors in the district’s economy.

6.3 Demographics

The Moqhaka Local Municipality has been experiencing a decrease in population size over the years; there were approximately 154 732 people in 2016, which is a decline from 160 532 people captured in 2011, resulting in a -0.84% population growth per annum. Moqhaka LM can be described as a less urbanized area when compared to its surrounding municipalities, therefore the decrease in the population size could be attributed to the migration of people from rural to urban areas in search of improved social and economic opportunities (Municipal IDP, 2020). Figure 7 below shows the change in population size over the years.

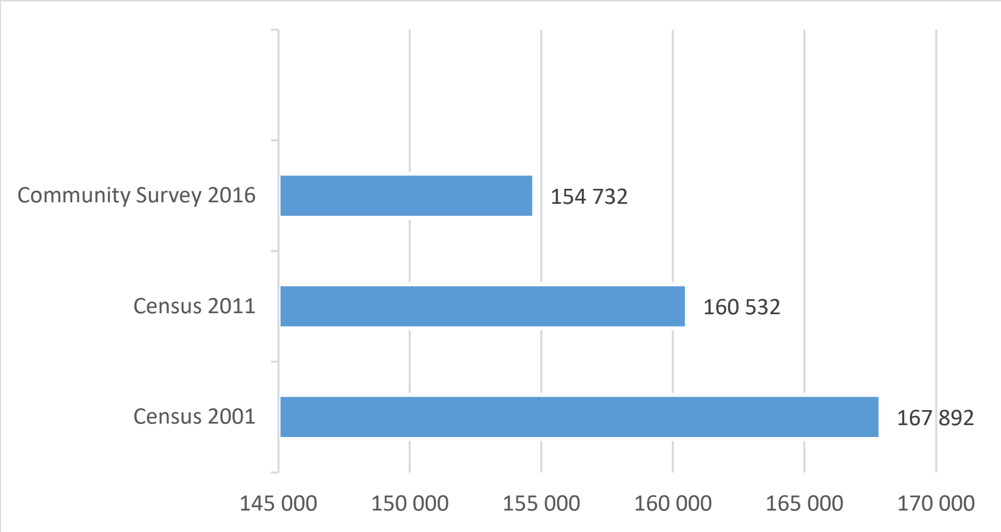


Figure 7: Population Overview

Source: Statistics SA: Community Survey 2016

The decline in population in the municipality has been sustained over the sixteen years in which data has been collected.

6.4 Household Dynamics

The Community Survey recorded 45 661 households in 2011 which increased to 53 601 in 2016; this is an increase of approximately 17% of households in a period of four years. To achieve this despite a decrease in overall population size, the average household size dropped from 3.5 in 2011 to 2.9 in 2016. As the population migrates out of the local municipality, smaller households are being formed with the remainder of the population.

Out of the 53 601 households; 13% live in informal dwellings and approximately 86% live in formal dwellings. An index ratio of males to females indicates that the majority of households comprise of males as their heads; with Moqhaka LM being 59%; Fezile Dabi being 61% and the provincial level accounting for 58% (StatsSA, 2011 & 2016). Table 3 represents the demographic data below.

Table 3: Regional Study Area Demographic Data

Indicator Name		Free State	FDDM	Moqhaka LM
Head of Household	Male	58%	40%	59%
	Female	42%	61%	41%
Population Group	Black/African	89%	86%	88%
	Colored	3%	2%	3%
	White	8%	12%	9%
	Indian/Asian	0%	0%	0.2%
Spoken Languages	Sesotho	71%	75%	82%
	Afrikaans	11%	12%	11%

Indicator Name		Free State	FDDM	Moqhaka LM
	Isizulu	2%	4%	Not comparable
	Isixhosa	5%	4%	2%
	Other	2%	2%	1%

Source: Statistics SA: Community Survey 2016

The Sesotho language is the most spoken language in the Free State; across the District and the Local Municipalities; which can be attributed to the fact that there are more African people who live in these areas. Afrikaans is the second most spoken language in both the Secondary and Regional study area, resulting in the decline of other spoken languages by 2016 (STATSSA, 2016).

6.5 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. Moqhaka LM has witnessed a decline in the number of children who are 20 years and above without any formal education; in 2011 there were 5.4% which reduced to 4% in 2016 (StatsSA, 2011-2016).

There were 32% of people above 20 years of age who completed matric in 2016, although the percentage is still relatively low it is a positive change from the 28% of the population who attained this level 2011. In 2016 there were only 3% of people having completed higher education. The youth unemployment rate was 47% in 2011 (Municipal IDP, 2017-2022). The low levels of matric completion could have had a ripple effect on the decreased number of children completing their higher education as well as the high youth unemployment rate across the municipality. (StatsSA, 2011-2016).

Table 4 presents the education profile below.

Table 4: Education Profile for Those above 20 Years of Age

Highest Education Level	Free State	FDDM	Moqhaka LM
No Schooling	105 014 (13%)	21 576 (15%)	3 924 (9%)
Some or Completed Primary School	84 968 (11%)	13 621 (10%)	4 510 (11%)
Some or Completed Secondary School	544 168 (70%)	101 894 (71%)	32 281 (77%)
Higher Education	21 915 (6%)	6 646 (4%)	1 454 (3%)

Source: Statistics SA: Community Survey 2016

6.6 Economy

The Fezile Dabi district's economy is sustained by several industries which range from manufacturing; electricity, mining and community services to name a few. The manufacturing industry is the highest contributor towards the GVA within the district (27%); the second highest contributor being the mining industry (18%); which is then followed by the community services (13%). The agriculture sector is lagging behind with a -3% average annual growth, which was the lowest within the district; followed by the electricity sector with 0.43% (Fezile Dabi IDP, 2020: 23).

The overall economy in Moqhaka LM is dominated by agriculture and therefore there is a total of 7 221 agricultural households in the municipality; in most cases each household engages in more than one agricultural activity as a way of generating income (StatsSA, 2016).

Figure 8 displays household income in the municipality below.

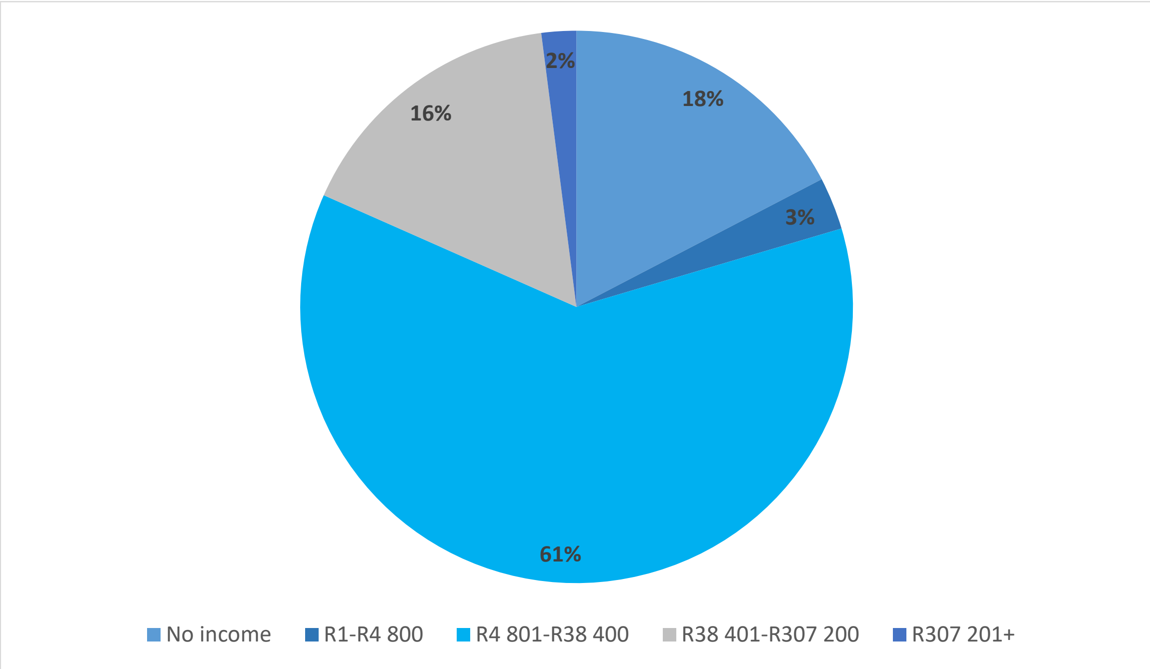


Figure 8: Household income in Moqhaka Municipality [R/annum]

Source: Statistics SA: Community Survey 2016

Household income is dominated by low-income families, with 82% of the families earning les than R38 000 per annum in 2016. Two percent of households earnt more than R307 200 per annum.

6.7 Labor Force

In 2011 approximately 36 040 (34%) people were employed in Moqhaka municipality, which is relatively lower than the employment rate in both Free State 649 661 (36%) and Fezile Dabi 117 732 (37%). From those employed in Moqhaka LM 66% of them were employed in the formal sector and 17% in the informal sector (Census 2011). The above figures point to the fact that the study area comprises of a high number of individuals who are not economically active (people who are either too young or too old to work).

Figure 9 gives an overview of the employment and unemployment rates below.

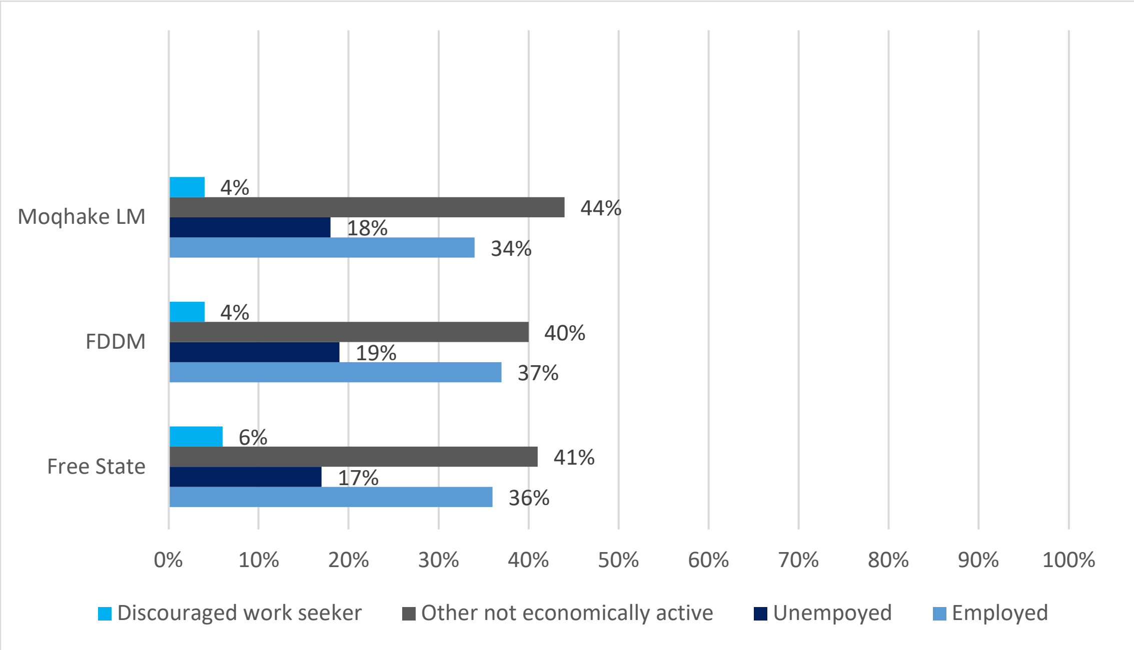


Figure 9: Employment and Unemployment rates

Source: Statistics SA: Census 2016

The employment and income measures both point to high levels of poverty in the municipality, low employment rates being the cause of low income. It is suggested that the low attainment of higher than matric education is a contributing factor to this dynamic.

6.8 Access to Electricity

Moqhaka LM is currently providing approximately 129 101 (83%) of the population with pre-paid electricity, which is higher than the rate in Fezile Dabi 397 373 (80%) and also higher than the rate in Free State 2 325 719 (82%). A further 4 458 (3%) of the population are yet to be granted access to electricity in the municipality; which is less when compared to Fezile Dabi 32 081 (6%) and Free State with 134 750 (55) of the population that are still without electricity supply. A further 1 210 (1%) of the population in Moqhaka LM rely on other sources for energy; which could vary from gas; paraffin and/or candles; which is an indicator of the improvement of the distribution of electrical supply throughout the municipality over the years (Community Survey, 2016).

6.9 Water and Sanitation

There has been an increased access to the usage of flush/chemical toilets at Moqhaka LM, with 143 242 (93%) of the population making use of these facilities; 408 294 (83%) in Fezile Dabi and the overall province accounting for 2 035 212 (72%). By 2016 only 7% of the overall households in the municipality were still making use of alternative toilet facilities; ranging from pit toilets and the bucket system (Community Survey, 2016). Table 5 displays the distribution of other household services below.

Table 5: Household Services

Area	Households (% of total)			
	Flush Toilet with Sewerage	Piped Water Inside Yard	Weekly Refuse Removal	No Access to Electricity
Free State Province	2 035 212 (72%)	1 520 464 (54%)	1 978 504 (70%)	134 750 (5%)
Fezile Dabi District	408 294 (83%)	226 331 (46%)	416 032 (84%)	32 081 (7%)
Moqhaka LM	96 397 (81%)	74 670 (63%)	102 055 (86%)	4 856 (4%)

Source: Statistics SA: Census 2016

In South Africa Rand Water is the leading supplier of water services across the country and by 2016; 140 246 (91%) of the population in Moqhaka LM were receiving water from a regional or local service provider; which was less than the rate in Fezile Dabi with 461 591 (93%) and less than the rate in the Free State with 2 669 748 (94%) (Community Survey, 2016).

Half of the population in Moqhaka LM which is approximately 77 361 (50%) of households have piped water inside the house; which is higher than the rate in Fezile Dabi; 239 196 (48%) and higher than that in the provincial level 1 064 388 (38%). By 2016 only 1 642 (1%) of the population were reported to receive water on community stand in Moqhaka LM; 3 193 (1%) in Fezile Dabi and 20 649 (1%) in the Free State (Community Survey, 2016). It can be concluded that the study area is gradually being modernized and this is evident in that boreholes for water supply and pit latrine toilets are being phased out.

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 area is dominated by agriculture, being crop, livestock and game farming. The proposed site is currently grazing land, whilst game such as springbok, buffalo and lion are located on some of the adjacent farms. Crops such as maize, sunflower, potatoes and pumpkins are produced on farms in the area, with livestock being Bonsmara beef cattle, sheep and chicken. The hunting season is from May to August, which brings in tourists and makes the area busier than other times of the year.

Figure 10: Sunflower farm

According to Kotzé et al.(2020) "about 70% of the land surface is currently used for grazing on natural (unplanted) rangelands and these rangelands are of paramount importance for the protection of the immensely rich biodiversity of a region". The project area is rich in biodiversity. Land use intensity has resulted to severe economic losses over the years. Decreasing grazing capacity has a likelihood of reduced yields, decreased quality, and increased control costs to the socio-economic environment. It is thus possible that migrating game animals that contribute immensely to biodiversity within this area will be impacted by the project. Pro-active mitigation and management measures as highlighted by the biodiversity specialist can be of significance in addressing issues related to grazing land.

The below image depicts the nature of the grazing land in the area.

Figure 11: Grazing Land

The closest central business district is in Kroonstad. The town is located approximately 16.5km north of the project site. Surrounding rural areas and small towns rely on Kroonstad central for commercial, industrial and administrative services. The city center is easily accessible along the R76 from the project site. Steynsrus is small farm town, located twenty kilometers south-east of the Oslaagte farm. Many of the people who work in the direct study area live in this town. Both towns are social receptors in close proximity to the study area.

The Zoutspruit Guesthouse is roughly two kilometers from the project site. The facility offers ecotourism activities such as hiking, outside entertainment, mountain biking and hospitality services. The project's impact on Zoutspruit is likely to contribute positively to the growth of sustainable tourism in this direct area.

Figure 12 below depicts a graph of elevation from the Zoutspruit guesthouse to Oslaagte Solar 2.

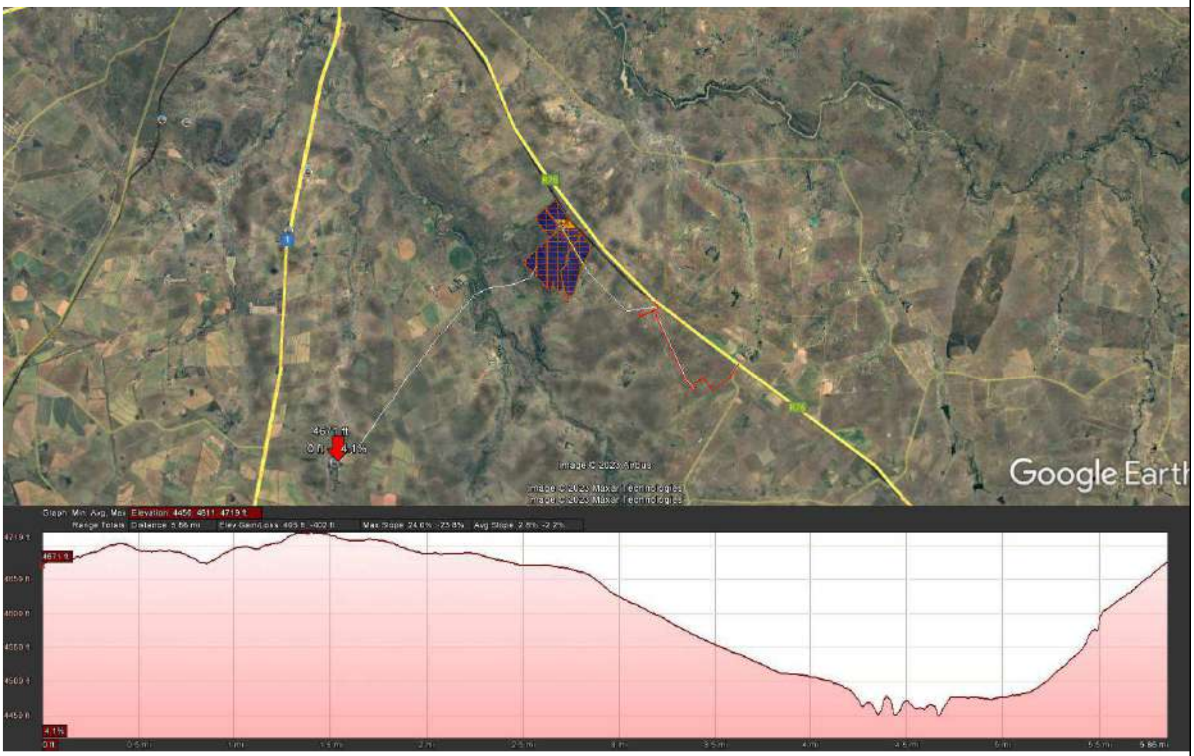


Figure 12: Elevation Profile from Zoutspruit Guesthouse to Oslaagte

Source: Google Earth

The guesthouse will have a very limited view of the solar panels, there being a small ridgeline between the guesthouse and the proposed solar farm.

7.2 Profile of the Receiving Environment

This section of the report details the status quo of the social environment.

7.2.1 Access to basic services

Basic services such as water, electricity and sanitation are provided and supplied by landowners. Solar powered properties were also identified in the area.

Water tanks, reservoirs, piping and boreholes were visible water infrastructure in the area and on the adjacent properties.

The farm communities rely on flush or chemical toilets inside their houses, with septic tank systems processing the waste. Farm based solid waste management systems are in place and some landowners manage their solid waste using reduce-reuse-recycle principles. Municipal waste collection services do not cover the project area. In some cases, households also rely on communal dumps as convenient methods of refuse disposal.

7.2.2 Identified Economic Activities.

The area is dominated by agriculture and tourism. Crop farming or animal husbandry are the dominant economic activities, although game farming and hunting are significant contributors to local economic activity.

7.2.3 Community Facilities

Education, health and administrative facilities are in located within Kroonstad and in Steynsrus. Local communities travel to access these facilities.

7.2.4 Road infrastructure

The main road that services the project area is the R76, with feeder routes being gravelled. The R76 is undergoing reconstruction and rehabilitation. A railway line runs alongside the road and according to local interviewees, this line has not been functional for several years. The images below provide some context for the receiving environment.

Table 6: Images of the Receiving Environment

	
Existing Railway Line	Women Employed in the R76 Road Upgrade Project.

Roadworks along the R76

7.2.5 Livelihoods

The IFC PS5 defines livelihoods as “the full range of means that individuals, families, and communities utilise to make a living, such as a wage-based income, agriculture, fishing, foraging and other natural resource-based livelihoods, petty trade and bartering”.

Engagements within the community, stressed the male dominated nature of employment in the area. Examples of generally male employment included farm work and seasonal work at farms and lodges. This phenomenon led to an over-representation of men in the project area, since most of this work is carried out by people who do not live at home when carrying out their duties. It was stated that this absence of men living within a family structure within the five-kilometre boundary contributes to family structures breakdown patterns. Moreover, women face limited options of obtaining employment from the existing farms.

The agricultural sector is the dominant income contributor within this area, however economic opportunities are limited and poverty is entrenched. Stakeholders in the regional area indicated that in some cases this leads to substance abuse and prostitution.

The agricultural sector is the dominant income contributor within this area. Due to limited economic opportunities, background contributing factors such as poverty, economic and environment challenges have resulted to the excessive substances abuse and to prostitution amongst.

Farm communities within the five kilometre radius comprised of farm managers, caretakers, farm workers, and their immediate families. The low-income levels are reflected by the limited opportunities within the area and dependence from the agricultural sector. According to interviewees the maximum income received by most male agricultural workers is about R3 000 per month and the working hours are more than 12 hours a day. The gazetted minimum wage is roughly 50% below the living wage. This challenges the capacity of farm workers to engage in sustainable livelihoods.

7.2.6 Crime, Safety & Security

The closest police station to the project site is in Kroonstad Central. According the to the South Africa Police Service's Fourth Quarter Crime Statistics for 2012/2022, this station is not amongst the top 30 crime stations in the country and crimes most common at the station are: common assault; common robbery; robbery with aggravating circumstances, assault with the intent to inflict grievous bodily harm and sexual offences. Stock and cattle theft is one of the most common economic crimes in this area.

According to local people, a growing informal settlement (Snake Park) located approximately six kilometres to the south-east of the project area has had a noticeable negative impact on crime levels in the area.

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

The process of collating comments and inputs is still ongoing. Site notices have been placed around the project area to sensitise I&AP about the project. 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. The overall socio-economic comments received during the commenting period have been incorporated into this report.

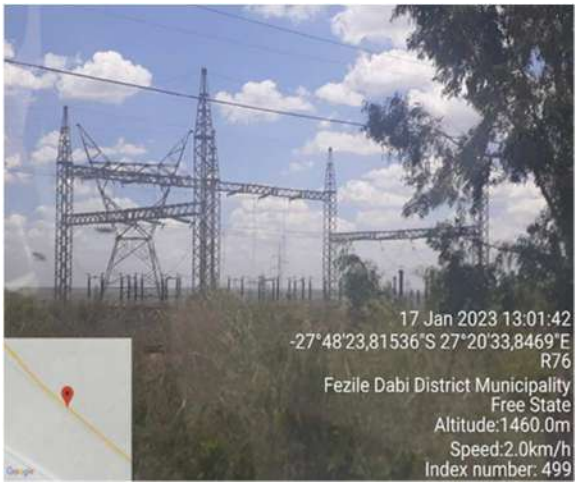
7.3.2 Primary Data Collection Report

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 project area.

7.3.3 Rapid Rural Assessment Process.

A site visit was conducted on 16 and 17 January 2023. The purpose of the visit was to compile and collect primary data on the receiving social environment, and to understand the expectations of the local communities with reference to the proposed project. During the site visit, the following key socio-economic characteristics were observed in the receiving environment.

Figure 13: Key Socio-Economic Characteristics of the Project Area



Substation

Grazing Land

Oslaagte Farm Workers Housing

Wonderkop Primary School, now used as housing

Homestead using borehole water	Solar Powered Security Camera

7.3.4 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 7: List of Interviewed People

Name	Designation
Ms S	Snake Park Informal Settlement Resident
Mr MD	General Worker at Oslaagte
Mr MM	Resident
Mr MDf	Resident
Ms D M	Resident
Ms ZG	Landowner
Mr F	Landowner

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 which will be submitted to DEA and the information about the project has been properly disseminated to the local community.

A questionnaire was compiled and used as a technique to gather inputs and comments from the local communities.

Overall, attitudes towards the project were mixed, with differing expectations of proposed project. Opposition from some of the adjacent landowners was noted in which they expressed concern regarding increased crime rates, a failing political system, farm intrusion and existing poor service delivery. Moreover, concerns about the adjacent agricultural land depreciating in value due to long term solar facilities were a concern.

On the other hand, some of the residents expressed interest in the proposed project as it has the likelihood of creating opportunities in terms of jobs, skills development and increased economic stimulus in the area.

Table 8: 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.

Key Needs / Issues Identified	Mitigation Measure
	• Implementation of diverse economic activities and radically drive farming communities to be fully involved. • Create broad based economic activities.
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. • Implement training programmes that will maximise employment opportunities for the local community.
Roads Development	• Improvement of feeder routes in the project area
Security	• There is a need to increase/improve security measures.

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 9: 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 10: Activity, Aspects and Impacts of the Project

Activity	Aspect	Potential Impact – Positive	Potential Impact – Negative
Land and Servitude Rights Acquisition	Land Acquisition		Loss of agricultural production
			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)

Activity	Aspect	Potential Impact – Positive	Potential Impact – Negative
		Sourcing of equipment, machinery, and services locally	
			Livestock and game animal safety
	Transport of goods to site and employment of staff		Increased traffic
	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
- Social pathologies

Quality and the Living Environment Impacts

- Risk of intrusion
- Dust
- Noise

Economic and Material Well-Being Impacts

- Loss of land
- Restrictions on land

- Economic and social stimuli
- Informal settlements
- Damage to property

Cultural Impacts

- Cultural resistance
- Influx of job seekers
- Community conflict over non-local employment

Gender Relations Impacts

- Cultural resistance
- 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

The institutional, legal political and equity impacts associated with the project include:

- Loss of land through project infrastructure
- 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 below:

Table 11: Planning Phase Impacts - Institutional, Legal, Political and Equity

Environmental Feature	Institutional, Legal, Political and Equity					
Project life cycle	All Phases					
Potential Impact	Proposed Management Objectives / Mitigation Measures					
Loss of land through project infrastructure	• 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.					
	• Promptly address any concerns raised by the public in a transparent manner.					
	• Include all relevant community members in decisions affecting them.					
Some restrictions on use of productive land	• 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.					
	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Site	Moderate	Long Term	High	2
After Mitigation	Negative	Site	Low	Long Term	High	1
Significance of Impact and Preferred Alternatives	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.					

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
- 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 1 387 job years in the regional study area. Considering experience with renewable project implementation in South Africa, 111 job years (8%) are likely to accrue to females, and a total of 624 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 12: 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

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 Moqhaka 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 13: Construction Phase Impacts - Gender Relations

Environmental Feature	Gender Relations
Project life-cycle	All phases
Potential Impact	Proposed Management Objectives / Mitigation Measures
Cultural resistance towards women because of increased gender representation in the workforce	• Sensitise staff in respect of gender sensitive issues that are pertinent to the workplace.
	• Ensure gender inclusivity and equity with respect to all compensation.
	• Prioritise gender inclusivity and equity in access to resources, goods, services and decision making with the aim of empowering women.
	• Promote equal job opportunities for women and men during the construction and operational processes.
	• Prioritise and articulate gender inclusivity and equity in the project documents by including specific strategies and guidelines for implementation.
	• 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.

		• Develop a grievance procedure to specifically address gender matters.				
		• Factors such as culture should be considered when planning for gender activities since they play a great role in influencing gender relations.				
	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Site	Moderate	Short term	High	2
After Mitigation	Negative	Site	Low	Short term	High	1
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
- 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 following impact and mitigation measures are presented:

Table 14: 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
- 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 15: 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 16: 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. • Gender sensitive work place practises should be planned for and adopted on site. Employment practises should be demonstrated free of coercion or harassment.					
Protecting the Vulnerable	• 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.					
	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	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.					

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 Moqhaka Local Municipality. The fact that Kroonstad is 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 Moqhaka Local Municipality. The fact that Kroonstad and Steynsrus are close to the construction site will obviate the need for communal living conditions 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 impact and mitigation table below.

Table 17: Construction Phase Impacts - Influx of Job Seekers

Environmental Feature	Influx of Job Seekers
Project life cycle	Construction Phase
Potential Impact	Proposed Management Objectives / Mitigation Measures
Job seekers influx into the community.	• 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.
Increased community conflicts due to employment of local and non-local labourers	• 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.
Increase health risk	• Measures should be taken to provide condoms and, where necessary, access to counselling to address any risks to health.
Increased social pathologies such as crime, drug abuse and sexual behaviours.	• 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

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Site	Moderate	Short term	High	2

After Mitigation	Negative	Site	Low	Short term	High	1
Significance of Impact and Preferred Alternatives	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.					

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 18: 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 175 jobs will be created directly by the project over its 20-year operational lifespan. In total it was estimated that 96 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 19: Construction Phase Impacts - Economic Impacts (positive)

Environmental Feature	Economic Impacts (positive)					
Project life-cycle	Operational Phase					
Potential Impact	Proposed Management Objectives / Mitigation Measures					
Economic	• 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					
Local Procurement	• Local SMMEs should be given an opportunity to participate in the operation of the project through the supply of services, material or equipment.					
	• 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.					
Job Creation and Skills Development	• Women should be given equal employment opportunities and encouraged to apply for positions.					
	• 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.					
	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Positive	Regional	High	Long Term	Likely	3
After Mitigation	Positive	Regional	High	Long Term	Likely	3

Significance of Impact and Preferred Alternatives	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.

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 20: Operational Phase Impacts - Economic Well Being (Negative)

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 and no layout alternatives were proposed for this project. The internal layouts of the facility will not impact upon the social environment beyond the plant.

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 by changes to the layouts of the panels and management rules and practises. 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.

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APPENDIX ONE: CENSUS OF POSSIBLE SOCIAL RECEPTORS

No	Description	Coordinates	Satellite Image
1	Dwellings	27°49'12.65" S 27°22'19.93" E	
2	Feeder road	27°49'25.19" S 27°22'05.05" E	

3	Farm Workers Homestead	27°49'45.39" S 27°22'28.33" E	
4	Dwellings	27°50'54.41" S 27°18'37.09" E	

5	Dwellings	27°49'04.72" S 27°18'12.56" E	
6	Dwellings	27°47'42.03" S 27°17'50.58" E	
8	Dwellings	27°47'08.64" S 27°17'30.96" E	

9	Structures	27°47'32.88" S 27°17'50.57" E	
10	Existing Substation	27°46'59.75" S 27°18'33.08" E	
11	Water catchment area	27°46'07.09" S 27°19'13.82" E	

12	Dwellings	27°47'27.60" S 27°21'29.47" E	
13	Plantation	27°48'11.67" S 27°22'06.99" E	
14	Zoulspruit Guesthouse	27°51'07.43" S 27°14'06.76" E	

15	School	27°51'30.98" S 27°24'32.29" E	
16	Dwellings	27°51'29.37" S 27°24'50.22" E	
17	Laydown area	27°51'28.43" S 27°25'03.17" E	

18	Farm Properties	27°51'11.95" S 27°25'19.26" E	
19	Informal settlement	27°51'23.13" S 27°25'22.48" E	

APPENDIX E8: Visual Impact Assessment

SPECIALIST ASSESSMENT

ENVIRONMENTAL VISUAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED OSLAAGTE SOLAR 2 PHOTOVOLTAIC PROJECT SOUTHEAST OF KROONSTAD, FREE STATE PROVINCE, SOUTH AFRICA.

ENVASS
GROUP OF COMPANIES

PREPARED FOR:	OSLAAGTE SOLAR 2 (PTY) LTD
PREPARED BY:	ENVIRONMENTAL ASSURANCE (PTY) LTD.
SUBMITTED TO:	NEMAI CONSULTING CC
MONTH:	MAY 2023
REPORT NUMBER:	SPS-VIA-049-23_24 OS2
VERSION:	0.1

DOCUMENT CONTROL

Document Title	Environmental Visual Impact Assessment Report for the Proposed Oslaagte Solar 2 Photovoltaic Project Southeast of Kroonstad, Free State Province, South Africa.
Report Number	SPS-VIA-049-23_24 OS2
Version	0.1
Date	May 2023
Submitted to	Client: Nemai Consulting CC Contact Person: Jacqui Davis Position: Environmental Consultant
Distribution	1 x Nemai Consulting CC 1 x Environmental Assurance (Pty) Ltd

QUALITY CONTROL

	Originated By:	Internal Reviewer:	Technical Reviewer:
Name	Richard Viljoen	Andre Buys	Carl Schoeman
Designation	Environmental Consultant	Environmental Specialist Pr.Sci.Nat - 119183	Environmental Specialist Pr.Sci.Nat - 114848
Signature			
Date	10-05-2023	11-05-2023	12-05-2023

DISCLAIMER

DECLARATION OF INDEPENDENCE

I, **Richard Viljoen**, 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.

Richard Viljoen (Environmental Consultant)

Environmental Consultant	Relevant expertise
Richard Viljoen	Has completed a B.Ss. in Geography and Environmental Management, followed by a B.Sc. (Hons) Geography and Environmental Management and M.Sc. Environmental Science specialising in GIS and Remote Sensing. He has comprehensive experience and knowledge on compliance monitoring, project management and specialist reporting. As an environmental consultant, Richard 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 Oslaagte Solar 2 (Pty) Ltd to undertake a visual impact assessment for the proposed development of the 460MW Oslaagte Solar 2 Photovoltaic (PV) Project southeast of Kroonstad, in the Free State 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.

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, 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. In terms of visual impacts of the two (2) alternatives the visual impacts between the two are negligible. Therefore, the specialist’s recommendation is that alternative two (2) be used as the preferred layout due to the reduced area of the infrastructure. All mitigation measures recommended herein should be considered and included in the Environmental Management Programme (EMPr) relevant to the proposed project.

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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 Oslaagte Solar 2 (Pty) Ltd to undertake a visual impact assessment for the proposed development of the 460MW Oslaagte Solar 2 Photovoltaic (PV) Project southeast of Kroonstad, in the Free State Province (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.

1.2 LOCALITY

The proposed site is situated west of Kroonstad, approximately eighteen (18) kilometres southeast of the central business district (CBD). It falls under the jurisdiction of the Moqhaka Local Municipality. The proposed project area in close proximity to the R76 which runs along the eastern boundary of the site. The footprint of the project is approximately 600 hectares (ha). The surrounding area can be characterized by agricultural, residential and commercial activities. According to the SA Renewable Energy EIA Application (REEA) Database, there are three (3) renewable energy applications recently made for properties located near Kroonstad. The proposed site elevation ranges from approximately 1397 to 1444 metres above mean sea level (mamsl). predominantly flat, with a few small hills and rocky outcrops scattered throughout the area. The vegetation in the area consists mainly of grasses, shrubs, and trees. The surrounding area includes several reserves and game farms in the surrounding area, which are home to a variety of wildlife species. Overall, the landscape and terrain around Kroonstad are typical of the highveld region of South Africa, with wide open spaces and a mix of grassland and bushveld vegetation.

1.3 ACTIVITY DESCRIPTION

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

- PV modules and mounting structures which will consist of either Monofacial or Bifacial PV panels, mounted on either fixed-tilt, single-axis tracking, and/or double-axis tracking systems.
- 132kV power line that is 3.45km in length.
- Inverter stations, transformers, switchgear and internal electrical reticulation (underground cabling).
- Battery Energy Storage System (BESS), potentially Lithium Battery Technologies, with an area up to 5ha.
- Facility grid connection infrastructure, including:
    - 33kV cabling between the project components and the facility substation;
    - A 132kV facility substation. The maximum size of the facility substation will not exceed 1 ha. The facility substation will collect the power from the facility and transform it from medium voltage (up to 33 kV) to high voltage (132 kV).
    - 33kV or 132kV cabling or powerline between the facility substation and the proposed Eskom collector switching station/Main Transmission Substation (MTS).

- Temporary construction laydown area up to seven (7) ha and permanent laydown area up to 1 ha (to be located within the area demarcated for the temporary construction laydown).
- Internal roads will be up to 6 m wide, to allow access to the Solar PV modules for operations and maintenance activities.
- Main access road is up to 8 m wide. The site is accessible via the R76.
- Operation and Maintenance buildings including a gate house and security building, control centre, offices, warehouses and workshops for storage and maintenance. The buildings will occupy an area of 1.5ha.
- Fencing around the PV site to a height of 3.5m.

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 to30-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 1: Technical details of the proposed PV Plant (Nemai Consulting CC)

No.	Component	Alternative 1 - Description / Dimensions	Alternative 2 - Description / Dimensions
1	Height of PV panels	Up to 5m	Up to 5.5 m
2	Area of PV Array	Up to approximately 445.5 ha	Monofacial or Bifacial PV panels, mounted on either fixed-tilt, single-axis tracking, and/or double-axis tracking systems. Area: Up to 585 ha
3	Area occupied by inverter / transformer stations / substations	Up to 1ha	It is estimated that the maximum size of the facility substation will not exceed 2 ha. Each facility will require inverter-stations, transformers, switchgear and internal electrical reticulation (underground cabling).
4	Capacity of on-site substation	Medium (33kV) to High voltage (132 kV)	The facility substation will collect the power from the facility and transform it from medium voltage (up to 33 kV) to high voltage (132 kV).
5	BESS	Area up to ± 5ha	Area: up to ± 5 ha
6	Area occupied by both permanent and construction laydown areas	Temporary: Up to 7ha Permanent: Up to 1 ha (located within the area demarcated for temporary construction laydown)	Temporary construction laydown area up to 10 ha. Permanent laydown area up to 1 ha (to be located within the area demarcated for the temporary construction laydown).
7	Area occupied by buildings	Up to 1.5 ha	Up to 1.5 ha
8	Length of internal roads	Up to 33km	Up to 33 km
9	Width of internal roads	The internal roads will be up to 6 m wide. The access roads will be up to 8 m wide.	The internal roads will be up to 6 m wide. The access roads will be up to 8 m wide.
10	Proximity to grid connection	±7.30 km	Approximately 6 - 8 km
11	Height of fencing	Up to 3.5m	Up to 3.5m
12	Type of fencing	Type will vary around the site, welded mesh, palisade and electric fencing	Type will vary around the site, welded mesh, palisade and electric fencing

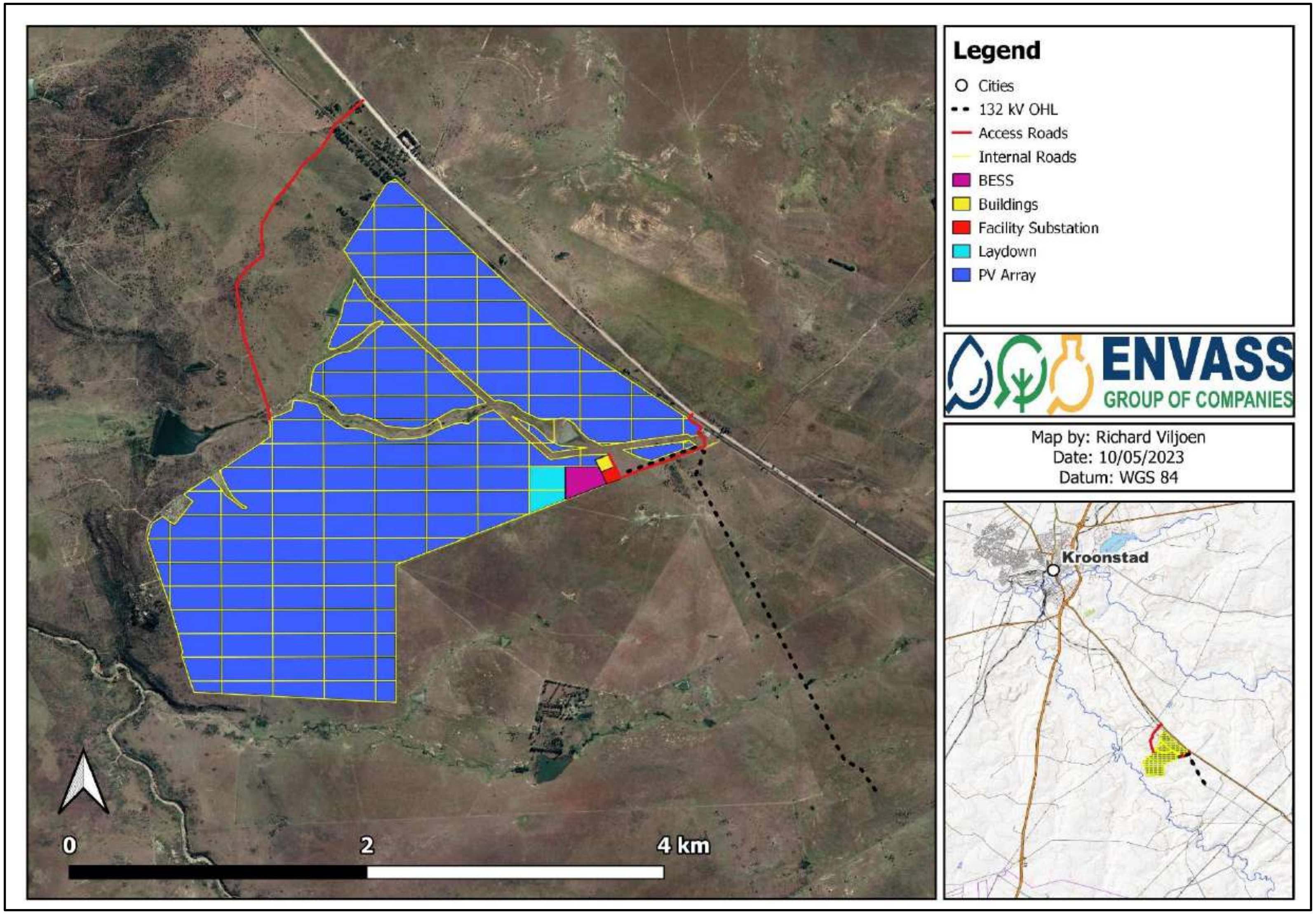

Figure 1: Proposed project locality and alternative 1 layout map

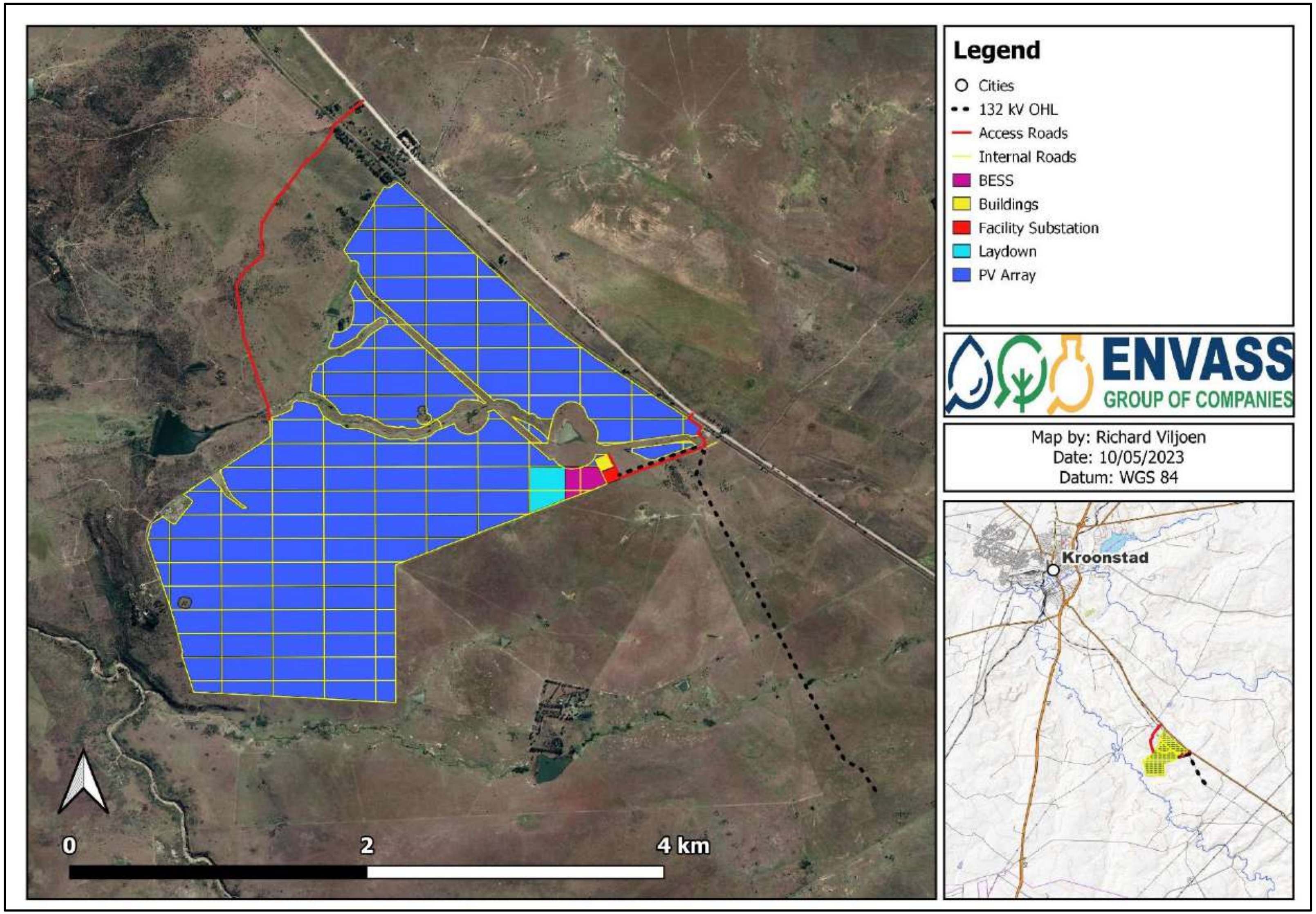

Figure 2: Proposed project locality and alternative 2 layout map

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 1). This document reports on the visual impact assessment conducted, and outlines findings made supported by recommendations to the authorisation of the proposed project. The site is located approximately eighteen (18) kilometres southeast of Kroonstad, Free State Province, South Africa.

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 25th and 26th of April 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 25th and 26th of April 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 proposed site is located approximately eighteen (18) kilometres southeast of Kroonstad, Free State Province, South Africa. The proposed project is accessed by the R76. 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 7.30km from the Project area. Grazing is the dominant land use in the Project area. The surrounding area can be characterized by agricultural, commercial and residential activities. According to the SA REEA Database, there are three (3) renewable energy applications have been made for properties located near Kroonstad.

Table 2: Desktop study attributes and descriptions relevant to the study area.

Hydrological Setting (DWS, 2012)	
Water Management Area (WMA)	Middle Vaal
Sub-WMA	Rhenoster/Vals
Quaternary Catchment Area	C60F and C60D
Sub-Quaternary Reach (SQR)	C60F – 2458 (Blomspruit) and C60D – 2473 (Vals) PES: Class C (Moderately modified) and Class D (Largely 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)
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 - 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**

Herbaceous wetlands Open & Sparse Planted Forest Fallow Land & Old Fields (Grass) Natural Grassland Commercial Crops Artificial dams	The onsite conditions for the most part mimic the presumed desktop landcover classes.
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 are in the project area.
Fish sanctuary	The project area does not fall within a catchment that has been flagged as a fish sanctuary.
NFEPA Rivers	The Blomspruit borders the southwestern portion of the project area.
NFEPA Wetlands	Six (6) wetlands are in close proximity to the project area.
WetVeg	The project area falls within one (1) (WetVeg) unit namely the Dry Highveld Grassland Group 4.
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 is underlain by Sedimentary mudstones and sandstone mainly of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) as well as those of the Ecca Group (Karoo Supergroup) which results in vertic, melanic and red soils (typical forms are Arcadia, Bonheim, Kroonstad, Valsrivier and Rensburg).
Conservation Attributes (SANBI, 2018; SANBI, 2006-18; DFFE, 2021)	
CBA	CBAs are areas that are important for conserving biodiversity. • The study area does not occur within a CBA at a desktop level.
ESA	ESAs are areas that are important to ensure the long-term persistence of species or functioning of other important ecosystems. • The study area occurs within an ESA.
Threatened Ecosystems	The project area does not fall within a threatened ecosystem.
Protected Areas	These are areas that are considered protected and imperative for conservation purposes: • The project area does not fall within a protected area. The closest protected area is the Serendipidie Private Nature Reserve, which is approximately 3.2km southeast of the solar array, however, approximately 340m from the proposed 132kV OHL.
Vegetation Types	The primary or reference vegetation unit of the study area is the Central Free State Grassland. This vegetation unit is classified as 'Vulnerable' (Skowno *et al*, 2019). During the infield assessment, the general vegetation structure was observed to be 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.

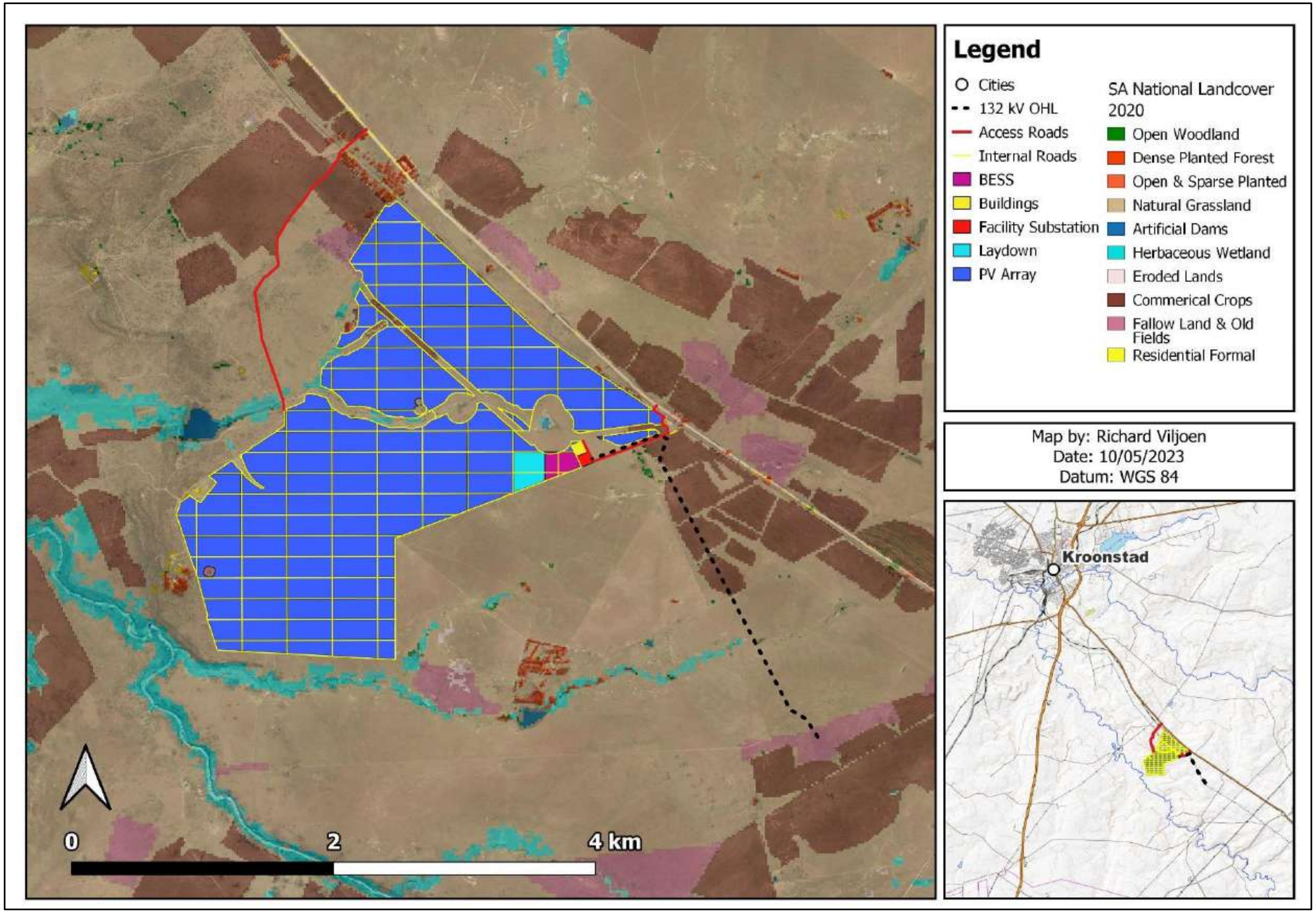

Figure 3: Proposed Oslaagte Solar 2 Landcover

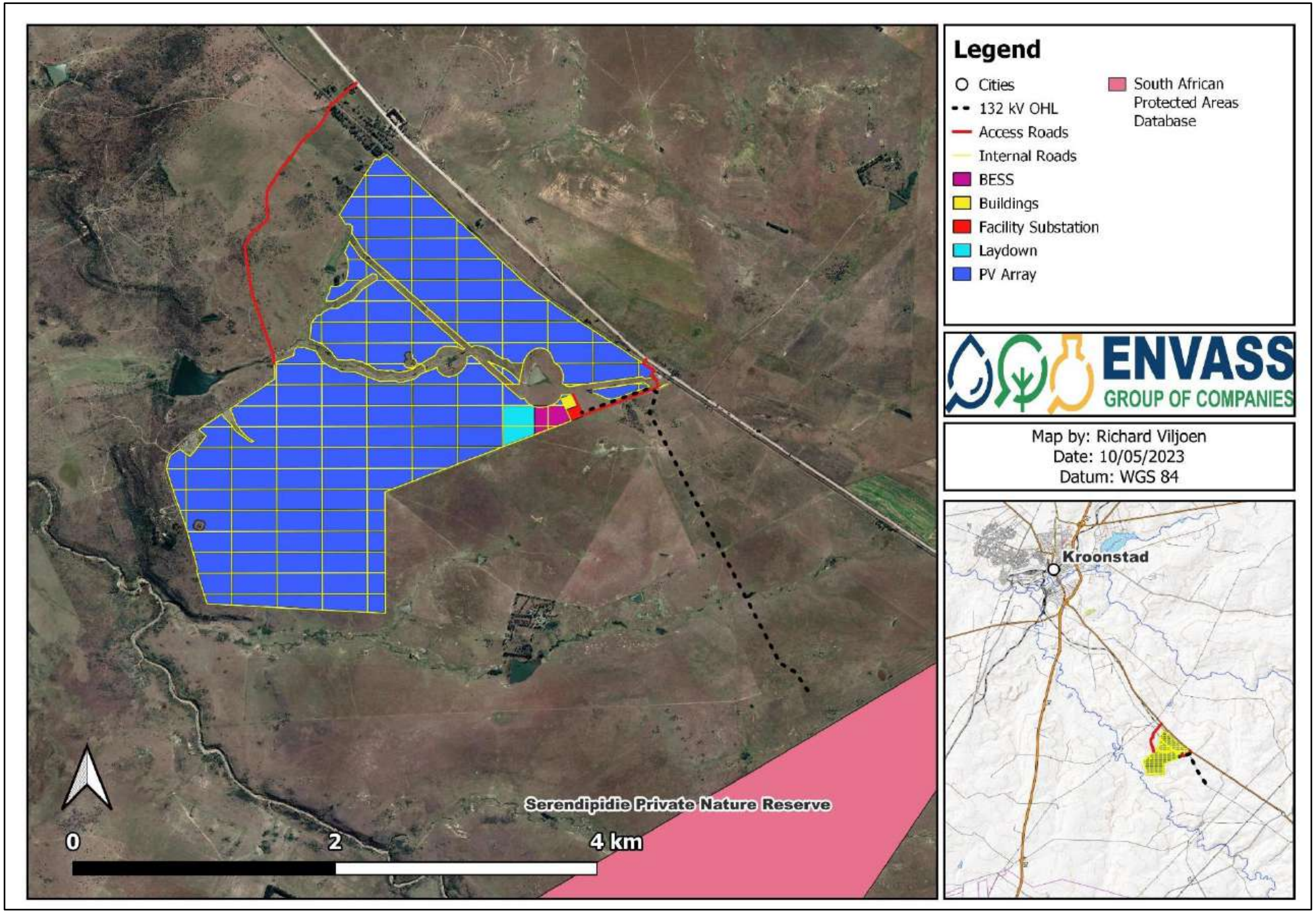

Figure 4: Proposed Oslaagte Solar 2 Protected Areas

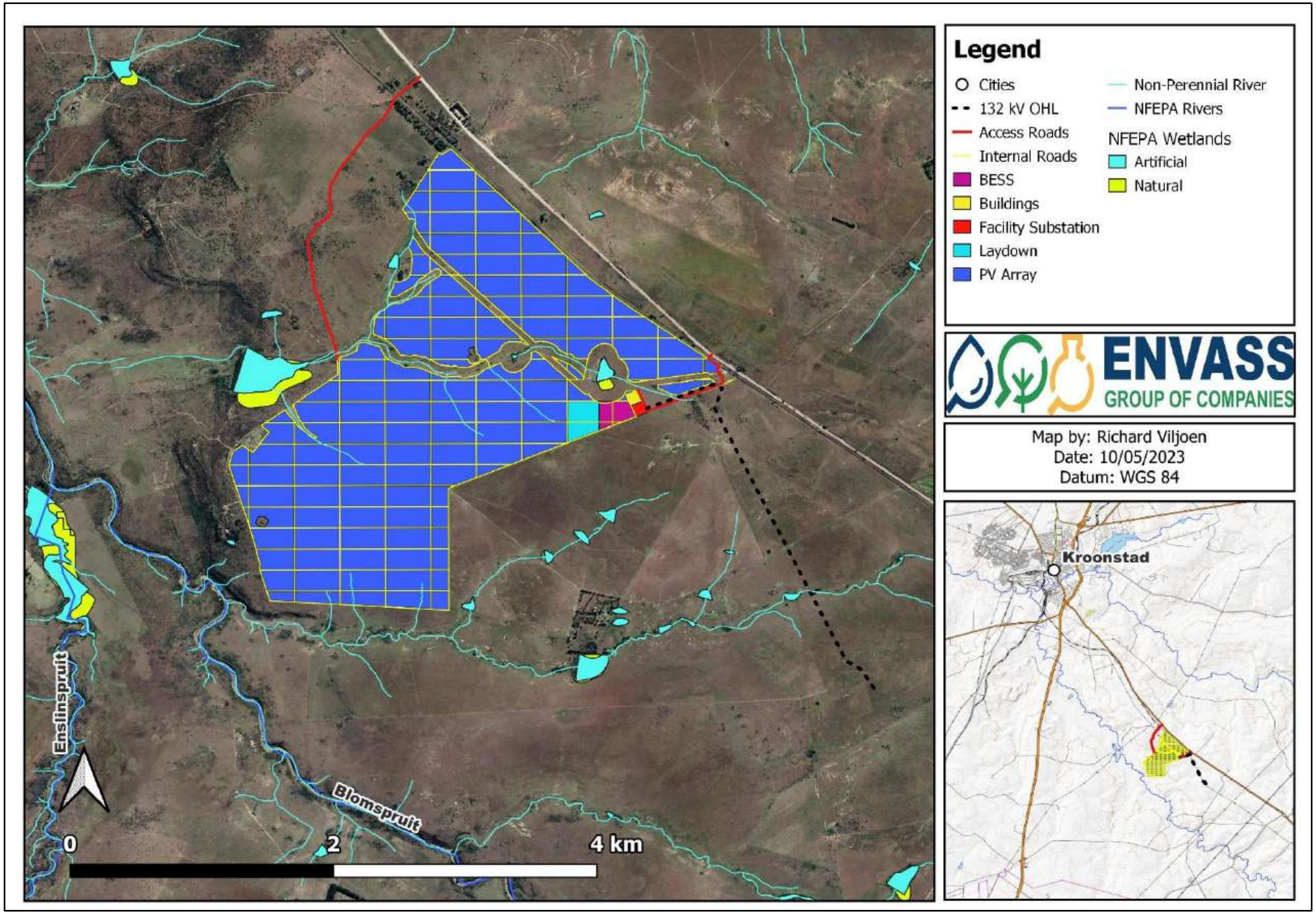

Figure 5: Proposed Oslaagte Solar 2 Watercourses

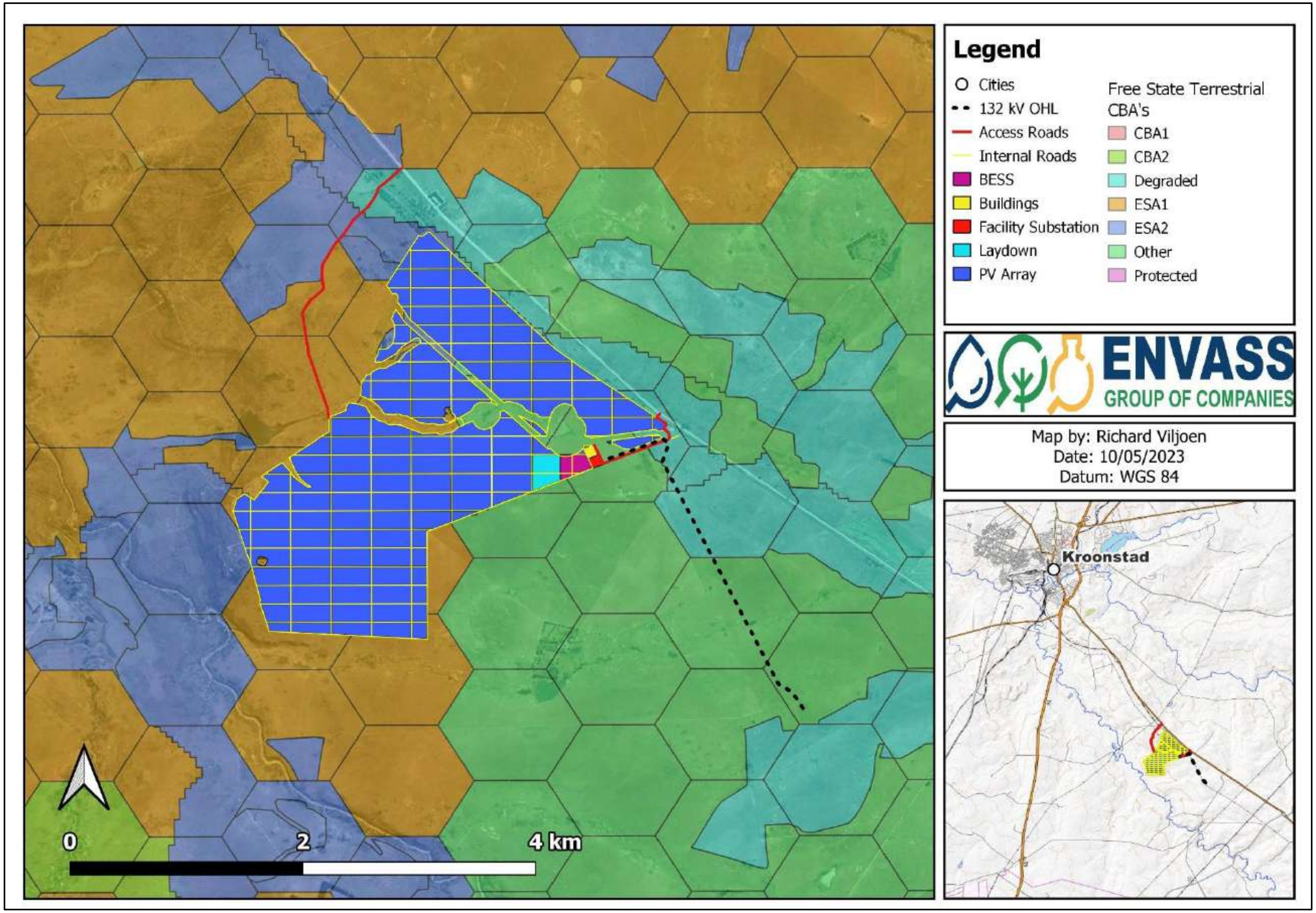

Figure 6: Proposed Oslaagte Solar 2 CBAs and ESAs

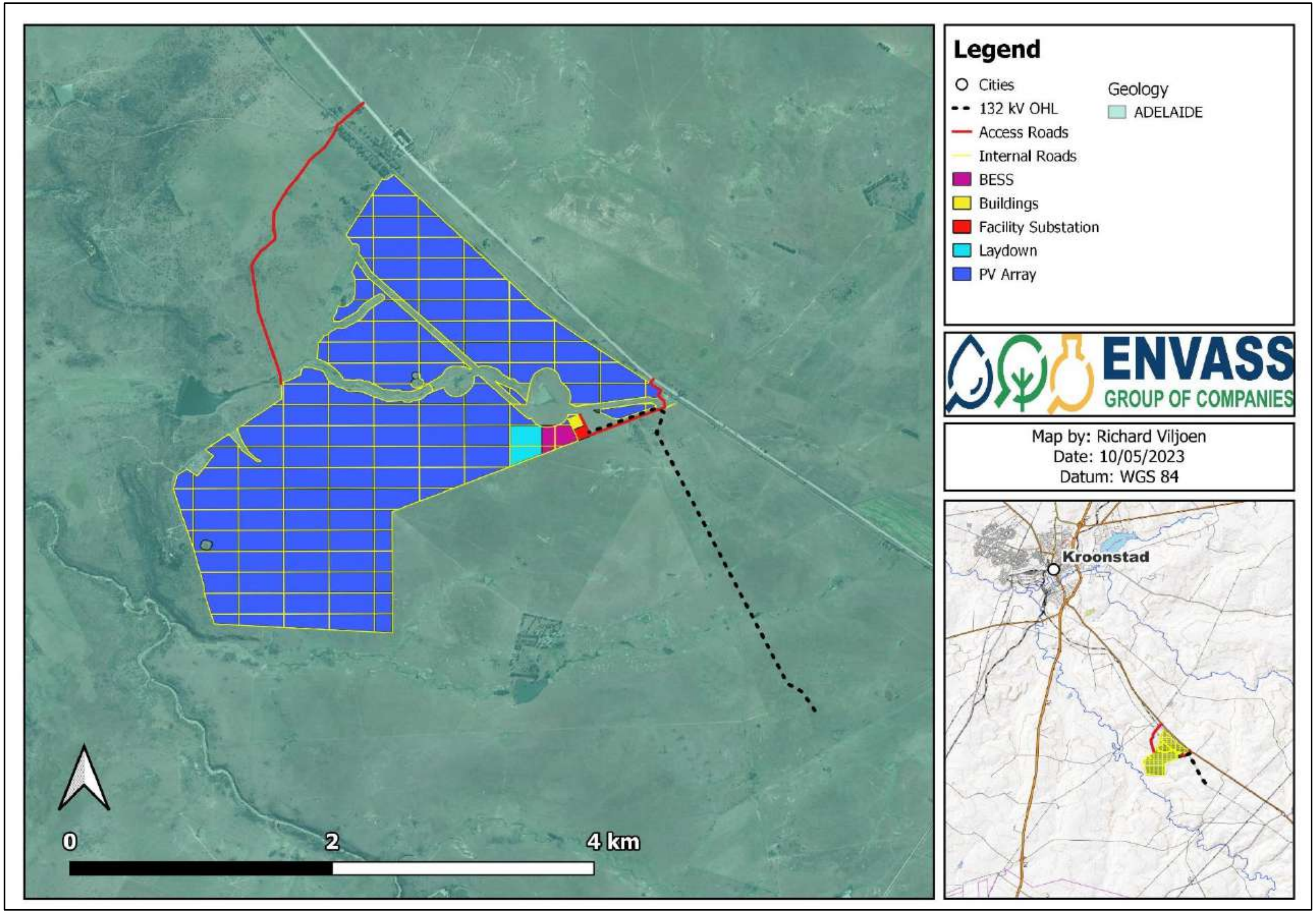

Figure 7: Proposed Oslaagte Solar 2 Geology

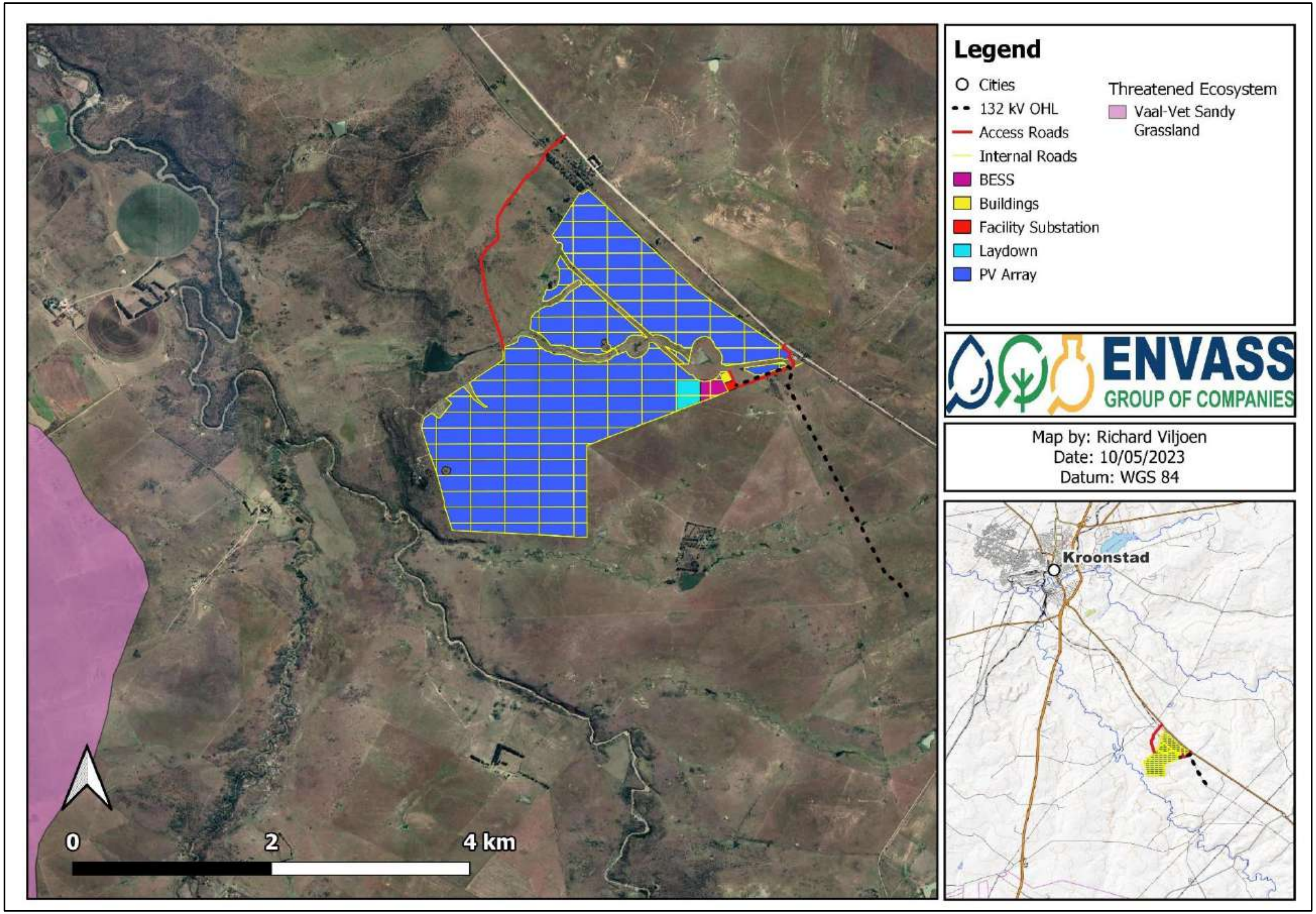

Figure 8: Proposed Oslaagte Solar 2 Threatened Ecosystem

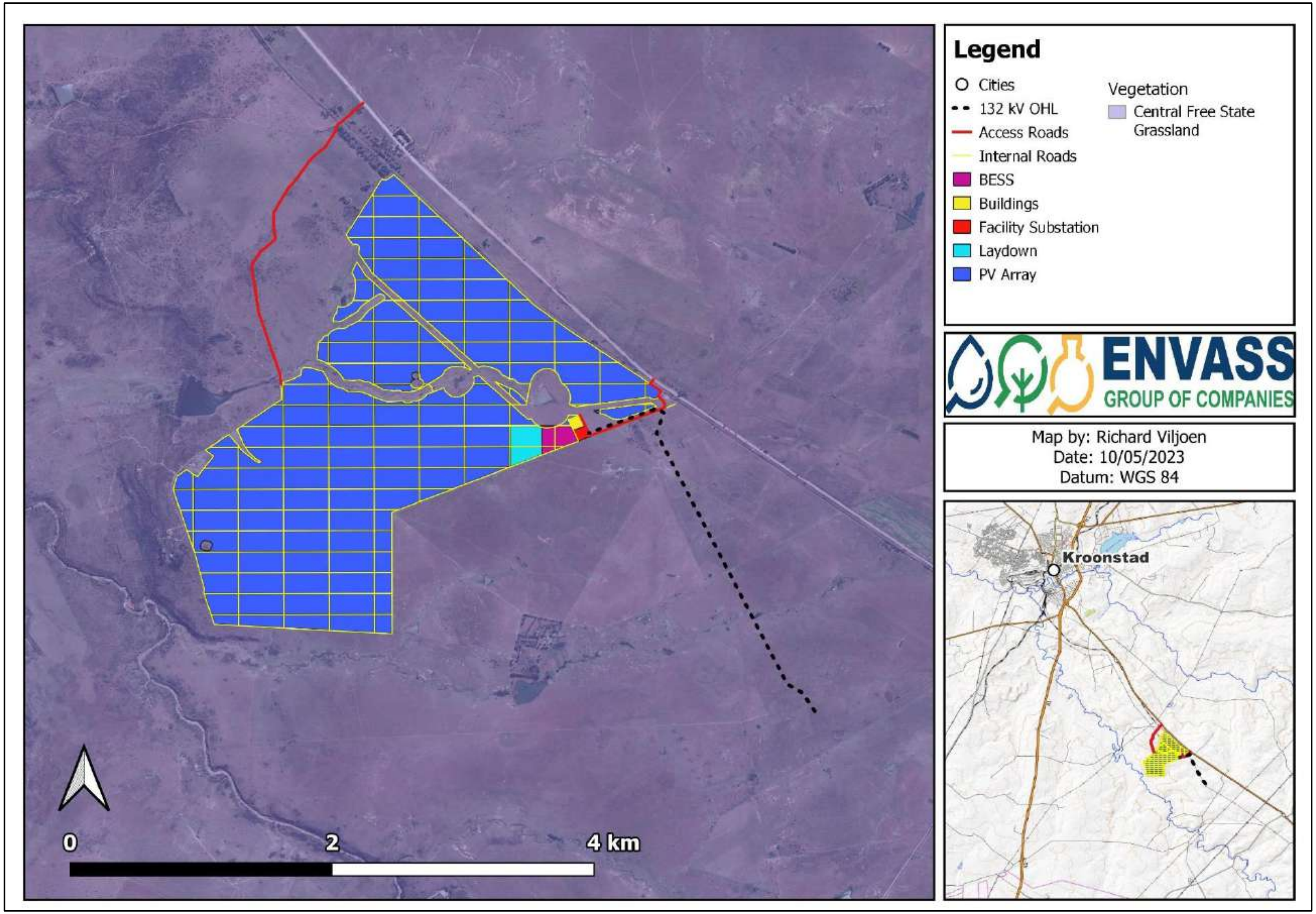

Figure 9: Proposed Oslaagte Solar 2 Vegetation

4.5 SENSE OF PLACE

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 Kroonstad.

Kroonstad is a small city located in the Free State province of South Africa, and it is situated approximately halfway between Johannesburg and Bloemfontein. The sense of place of Kroonstad is shaped by its history, location, culture, and natural surroundings.

History:
Kroonstad has a rich history dating back to the 19th century when it was founded as a Dutch Reformed Church parish. It played a significant role in the South African War (1899-1902), as it was the site of a major battle between the Boer and British armies. Today, there are several historical sites and monuments in Kroonstad that commemorate the city's role in the war, including the Blockhouse and the Anglo-Boer War Museum.

Location:
Kroonstad is situated in the heart of the Free State province, surrounded by fertile farmland and rolling hills. The Vaal River, which runs through the city, is an important source of water and a popular recreational area. The city is also located near several nature reserves and game parks, including the Willem Pretorius Game Reserve and the Vredefort Dome, a UNESCO World Heritage Site.

Culture:
Kroonstad is a predominantly Afrikaans-speaking city, with a rich cultural heritage. The city is home to several festivals and events throughout the year, including the Boertjiefees, a celebration of Afrikaans culture, and the Kroonstad Agricultural Show, which showcases the region's agricultural produce. The city is also known for its hospitality, with several guesthouses and bed and breakfasts offering accommodation to visitors.

Natural Surroundings:
Kroonstad is surrounded by the natural beauty of the Free State province, with its rolling hills, grasslands, and game reserves. The Vaal River, which runs through the city, provides opportunities for fishing, boating, and other water-based activities. The region is also known for its birdlife, with several birdwatching sites located in and around Kroonstad.

In summary, the sense of place of Kroonstad is shaped by its rich history, location in the heart of the Free State province, cultural heritage, and natural surroundings. The city offers visitors a chance to experience the beauty of the South African countryside, as well as a glimpse into its past.

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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 10, fourteen (14) viewpoints were identified from where characterisation were conducted, and corresponding visual influence and characteristics have been defined.

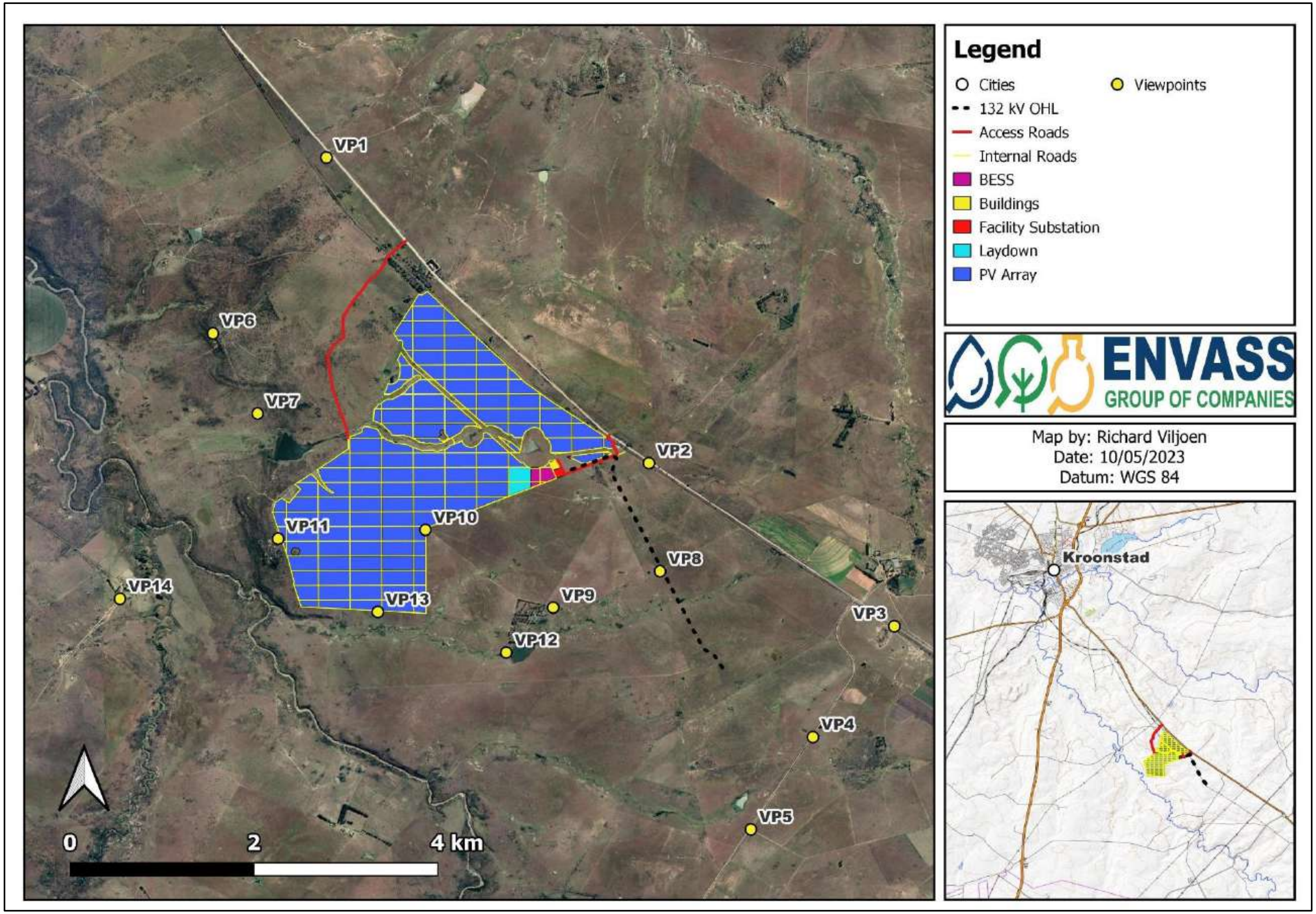

Figure 10: Viewpoints of the proposed Oslaagte Solar 2

5.1.1 Viewpoint 1 (V1):

Viewpoint 1 is located by the R76 approximately 2km north of the project area. View 3 (South) has been taken towards the proposed project area. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation and dwarf and larger shrubs. In addition, powerlines, railway lines, shrubs and trees of various heights are visible in the distance.

Figure 11: View 1 (North)

Figure 12: View 2 (East)

Figure 13: View 3 (South)

Figure 14: View 4 (West)

5.1.2 Viewpoint 2 (V2):

Viewpoint 2 is located near the proposed 132 kV OHL and approximately 450m southeast of the proposed solar array. View 4 (West) has been taken towards the proposed project area. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation and of dwarf and larger shrubs. In addition, powerlines, railway lines, shrubs and trees of various heights are visible in the distance.

Figure 15: View 1 (North)

Figure 16: View 2 (East)

Figure 17: View 3 (South)

Figure 18: View 4 (West)

5.1.3 Viewpoint 3 (V3):

Viewpoint 3 is located along the R76 and is approximately 1.9km east of the proposed 132 kV OHL. View 4 (West) has been taken towards the proposed 132 kV OHL. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation and dwarf and larger shrubs. In addition, powerlines, railway lines, shrubs and trees of various heights are visible in the distance.

Figure 19: View 1 (North)

Figure 20: View 2 (East)

Figure 21: View 3 (South)

Figure 22: View 4 (West)

5.1.4 Viewpoint 4 (V4):

Viewpoint 4 is located along the dirt road to the south of the proposed 132 kV OHL. The viewpoint is approximately 1.3km southeast of the proposed 132 kV OHL. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation and dwarf and larger shrubs. In addition, powerlines, shrubs and trees of various heights are visible in the distance.

Figure 23: View 1 (North)

Figure 24: View 2 (East)

Figure 25: View 3 (South)

Figure 26: View 4 (West)

5.1.5 Viewpoint 5 (VP5):

Viewpoint 5 is located along the dirt road to the south of the proposed 132 kV OHL. The viewpoint is approximately 1.9km south of the proposed 132 kV OHL. View 1 (North) has been taken towards the proposed 132 kV OHL. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation and dwarf and larger shrubs. In addition, powerlines, shrubs and trees of various heights 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)

5.1.6 Viewpoint 6 (VP6):

Viewpoint 6 is located approximately 1.9km northwest the proposed solar array near a farm residence. View 2 and 3 (East and 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 a mixture of grass and a dense covering of dwarf and larger shrubs. In addition, powerlines and shrubs of various heights are visible in the distance.

Figure 31: View 1 (North)

Figure 32: View 2 (East)

Figure 33: View 3 (South)

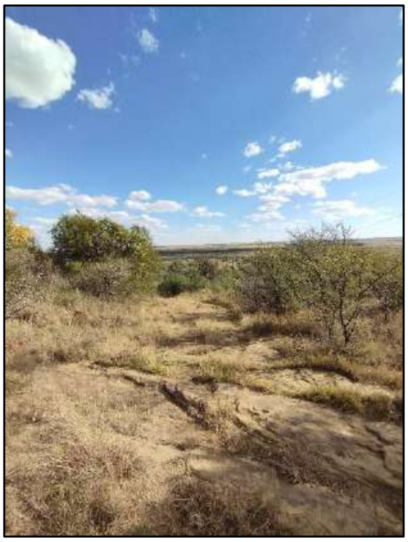

Figure 34: View 4 (West)

5.1.7 Viewpoint 7 (VP7):

Viewpoint 7 is located 950 west of the western portion the proposed solar array. View 2 and 3 (East and 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 a mixture of grass and a dense covering of dwarf and larger shrubs. In addition, powerlines and shrubs of various heights are visible in the distance.

Figure 35: View 1 (North)

Figure 36: View 2 (East)

Figure 37: View 3 (South)

Figure 38: View 4 (West)

5.1.8 Viewpoint 8 (VP8):

Viewpoint 8 is located along the proposed 132 kV OHL route. View 1, 3 and 4 (North, South and West) have been taken towards the proposed 132 kV OHL and project area. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation and dwarf and larger shrubs. In addition, powerlines, shrubs and trees of various heights are visible in the distance.

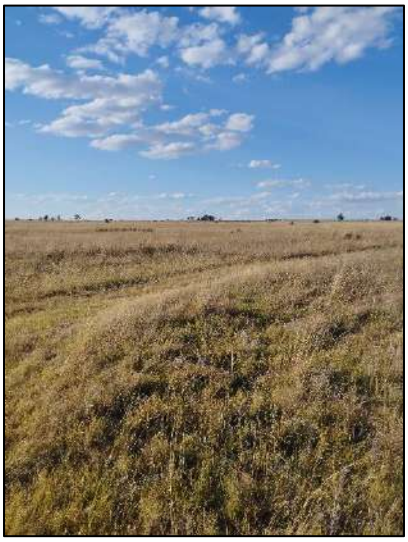

Figure 39: View 1 (North)

Figure 40: View 2 (East)

Figure 41: View 3 (South)

Figure 42: View 4 (West)

5.1.9 Viewpoint 9 (VP9):

Viewpoint 9 is located approximately 1.2km west of the proposed 132 kV OHL route near a farm residence. View 1, 3 and 4 (North, South and West) have been taken towards the proposed 132 kV OHL and project area. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation and dwarf and larger shrubs. In addition, powerlines, shrubs and trees of various heights are visible in the distance.

Figure 43: View 1 (North)

Figure 44: View 2 (East)

Figure 45: View 3 (South)

Figure 46: View 4 (West)

5.1.10 Viewpoint 10 (VP10):

Viewpoint 10 is located adjacent to the project area. Views 1, 3 and 4 (North, South and West) have been taken towards the proposed project area and View 2 (East) has been taken towards the proposed 132kV OHL. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation. In addition, powerlines, shrubs and trees of various heights are visible in the distance.

Figure 47: View 1 (North)

Figure 48: View 2 (East)

Figure 49: View 3 (South)

Figure 50: View 4 (West)

5.1.11 Viewpoint 11 (VP11):

Viewpoint 11 is located adjacent to the western portion of the solar array near a farm residence. View 2 (East) has been taken towards the proposed project area. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation and dwarf and larger shrubs. In addition, powerlines, shrubs and trees of various heights are visible in the distance.

Figure 51: View 1 (North)

Figure 52: View 2 (East)

Figure 53: View 3 (South)

Figure 54: View 4 (West)

5.1.12 Viewpoint 12 (VP12):

Viewpoint 12 is located approximately 1.8km to the south of the proposed project area. View 1 (North) has been taken towards the proposed project area while View 2 (East) has been taken towards the proposed 132 kV OHL. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation and dwarf and larger shrubs. In addition, powerlines, shrubs and trees of various heights are visible in the distance.

Figure 55: View 1 (North)

Figure 56: View 2 (East)

Figure 57: View 3 (South)

Figure 58: View 4 (West)

5.1.13 Viewpoint 13 (VP13):

Viewpoint 13 is located adjacent to the southern portion of the proposed solar array. View 1 (North) has been taken towards the proposed project area. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately grassland vegetation and dwarf and larger shrubs. In addition, powerlines, shrubs and trees of various heights are visible in the distance.

Figure 59: View 1 (North)

Figure 60: View 2 (East)

Figure 61: View 3 (South)

Figure 62: View 4 (West)

5.1.14 Viewpoint 14 (VP14):

Viewpoint 14 is located approximately 1.9km west of the proposed project area near a farm residence. From the viewpoint, the visual character comprises of a predominantly flat terrain. The area comprises predominately of natural grassland and agricultural activities. In addition, powerlines, scattered shrubs, and trees of various heights are visible in the distance. The existing powerlines are visible.

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 3: 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 –** The proposed site elevation ranges from approximately 1397 to 1444 metres above mean sea level (mamsl). predominantly flat, with a few small hills scattered throughout the area. The topography or terrain morphology of the region is broadly described as plains with low to moderate relief. The main topographical feature on the site is a drainage line to the west of the project areas that flows from south to north. Therefore, the topography is considered to have a **moderate** value.
- **Hydrology –** There are three visually prominent water drainage courses near the proposed project area. From a wetland perspective, there are six (6) NFEPA wetlands (artificial and natural) which are located near the

development area and outside of the development boundary, which are visible. Therefore, the aesthetic value of the hydrology is **moderate**.

- **Vegetation cover –** The landscape is primarily characterized by grassy plains and agricultural 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, while land use activities within the broader area are predominantly described as agricultural, residential areas, and commercial 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 4: Visual resource value determination

VISUAL BASELINE ATTRIBUTES	TOPOGRAPHY	HYDROLOGY	VEGETATION	LAND USES
Visual resource value score	2	2	2	2
			Total	**8**

Based on the above score ranges, the overall visual resource value of the study area is rated as **moderate** (8).

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 5: 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 **moderate** and the VAC of the study area has been rated as **low**. Therefore, a **high** (1.2) 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 R76 is the main road 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, commercial areas and agricultural activities. The proposed project area may potentially be visible from the R76 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 6.

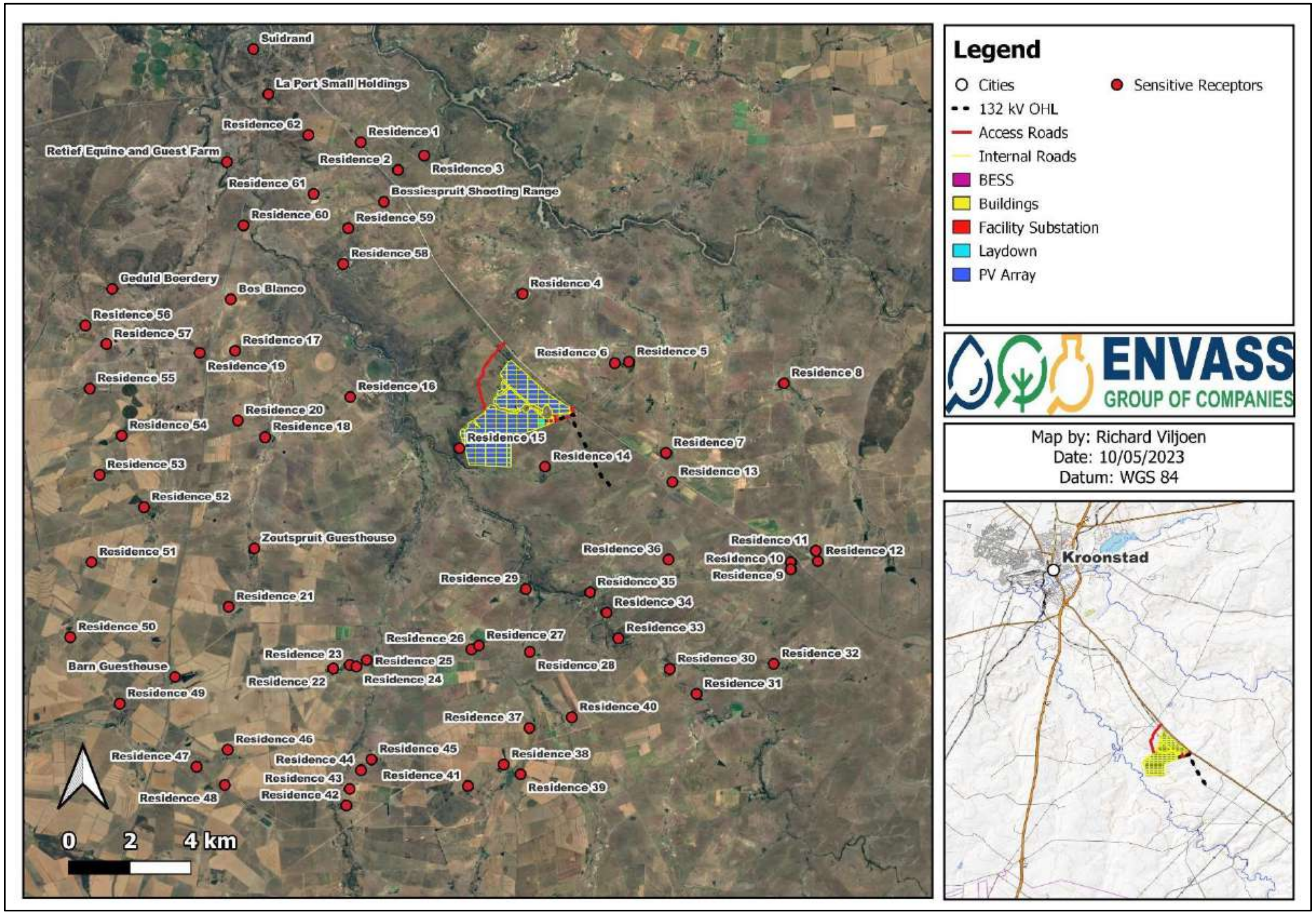

Figure 67: Sensitive Receptors for the proposed Oslaagte Solar 2

Table 6: 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 moderate 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 near the R76 (being the main road to access these areas), 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 7: 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 Nemai Consulting, 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 8: 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 **moderate.**

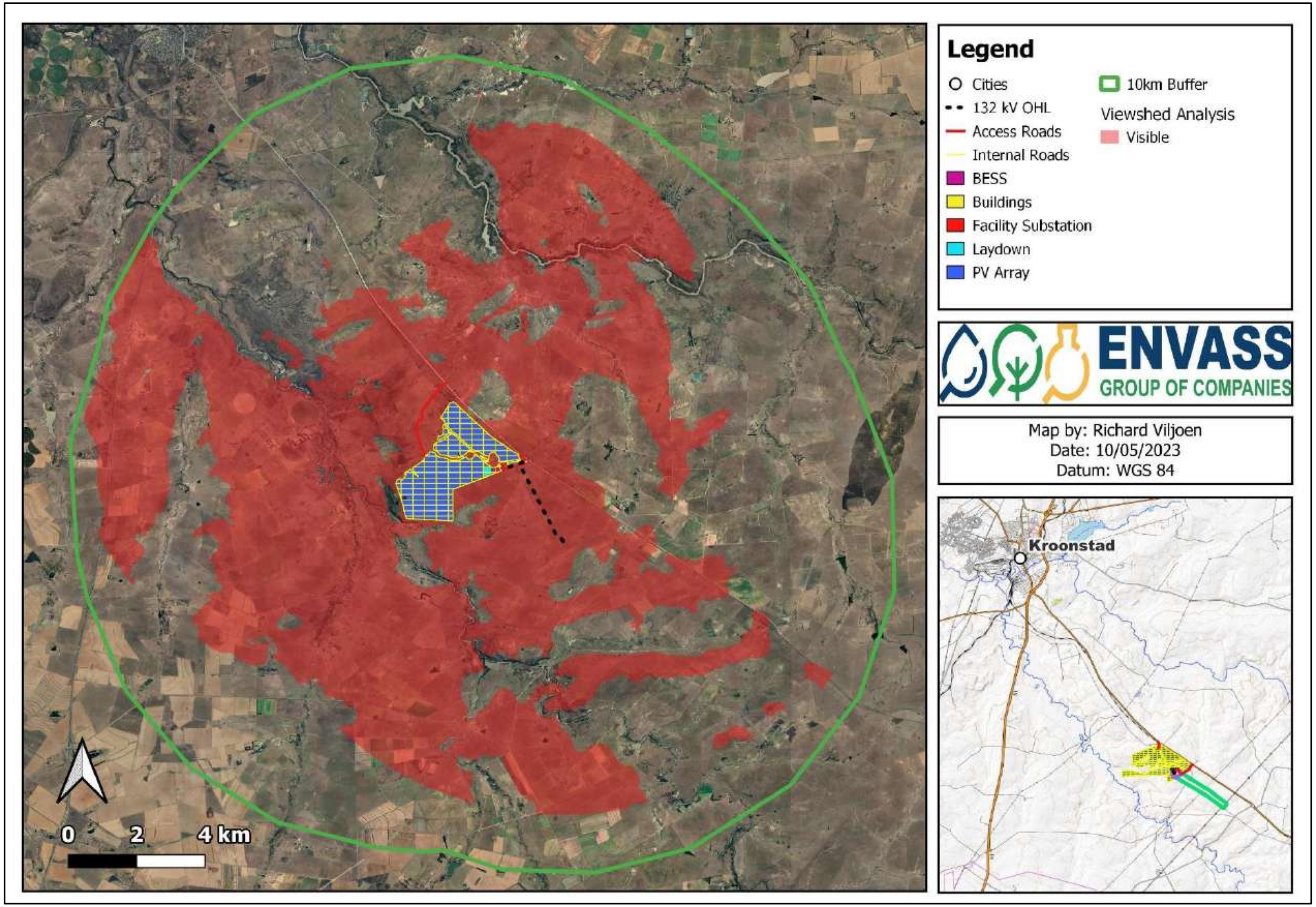

Figure 68: Viewshed analysis for the proposed Oslaagte Solar 2

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 **moderate** 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 **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 **low** as most 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 9: 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 10: 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. Use of security lighting.	2	1.2	2	2	2	1.0	14.4 (Moderate)

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 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 11: 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.	2	1.2	2	2	2	1.0	14.4 (Moderate)
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: 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.	2	1.2	2	2	2	1.0	14.4 (Moderate)
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 13: 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 13 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 14: 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 15: 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

The differences between the two (2) alternatives are negligible from a visual perspective resulting in the impact assessment being similar. Therefore, the impact assessment below is for both alternatives. 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 16: 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 because 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 three (3) renewable energy applications have been made for properties located near the project site. The majority of the proposed site currently grassland vegetation and land previously used for agricultural purposes. 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 the majority 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.

7.1 ALTERNATIVES

The alternative 2 layout is preferred for site design as it results in reduced visual impacts compared to alternative 1 layout. This is primarily due to the decreased size of the infrastructure in alternative 2 layout. The reduced size of the infrastructure reduces its visibility and minimizes its impact on the surrounding landscape, however, only by a negligible amount. Therefore, the impact assessment resulted in the same impact ratings for both alternatives. Overall, alternative 2 layout is a favourable option for site design due to its marginally reduced visual impacts.

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 of time. Cumulative visual impacts resulting from landscape modifications as a result of the proposed activities in conjunction with other 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.
- Plant indigenous trees around the site boundary where possible.
- 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, commercial, tourism, and agricultural activities. According to the REEA Database, there are three (3) renewable energy applications have been made for properties located near the project site. The proposed site ranges from approximately 1397 to 1444 metres above mean sea level (mamsl). predominantly flat, with a few small hills and rocky outcrops scattered throughout the area. The landscape is characterized by open grasslands, and scattered trees, typical of the Highveld region of South Africa. The surrounding areas comprises with a mix of residential activities, agricultural, tourism and commercial 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**.

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. The alternative 2 layout is preferred for site design as it results in reduced visual impacts compared to alternative 1 layout. This is primarily due to the decreased size of the infrastructure in alternative 2 layout. 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

CARL SCHOEMAN

SENIOR MANAGER AND ENVIRONMENTAL CONSULTANT
Environmental Assurance
Environmental consulting

ENVIRONMENTAL ASSURANCE (PTY) LTD
394 Tram Street, New Muckleneuk, Pretoria, 0181
T : 012 460 9768 ; M : 071 371 1178; F : 012 460 3071 ; E mail : carl@envass.co.za
Date of Birth : 3 November 1989; Place of Birth : South Africa
Ethnic Group and Gender : White Male ; Disabilities : None

AREAS OF EXPERTISE

- Legislative Compliance
- Compliance Auditing
- Environmental Control Officer
- WUL, EA, EMPr, WML, ROD, S24G Compliance assessments and Audits
- Specialist Works in Air, Water, Soil, Visual, Odour, Noise, etc.
- Ambient Air Quality and noise baselines
- Regulation 34 Compliance assessments
- Customer Relationships and marketing;
- SACNASP Registered (Pr.Sci.Nat - 114848).
- ISO 14001: Maintenance & Lead Auditor

CAREER HISTORY

Employer: **ENVIRONMENTAL ASSURANCE (PTY) LTD**
Period: July 2013 – Current
Position: **Senior Manager and Environmental Consultant (Pr.Sci.Nat)**
Responsibilities: Develop and maintain environmental compliance monitoring programmes in conjunction with site audits (WUL and Legal) and assessments. Create and update site and area maps (GIS). Maintain data and results from monitoring programmes in databases. Assess sites, determine EMP compliance ratings and report on current conditions. Compile reports on water-, noise-, soil-, air-quality and site findings and observations, with interpretation of results and possible recommendations. Maintain and build customer relationships with guidance on environmental matters and updates on environmental legislation. Market to potential clients with site specific marketing material.

WORK EXPERIENCE AND SKILLS

Specialist studies: Noise & Dust Baselines, EMP Performance Reviews, Air Emission Licenses (AEL), WUL Audits, Legal Compliance Audits, ECO Work, Internal and External Legal Compliance Site Audits, Alien Vegetation Identification, Management Plans, EMP-Performance Assessments.

Day to day: Compliance assessments, Reporting, data capturing, data interpretation and recommendations. Site assessments and inspections. GIS map making. Report writing with recommendations. Client interaction. Environmental legislation interpretation and implementation.

EDUCATION AND QUALIFICATIONS

North-West University; Masters M.Env.Man Environmental Water Requirements – (In progress)
North-West University; Honours BSc. Environmental Science and Management - 2013
North-West University; Degree BSc. Environmental Science Geology and Geography - 2012

PROFESSIONAL STATUS

Registered as a Professional Natural Scientist with the South African Council of Natural Scientific Professions (SACNASP) - 2016

CONTINUED PROFESSIONAL DEVELOPMENT

COURSE	INSTITUTION	COMPLETED
ISO14001: Lead Auditor	BSI	2021
Environmental Law	WITS	2021
ISO14001: Requirements	BSI	2018
ISO14001: Implementation	BSI	2018
SHE Representative	NOSA	2017
Environmental Law	MacRobert Attorneys	2017
Environmental Law for Environmental Managers (NQF 7)	Centre for Environmental Management (CEM)	2016
Invasive Species Training: Alien Management Plans	South African Green Industries Council (SAGIC)	2016
GRI Course on Sustainability Reporting	Environmental Sustainability Solutions CC (ESS)	2015
Invasive Species Certification Training	South African Green Industries Council (SAGIC)	2015
Essential Air Quality Management	Centre for Environmental Management (CEM)	2014
Water Law in South Africa – Workshop	IMBEWU Sustainability Legal Specialists	2013
Mining Law in South Africa - Workshop	IMBEWU Sustainability Legal Specialists	2013

PROJECT EXPERIENCE

Recent Project Environmental consulting services:

PROJECT DESCRIPTION	CLIENT
Environmental Control Officer	• DWS – Vlakfontein • Lynca Meats • Everite Building Products • Samancor Elkem • Rosema Delmas • Victoria Bricks
Auditor and Independent Environmental Consultant	• Gautrain Operations
Lead Auditor – Compliance Audits	• Glencore Alloys • Sephaku Cement • Samancor Chrome • Umlabu Colliery • Geocycle

	• Blyvoor Gold • Kudumane Manganese Resources • Eskom Grootvlei • Mortimer Smelter • Ivanplats Platinum • Zululand Anthracite Colliery • Siyanda Bakgatla Platinum Mine • Tronox Namakwa Sands
AEL Applications	• Nigel Brick and Clay • Hercules Bricks • Makoya Blinkpan Siding • New Energy – Pyrolysis Plant
Basic Assessment	• Rustenburg Base Metals Refiner
EMP Update	• PPC Cement – Slurry, De Hoek, Riebeeck, Vanrhynsdorp • Siyanda Bakgatla Platinum Mine
ISO 14001 – Maintenance	• Geocycle • Barnes Reinforcing Industries
Water and Air Quality Monitoring and Site Inspections	• NuCoal Mining -Woestalleen Colliery • Coal of Africa – Mooiplaats Colliery • Canyon Coal – Ukufisa, Singani and Phalanndwa Collieries • SACMH – Umlabu Colliery
Water Quality Monitoring, Site inspection and EMP Performance Review	• Umlabu Colliery – Coal mining and processing
Soil Sampling and Analysis	• Assmang – Black Rock Mine Operations – Manganese Mining • Canyon Coal – Coal Mining • Group Five – Everite
Air, Noise and Visual Assessments	• Samancor ECM • MOJ Petroleum • Mamatwan Manganese • Jindal Mining • Locksand Mining • Ivanplats Platinum • Canyon Coal • Zilkaats Nek • Kranskop Tebogony

REFERENCES

CONTACT NAME	COMPANY	RELATIONSHIP	CONTACT NR
Karen van Niekerk	ENVASS	Business Process Manager	013 460 9768
Louise Thuynsma	ENVASS	Senior Operations Manager	012 460 9768

RICHARD VILJOEN

Business Unit Head /
Environmental Consultnt

ENVIRONMENTAL ASSURANCE (PTY) LTD

394 Tram Street, New Muckleneuk, Pretoria, 0181

T : 012 460 9768 ; M : 071 122 1443; F : 012 460 3071 ; E mail : richard@envass.co.za

Date of Birth : 8 July 1991; Place of Birth : South Africa

Ethnic Group and Gender : White Male ; Disabilities : None

AREAS OF EXPERTISE

- Report Writing
- Site Investigation
- Air Quality
- Data Analysis
- Field Sampling
- Compliance Auditing
- GIS
- Water Quality
- Visual Impact Assessments

CAREER HISTORY

Employer FOUNTAIN CIVIL ENGINEERING

Period March 2018 – December 2018

Position ENVIRONMENTAL OFFICER

Responsibilities Daily site inspections for environmental compliance. Weekly water quality testing. Inspection report writing. Incident reporting and investigation. Internal compliance auditing.

Employer ENVIRONMENTAL ASSURANCE (PTY) LTD

Period June 2019 – Current

Position BUSINESS UNIT HEAD / ENVIRONMENTAL CONSULTANT

Responsibilities

Environmental Consultant and Auditor

Develop and maintain environmental compliance monitoring programmes in conjunction with site audits and assessments. Specialist and auditing co-ordination and planning of all relevant projects. Maintaining data and results from monitoring programmes and databases. Conduct compliance audits, determine compliance ratings and report on conditions. Compile 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.

WORK EXPERIENCE AND SKILLS

Site inspections, environmental compliance auditing, noise assessments, visual assessments, ambient air quality monitoring, surface water quality testing, data capture and analysis, and report writing

EDUCATION AND QUALIFICATIONS

UKZN; M.Sc. Environmental Science (GIS and Remote Sensing) – 2018
UKZN; B.Sc (Hons). Geography and Environmental Management – 2016
UKZN; B.Ss Degree. Geography and Environmental Management – 2015

CONTINUED PROFESSIONAL DEVELOPMENT

In-house Training – Legal update	Environmental Assurance	2019
ISO 14001:2015 Environmental Management Systems: Requirements	BSI	2021
In-house Training – Legal update	Environmental Assurance	2021
Environmental legal compliance & auditing	Janice Tooley Attorneys	2021
Environmental Law Update	inlexso	2022
HSE Representative Course	NOSA College Centurion	2022
Defensive Driving	NOSA College Centurion	2022
Environmental Management and Regulation	University of Pretoria	2022

PROJECT EXPERIENCE

Environmental consulting services for:

CURRENT PROJECT DESCRIPTION	CLIENT
Environmental Monitoring – Dust Fallout, Noise, Soil and Water Quality	Canyon Coal
Environmental Monitoring – Dust Fallout and Water Quality	Infrabuild Cement
Environmental Monitoring – Dust Fallout	Federale Stene
Environmental Monitoring – Dust Fallout, Noise and Water Quality	Sitatunga Manganese
Environmental Monitoring – Water Quality	Bright Alloys
Environmental Monitoring – Noise Assessment	Envirocycle
Environmental Monitoring – Noise Assessment	Phalanndwa Colliery
Environmental Monitoring – Noise Assessment	SA Brix
Environmental Monitoring – Noise Assessment	Rustenburg Base Mineral Refinery
Visual Impact Assessment	Mawedza Consulting
Visual Impact Assessment	Nigel Brick and Clay
Visual Impact Assessment	SA Brix
Visual Impact Assessment	Boshoek Smelter
Visual Impact Assessment	Anglo American
Visual Impact Assessment	Glubay Coal
Visual Impact Assessment	Mainstream Renewable Power
Visual Impact Assessment	Anglo American Platinum
Visual Impact Assessment	Zonglin Resources
Technical Environmental Audits (AEL, WUL and WML)	Glencore (Wonderkop Smelter)
Technical Environmental Audits (WUL and WML)	Glencore (Helena, Magareng and Thorncliffe)
Technical Environmental Audits (AEL, WUL and WML)	Glencore (Lion Smelter)

WUL Audit	Ocon Bricks
WUL and GNR 704 Audits	Mortimer Smelter
WUL and WML Audits	Boshoek Smelter
WUL and WML Audits	Sephaku Cement
WUL Audits	Kangra Coal
WUL and WML Audits	Bright Alloys
EMPr PAR Audit	Zululand Anthracite Colliery
EMPr Audit	Lynca Meats
EMPr, AEL, WUL Audits	Mokoya - Blinkpan
AEL Technical Audit	Wonderkop Smelter
WUL Audits	Kangra Coal
WUL Audit	Anglo American Platinum – Rustenburg Operations
Soil Assessment	Exxaro - Leeuwpan
Soil Assessment	Zululand Anthracite Colliery
Soil Assessment	Miniandante

REFERENCES

CONTACT NAME	COMPANY	RELATIONSHIP	CONTACT NR
Andre Buys	ENVASS	Divisional Manager Specialist Studies	083 555 4354
Carl Schoeman	ENVASS	Senior Divisional Manager	071 371 1178
Elaine Govender	Fountain Civil Engineering	Manager	083 232 8861
Paul Olivier	SMEC	Resident Engineer	082 376 8198

CERTIFICATION

I, **RICHARD VILJOEN**

Declare that, to the best of my knowledge, all the information contained herein is true.

Signature: RViljoen

On the 10 day of May 2023.

APPENDIX E9: Traffic Impact Assessment

PROPOSED OSLAAGTE SOLAR 2 SOLAR PHOTOVOLTAIC FACILITY, FREE STATE PROVINCE

TRANSPORT IMPACT ASSESSMENT

MAY 2023

First Issue

Prepared by:

JG AFRIKA (PTY) LTD

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VERIFICATION PAGE	Qual-frm-026
	Rev 14

TITLE:

PROPOSED OSLAAGTE SOLAR 2 SOLAR PHOTOVOLTAIC FACILITY, FREE STATE PROVINCE
TRANSPORT IMPACT ASSESSMENT

JGA REF. NO.	DATE:	REPORT STATUS
5928	24/05/2023	First Issue

CARRIED OUT BY:	COMMISSIONED BY:
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AUTHOR	CLIENT CONTACT PERSON
S Patandin	M Johnson

SYNOPSIS

Preparation of a Transport Impact Assessment report for the Proposed Oslaagte Solar 2 solar photovoltaic facility in the Free State Province, pertaining to all relevant traffic and transportation engineering aspects.

KEY WORDS:

Transport Impact Assessment, Environmental Impact Assessment, Solar Energy, Photovoltaic, PV

QUALITY VERIFICATION

This report has been prepared under the controls established by a quality management system that meets the requirements of ISO 9001: 2015 which has been independently certified by DEKRA Certification.

Verification	Capacity	Name	Signature	Date
By Author:	Technologist	S Patandin		24/05/2023
Checked by:	Associate	A Johnson		24/05/2023
Authorised by:	Director	D Petersen		24/05/2023
Filename:	https://jgafrika.sharepoint.com/sites/Job5928-team-100-WIP-Internal-Eng/Shared Documents/100-WIP-Internal-Eng/104-Studies/Oslaagte 1_2_3/5928_Oslaagte Solar 2 Kroonstad TIA EIA_24052023.docx			

Report template version: 2017-10-30

PROPOSED OSLAAGTE SOLAR 2,
FREE STATE PROVINCE
TRANSPORT IMPACT ASSESSMENT

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PROPOSED OSLAAGTE SOLAR 2, FREE STATE PROVINCE TRANSPORT IMPACT ASSESSMENT

1 INTRODUCTION AND METHODOLOGY

1.1 Scope and Objectives

The Applicant, Oslaagte Solar 2 (Pty) Ltd, is proposing the construction of a photovoltaic (PV) solar energy facility (known as the Oslaagte Solar 2) located on the Farm Oslaagte No. 2564, approximately 17,5 km south east of Kroonstad in the Free State Province, as shown in **Figure 1-1.**

The solar PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 460 MW.

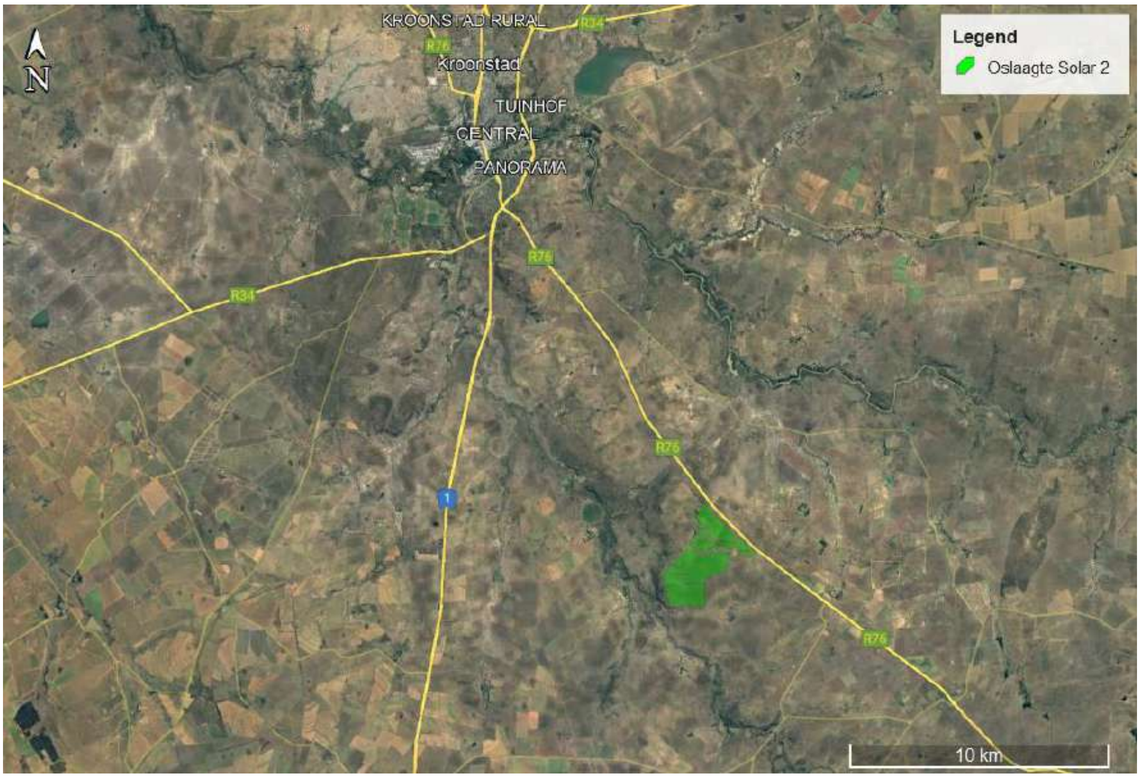

Figure 1-1: Proposed Oslaagte Solar 2 Solar PV Facility

Four additional PV facilities are concurrently being considered on the surrounding properties and are assessed through separate Environmental Impact Assessment (EIA) processes.

As part of the Environmental Impact Assessment (EIA) process undertaken, the services of a Transportation Specialist are required to conduct a Transport Impact Assessment.

The following two main transportation activities will be investigated:

- Abnormal load vehicles transporting components to the site.

- The transportation of construction materials, equipment and people to and from the site/facility.

The transport study will aim to provide the following objectives:

- Assess activities related to traffic movement for the construction and operation (maintenance) phases of the facility.
- Recommend a preliminary route for the transportation of the components to the proposed site.
- Recommend a preliminary transportation route for the transportation of materials, equipment and people to site.
- Recommend alternative or secondary routes where possible.

1.2 Terms of Reference

General:

A specialist report prepared in terms of the Regulations must contain the following:

(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; and (considering impacts and expected cumulative impacts).

  (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.

Specific:

- Extent of the transport study and study area;
- The proposed development;
- Trip generation for the facility during construction and operation;
- Traffic impact on external road network;
- Accessibility and turning requirements;
- National and local haulage routes;
- Assessment of internal roads and site access;
- Assessment of freight requirements and permitting needed for abnormal loads; and
- Traffic accommodation during construction.

1.3 Approach and Methodology

The report deals with the traffic impact on the surrounding road network in the vicinity of the site:

- during the construction of the access roads;
- construction of the facility; and
- operation and maintenance during the operational phase.

This transport study was informed by the following:

<u>Site Visit and Project Assessment</u>

- Overview of project background information including location maps, component specs and any possible resulting abnormal loads to be transported.
- Research of all available documentation and information relevant to the proposed facility; and
- Site visit to gain sound understanding of the project.

The transport study considered and assessed the following:

Traffic and Haul Route Assessment

- Estimation of trip generation;
- Discussion on potential traffic impacts;
- Assessment of possible haul routes; and
- Construction and operational (maintenance) vehicle trips.

Site layout, Access Points and Internal Roads Assessment per Site

- Description of the surrounding road network;
- Description of site layout;
- Assessment of the proposed access points; and
- Assessment of the proposed internal roads on site.

1.4 Assumptions and Limitations

The following assumptions and limitations apply:

- This study is based on the project information provided by the Client.
- According to the Eskom Specifications for Power Transformers (Eskom Power Series, Volume 5: Theory, Design, Maintenance and Life Management of Power Transformers), the following dimensional limitations need to be kept when transporting the transformer – total maximum height 5 000mm, total maximum width 4 300 mm and total maximum length 10 500 mm.
- Maximum vertical height clearances along the haulage route is 5.2 m for abnormal loads.
- Imported elements will be transported from the most feasible port of entry, which is deemed to be Richards Bay Port.
- If any elements are manufactured within South Africa, these will be transported from their respective manufacturing centres, which would be either in the greater Johannesburg area, Pinetown/Durban or Cape Town.
- All haulage trips will occur on either surfaced national and provincial roads or existing gravel roads.
- Construction materials will be sourced locally as far as possible.

1.5 Source of Information

Information used in a transport study includes:

- Project Information provided by the Client;
- Google Earth.kmz provided by the Client;
- Google Earth Satellite Imagery;
- Road Traffic Act, 1996 (Act No. 93 of 1996)
- National Road Traffic Regulations, 2000
- SANS 10280/NRS 041-1:2008 - Overhead Power Lines for Conditions Prevailing in South Africa
- The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads
- Information gathered during the site visit; and
- Project research of all available information.

2 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO THE TRANSPORT STUDY

2.1 Port of Entry

It is assumed that if components are imported to South Africa, it will be via the Port of Richards Bay, which is located in KwaZulu Natal. Components imported to South Africa will be via the Richards Bay Port. A deep-sea water port and boasting 13 berths, the terminal handles dry bulk ores, minerals and break-bulk consignments with a draft that easily accommodates Cape size and Panamax vessels. The terminal exports over 30 varied commodities from magnetite to ferrochrome, woodchips to aluminium and steel. A large percentage of dry bulk commodities are handled via a computer-controlled network of conveyor belts extending 40 km to seven harbour bound industries. These belts transport cargo between the quayside and the respective manufacturers. Break bulk cargo on the other hand, is a skip-loading operation that due to the density of the commodities, chiefly relies on road motor transport (RMT) to and from the point of trade. The Port is operated by Transnet Port Terminals.

2.2 Transportation requirements

It is anticipated that the following vehicles will access the site during construction:

- Conventional trucks within the freight limitations to transport building material to the site;
- 40ft container trucks transporting solar panels, frames and the inverter, which are within freight limitations;
- Flatbed trucks transporting the solar panels and frames, which are within the freight limitations;
- Light Differential Vehicle (LDV) type vehicles transporting workers from surrounding areas to site;
- Drilling machines and other required construction machinery being transported by conventional trucks or via self-drive to site; and
- The transformers will be transported as abnormal loads.

2.3 Abnormal Load Considerations

It is expected that the transformers will be transported with an abnormal load vehicle. Abnormal permits are required for vehicles exceeding the following permissible maximum dimensions on road freight transport in terms of the Road Traffic Act (Act No. 93 of 1996) and the National Road Traffic Regulations, 2000:

- Length: 22m for an interlink, 18.5m for truck and trailer and 13.5m for a single unit truck
- Width: 2.6m
- Height: 4.3m measured from the ground. Possible height of load – 2.7m.
- Weight: Gross vehicle mass of 56t resulting in a payload of approximately 30t
- Axle unit limitations: 18t for dual and 24t for triple-axle units
- Axle load limitation: 7.7t on the front axle and 9t on the single or rear axles

Any dimension / mass outside the above will be classified as an Abnormal Load and will necessitate an application to the Department of Transport and Public Works for a permit that will give authorisation for the conveyance of said load. A permit is required for each Province that the haulage route traverses.

2.4 Further Guideline Documentation

The Technical Recommendations for Highways (TRH 11): “Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads” outlines the rules and conditions that apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts.

The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power / mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the Road Traffic Act and the relevant regulations.

2.5 Permitting – General Rules

The limits recommended in TRH 11 are intended to serve as a guide to the Permit Issuing Authorities. It must be noted that each Administration has the right to refuse a permit application or to modify the conditions under which a permit is granted. It is understood that:

a) A permit is issued at the sole discretion of the Issuing Authority. The permit may be refused because of the condition of the road, the culverts and bridges, the nature of other traffic on the road, abnormally heavy traffic during certain periods or for any other reason.
b) A permit can be withdrawn if the vehicle upon inspection is found in any way not fit to be operated.
c) During certain periods, such as school holidays or long weekends an embargo may be placed on the issuing or permits. Embargo lists are compiled annually and are obtainable from the Issuing Authorities.

2.6 Load Limitations

The maximum load that a road vehicle or combination of vehicles will be allowed to carry legally under permit on a public road is limited by:

- the capacity of the vehicles as rated by the manufacturer;
- the load which may be carried by the tyres;
- the damaging effect on pavements;
- the structural capacity on bridges and culverts;
- the power of the prime mover(s);
- the load imposed by the driving axles; and
- the load imposed by the steering axles.

2.7 Dimensional Limitations

A load of abnormal dimensions may cause an obstruction and danger to other traffic. For this reason, all loads must, as far as possible, conform to the legal dimensions. Permits will only be considered for indivisible loads, i.e. loads that cannot, without disproportionate effort, expense or risk of damage, be divided into two or more loads for the purpose of transport on public roads. For each of the characteristics below there is a legally permissible limit and what is allowed under permit:

- Width;
- Height;
- Length;
- Front Overhang;
- Rear Overhang;
- Front Load Projection;
- Rear Load Projection;
- Wheelbase;
- Turning Radius; and
- Stability of Loaded Vehicles.

2.8 Transporting Other Plant, Material and Equipment

In addition to transporting the specialised equipment, the normal Civil Engineering construction materials, plant and equipment will need to be transported to the site (e.g. sand, stone, cement, gravel, water, compaction equipment, concrete mixers, etc.). Other components, such as electrical cables, pylons and substation transformers, will also be transported to site during construction. The transport of these items will generally be conducted with normal heavy loads vehicles, except for the transformers which require an abnormal load vehicle.

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 Description of the site

The proposed Oslaagte Solar 2 Solar PV facility will be located approximately 16,5 km south east of Kroonstad in the Free State Province, as shown in **Figure 3-1**. The development area is situated within the Moqhaka Local Municipality within the Fezile Dabi District Municipality. The site is accessible via the R76, located adjacent to the development area.

Figure 3-1: Aerial View of the Proposed Oslaagte Solar 2 Facility

The proposed Oslaagte Solar 2 will cover approximately 600 ha and will include the following infrastructure:

- PV modules and mounting structures
- Inverters and transformers
- Battery Energy Storage System (BESS)
- Site access roads up to 8m wide
- Internal access roads up to 6m 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, including:
    - 33kV cabling between the project components and the facility substation
    - A 132kV facility substation
    - 33kV or 132kV cabling or powerline between the facility substation and the Eskom collector switching station/Main Transmission Sustation (MTS) or the Kroonstad Switching Station

3.2 National Route to Site for Imported Components

There are two viable options for the port of entry for imported components - the Richards Bay Port in KwaZulu Natal and the Port of Ngqura in the Eastern Cape.

The Richards Bay Port is located approximately 669km travel distance from the proposed site whilst the Port of Ngqura is located approximately 853km travel distance from the proposed site. The Richards Bay Port is the preferred port of entry, however, the Port of Ngqura can be used as an alternative should the Richards Bay Port not be available.

The preferred route from the Richards Bay Port is shown in green in **Figure 3-2** below. The route follows the N2 to Durban, where vehicles will access the N3 to Harrismith and the N5 to Bethlehem. From Bethlehem, vehicle will travel on the R76 to access point the proposed site.

The alternative route from the Port of Ngqura, shown in orange in **Figure 3-2**, will follow the N10 north to Cradock, where vehicles will take the R390 north, before turning west onto the R58 at Venterstad. Vehicles will access the N1 via the R701 to Bloemfontein and will continue on the N1 to Kroonstad. Vehicles will access the proposed site via the R76.

Figure 3-2: Preferred and Alternative Routes from Ports

It is critical to ensure that the abnormal load vehicle will be able to move safely and without obstruction along the preferred route. The preferred route should be surveyed prior to construction to identify any problem areas, e.g., intersections with limited turning radii and sections of the road with sharp horizontal curves or steep gradients, that may require modification. After the road modifications have been implemented, it is recommended to undertake a "dry-run" with the largest abnormal load vehicle, prior to the transportation of any components, to ensure that the delivery will occur without disruptions.

It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will need to be maintained during the additional loading of the construction phase and reinstated after construction is completed.

3.3 Route for Components manufactured locally

As mentioned in Section 1.4 (Assumptions and Limitations), it is anticipated that elements manufactured within South Africa will be transported to the site from the Cape Town, Johannesburg and Pinetown/Durban areas. It is also assumed that the transformer, which will be transported with an abnormal load vehicle, will be transported from the Johannesburg area and therefore it needs to be verified that the route from the manufacturer to the site does not have any load limitations for abnormal vehicles. At this stage, only a high-level assessment can be undertaken as no information of the exact location of the manufacturer is known and all road structures (such as bridges and culverts) need to be confirmed for their load bearing by SANRAL or the respective Roads Authority.

3.4 Route from Cape Town to Proposed Site

Components, such as PV panels, manufactured in Cape Town will be transported to site via road as shown in **Figure 3-3**. Haulage vehicles will mainly travel on the national highway and the total distance to the proposed site is approximately 1 224km.

Figure 3-3: Route from Cape Town to Proposed Site

3.5 Route from Johannesburg to Proposed Site

It is assumed that the inverter and support structure will be manufactured in the Johannesburg area and transported to site. The travel distance is around 207km, and no road limitations are expected on this route for normal loads vehicles as it will mainly follow national and provincial roads. The route is shown in **Figure 3-4**.

Figure 3-4: Route from Johannesburg to Proposed Site

3.6 Route from Pinetown / Durban to Proposed Site

If the PV panels are manufactured in South Africa, they could possibly be manufactured in the Pinetown area, close to Durban and transported to site via road. These elements are normal loads and no road limitations are expected along the routes, which is shown in **Figure 3-5**. Haulage vehicles will mainly travel on national and provincial roads and the total distance to the proposed site is approximately 507km.

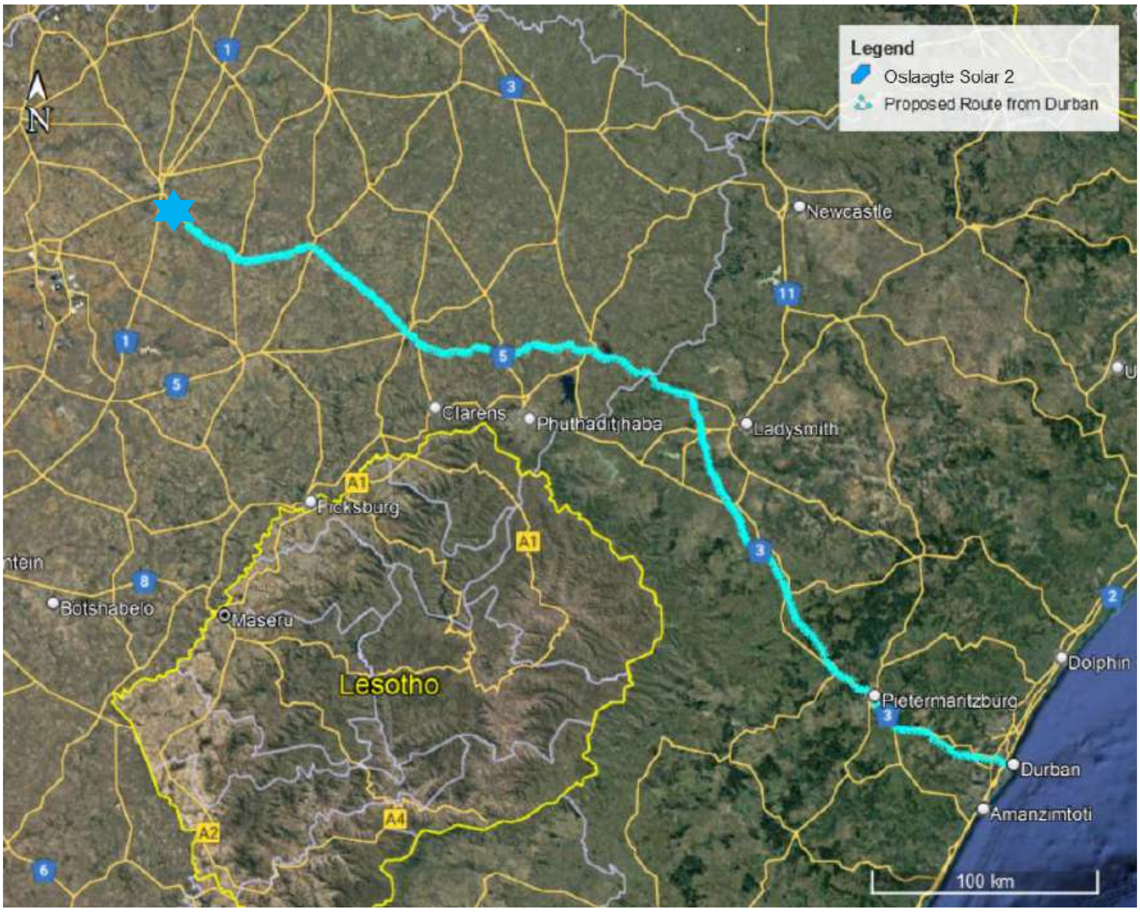

Figure 3-5: Route from Durban to Proposed Site

3.7 Route from Johannesburg Area to Site – Abnormal Load

It is assumed that the transformer will be manufactured locally in South Africa and be transported from the Johannesburg area to site. As the transformer will be transported with an abnormal load vehicle, the route planning needs a more detailed investigation of the feasible routes considering any limitations due to existing road features. Furthermore, a load of abnormal dimensions may cause an obstruction and danger to other traffic and therefore the transformer needs to be transported as far as possible on roads that are wide enough for general traffic to pass. It is expected that the transformer can be transported to site via the same route used for normal loads.

There are several bridges and culverts along this route, which need to be confirmed for load bearing and height clearances. There are several turns along the way and small towns to pass through. According to the desktop study, all turning movements along the route are manageable for the abnormal vehicle.

However, there are many alternative routes which can be investigated if the above route or sections of the route should not be feasible.

3.8 Proposed Access Points and Access Roads to the Proposed Development

The proposed main access points and access roads to the site will be located off the R76, as shown in **Figure 3-6**. It should be noted that the R76 is currently under construction.

The proposed access roads, shown in red, will link to the internal road network of the facility.

A railway line runs parallel to the R76 and connects Kroonstad in the north to Bethlehem in the southeast. The Client should note that application for wayleaves and permits should be made to the railway authority well in advance of construction commencing. Special safety measures e.g. access booms might be required to protect drivers of vehicles from oncoming railway traffic, especially in instances of poor visibility and increased traffic flow. Height clearances, of overhead power supply at the railway crossing need to physically be verified.

The **proposed access points are deemed suitable** from a transport engineering perspective, with the access point exceeding the shoulder sight distance requirements of TRH17.

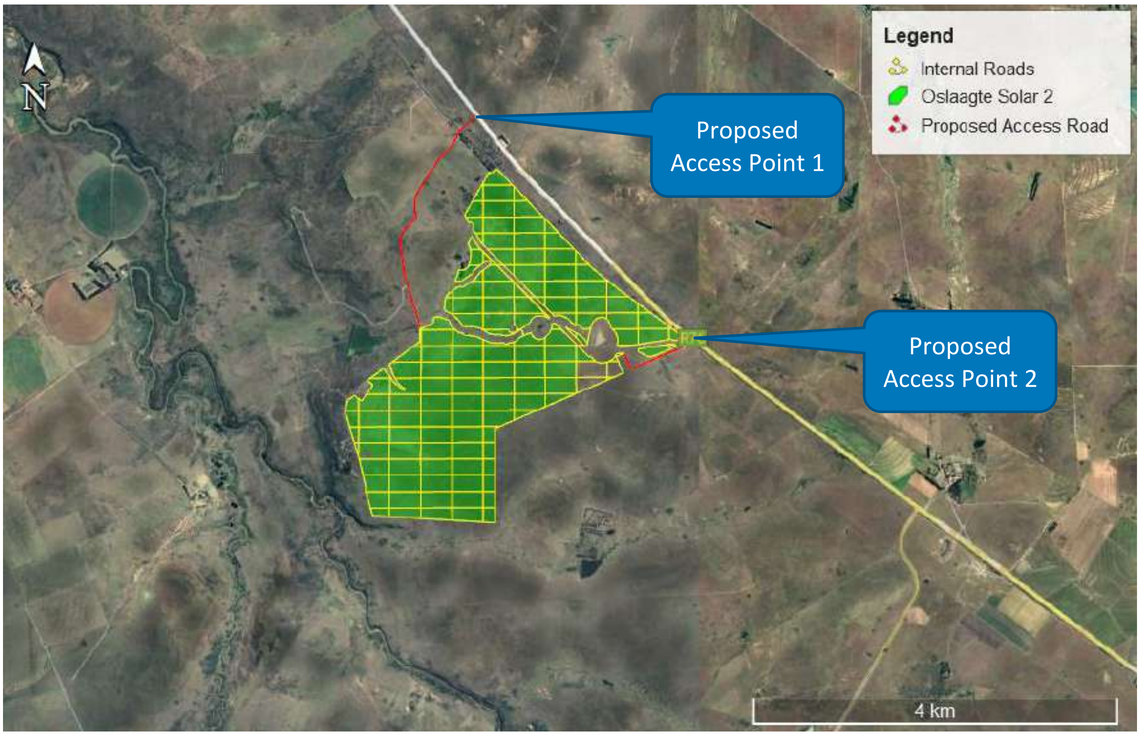

Figure 3-6: Proposed Access Point

Figure 3-7: Proposed Access Point 1

Figure 3-8: Proposed Access Point 2

Figure 3-9: Construction on R76

A minimum required road width of 4 m needs to be maintained and all turning radii must conform with the specifications needed for the abnormal load vehicles and haulage vehicles. It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will hence need to be maintained during the additional loading of the construction phase and then reinstated after construction is completed. The gravel roads will require grading with a grader to obtain a flat even surface and the geometric design of these gravel roads needs to be confirmed at detailed design stage.

3.9 Main Route for the Transportation of Materials, Plant and People to the proposed site

The nearest towns in relation to the proposed development site are Kroonstad and Welkom. It is envisaged that most materials, water, plant, services and people will be procured within a 100km radius of the proposed facility.

Concrete batch plants and quarries in the vicinity could be contracted to supply materials and concrete during the construction phase, which would reduce the impact on traffic on the surrounding road network. Alternatively, mobile concrete batch plants and temporary construction material stockpile yards could be commissioned on vacant land near the proposed site. Delivery of materials to the mobile batch plant and the stockpile yard could be staggered to minimise traffic disruptions.

4 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

Key legal requirements pertaining to the transport requirements for the proposed development are:

- Abnormal load permits, (Section 81 of the National Road Traffic Act)
- Port permit (Guidelines for Agreements, Licenses and Permits in terms of the National Ports Act No. 12 of 2005), and
- Authorisation from Road Authorities to modify the road reserve to accommodate turning movements of abnormal loads at intersections.

5 IDENTIFICATION OF KEY ISSUES

5.1 Identification of Potential Impacts

The potential transport related impacts are described below.

5.1.1 Construction Phase

Potential impact

- Construction related traffic
- The construction traffic would also lead to noise and dust pollution.
- This phase also includes the construction of roads, excavations, trenching for electrical cables and other ancillary construction works that will temporarily generate the most traffic.

5.1.2 Operational Phase

Potential impact

- During operation, it is expected that staff and security will visit the facility.
- Maintenance vehicles are expected on site at times.
- Should municipal water not be available, water will have to be transported to the site.

5.1.3 Cumulative Impacts

Potential impact

- Traffic congestion/delays on the surrounding road network.
- Noise and dust pollution

6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

6.1 Potential Impact (Construction Phase)

6.1.1 Nature of the impact

- Potential traffic congestion and delays on the surrounding road network and associated noise and dust pollution.

6.1.2 Significance of impact without mitigation measures

- Traffic generated by the construction of the facility will have a significant impact on the surrounding road network. The exact number of trips generated during construction will be determined by the contractor, the haulage company transporting the components to site, the staff requirements and where equipment is sourced from.

6.1.3 Trip Generation – Construction Phase

From experience on other projects of similar nature, the number of heavy vehicles per 7MW installation is estimated to range between 200 and 300 trips depending on the site conditions and requirements. For the 460MW, the total trips can therefore be estimated to be between 13 143 and 19 715 heavy vehicle trips, which will generally be made over a 12-month construction period. Choosing the worst-case scenario of 19 715 heavy vehicles over a 12-month period travelling on an average of 22 working days per month, the resulting daily number of vehicle trips is 75. Considering that the number of vehicle trips during peak hour traffic in a rural environment can roughly be estimated at around 20-40% of the average daily traffic, the resulting peak hour vehicle trips for the construction phase are approximately 15 - 30 trips.

If the panels are imported instead of manufactured within South Africa, the respective shipping company will be able to indicate how the panels can be packed (for example using 2MW packages and 40ft containers). These can then be stored at the port and repacked onto flatbed trucks.

It is assumed that during the peak of the construction period, 300 employees will be active on site. Staff trips are assumed to be:

Table 6-1: Estimation of daily staff trips

Vehicle Type	Number of vehicles	Number of Employees
Car	10	10 (assuming single occupant)
Bakkie	20	30 (assuming 1.5 occupants)
Taxi – 15 seats	12	180
Bus – 80 seats	1	80
Total	**43**	**300**

It is difficult to accurately estimate the construction traffic for the transportation of materials as it depends on the type of vehicles, tempo of the construction, source/location of construction material etc. However, it is assumed that at the peak of construction, approximately 250 construction vehicle trips will access the site per day.

The total estimated daily site trips, at the peak of construction, are shown in the table below.

Table 6-2: Estimation of daily site trips

Activity	Number of trips
Component Delivery	39
Staff Trips	43
Construction Trips	250
Total	**332**

The impact on the surrounding road network and the general traffic is therefore deemed nominal, with mitigation, as the 332 trips will be distributed across a 9-hour working day. The majority of the trips will occur outside the peak hours.

The significance of the transport impact without mitigation measures during the construction phase can be rated as medium. However, considering that this is temporary and short term in nature, the impact can be mitigated to an acceptable level.

6.1.4 Trip Generation – Operational Phase

During operation, it is assumed that approximately ten (10) full-time employees will be stationed on site and hence vehicle trips generated are low and will have a negligible impact on the external road network.

The solar modules would need to be cleaned twice a year. The Developer is investigating the availability of service and as such a worst-case scenario of transporting water to site has been assessed. The following assumptions have been made to estimate the resulting trips generated from transporting water to the site:

- 5 000 litre water bowsers to be used for transporting the water
- Approximately 5 litres of water needed per panel
- Assuming that a maximum of 600 000 solar modules are used, this would amount to approximately 600 vehicle trips
- Solar modules will be cleaned twice a year.

It is expected that these trips will not have a significant impact on external traffic. However, to limit the impact, it is recommended to schedule these trips outside of peak traffic periods and to clean the solar modules over the course of a few days i.e., spread the trips over a few days. Additionally, the provision of rainwater tanks on site would decrease the number of trips.

6.1.5 Proposed general mitigation measures

The following are general mitigation measures to reduce the impact that the additional traffic will have on the road network and the environment.

- The delivery of components to the site can be staggered and trips can be scheduled to occur outside of peak traffic periods.

- Dust suppression of gravel roads located within the site boundary, including the main access road to the site and the site access road, during the construction phase, if required.
- Regular maintenance of gravel roads located within the site boundary, including the access road to the site, by the Contractor during the construction phase and by the Owner/Facility Manager during the operation phase, if required.
- The use of mobile batch plants and quarries near the site would decrease the traffic impact on the surrounding road network, if available and feasible.
- Staff and general trips should occur outside of peak traffic periods as far as possible.
- The Contractor is to ensure that all drivers entering the site adhere to the traffic laws.
- Vehicular movements within the site boundary are the responsibility of the respective Contractor and the Contractor must ensure that all construction road traffic signs and road markings (where applicable) are in place. It should be noted that traffic violations on public roads is the responsibility of Law Enforcement, and the public should report all transgressions to Law Enforcement and the Contractor.
- If required, low hanging overhead lines (lower than 5.1m) e.g., Eskom and Telkom lines, along the proposed routes will have to be moved (to be arranged by haulage company) to accommodate the abnormal load vehicles. The Contractor and the Developer is to ensure that the haulage company is aware of this requirement. The haulage company is to provide evidence to the Contractor and the Developer that any affected overhead lines have been moved or raised.
- The preferred route should be surveyed to identify problem areas (e.g., intersections with limited turning radii and sections of the road with sharp horizontal curves or steep gradients, that may require modification). After the road modifications have been implemented, it is recommended to undertake a "dry-run" with the largest abnormal load vehicle, prior to the transportation of any components, to ensure that delivery will occur without disruptions. This process is to be undertaken by the haulage company transporting the components and the contractor, who will modify the road and intersections to accommodate abnormal vehicles. The "dry-run" should be undertaken within the same month components are expected to arrive. The haulage company is to provide evidence that the route has been surveyed and deemed acceptable for the transportation of the abnormal load.
- The Contractor needs to ensure that the gravel sections of the haulage routes (i.e., the site access road and the main access road to the site) remain in good condition and will need to be maintained during the additional loading of the construction phase and reinstated after construction is completed.
- Design and maintenance of internal roads. The internal gravel roads will require grading with a grader to obtain a camber of between 3% and 4% (to facilitate drainage) and regular maintenance blading will also be required. The geometric design of these gravel roads needs to be confirmed at detailed design stage. This process is to be undertaken by a civil engineering consultant or a geometric design professional.

6.1.6 Significance of impact with mitigation measures

It should be noted that the construction phase is temporary and short term in nature and the associated impacts can be mitigated to an acceptable level. The proposed mitigation measures for the construction traffic will result in a reduction of the impact on the surrounding road network and the impact on the local traffic will be very low as the existing traffic volumes are deemed to be low. The dust suppression will result in significantly reducing the impact.

7 NO-GO ALTERNATIVE

The no-go alternative implies that the proposed Oslaagte Solar 2 facility does not proceed. This would mean that there will be no negative environmental impacts and no traffic impact on the surrounding network. However, this would also mean that there would be no socio-economic benefits to the surrounding communities, and it will not assist government in meeting the targets for renewable energy. **Hence, the no-go alternative is not a preferred alternative.**

8 POTENTIAL IMPACT ASSESSMENT SUMMARY

The assessment of potential impacts discussed above are collated in the tables below.

8.1 Construction Phase

Table 8-1: Impact Rating - Construction Phase – Traffic Congestion

TRAFFIC CONGESTION CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Traffic congestion during the construction phase	• Stagger component delivery to site • Reduce the construction period, where possible • Source mobile batch plants and quarries in close proximity to the site • Staff and general trips should occur outside of peak traffic periods as much as possible • Conduct regular maintenance of gravel roads by the Contractor during the construction phase and by Client/Facility Manager during operation phase.					
Without Mitigation	Status	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Short-term	Almost certain	2
With Mitigation	Status	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

Table 8-2: Impact Rating - Construction Phase – Air Quality

AIR QUALITY CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Air quality will be affected by dust pollution	• Dust suppression of gravel roads during the construction phase, as required. • Regular maintenance of gravel roads by the Contractor during the construction phase and by Client/Facility Manager during operation phase.					
Without Mitigation	Status	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Short-term	Almost certain	2
With Mitigation	Status	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

Table 8-3: Impact Rating - Construction Phase – Noise Pollution

NOISE POLLUTION CONSTRUCTION PHASE						
Potential Impact	Mitigation					
Noise pollution due to the increase in traffic	• Stagger component delivery to site • Reduce the construction period, where possible • The use of mobile batch plants and quarries in close proximity to the site • Staff and general trips should occur outside of peak traffic periods					
Without Mitigation	Status	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Medium	Short-term	Almost certain	2
With Mitigation	Status	Extent	Magnitude	Duration	Probability	Significance
	Negative	Local	Low	Short-term	Likely	1

8.2 Operational Phase

Table 8-4: Impact Rating – Operational Phase

IMPACT TABLE – OPERATIONAL PHASE
The traffic generated during this phase will be minimal and will have not have any impact on the surrounding road network. However, the Client/Facility Manager is to ensure that regular maintenance of gravel roads occurs during operation phase to minimize/mitigate dust pollution.

8.3 Decommissioning Phase

Table 8-5: Potential Impact - Decommissioning Phase

IMPACT TABLE – DECOMMISSIONING PHASE
This phase will have a similar impact as the Construction Phase i.e. traffic congestion, air pollution and noise pollution, as similar trips/movements are expected.

9 CUMULATIVE IMPACTS

The cumulative impact assumes that all proposed and authorized renewable energy projects within 50 km be constructed at the same time. This is a precautionary approach, as in reality these projects would be subject to a highly competitive bidding process. Only a handful of projects would be selected to enter into a power purchase agreement with Eskom, and construction is likely to be staggered depending on project-specific issues.

The construction and decommissioning phases are the only significant traffic generators for renewable energy projects. The duration of these phases is short term (i.e., the impact of the generated traffic on the surrounding road network is temporary and renewable energy facilities, when operational, do not add any significant traffic to the road network). Even if all renewable energy projects within the area are constructed at the same time, the roads authority will consider all applications for abnormal loads and work with all project companies to ensure that loads on the public roads are staggered and staged to ensure that the impact will be acceptable.

10 ENVIRONMENTAL MANAGEMENT PROGRAM INPUTS

It is recommended that dust suppression and maintenance of gravel roads form part of the EMPr. This would be required during the Construction phase where an increase in vehicle trips can be expected. No traffic related mitigation measures are envisaged during the operational phase due to the negligible traffic volume generated during this phase.

Project component/s	Construction Phase traffic
Potential Impact	Dust and noise pollution due to increase in traffic volume
Activity/risk source	Transportation of material, components, equipment and staff to site
Mitigation: Target/Objective	Minimize impacts on road network and surrounding communities

Mitigation: Action/control	**Responsibility**	**Timeframe**
• Stagger component delivery to site • The use of mobile batch plants and quarries near the site would decrease the impact on the surrounding road network • Dust suppression • Reduce the construction period as far as possible • Maintenance of gravel roads • Apply for abnormal load permits prior to commencement of delivery via abnormal loads • Assess the preferred route and undertake a 'dry run' • Staff and general trips should occur outside of peak traffic periods as far as possible. • Any low hanging overhead lines (lower than 5.1m) e.g., Eskom and Telkom lines, along the proposed routes will have to be moved to accommodate the abnormal load vehicles, if required	• Holder of the EA	• Before construction commences and regularly during construction phase

Performance Indicator	Staggering or reducing the construction trips will reduce the impact of dust and noise pollution.
Monitoring	• Regular monitoring of road surface quality. • Monitoring congestion levels (increase in vehicle trips) • Apply for required permits prior to commencement of construction

11 CONCLUSION AND RECOMMENDATIONS

This report addressed key issues to be considered for the proposed Oslaagte Solar 2 facility.

- The preferred Port of Entry for imported components is Richards Bay.
- The proposed access points and access roads located off the R76 are deemed suitable.
- Applications for wayleaves and permits for crossing the railway line, which runs parallel to the R76, should be made to the railway authority well in advance of construction commencing. Special safety measures e.g. access booms might be required to protect drivers of vehicles from oncoming railway traffic, especially in instances of poor visibility and increased traffic flow. Height clearances, of overhead power supply at the railway crossing need to physically be verified.
- It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will hence need to be maintained during the additional loading of the construction phase and then reinstated after construction is completed. The gravel roads will require grading with a grader to obtain a flat even surface and the geometric design of these gravel roads needs to be confirmed at detailed design stage.
- The construction phase traffic, although significant, will be temporary and can be mitigated to an acceptable level.
- During operation, it is expected that staff and security will periodically visit the facility. The traffic generated during this phase will be minimal and will not have an impact on the surrounding road network.
- The construction and decommissioning phases of a development is the only significant traffic generator and therefore noise and dust pollution will be higher during this phase. The duration of this phase is short term i.e., the impact of the traffic on the surrounding road network is temporary and solar facilities, when operational, do not add any significant traffic to the road network.

The potential mitigation measures mentioned in the construction phase are:

- Dust suppression
- Component delivery to/ removal from the site can be staggered and trips can be scheduled to occur outside of peak traffic periods.
- The use of mobile batch plants and quarries near the site would decrease the impact on the surrounding road network.
- Staff and general trips should occur outside of peak traffic periods.
- A “dry run” of the preferred route.
- Design and maintenance of internal roads.
- If required, any low hanging overhead lines (lower than 5.1m) e.g. Eskom and Telkom lines, along the proposed routes will have to be moved to accommodate the abnormal load vehicles.

The potential mitigation measures mentioned in the operational phase are:

- Staff and general (maintenance) trips should occur outside of peak traffic periods as far as possible.
- The provision of water storage tanks and/or boreholes.

- Water bowsers trips should occur outside of peak traffic periods as far as possible.
- Spread the cleaning of the panels over a week.
- Using a larger water bowser.

The construction and decommissioning phases of a development is the only significant traffic generator and therefore noise and dust pollution will be higher during this phase. The duration of this phase is short term i.e., the impact of the traffic on the surrounding road network is temporary and solar facilities, when operational, do not add any significant traffic to the road network.

The development is supported from a transport perspective provided that the recommendations and mitigations contained in this report are adhered to.

The impacts associated with the facility are acceptable with the implementation of the recommended mitigation measures and can therefore be authorised.

12 REFERENCES

- Google Earth Pro
- National Road Traffic Act (Act No. 93 of 1996)
- National Road Traffic Regulations, 2000
- SANS 10280/NRS 041-1:2008 - Overhead Power Lines for Conditions Prevailing in South Africa
- The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads
- The Technical Recommendations for Highways (TRH 17): Geometric Design of Rural Roads

13 ANNEXURES

Annexure A – SPECIALIST EXPERTISE

ADRIAN JOHNSON

Position in Firm	*Associate and Manager – Traffic and Transportation*
Area of Specialisation	*Traffic & Transportation Engineering*
Qualifications	*PrTechEng, Master of Transport Studies,* *BSc (Hons) (Applied Science: Transport Planning),* *BTech Civil Engineering*
Years of Experience	*18 Years*
Years with Firm	*6 Years*

SUMMARY OF EXPERIENCE

Adrian Johnson is a Professional Technologist registered with ECSA (201570274). He joined JG Afrika (Pty)Ltd. in January 2017. Adrian holds a BSc (Hons) (Applied Sciences: Transportation Planning) degree from the University of Pretoria, a BTech degree in Civil Engineering from the Cape Peninsula University of Technology and completed a Masters' degree in Transport Studies at the University of Cape Town in 2020. He has more than 18 years of experience in a wide range of engineering projects.

He has technical and professional skills in traffic impact studies, transport impact assessments, public transport planning, non-motorised transport planning & design, data analysis of public transport systems, access management plans, quality control, project planning and implementation, geometric design, site supervision, transport assessments for renewable energy projects, speed limit reviews and road safety audits.

PROFESSIONAL REGISTRATIONS & INSTITUTE MEMBERSHIPS

PrTechEng - Engineering Council of South Africa, Registration No 201570274
SAICE - South African Institute of Civil Engineering. No 201700129
SARF WR South African Road Federation Western Region Administrator and Committee Member

EDUCATION

2004 - National Diploma (Civil) – Peninsula Technikon
2006 - BTech (Civil) – Cape Peninsula University of Technology
2011 - BSc (Hon) (Applied Sciences: Transportation Planning) – University of Pretoria
2020 – Master of Transport Studies – University of Cape Town

SPECIFIC EXPERIENCE (Selection)

JG Afrika (Pty) Ltd (Previously Jeffares & Green (Pty) Ltd)
September 2022 – Date
Position – Associate and Manager – Traffic and Transportation

JG Afrika (Pty) Ltd (Previously Jeffares & Green (Pty) Ltd)
2017 – June 2022
Position – Senior Technologist (Traffic and Transportation Engineering)
Various Transport Impact Statements (TIA) and Traffic Impact Statements (TIS) for private clients including:

- Weltevreden Clinic TIS for Edifice Consulting Engineers
- Oakhurst Primary TIS for BVZ Plan
- Sinai Academy TIS for Bettesworth Scott Planners
- Rustlamere TIA for Bettesworth Scott Planners
- Joostenbergvlakte Farms 732 and 728 TIA for Asla
- Garden Emporium TIA for Rory Cameron Smith Architects
- Strandfontein Sandmine TIS for Chand Environmental Consultants
- Proposed development of Erf 538 Grassy Park TIA for First Plan
- Riebeek West: Proposed Function/Wedding Venue TIS for Elco Property Developers

Limpopo Road Asset Management System Undertake network level road safety assessments and analysis of accident statistics of the Limpopo road network (5 000km). – Client: Roads Agency Limpopo SOC Ltd

Kampies Housing Development Proposed upgrade of the informal settlement on Cape Farm 616 Philipi and Erf 63 Spring Field, providing 275 units. Client: Ian Rout & Associates

Highlands Housing Project Traffic calming plans for three proposed sites in Mitchells Plain, Cape Town – Client: City of Cape Town

Richards Bay Gas to Power Facility Transport study for the proposed renewable energy facility in Richards Bay, KwaZulu Natal – Client: Private Client

Solid Waste Management Sector Plan – Collections Work Brief Information Analyst assisting with the assessments and detailed analysis of the collections and drop-off facilities operating model of the City of Cape Town – Client: City of Cape Town

Nooiensfontein Housing Project Transport Study for the Nooiensfontein Housing Development in Bluedowns (2500 units) – Client: Ian Rout & Associates

Bardale Housing Development Transport Impact Assessment and Signal timing plan, Western Cape – Client: Integrated Housing Development

Enkanini Housing Transport Impact Assessment for the development of the Enkanini Informal Settlement, Kayamandi - Client: Stellenbosch Municipality

Sutherland and Rietrug Access Road Transport study for the upgrading and widening of the access road to the proposed Sutherland Windfarm, Northern Cape Client: Nala Environmental Consulting

Pienaarspoort Windfarm Transport study for the proposed Pienaarspoort Windfarm, Western Cape Client: Savannah Environmental (Pty) Ltd

Speed Limit Review Main Road 546, Main Road 552 and Divisional Road 2220, Lutzville, Western Cape – Client: Western Cape Government

Gromis and Komis Wind Energy Facility Transport study for the proposed Windfarm, Northern Cape. Client: CSIR

Geelkop Solar Facility Transport study for the proposed Geelkop Solar PV Facility near Upington, Northern Cape – Client: AEP (Pty) Ltd

Khunab Solar Facility Transport study for the proposed Khunab Solar PV Facility near Upington, Northern Cape – Client: AEP (Pty) Ltd

Bloemsmond Solar Facility Transport study for the proposed Bloemsmond Solar PV Facility near Upington, Northern Cape – Client: AEP (Pty) Ltd

NMT Study for the Upgrading of DR1285, Elgin – Client: Western Cape Government

Traffic Study for the Kudusberg and Rondekop Wind Energy Facilities, Northern Cape. Client: G7

Speed Limit Review Main Road 540, Elandsbay, Western Cape – Client: Western Cape Government

Road Safety Audit for N1 Section 16 Winburg to Ventersburg – Client: Aurecon on behalf of SANRAL

Road Safety Audit for the for the N4 at Bapong, Client: Bakwena

Road Safety Audit for N2 Wild Coast Toll Road Projects, Eastern Cape & Natal, Client: Aurecon/Knight Piesold on behalf of SANRAL

Kuruman Wind Energy Facility Transport study for the proposed Kuruman Windfarm, Northern Cape. Client: CSIR

Coega West Windfarm Transportation and Traffic Management Plan for the proposed Coega Windfarm in Coega, Port Elizabeth – Client: Electrawinds Coega

Parking Audit of the Groenvallei area in Bellville – Client: City of Cape Town

Road Safety Appraisals for the Mpumalanga Province – Client: Mpumalanga Provincial Government

Transportation and Traffic Management Plan for the proposed Coega West Wind Energy Facility in Port Elizabeth – Client: Electrawinds Coega (Pty) Ltd

Road Safety Appraisals for North Region of Cape Town – Client: Aurecon on behalf of City of Cape Town

Speed Limit Reviews for North Region of Cape Town – Client: Aurecon on behalf of City of Cape Town

Road Safety Audit for the Upgrade of N1 Section 4 Monument River – Client: Aurecon on behalf of SANRAL

Road Safety Audit for the Upgrade of N2 Section 8 Knysna to Wittedrift – Client: SMEC on behalf of SANRAL

Road Safety Audit for the Upgrade of N1 Section 16 Zandkraal to Winburg South – Client: SMEC on behalf of SANRAL

Traffic and Road Safety Studies for the Improvement of N7 Section 2 and Section 3 (Rooidraai and Piekenierskloofpass) – Client: SANRAL

Traffic Engineer for the Upgrade of a 150km Section of the National Route N2 from Kangela to Pongola in KwaZulu-Natal, Client: SANRAL

Annexure B – IMPACT ASSESSMENT METHODOLOGY

Nature (/Status) 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 social functions and processes are not affected or minimally affected. • Medium - affected environment is notably altered; natural and social functions and processes continue albeit in a modified way. • High - natural or social 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.

<table>
<tr><th colspan="7">FLORA
CONSTRUCTION PHASE</th></tr>
<tr><td colspan="2">Potential Impact</td><td colspan="5">Mitigation</td></tr>
<tr><td colspan="2">Proliferation of alien invasive species.</td><td colspan="5">• To prevent unnecessary alien plant infestations, an alien plant monitoring and eradication programme needs to be in place, at least until the disturbed areas have recovered and properly stabilised.
• The construction area and immediate surroundings should be monitored regularly for emergent invasive vegetation.
• Promote awareness of all personnel.
• Larger exotic species that are not included in the Category 1b list of invasive species could also be allowed to remain for aesthetic purposes</td></tr>
<tr><td>Without Mitigation</td><td>Status</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Medium</td><td>Medium-term</td><td>Almost certain</td><td>2</td></tr>
<tr><td>With Mitigation</td><td>Status</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td></td><td>Negative</td><td>Local</td><td>Low</td><td>Short-term</td><td>Likely</td><td>1</td></tr>
</table>

APPENDIX E10: Specialist Declarations

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Kroonstad South / Oslaagte Solar PV Cluster – Social Impact Assessment

Kindly note the following:

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Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Nemai Consulting (PTY) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	1	Percentage Procurement recognition	135%
Specialist name:	Ciaran Chidley			
Specialist Qualifications:	B.Sc (Eng), BA (Econ), MBA			
Professional affiliation/registration:	ECSA, Pr. Eng.			
Physical address:	147 Bram Fischer Drive, Ferndale, 2194			
Postal address:	PO Box 1673, Sunninghill, 2157			
Postal code:	2157	Cell:		
Telephone:	011 781 1730	Fax:		
E-mail:	CiaranC@nemai.co.za			

2. DECLARATION BY THE SPECIALIST

I, ______Ciaran Chidley____________________, 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.

____
Signature of the Specialist

Nemai Consulting (PTY) Ltd
____
Name of Company:

2022/06/02
____
Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, ____Ciaran Chidley____________________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Nemai Consulting (PTY) Ltd

Name of Company

2023/06/02

Date

80369511

SGT MAIANGANSE

Signature of the Commissioner of Oaths

2023.06.02

Date

SOUTH AFRICAN POLICE SERVICE

COMMUNITY SERVICE CENTRE

2023 -06- 02

LINDEN

SUID-AFRIKAANSE POLISIEDIENS

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

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File Reference Number:	
NEAS Reference Number:	DEA/EIA/
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Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Palaeontological Impact Assessment to assess the proposed Oslaagte Solar 2 Photovoltaic Project south east of Kroonstad, Free State Province.

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Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Banzai Environmental (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	Level Four	Percentage Procurement recognition	51%
Specialist name:	Elize Butler			
Specialist Qualifications:	MSc			
Professional affiliation/registration:				
Physical address:	14 Eddie de Beer, Dan Pienaar, Bloemfontein			
Postal address:	14 Eddie de Beer, Dan Pienaar, Bloemfontein			
Postal code:	9301	Cell:	0844478759	
Telephone:		Fax:		
E-mail:	info@banzai-group.com			

2. DECLARATION BY THE SPECIALIST

I, Elize Butler, 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.

Signature of the Specialist

Banzai Environmental

Name of Company:

23 May 2023

Date

2. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Elize Butler, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Banzai Environmental Pty Ltd

Name of Company

22 May 2023

Date

7187037-2 SG7 7SOAEG

Signature of the Commissioner of Oaths

2023-05-22

Date

SUID AFRIKA POLISIE DIENS
PLY CH. MANAGEMENT
2023 -05- 22
BAYSWATER
SOUTH AFRICAN POLICE SERVICE

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

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File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

KROONSTAD SOUTH SOLAR PV PROJECT, FREE STATE PROVINCE.

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473 Steve Biko Road
Arcadia

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Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	NITAI CONSULTING (PTY) LTD.			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	1	Percentage Procurement recognition	
Specialist name:	DIVAN VAN ROOYEN			
Specialist Qualifications:	Ph. D. ENVIRONMENTAL SCIENCE (AQUATIC HEALTH)			
Professional affiliation/registration:	SACNASP (CAN. NAT. SCI. AQUATIC SCIENCE: 151272)			
Physical address:	167 BRAM FISCHER DR. FERNDALE, RANDBURG.			
Postal address:	P.O. BOX 1673, SUNNINGHILL			
Postal code:	2157	Cell:	083 265 8776	
Telephone:	011 781 1730	Fax:		
E-mail:	divan VR@nitaiconsulting.co.za			

2. DECLARATION BY THE SPECIALIST

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;
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- 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.

Signature of the Specialist

Nitai ~~[illegible]~~ CONSULTING (PTY) LTD.

Name of Company:

28/05/2023

Date

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, DIVAN VAN ROOYEN, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

NITAI CONSULTING (PTY) LTD.

Name of Company

28/05/2023

Date

7086002 SQ

Signature of the Commissioner of Oaths

2023-05-28

Date

SOUTH AFRICAN POLICE SERVICE
CSC COMMANDER
2023 -05- 28
DOUGLASDALE
SOUTH AFRICAN POLICE SERVICE

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

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File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Oslaagte Solar PV 2

Kindly note the following:

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473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	The Biodiversity Company			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Dr Lindi Steyn			
Specialist Qualifications:	PhD Biodiversity and Conservation			
Professional affiliation/registration:	SACNASP Pr Sci Nat 119992			
Physical address:	777 Peridot Street Jukskei Park			
Postal address:				
Postal code:	2188	Cell:	0721293759	
Telephone:		Fax:		
E-mail:	lindi@thebiodiversitycompany.com			

2. DECLARATION BY THE SPECIALIST

I, Lindi Steyn, 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;
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- 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.

Signature of the Specialist

The Biodiversity Company

Name of Company:

15/05/2023

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Lindi Steyn, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

The Biodiversity Company

Name of Company

15/05/2023

Date

Signature of the Commissioner of Oaths

15/05/2023

Date

Certified as a true copy of original

Farai Shadreck Mbirimi BD52805
Minister of Religion / Commissioner of Oaths
391 11th Road, Erand, Midrand 1685

Date 15/05/2023

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

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Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Proposed Up To 460 MW Oslaagte Solar 2 Photovoltaic Project South East of Kroonstad, Free State Province

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Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Environmental Assurance (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	2	Percentage Procurement recognition	
Specialist name:	Richard Viljoen			
Specialist Qualifications:	MSc. Environmental Science			
Professional affiliation/registration:				
Physical address:	394 Tram Street, Brooklyn, Gauteng			
Postal address:	394 Tram Street, Brooklyn, Gauteng			
Postal code:	0181	Cell:	071 122 1443	
Telephone:	012 460 9768	Fax:	NA	
E-mail:	richard@envass.co.za			

2. DECLARATION BY THE SPECIALIST

I, Richard Geoffrey Viljoen, 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;
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- 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.

RViljoen

Signature of the Specialist

Environmental Assurance (Pty) Ltd

Name of Company:

2023-05-12

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Richard Viljoen**, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Environmental Assurance (Pty) Ltd

Name of Company

2023-05-12

Date

12/05/2023

Signature of the Commissioner of Oaths

Commisioner of Oaths Ref No: 9/1/8/2 Pretoria
Mandy Lynn Moiring
Manager Postnet Brooklyn Mall

Date

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

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Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Oslaagte Solar PV Project, near Kroonstad, Free State Province

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Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Nitai Consulting (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	1	Percentage Procurement recognition	
Specialist name:	**Jennifer Kitto**			
Specialist Qualifications:	BA Hons			
Professional affiliation/registration:	Association Southern African Professional Archaeologists (ASAPA) International Association for Impact Assessment (South Africa) IAIAsa			
Physical address:	147 Bram Fischer Drive, Randburg 2194,South Africa			
Postal address:	PO Box 1673, Sunninghill, South Africa			
Postal code:	2157	Cell:	+27 63 331 6606	
Telephone:	+27 11 781 1730	Fax:	+27 11 781 1731	
E-mail:	jenniferk@nitaiconsulting.co.za			

2. DECLARATION BY THE SPECIALIST

I, JENNIFER KITTO, 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.

JKitto

Signature of the Specialist

NITAI CONSULTING

Name of Company:

19/05/2023

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, JENNIFER KITTO, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

NITAI CONSULTING

Name of Company

19/05/2023

Date

Signature of the Commissioner of Oaths

19/05/2023

Date