# VREDE PHOTOVOLTAIC SOLAR ENERGY FACILITY, BATTERY ENERGY STORAGE SYSTEM (BESS) AND ASSOCIATED INFRASTRUCTURE
# FREE STATE PROVINCE

Environmental Impact Assessment Report

June 2021

savannah environmental

t +27 (0)11 656 3237 f +27 (0)86 684 0547

e info@savannahsa.com w www.savannahsa.com

**Prepared for:**

South Africa Mainstream Renewable Power Developments (Pty) Ltd
4th Floor Mariendahl House,
Newlands on Main,
Corner Main Road and Campground,
Claremont,
Cape Town

**Prepared by:**

savannah environmental

t +27 (0)11 656 3237 f +27 (0)86 684 0547 e info@savannahsa.com w www.savannahsa.com
First Floor, Block 2, 5 Woodlands Drive Office Park, Cnr Woodlands Drive & Western Service Road, Woodmead, 2191

# PROJECT DETAILS

| | | |
|---|---|---|
| **DEFF Reference** | : | 14/12/16/3/3/2/2038 |
| **Title** | : | Environmental Impact Assessment Process: Environmental Impact Assessment Report for the proposed construction and operation of the 100 MWac Vrede Photovoltaic Solar Energy Facility, Battery Energy Storage System (BESS) and associated infrastructure located near Kroonstad in the Moqhaka Local Municipality, Fezile Dabi District in the Free State Province of South Africa |
| **Authors** | : | Savannah Environmental (Pty) Ltd<br>Gideon Raath<br>Jo-Anne Thomas |
| **Client** | : | South Africa Mainstream Renewable Power Developments (Pty) Ltd |
| **Report Revision** | : | Version 0, first issue |
| **Report Status** | : | Environmental Impact Assessment Report for authority decision making |
| **Date** | : | June 2021 |

**When used as a reference this report should be cited as:** Savannah Environmental (2021) Final Environmental Impact Assessment Report for the Vrede Solar PV facility, Battery Energy Storage System and associated infrastructure, Free State Province.

# PURPOSE OF THE EIA REPORT AND INVITATION TO COMMENT

The Applicant, South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing the construction and operation of the 100MWac Vrede Photovoltaic (PV) Solar Energy Facility (hereafter known as 'the Vrede Solar PV Facility'), Battery Energy Storage System (BESS) and associated infrastructure located near the town of Kroonstad in the Moqhaka Local Municipality (Fezile Dabi District) of the Free State Province of South Africa. The solar energy facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 100MWac. The facility will be located within the Remaining extent of the Farm Vrede No. 1152, and Portion 1 of the Farm Uitval No. 1104. The Vrede Solar PV facility will be connected to the grid via a separately authorised grid connection solution, which will consist of a 132kV distribution line from the on-site 33/132kV Eskom substation via a loop in loop out into the Eskom 132kV Kroonstad Municipality – Theseus 1 switching station power line.

Mainstream appointed Savannah Environmental as the independent environmental consultant to undertake the Environmental Impact Assessment (EIA) for the proposed project. The EIA process being conducted for the Vrede Solar PV Facility is undertaken in accordance with Section 24(5) of the NEMA, which defines the procedure to be followed in applying for Environmental Authorisation (EA), and requires that the potential consequences for, or impacts of, listed or specified activities on the environment be considered, investigated, assessed, and reported on to the competent authority. Listed Activities are activities identified in terms of Section 24 of the NEMA which are likely to have a detrimental effect on the environment, and which may not commence without an EA from the competent authority subject to the completion of an environmental assessment process (either a Basic Assessment (BA) or full Scoping and EIA).

In terms of NEMA, the 2014 EIA Regulations (GNR 326), and Listing Notices (Listing Notice 1 (GNR 327), Listing Notice 2 (GNR 325), and Listing Notice 3 (GNR 324)), the proposed development of the Vrede Solar PV Facility requires Environmental Authorisation (EA) from the National Department of Forestry, Fisheries & the Environment (DFFE) subject to the completion of a full Scoping and Environmental Impact Assessment (S&EIA), as prescribed in Regulations 21 to 24 of the 2014 EIA Regulations (GNR 326). The need for EA subject to the completion of a full S&EIA is triggered by the inclusion of, amongst others, Activity 1 of Listing Notice 2 (GNR 325), namely:

> *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20MW or more."*

In terms of GNR 779 of 01 July 2016, the National DFFE has been determined as the Competent Authority (CA) for all projects which relate to the Integrated Resource Plan for Electricity (IRP) 2010 – 2030, and any updates thereto. Through the decision-making process, the DFFE will be supported by the Free State Department of Economic Development, Tourism and Environmental Affairs (DEDTEA) as the provincial commenting authority.

This Environmental Impact Assessment (EIA) Report represents the findings of the EIA Phase of the EIA process and contains the following chapters:

- **Chapter 1** provides background to the Vrede Solar PV Facility project and the environmental impact assessment.
- **Chapter 2** provides a project description of the Vrede Solar PV Facility.
- **Chapter 3** describes identified project alternatives.

- **Chapter 4** outlines strategic regulatory and legal context for energy planning in South Africa and specifically relating to the project.
- **Chapter 5** describes the need and desirability of Vrede Solar PV Facility.
- **Chapter 6** outlines the approach to undertaking the Scoping/EIA process.
- **Chapter 7** describes the existing biophysical and social environment within and surrounding the study and development area.
- **Chapter 8** provides a description and assessment of the potential issues associated with the proposed solar PV facility and associated infrastructure.
- **Chapter 9** provides a description and assessment of the potential cumulative issues associated with **the** proposed Vrede Solar PV Facility and associated infrastructure.
- **Chapter 10** presents the conclusions and recommendations based on the findings of the EIA for the Vrede Solar PV Facility**.**
- **Chapter 11** provides references used to compile the EIA Report.

The EIA Report was made available for review from **30 April – 01 June 2021** at (http://www.savannahsa.com/public-documents/energy-generation/). All comments received and recorded during the 30-day review and comment period has been included, considered and addressed within this final EIA report submitted for the consideration of the Competent Authority. Changes made in this EIA report for submission have been underlined for ease of reference.

# EXECUTIVE SUMMARY

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing the construction and operation of the 100MWac Vrede Photovoltaic (PV) Solar Energy Facility (hereafter known as 'the Vrede Solar PV Facility'), Battery Energy Storage System (BESS) and associated infrastructure located near the town of Kroonstad in the Moqhaka Local Municipality (Fezile Dabi District) of the Free State Province of South Africa. The facility will be located within the Remaining extent of the Farm Vrede No. 1152, and Portion 1 of the Farm Uitval No. 1104. The Vrede Solar PV facility will be connected to the grid via a separately authorised grid connection solution, which will consist of a 132kV distribution line from the on-site 33/132kV Eskom substation via a loop in loop out into the Eskom 132kV Kroonstad Municipality – Theseus 1 Switching Station power line.

The Vrede Solar PV Facility comprises the following:

- Solar Arrays:
  - Solar Panel Technology - Mono and Bifacial Photovoltaic (PV) Modules;
  - Mounting System Technology – single axis tracking, dual axis tracking or fixed axis tracking PV;
  - Underground cabling (up to 33kV)
  - Centralised inverter stations or string inverters; Power Transformers;
- Building Infrastructure
  - Offices;
  - Operational control centre;
  - Operation and Maintenance Area / Warehouse / workshop;
  - Ablution facilities;
  - Battery Energy Storage System;
  - Substation building.
- Electrical Infrastructure
  - 33/132kV Independent Power Producer (IPP) onsite substation including associated equipment and infrastructure
  - Underground cabling and overhead power lines (up to 33kV)
- Associated Infrastructure:
  - Access roads and Internal gravel roads;
  - Fencing and lighting;
  - Lightning protection
  - Permanente laydown area;
  - Temporary construction camp and laydown area;
  - Telecommunication infrastructure;
  - Stormwater channels;
  - Batching plant (if required);
  - and water pipelines

A development area of approximately 264ha has been identified within the project site by the proponent for the development. Site-specific studies and assessments have delineated areas of potential sensitivity within the identified project site. These have been excluded from the layout proposed for the facility (refer to **Figure 1**).

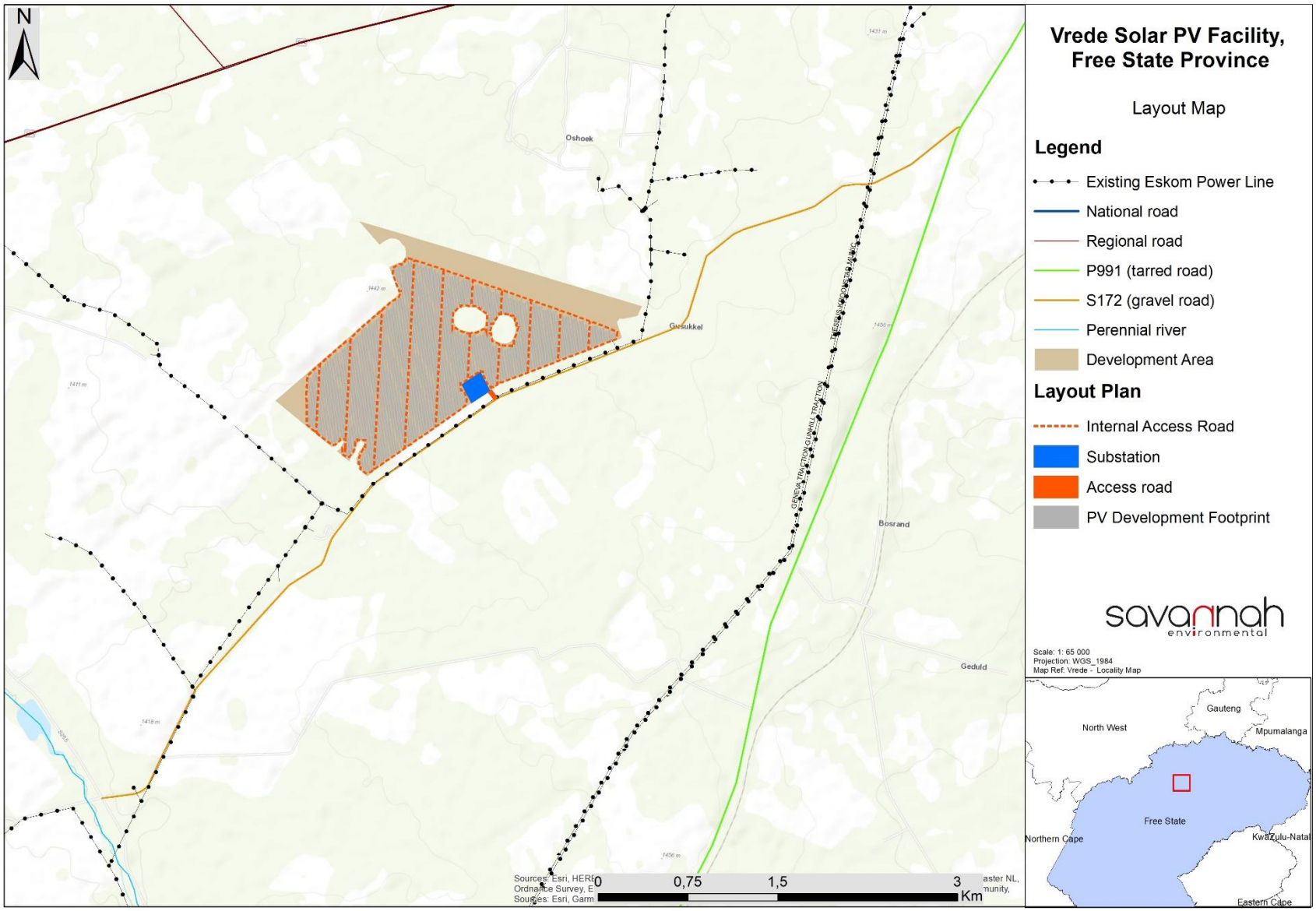


**Figure 1:** Site layout map

No environmental fatal flaws were identified in the detailed specialist studies conducted, provided that the recommended mitigation measures are implemented. These measures include, amongst others, the avoidance of features of high sensitivity within the project development area by the development footprint and the undertaking of monitoring, as specified by the specialists. As shown in Figure 10.1, areas of sensitivity have been avoided by the appropriate placement of infrastructure planned for the facility.

The potential environmental impacts associated with Vrede Solar PV Facility identified and assessed through the EIA process include:

» Impacts on ecology, flora and fauna;
» Impacts on freshwater resources;
» Impacts on avifauna;
» Visual impacts on the area imposed by the components of the facility;
» Impacts on heritage resources, including archaeology and palaeontology;
» Socio- economic impacts;
» Impacts to soils and agricultural potential;
» Risks associated with the BESS; and
» Cumulative impacts.

### *1.* Impacts on Ecology (including flora and fauna)

The Terrestrial Ecology Assessment (**Appendix D**) undertaken determined that there are no impacts associated with the Vrede Solar PV Facility that cannot be mitigated to an acceptable level and as such, the assessed layout was considered acceptable. The most significant potential impacts expected to occur with the development of the proposed Vrede Solar PV Facility are:

» Reduction of a stable vegetation cover and associated below-ground biomass that currently increases soil surface porosity, water infiltration rates and thus improves the soil moisture availability. Without the vegetation, the soil will be prone to extensive surface capping, leading to accelerated erosion and further loss of organic material and soil seed reserves from the local environment.
» Disturbed vegetation in the study area carries a high risk of invasion by alien invasive plants, which may or may not be present in the study area or nearby. The control and continuous monitoring and eradication of alien invasive plants will form and integral part of the environmental management of the facility from construction up to decommissioning.

The majority of impacts associated with the development would occur during the construction phase as a result of the disturbance associated with the operation of heavy machinery at the site and the presence of construction personnel.

The footprint of the development is confined to an area of less than 217 ha, located mostly in an area transformed through historical cultivation practices and overgrazing, and bush encroachment. Approximately 30% of the project site is situated within a CBA1, mainly due to its location within the Vaal-Vet Sandy Grassland which is classified as an Endangered Ecosystem (Mucina & Rutherford, 2006 and National Ecosystem List, GN1002 of 2011). However, during this study it was determined that most of these areas identified as Natural Vaal-Vet Sandy Grassland have been historically subjected to cultivation and vegetation transformation, with small patches of remaining natural vegetation, resembling natural, untransformed Vaal-Vet Sandy Grassland. These patches of natural grassland, collectively, only cover

an area of less than 15% of the proposed project site. Furthermore, most of these patches of natural Vaal-Vet Sandy Grassland along the northern boundary will be avoided, according the development layout. Although the development will impact at a small local scale it is highly unlikely that this development will impact on the status of this vegetation type (impact on a regional scale) as the majority of the development will occur, as mentioned, within mostly transformed habitats.

Sensitive habitat types such as riparian fringes, seepages and other wetland habitat types are avoided (including buffer areas around these habitats) within the current layout and subsequently these areas will not be threatened by the development.

Consequently, there are no highly significant impacts present at the site which cannot be mitigated to a low level and which would represent a red flag for the development, and the development is considered acceptable from an ecological perspective. General Development Recommendations from the specialist assessment include:

- To prevent the onset of accelerated erosion, it is recommended that vegetation clearing be limited to clearing high shrubs, all invasive trees and other alien invasives, even if that means that remaining vegetation will be subjected to vehicle damage (from which it can recover over time). Grading should only be done where absolutely necessary and to mitigate existing erosion channels. If extensive grading will become necessary, it will be advisable to create contour buffer strips to slow down runoff and prevent erosion, which could develop into gully erosion damaging the development in the long run as well.
- It is currently not known which species will be able to persist under the shading of PV arrays, but the establishment of the naturally occurring *Cynodon dactylon* (couch grass), a low creeping grass, should be encouraged. Its dense and deep rooting system will spread to stabilise soil, whilst potentially dense mats could greatly reduce rain splash impact. In addition, its stature and biomass would be too low to present a fire risk.
- All indigenous shrubs that will be cleared should be shredded and added to the soil as mulch.
- Alien species must be removed entirely from site and not used as mulch to prevent the spread of regenerative material.

**2. Impacts on Freshwater Resources**

Solar energy facilities require an initial high intensity disturbance of a fairly large surface area including the clearance of the vegetation cover and the levelling of earth on different terraces where necessary and the compaction of local soil within the development footprint. Concrete foundations for the framework on which the PV panels will be mounted. Soil disturbance, vegetation clearance and hardened surfaces will also be associated with the construction of access and internal roads within the PV solar facility. The internal substation would also need to be constructed within the site. Temporary laydown and storage areas would need to be placed within the site for the construction works.

The Freshwater Resources Assessment (**Appendix F**) identified a number of wetland areas within the development area and were defined as no-go areas. As indicated in Figure 10.1, these features have been avoided by the proposed layout. Indirect impacts on wetland features are however still possible during the construction and operational phases of the project. With the implementation of mitigation measures, impacts will be localised, short-term and of low intensity and is expected to have a moderate-low to low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Based on the findings of the Freshwater Resources Impact Assessment there is no objection to the authorisation of the proposed activities.

### *3.* Impacts on Avifauna

The Avifauna Assessment (**Appendix E**) identified a number of avifauna species using the site, i.e. Egyptian Goose, Fiscal Flycatcher, the South African Shelduck and the Fairy Flycatcher. The avifaunal specialist determined that a 100m solar panel free buffer zone must be implemented around the pans on site (-27.736377° 27.134694°, -27.740910° 27.141575°, -27.741723° 27.144815°) to provide avifauna with unhindered access to the water. In addition, a 100m solar panel free buffer zone must be implemented on both sides of the drainage line on the development area, to maintain a corridor of woodland. The layout presented in **Figure 10.1** above considers the above sensitives by exclusion of these areas from the development footprint and facility layout.

Potential impact associated with the project were identified to include:

Construction
- Displacement of priority species due to disturbance associated with construction of the PV plant and associated infrastructure;
- Displacement of priority species due to habitat transformation associated with construction of the PV plant and associated infrastructure.

Operation
- Mortality of priority species due to collisions with solar panels;
- Entrapment of large-bodied birds in the double perimeter fence;
- Mortality of priority species due to electrocution on the 33kV internal reticulation network.

Decommissioning
- Displacement of priority species due to disturbance associated with decommissioning of the PV plant and associated infrastructure

Cumulative
- Cumulative impact of displacement due to construction and habitat transformation, collisions with solar panels and entrapment in fences.

It was concluded that the proposed facility will have a medium to low negative impact on priority avifauna following mitigation, with no high sensitivity impacts determined. The development is supported provided the mitigation measures listed in this report is strictly implemented. No fatal flaws were discovered in the course of the investigations.

### *4.* Visual Impacts

The findings of the Visual Impact Assessment (**Appendix I**) undertaken for the proposed 100MWac PV facility is that the visual environment surrounding the site, especially within a 1 - 3km radius, may be visually impacted during the anticipated operational lifespan of the facility (i.e. a minimum of 20 years). The following impacts were determined by the visual specialist:

Construction

» Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed solar energy facility.

Operation

» Visual impact on observers travelling along the S172 secondary road and residents at homesteads within a 1km radius of the solar energy facility structures;
» Visual impact on observers travelling along the roads and residents at homesteads within a 1 – 3km radius of the PV facility structures;
» Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed facility;
» The visual impact of solar glint and glare as a visual distraction and possible air travel hazard;
» Visual impact of the ancillary infrastructure during the operation phase on observers in close proximity to the structures;
» The potential impact on the sense of place of the region.

Cumulative

» The potential cumulative visual impact of the solar energy facilities on the visual quality of the landscape.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from moderate to low significance. Anticipated visual impacts on sensitive visual receptors (if and where present) in close proximity to the proposed facility are not considered to be fatal flaws for the proposed PV facility.

Considering all factors, it is recommended that the development of the facility as proposed be supported, subject to the implementation of the recommended mitigation measures (refer Appendix I) and management programme as provided in the specialist report.

***5.* Impacts on Heritage Resources (archaeological and paleontological)**

The area proposed for the development of the Vrede Solar Energy facility was thoroughly assessed in the field assessment as detailed in the Heritage Impact Assessment (Refer **Appendix H**). It was noted that the area proposed for development has been historically disturbed through agricultural activities. Based on the outcomes of this assessment, it is not anticipated that the proposed development of the SEF at Vrede will negatively impact on any archaeological heritage resources. However, due to the nature of archaeological resources, it is possible that significant archaeological heritage may exist below the ground surface and as such, mitigation measures are recommended in this regard below.

The overall palaeontological sensitivity of the areas proposed for the Vrede and Rondavel SEFs and their associated infrastructure is high to very high. The field survey identified a number of areas of possibly fossiliferous outcrops of the underlying bedrock. In addition, examples of fossilised wood were identified on a neighbouring property. Although ex situ, these findings corroborate the high palaeontological sensitivity of the area. In general, it is preferred that excavations take place into fossiliferous bedrock rather than avoiding impact as this allows palaeontologists access to otherwise inaccessible palaeontological resources. The negative impacts of such excavations to palaeontological resources are managed through careful monitoring of excavations into bedrock by a suitably qualified

palaeontologist. It is therefore preferable that excavations do indeed take place on condition that these excavations are properly monitored.

There is no objection to the proposed development on heritage grounds on condition that:

» All excavations into bedrock are monitored by a suitably qualified palaeontologist and a report on the outcomes of the monitoring activities must be submitted to SAHRA on completion of the development of the facility.
» All other excavation activities are subject to the Palaeontological Chance Finds Procedure.
» Should any previously unrecorded archaeological resources or possible burials be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.

**6. Social Impacts**

The Social Impact Assessment (**Appendix J**) indicated that the development of the proposed 100MWac Vrede Solar PV Facility will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust will also benefit the local community. The enhancement measures listed in the SIA report should be implemented in order to maximise the potential benefits. The significance of this impact (establishment of a Community Trust) is rated as High Positive. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the negative environmental and socio-economic impacts associated a coal-based energy economy and the challenges created by climate change, represents a significant positive social benefit for society as a whole. The findings of the SIA also indicated that the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has resulted in significant socio-economic benefits, both at a national level and at a local, community level. These benefits are linked to foreign Direct Investment, local employment and procurement and investment in local community initiatives. The establishment of the proposed 100 MWac Vrede Solar PV Facility was therefore supported by the findings of the SIA.

***7. Impacts on Soil and Agricultural Potential***

The agricultural specialist determined that even though the development footprint includes areas with High agricultural sensitivity, this application may be considered favourably. The area has not been used for crop production since 2005 (according to the land owner) and aerial imagery has confirmed that the area has not been used for annual crops at least the past ten years. The landowner also indicated that crop farming is not a viable option and that he will not return the fields to crop fields again. The farm is currently used for commercial cattle production of 35 head of cattle and can at most provide employment for two farmworkers.

In contrast to that, the proposed Vrede Solar PV Facility will contribute a significant amount of expenditure to the area and employ 250-300 workers during the construction phase and more than 17 workers during the operational phase. In the light of the high number of employment opportunities that will be created per hectare of land, the proposed Vrede solar PV facility is considered an acceptable land use change.

Considering the results of the specialist assessment, the project is considered acceptable on the condition that the mitigation measures stipulated in the report (refer **Appendix G**) are followed to prevent soil erosion and soil pollution and to minimise impacts on the veld quality of the farm portions that will be

affected. The project infrastructure should also remain within the proposed footprint boundaries that will be fenced off and the construction corridor around the access road must be as narrow as possible.

### *8.* Risks Associated with the Battery Energy Storage System

A Battery Energy Storage Systems (BESS) will allow for energy storage for an extended period (of up to 4 hours). The general purpose and utilisation of the BESS will be to save and store excess electrical output from the facility as it is generated, allowing for a timed release to the national grid when the capacity is required. The BESS will be contained within insulated containers on site and will connect to the on-site facility substation via underground cabling which will follow the internal access roads of the facility.

The risks associated with battery technologies are generally well understood and researched. The primary risks relate to fire hazards and the potential for a condition known as 'thermal runaway'. Thermal runaway occurs in situations where an increase in temperature changes the conditions in a way that causes a further increase in temperature, often leading to a destructive result. The risks detailed in the table below considers only the risks associated with on-site use of battery energy storage systems for PV facilities.

Possible risks associated with the construction and operation of the BESS from a technical perspective within the development footprint of Vrede Solar PV Facility are limited to health and safety aspects during the project life cycle of the BESS as well as the solar energy facility. The risks identified for the construction and operation of the BESS are detailed in Chapter 8 of this report. Mitigation measures have been included within the project EMPr (refer to **Appendix K**).

### 9. Assessment of Cumulative Impacts

Cumulative impacts are expected to occur with the development Vrede Solar PV Facility throughout all phases of the project life cycle and within all areas of study considered as part of this EIA Report. The main aim for the assessment of cumulative impacts is to test and determine whether the development will be acceptable within the landscape proposed for the development, and whether the loss, from an environmental and social perspective, will be acceptable without whole-scale change.

There are only 2 other solar facilities proposed within a 30km radius of the Vrede Solar PV facility. Based on the specialist cumulative assessment and findings, the development Vrede Solar PV Facility and its contribution to the overall impact of all existing and proposed solar energy facilities within a 30km radius, it was concluded that cumulative impacts will be of a low to medium significance, with only a high positive impact determined in terms of social cumulative impacts. Therefore, the development of Vrede Solar PV Facility will not result in unacceptable, high cumulative impacts and will not result in a whole-scale change of the environment, and is therefore considered acceptable from a cumulative impact perspective.

### *10.* Environmental Sensitivity Mapping

As part of the specialist investigations undertaken within the project development area, specific environmental features and areas were identified. The environmental features identified within and directly adjacent to the development area and development footprint are illustrated in **Figure 10.2**. The features identified specifically relate to ecological and avifauna habitats and freshwater resources. The

following points provide a description of those features of very high and high sensitivity identified within the development area:

- **Ecological features:**
  - All wetland features are deemed very high ecological sensitivity and a 30m no-go buffer around them is recommended. These are considered no-go regions.
  - High sensitivity areas (within which development is considered acceptable) includes primary grassland.
- **Freshwater features:**
  - All wetland features are deemed high sensitivity and a 30m no-go buffer around them is recommended. These are considered no-go regions.
- **Avifaunal features:**
  - Very High sensitivity (No solar panels – other infrastructure allowed): Surface water features. Included in this category are areas within 100m of the pans on the development area. It is important to leave open space for birds to access and leave the surface water area unhindered. Surface water is also important area for raptors to hunt birds which congregate around water troughs, and they should have enough space for fast aerial pursuit. It is important to note that this only excludes solar panels and not other associated infrastructure related to the development.
  - Very High sensitivity (No solar panels – other infrastructure allowed): Drainage line woodland. Drainage lines are corridors of woodland which provide nesting and foraging opportunities for woodland species which are dependent on this habitat for their survival. The highest density of woodland and trees at the development area is concentrated around the drainage line. A 100m buffer zone should be implemented on both side of the drainage channel. It is important to note that this only excludes solar panels and not other associated infrastructure related to the development.
- **Soils and Agricultural Potential**
  - The largest portion of the development area has land with Moderate (Class 08) land capability that is suitable for dryland crop production. A section along the northern boundary of the site has land with Moderate-High (Class 09) land capability. The remaining areas consist of land with Low-Moderate (Class 06) and Low (Class 05) land capability. The sensitivity rating of the site was also based on land capability classification of the site. Approximately 155.3ha has High agricultural sensitivity, 47.8ha has Medium sensitivity and 9.1ha has Low sensitivity. The development footprint includes areas of all three sensitivity categories. Development in all areas is considered to be acceptable.

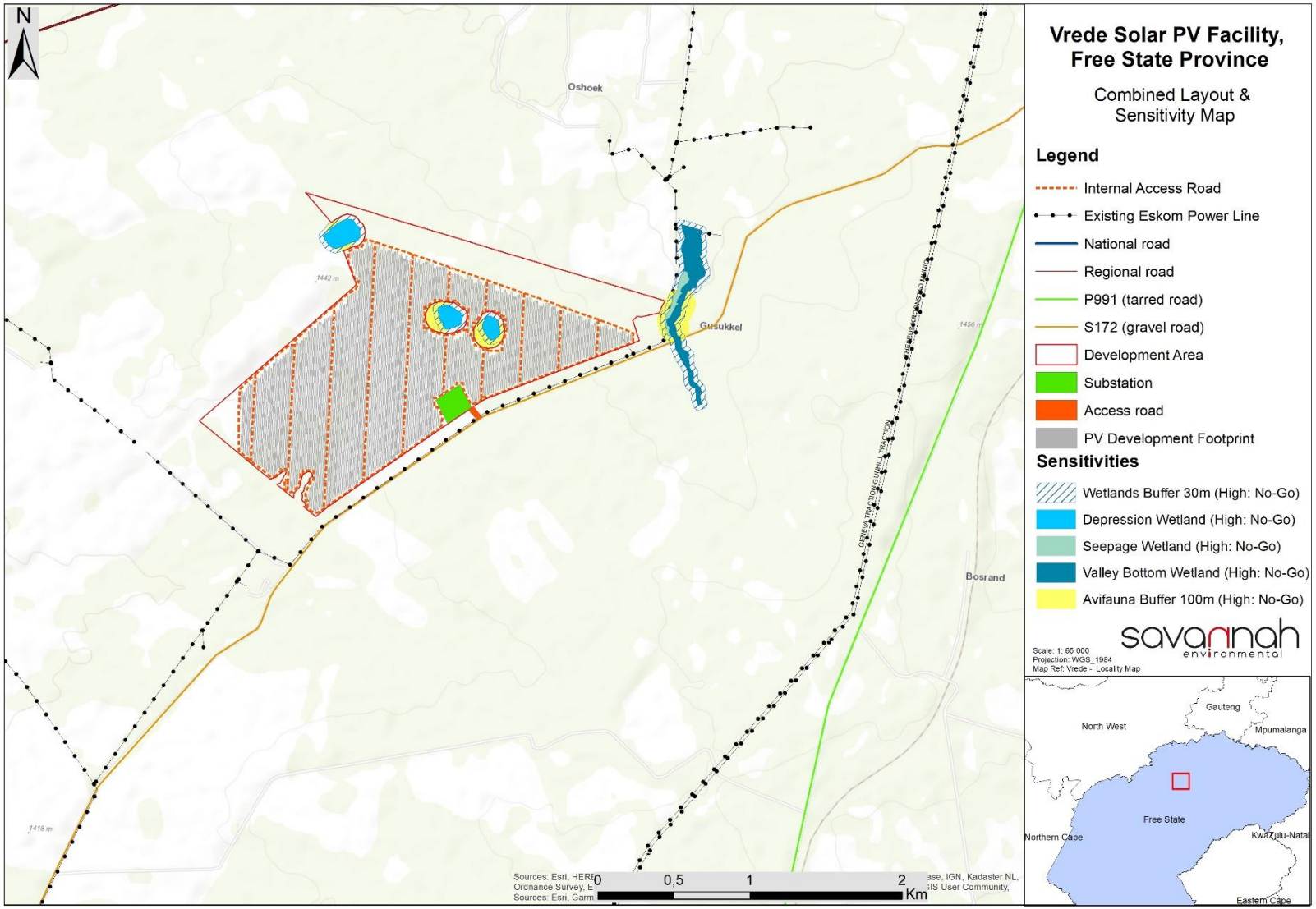


**Figure 2**: Environmental sensitivity map overlain with the layout of the proposed Vrede Solar PV Facility.

## *11.* Overall Conclusion (Impact Statement)

A technically viable development area and development footprint for the Vrede Solar PV facility was proposed by the developer and assessed as part of the EIA process. The environmental assessment of the development footprint (facility layout) within the development area was undertaken by independent specialists and their findings have informed the results of this EIA Report.

The specialist findings have indicated that there are no identified environmental fatal flaws associated with the implementation of Vrede Solar PV facility. The developer had proposed a technically viable layout for the project and associated infrastructure which has been assessed as part of the independent specialist studies. High sensitivity freshwater features, which are regarded as no-go areas, were identified within the development area. The design of the PV array and associated infrastructure to remain outside of this demarcated area minimises environmental impacts as far as possible. The proposed layout is therefore considered as the most appropriate from an environmental perspective and is considered to be acceptable within all fields of specialist study undertaken for the project. All impacts associated with the proposed layout can be mitigated to acceptable levels or enhanced through the implementation of the recommended mitigation or enhancement measures. The layout map included as **Figure 1** is considered to be the preferred facility layout for Vrede Solar PV Facility.

In addition, through the assessment undertaken in this EIA report the following can be concluded regarding the key environmental considerations in terms of the IFC Project Developers Guide for the Vrede Solar PV Facility:

- Construction phase impacts (i.e. OHS, temporary air emissions from dust and vehicle emissions, noise related to excavation, construction and vehicle transit, solid waste generation and wastewater generation from temporary building sites and worker accommodation) will be local in extent and of a low magnitude. The significance of impacts associated with the construction phase will be of a low to medium rating due to the remote location of the site. Those impacts associated with a temporary workforce will be of moderate significance for the local community for the duration of the construction period, as additional people will be residing in the area.
- Water usage (i.e. the cumulative water use requirements) will be kept to a minimum during construction and operation of the project. Appropriate water demand and conservation measures will be implemented.
- Matters relating to the land will be of low significance. The placement of the facility has been undertaken in consultation with the affected landowner, who will enter into a long-term lease agreement with the developer for the facility. There will be no involuntary land acquisition / resettlement associated with this project.
- Landscape and visual impacts (i.e. the visibility of the solar panels within the wider landscape and associated impacts on landscape designations, character types and surrounding communities) will be of low to medium significance and restricted to within 1-3km from the facility.
- Ecology and natural resources (i.e. habitat loss/fragmentation, impacts on designated areas and disturbance or displacement of protected or vulnerable species) will be impacted on by the project. The layout of the facility has been designed to avoid areas of high sensitivity thereby reducing impacts on these resources.
- Cultural heritage (i.e. impacts on the setting of designated sites or direct impacts on below-ground archaeological deposits as a result of ground disturbance during construction) is of low impact significance, and no heritage resources of significance are associated with the development area.

- Transport and access (i.e. impacts of transportation of materials and personnel) related to the project will be appropriately managed, and will make use of existing access roads during construction and operation.
- Consultation and disclosure (i.e. consulting with key authorities, statutory bodies, affected communities and other relevant stakeholders) has been undertaken for the project throughout the entire assessment phase, and documented for inclusion in the assessment of the project. All stakeholders and interested and affected parties have been offered the opportunity to participate in a meaningful way to the EIA for the project.
- An Environmental Management Programme (EMPr) has been compiled to ensure that mitigation measures are identified and taken forward as the project develops (refer to **Appendix K** of EIA Report).

Therefore, through the assessment of the development of the Vrede Solar PV Facility within the development footprint it can be concluded that the development of the facility is environmentally acceptable (subject to the implementation of the recommended mitigation measures).

### *12.* Overall Recommendation

Considering the findings of the independent specialist studies, the impacts identified, the proposed development footprint which avoids all identified no-go/highly sensitive environmental features within the project site, as well as the potential to further minimise the impacts to acceptable levels through mitigation, it is the reasoned opinion of the EAP that the development of the Vrede Solar PV Facility is acceptable within the landscape and can reasonably be authorised. The facility layout is illustrated in **Figure 10.1**. The period for which the Environmental Authorisation is required to remain valid is 10 years from the date of authorisation, with a period of 5 years for the design, planning, construction and commissioning of the activity to be concluded.

The authorisation for Vrede Solar PV Facility would include the following key infrastructure and components:

- Solar Arrays:
  - Solar Panel Technology - Mono and Bifacial Photovoltaic (PV) Modules;
  - Mounting System Technology – single axis tracking, dual axis tracking or fixed axis tracking PV;
  - Underground cabling (up to 33kV)
  - Centralised inverter stations or string inverters; Power Transformers;
- Building Infrastructure
  - Offices;
  - Operational control centre;
  - Operation and Maintenance Area / Warehouse / workshop;
  - Ablution facilities;
  - Battery Energy Storage System;
  - Substation building.
- Electrical Infrastructure
  - 33/132kV Independent Power Producer (IPP) onsite substation including associated equipment and infrastructure
  - Underground cabling and overhead power lines (up to 33kV)
- Associated Infrastructure:
  - Access roads and Internal gravel roads;
  - Fencing and lighting;

- Lightning protection
- Permanente laydown area;
- Temporary construction camp and laydown area;
- Telecommunication infrastructure;
- Batching plant (if required);
- Stormwater channels; and
- Water pipelines

The following key conditions would be required to be included within an authorisation issued for Vrede Solar PV Facility:

» All mitigation measures detailed within this EIA Report, as well as the specialist reports contained within **Appendices D to J** are to be implemented.
» The EMPRs as contained within **Appendix K** and **Appendix R** of this EIA Report should form part of the contract with the Contractors appointed to construct and maintain the Vrede Solar PV Facility in order to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of project is considered key in achieving the appropriate environmental management standards as detailed for this project.
» The high sensitivity wetlands and their associated buffer areas should be regarded as no-go areas for all construction activities.
» The proposed layout must be located within the identified development area. The final layout must be submitted to DFFE for review and approval following detailed design.
» A pre-construction walk-through of the final development footprint for species of conservation concern that would be affected and that can be translocated must be undertaken prior to the commencement of the construction phase.
» Before construction commences individuals of listed species within the development footprint that would be affected, must be counted and marked and translocated, where deemed necessary by the ecologist conducting the pre-construction walk-through survey. Permits from the relevant national and provincial authorities and/or the Department of Forestry, Fisheries, and the Environment (DFFE), must be obtained before the individuals are disturbed.
» The necessary water use authorisation must be obtained from the Department Human Settlements, Water and Sanitation (DHSWS) for impacts to a watercourse and for abstraction of water from natural resources (should this be required) prior to construction.
» The final project footprint must be kept as small as possible and must consider all sensitive environmental features not considered to be suitable for development (as identified by the respective specialists).
» A Chance Find Protocol must be developed and implemented in the event that archaeological or palaeontological resources are found. In the case where the proposed development activities bring these materials to the surface, work must cease and SAHRA must be contacted immediately.
» Alien invasive species management at the site should take place according to the Alien Invasive Management Plan.
» The period for which the Environmental Authorisation is required to remain valid is 10 years from the date of authorisation, with a period of 5 years for the design, planning, construction and commissioning of the activity to be concluded.

# DEFINITIONS AND TERMINOLOGY

**Alternatives:** Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

**Commence:** The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

**Commissioning:** Commissioning commences once construction is completed. Commissioning covers all activities including testing after all components of the wind turbine are installed.

**Construction:** Construction means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity. Construction begins with any activity which requires Environmental Authorisation.

**Cumulative impacts:** 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 (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

**Decommissioning:** To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned. This usually occurs at the end of the life of a facility.

**Development area:** The development area is that identified area (located within the project site) where the Vrede Solar PV Facility is planned to be located. This area has been selected as a practicable option for the facility, considering technical preference and constraints, and has been assessed within this report and by the respective specialists. The development area is ~263ha in extent.

**Development footprint:** The development footprint is the defined area (located within the development area) where the PV panel array and other associated infrastructure for the Vrede PV facility is planned to be constructed. This is the anticipated actual footprint of the facility, and the area which would be disturbed. The exact size of this area is subject to finalisation of the layout, however following initial layout optimisation is ~217ha.

**Direct impacts:** Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation, or maintenance of an activity and are generally obvious and quantifiable.

**'Do nothing' alternative:** The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

**Endangered species:** Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

**Emergency:** An undesired/ unplanned event that results in a significant environmental impact and requires the notification of the relevant statutory body, such as a local authority.

**Endemic:** An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

**Environment:** the surroundings within which humans exist and that are made up of:

i. The land, water and atmosphere of the earth;
ii. Micro-organisms, plant and animal life;
iii. Any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

**Environmental impact:** An action or series of actions that have an effect on the environment.

**Environmental management:** Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

**Environmental management programme:** An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

**Heritage:** That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

**Indigenous:** All biological organisms that occurred naturally within the study area prior to 1800.

**Indirect impacts:** Indirect or induced changes that may occur because of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place because of the activity.

**Interested and affected party:** Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups, and the public.

**Method statement:** A written submission to the ECO and the site manager (or engineer) by the EPC Contractor in collaboration with his/her EO.

**Mitigation hierarchy:** The mitigation hierarchy is a framework for managing risks and potential impacts related to biodiversity and ecosystem services. The mitigation hierarchy is used when planning and implementing development projects, to provide a logical and effective approach to protecting and conserving biodiversity and maintaining important ecosystem services. It is a tool to aid in the sustainable management of living, natural resources, which provides a mechanism for making explicit decisions that balance conservation needs with development priorities

**No-go areas:** Areas of environmental sensitivity that should not be impacted on or utilised during the development of a project as identified in any environmental reports.

**Pollution:** A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.

**Pre-construction:** The period prior to the commencement of construction, this may include activities which do not require Environmental Authorisation (e.g. geotechnical surveys).

**Rare species:** Taxa with small world populations that are not at present Endangered or Vulnerable but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare."

**Red data species:** Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

**Significant impact:** An impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment

# ACRONYMS

| | |
|---|---|
| BGIS | Biodiversity Geographic Information System |
| CBA | Critical Biodiversity Area |
| DFFE | Department Forestry, Fisheries of the Environment (National) |
| DWS | Department of Water and Sanitation |
| CBA | Critical Biodiversity Area |
| CR | Critically Endangered |
| CSIR | Council for Scientific and Industrial Research |
| DM | District Municipality |
| DMRE | Department of Mineral Resources Energy |
| EAP | Environmental Assessment Practitioner |
| EGIS | Environmental Geographic Information System |
| EIA | Environmental Impact Assessment |
| EMF | Environmental Management Framework |
| EMP | Environmental Management Plan |
| EMPr | Environmental Management Programme |
| EN | Endangered |
| EP | Equator Principles |
| ESA | Ecological Support Area |
| GA | General Authorisation |
| GHG | Greenhouse Gas |
| IBA | Important Bird Area |
| IDP | Integrated Development Plan |
| IEM | Integrated Environmental Management |
| IEP | Integrated Energy Plan |
| IFC | International Finance Corporation |
| IPP | Independent Power Producer |
| IRP | Integrated Resource Plan |
| IUCN | International Union for Conservation of Nature |
| I&AP | Interested and Affected Party |
| Km | Kilometre |
| kWh | Kilowatt hour |
| LC | Least Concern |
| LM | Local Municipality |
| LNG | Liquid Natural Gas |
| M | Metre |
| $m^2$ | Square meters |
| $m^3$ | Cubic meters |
| m amsl | Metres Above Mean Sea Level |
| MW | Megawatts |
| NDP | National Development Plan |
| NEMA | National Environmental Management Act (No. 107 of 1998) |
| NEM:AQA | National Environmental Management: Air Quality Act (No. 39 of 2004) |
| NEM:BA | National Environmental Management: Biodiversity Act (No. 10 of 2004) |
| NEM:WA | National Environmental Management: Waste Act (No. 59 of 2008) |
| NFA | National Forests Act (No. 84 of 1998) |

| | |
|---|---|
| NFEPA | National Freshwater Ecosystem Priority Area |
| NHRA | National Heritage Resources Act (No. 25 of 1999) |
| NT | Near Threatened |
| NWA | National Water Act (No. 36 of 1998) |
| ONA | Other Natural Area |
| PA | Protected Area |
| REIPP | Renewable Energy Independent Power Producer Procurement |
| SAHRA | South African Heritage Resources Agency |
| SAHRIS | South African Heritage Resources Information System |
| SAIAB | South African Institute for Aquatic Biodiversity |
| SANBI | South African National Biodiversity Institute |
| SDF | Spatial Development Framework |
| TOPS | Threatened or Protected Species |
| VU | Vulnerable |

# TABLE OF CONTENTS

# APPENDICES LIST

**Appendix A:** EIA Project Consulting Team CVs
**Appendix B:** Authority Correspondence
**Appendix C:** Public Participation Process
*Appendix C1:* *I&AP Database*
*Appendix C2:* *Site Notices and Newspaper Advertisements*
*Appendix C3:* Background *Information Document*
*Appendix C4:* *Organs of State Correspondence*
*Appendix C5:* *Stakeholder Correspondence*
*Appendix C6:* *Comments Received*
*Appendix C7:* *Minutes of Meetings*
*Appendix C8:* *Comments and Responses Report*
*Appendix C9:* *Public Participation Plan and Approval*
**Appendix D:** Ecology Impact Assessment
**Appendix E:** Avifauna Impact Assessment
**Appendix F:** Freshwater Impact Assessment
**Appendix G:** Soils and Agricultural Potential Compliance Statement
**Appendix H:** Heritage and Palaeontological Impact Assessment
**Appendix I:** Visual Impact Assessment
**Appendix J:** Social Impact Assessment
**Appendix K:** Environmental Management Programme (EMPr) (Facility)
**Appendix L:** A3 Maps
**Appendix M:** EAP Affirmation and Declaration of Independence
**Appendix N:** DFFE National web-based screening report
**Appendix O:** Specialist Declarations
**Appendix P:** Animal and Plant species protocol letter
**Appendix Q:** Project Coordinates
**Appendix R:** Generic Environmental Management Programme (EMPr) (on site substation)

# CHAPTER 1 INTRODUCTION

South Africa Mainstream Renewable Power Developments (Pty) ('Mainstream') is proposing the construction and operation of the 100MWac Vrede Photovoltaic (PV) Solar Energy Facility (hereafter known as 'the Vrede Solar PV Facility'), Battery Energy Storage System (BESS) and associated infrastructure (DFFE ref: 14/12/16/3/3/2/2038) located near the town of Kroonstad in the Moqhaka Local Municipality (Fezile Dabi District) of the Free State Province of South Africa (refer to **Figure 1.1**). The solar energy facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 100MWac. The facility will be located within the Remaining extent of the Farm Vrede No. 1152, and Portion 1 of the Farm Uitval No. 1104. The Vrede Solar PV facility will be connected to the grid via a separately authorised grid connection solution[1], which will consist of a 132kV distribution line from the on-site 33/132kV IPP substation via a loop in loop out into the Eskom 132kV Kroonstad Municipality – Theseus 1 Switching Station power line.

The PV facility is planned to be located a short distance from the proposed Rondavel 100MW Solar PV Facility, which is planned nearer to Kroonstad (and is the subject of a separate application for environmental authorisation and Environmental Impact Assessment (EIA) process – DFFE Ref: 14/12/16/3/3/2/2039). The broader project region is currently being utilised for agriculture, primary rainfed annual crop cultivation or planted pastures, although no cultivation or game farming activities have taken place on the farm parcels planned for this development over the last ten years. Site-specific studies and assessments undertaken as part of the EIA process aim to delineate areas of potential sensitivity within the identified project site[2]. Once constraining factors have been confirmed, the layout of the solar PV facility can be planned to minimise social and environmental impacts. The location of the development area[3], located within the project site, is indicated in **Figure 1.2**.

From a regional perspective, the Kroonstad area is considered favourable for the development of a commercial solar energy facility (SEF) by virtue of prevailing climatic conditions, relief, aspect, the extent of the affected property, the availability of nearby grid connection (i.e. a point of connection to the national grid) and the availability of land on which the development can take place.

The Vrede SEF is planned to be bid into the Department of Mineral Resource and Energy's (DMRE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, or similar suitable procurement programmes under the Integrated Resource Plan (IRP 2019, and any updates thereto), with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply with Vrede SEF set to inject up to 100MWac into the national grid.

[1] The grid connection solution for the Vrede Solar PV facility forms part of a separate application for environmental authorisation subject to a Basic Assessment, to be submitted in due course. This application will be submitted separately and does therefore not form part of this assessment.

[2] The project site is defined as the remaining extent of the farm Vrede No. 1152 and Portion 1 of the farm Uitval No. 1104, which combined have the extent of ~ 538ha.

[3] The development area is that identified area (located within the project site) where the Vrede Solar PV Facility is planned to be located. This area has been selected as a practicable option for the facility, considering technical preference and constraints. The development area is ~263ha in extent.

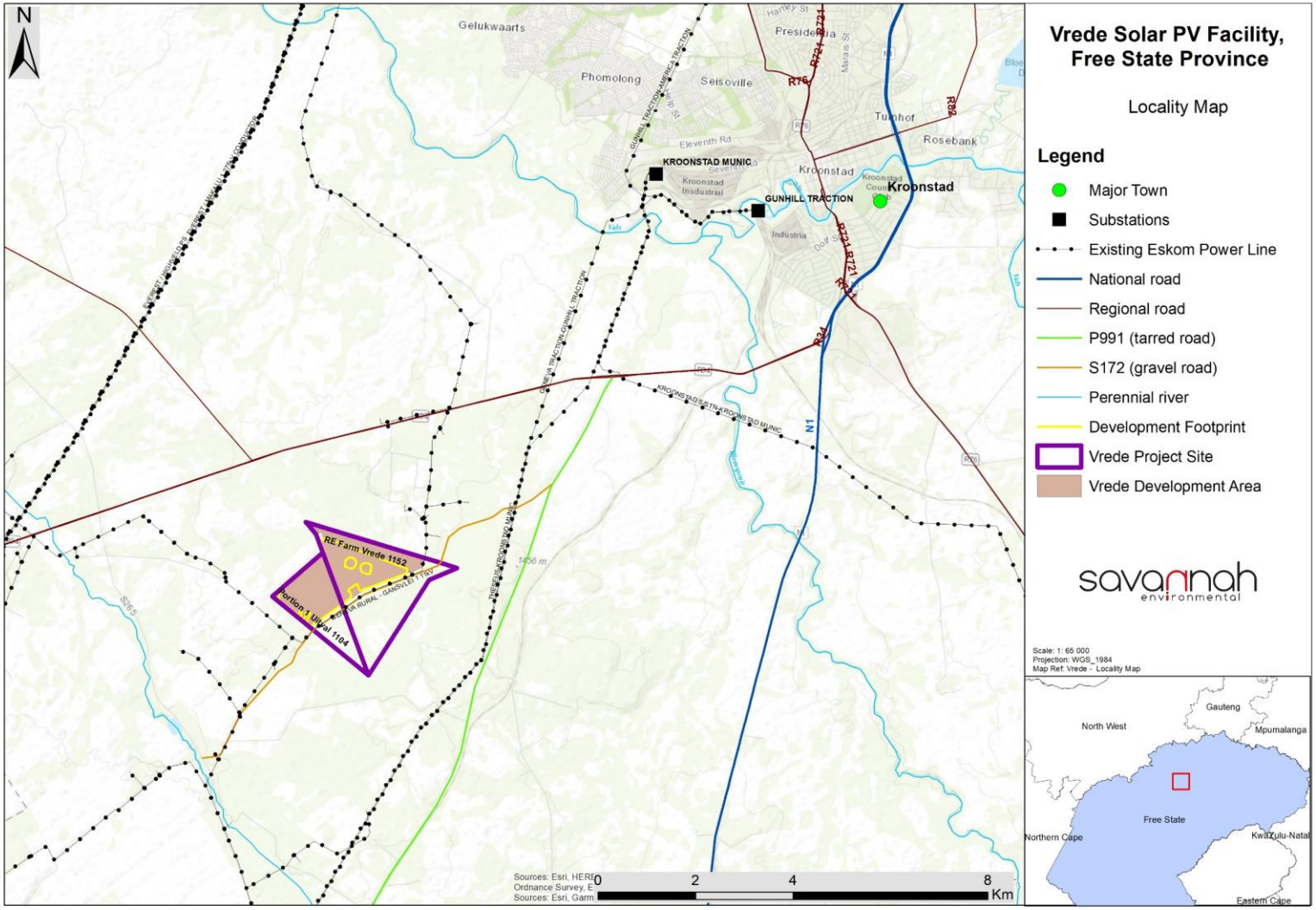


**Figure 1.1:** Locality map illustrating the location of the Vrede Solar Energy Facility project site on the Remaining extent of the farm Vrede No.1152, and Portion 1 of the Farm Uitval No. 1104 (refer to **Appendix J** for A3 maps).

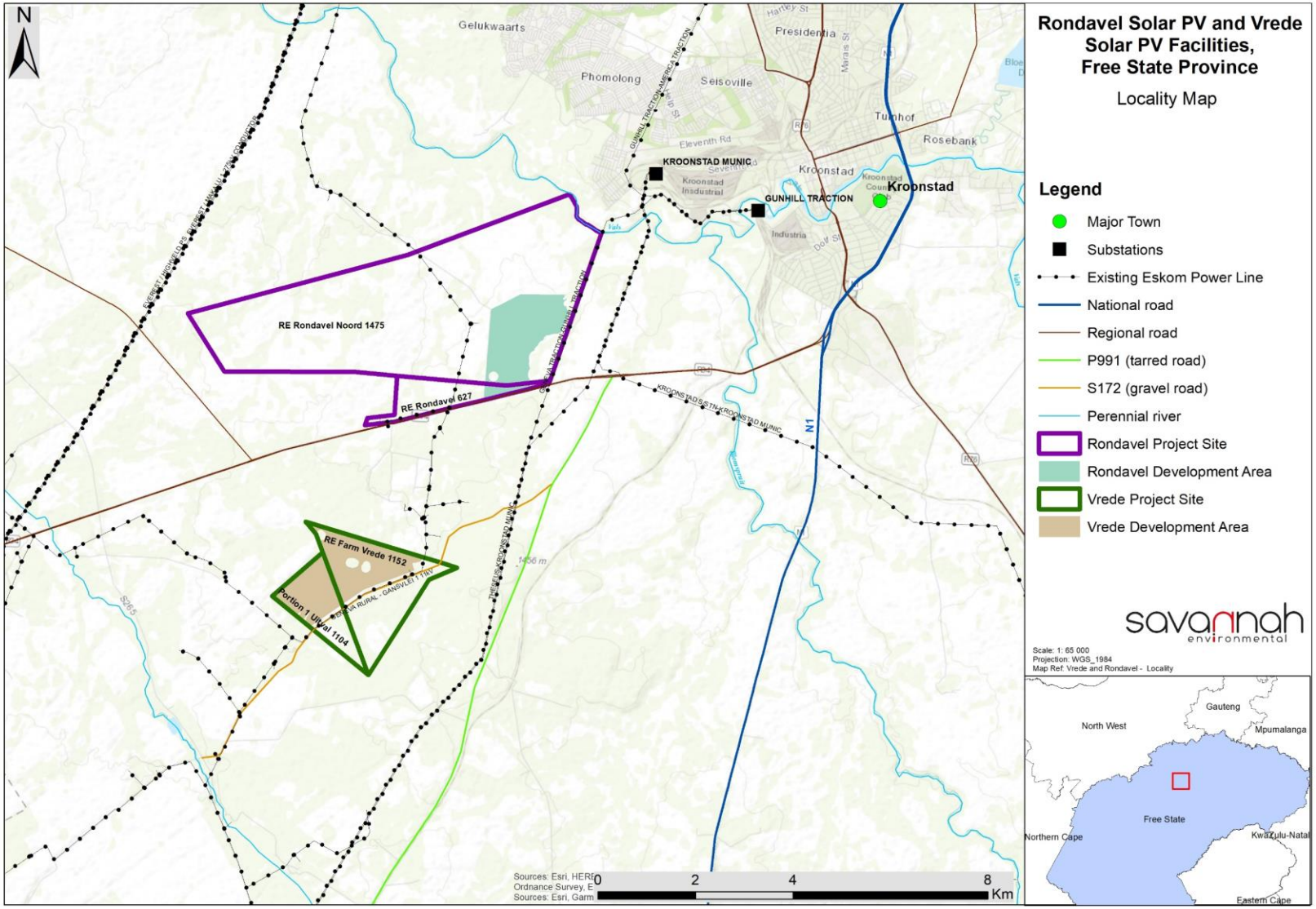


**Figure 1.2:** Locality map illustrating the locations of the planned Rondavel Solar PV Facility development area in relation to that of the Vrede Solar PV facility.

## 1.1 Project Overview

The project site has been identified by Mainstream as a technically feasible site which has the potential for the development of a solar PV facility, including a Battery Energy Storage System (BESS) through the consideration of a number of technical factors (refer to Chapter 3 for more details). During the Scoping Phase, the full extent of the project site (i.e. ~ 538ha) was considered to determine the suitability from an environmental and social perspective and identify areas that should be avoided in development planning. A development area of approximately 263ha has been identified within the project site by the proponent for the development. The PV infrastructure for the project is to be located within this area. A project development footprint, of ~217ha in extent has been identified for the placement of infrastructure, avoiding identified areas of sensitivity. Since the development area is larger than the area required for the development footprint, it provides the opportunity for the optimal placement of the infrastructure, ensuring avoidance of identified environmental sensitives where possible.

The table below provides an overview of the Vrede Solar PV development.

**Table 1.1:** A detailed description of the project.

| | |
|---|---|
| **Province** | **Free State Province** |
| **District Municipality** | Fezile Dabi District Municipality |
| **Local Municipality** | Moqhaka Local Municipality |
| **Ward Number (s)** | No. 7 |
| **Nearest town(s)** | Kroonstad (~13km north-east) |
| **Farm name(s) and number(s) of properties affected by the Solar Facility** | • Vrede No. 1152<br>• Uitval No. 1104 |
| **Portion number(s) of properties affected by the Solar Facility** | • Remaining extent of the farm Vrede No. 1152; and<br>• Portion 1 of the Farm Uitval No. 1104. |
| **SG 21 Digit Code (s)** | • Remaining extent of the Farm Vrede No. 1152: F02000000000115200000; and<br>• Portion 1 of the Farm Uitval No. 1104: F02000000000110400001. |
| **Current zoning** | Agricultural |
| **Site Coordinates (centre of development area)** | Latitude: 27°44'42.84"S;<br>Longitude: 27° 8'11.34"E |

PV technology is proposed to be utilised for the generation of electricity, and the facility will have a contracted capacity of up to 100MWac. Infrastructure associated with the solar PV facility will include the following:

» Solar Arrays:
- Solar Panel Technology - Mono and Bifacial Photovoltaic (PV) Modules;
- Mounting System Technology – single axis tracking, dual axis tracking or fixed axis tracking PV;
- Underground cabling (up to 33kV)
- Centralised inverter stations or string inverters; Power Transformers;

» Building Infrastructure
- Offices;
- Operational control centre;
- Operation and Maintenance Area / Warehouse / workshop;

- Ablution facilities;
- Battery Energy Storage System;
- Substation building.

» Electrical Infrastructure
- 33/132kV Independent Power Producer (IPP) onsite substation including associated equipment and infrastructure
- Underground cabling and overhead power lines (up to 33kV)

» Associated Infrastructure:
- Access roads and Internal gravel roads;
- Fencing and lighting;
- Lightning protection
- Permanente laydown area;
- Temporary construction camp and laydown area;
- Telecommunication infrastructure;
- Batching plant (if required);
- Stormwater channels;
- and water pipelines.

The key infrastructure components proposed as part of the facility are described in greater detail in Chapter 2 of this EIA Report.

The overarching objective for the Vrede Solar PV Facility is to maximise electricity production through exposure to the available solar resource, while minimising infrastructure, operational and maintenance costs, as well as potential social and environmental impacts. In order to meet these objectives, local level environmental and planning issues was assessed through the EIA process with the aid of site-specific specialist studies in order to delineate areas of sensitivity within the identified project site which served to inform and optimise the design of the solar PV facility.

## 1.2 Requirement for an Environmental Impact Assessment Process

Section 24 of the National Environmental Management Act (No. 107 of 1998) (NEMA) pertains to Environmental Authorisations (EA), and requires that the potential consequences for, or impacts of, listed or specified activities on the environment be considered, investigated, assessed, and reported on to the Competent Authority (CA). The 2014 Environmental Impact Assessment (EIA) Regulations, as amended, published under NEMA prescribe the process to be followed when applying for Environmental Authorisation (EA), while the Listing Notices[4] (Listing Notice 1 (GNR 983, as amended), Listing Notice 2 (GNR 984, as amended), and Listing Notice 3 (GNR 985, as amended) contain those activities which may not commence without EA from the CA.

The proposed development requires Environmental Authorisation (EA) from the National Department of Forestry Fisheries and Environment, (DFFE) subject to the completion of a full Scoping and Environmental Impact Assessment (S&EIA), as prescribed in Regulations 21 to 24 of the 2014 EIA Regulations (GNR 982, as amended). The need for EA, subject to the completion of a full Scoping and Environmental Impact

[4] GNR 983, 984 and 985 (2014), as amended 2017 (GNR 324 ,325, 327)

Assessment (S&EIR), is triggered by the inclusion of, amongst others, Activity 1 of Listing Notice 2 (GNR 984, as amended)[5], namely:

> *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20MW or more."*

In terms of GNR 779 of 01 July 2016, the National DEFF has been determined as the Competent Authority for all projects which relate to the Integrated Resource Plan for Electricity (IRP) 2010 – 2030, and any updates thereto. Through the decision-making process, the DEFF will be supported by the Free State Department of Economic Development, Tourism and Environmental Affairs as a commenting authority.

## 1.3 Legal Requirements as per the EIA Regulations, 2014 (as amended) for the undertaking of an Impact Assessment Report

This EIA Report has been prepared in accordance with the requirements of the EIA Regulations, 2014 (as amended) promulgated in terms of Chapter 5 of the National Environmental Management Act (Act No 107 of 1998). This chapter of the EIA Report includes the following information required in terms of Appendix 3: Content of Scope of Assessment and Content of Environmental Impact Assessment Report:

| Requirement | Relevant Section |
|---|---|
| (a) (i) the details of the EAP who prepared the report and (ii) the expertise of the EAP to carry out scoping procedures; including a curriculum vitae | The details of the EAP who prepared the report is included in **Section 1.5**. The Curriculum vitae of the Savannah Environmental team has been included as **Appendix A**. |
| (b) the location of the activity, including (i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties | The location of the proposed development has been included under **Section 1.1** and within **Table 1.1**. |
| (c) a plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken | A locality map illustrating the location of the proposed development has been included as **Figure 1.1**. |

This EIA Report consists of eleven chapters, which include:

- **Chapter 1** provides background to the Vrede Solar PV Facility project and the environmental impact assessment.
- **Chapter 2** provides a project description of the Vrede Solar PV Facility.
- **Chapter 3** describes identified project alternatives.
- **Chapter 4** outlines strategic regulatory and legal context for energy planning in South Africa and specifically relating to the project.
- **Chapter 5** describes the need and desirability of Vrede Solar PV Facility.

[5] Refer to **Chapter 6** for a full list of applicable listed activities.

- **Chapter 6** outlines the approach to undertaking the Scoping/EIA process.
- **Chapter 7** describes the existing biophysical and social environment within and surrounding the study and development area.
- **Chapter 8** provides a description and assessment of the potential issues associated with the proposed solar PV facility and associated infrastructure.
- **Chapter 9** provides a description and assessment of the potential cumulative issues associated with the proposed Vrede Solar PV Facility and associated infrastructure.
- **Chapter 10** presents the conclusions and recommendations based on the findings of the EIA for the Vrede Solar PV Facility**.**
- **Chapter 11** provides references used to compile the EIA Report.

## 1.4 Overview of this Environmental Impact Assessment (EIA) Process

An EIA is an effective planning and decision-making tool for the project developer as it allows for the identification and management of potential environmental impacts. It provides the opportunity for the developer to be forewarned of potential environmental issues and allows for the resolution of the issues reported on in the Scoping and EIA reports as well as dialogue with interested and affected parties (I&APs).

The EIA process comprised of two (2) phases (i.e. Scoping and Impact Assessment) and involves the identification and assessment of potential environmental impacts through the undertaking of independent specialist studies, as well as public participation. The processes followed in these two phases is as follows:

- The **Scoping Phase** included the identification of potential issues associated with the project through a desktop study (considering existing information) and consultation with affected parties and key stakeholders. This phase considers the broader project site in order to identify and delineate any environmental fatal flaws, no-go and / or sensitive areas. Following a public review period of the Scoping report, this phase culminated in the submission of a final Scoping Report and Plan of Study for the EIA to the CA for consideration and acceptance.
- The **EIA Phase** involved a detailed assessment of the potentially significant positive and negative impacts (direct, indirect, and cumulative) identified in the Scoping Phase. This phase considered a proposed development footprint within the project site and includes detailed specialist investigations as well as public consultation. Following a public review period of the EIA Report, this phase culminated in the submission of a final EIA Report and an Environmental Management Programme (EMPRs), including recommendations of practical and achievable mitigation and management measures, to the CA for final review and decision-making.

## 1.5 Appointment of an Independent Environmental Assessment Practitioner (EAP)

In accordance with Regulation 12 of the 2014 EIA Regulations (GNR 982, as amended), the applicant has appointed Savannah Environmental (Pty) Ltd as the independent environmental consultants responsible for managing the Application for EA and supporting Scoping and Environmental Impact Assessment (S&EIA) process; inclusive of comprehensive, independent specialist studies. The application for EA and S&EIA process will be managed in accordance with the requirements of NEMA, the 2014 EIA Regulations, and all other relevant applicable legislation.

Neither Savannah Environmental nor any of its specialist consultants are subsidiaries of, or are affiliated to the Applicant. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed facility.

### 1.6 Details and Expertise of the Environmental Assessment Practitioner (EAP)

Savannah Environmental is a leading provider of integrated environmental and social consulting, advisory and management services with considerable experience in the fields of environmental assessment and management. The company is wholly woman-owned (51% black woman-owned) and is rated as a Level 2 Broad-based Black Economic Empowerment (B-BBEE) Contributor. Savannah Environmental's team have been actively involved in undertaking environmental studies since 2006, for a wide variety of projects throughout South Africa, including those associated with electricity generation and infrastructure development.

The Savannah Environmental team for this project includes:

» **Gideon Raath** is the principle the author of this report, and EAP for the project. Gideon holds an MSc (Geography and Environmental Management; SU), a BSc Honours (Ecology and Environmental Studies - Cum laude; Wits) and a BSc (Geography and Environmental Management; UJ), and has been accredited with SACNASP as a professional natural scientist (Pr.Sci.Nat) since 2017 (registration no. 117178). Gideon's experience includes EIA permitting for ~94 different projects across 6.5 years, ranging from infrastructure, mining, energy, housing, renewable energy and the conservation industries. These include Environmental Authorisations (BAR, S&EIR), Water Use Licencing, Waste Licencing, Environmental Compliance Officer auditing, GIS studies and MPRDA permitting. He therefore has wide ranging experience with various legislation including NEMA, NHRA, NEM:WA, NEM:BA, MPRDA and NWA regulations, having applied them for numerous private and public sector clients across various industries for small, medium and large projects. Gideon also has experience beyond the permitting sphere through numerous screening assessments for potential developers, including fatal flaw screenings, regulatory and permitting approval screening as well as ecological and hydrological sensitivity screening. Gideon has also served in an advisory role for various infrastructure and mining projects, assisting with environmental due diligence, bankable feasibility study input and assistance towards financial close, most recently in the Renewable Energy sphere under the Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP).

» **Jo-Anne Thomas** holds a Master of Science Degree in Botany (M.S.c Botany) from the University of the Witwatersrand and is registered as a Professional Natural Scientist (400024/2000) with the South African Council for Natural Scientific Professions (SACNASP) and a registered Environmental Assessment Practitioner (EAP) with the Environmental Assessment Practitioners Association of South Africa (EAPASA) (2019/726). She has over 20 years of experience in the field of environmental assessment and management, and the management of large environmental assessment and management projects. During this time, she has managed and coordinated a multitude of large-scale infrastructure EIAs and is also well versed in the management and leadership of teams of specialist consultants, and dynamic stakeholders. She has been responsible for providing technical input for projects in the environmental management field, specialising in Strategic Environmental Advice, EIA studies, environmental permitting, public participation, EMPs and EMPrs, environmental policy, strategy and guideline formulation, and integrated environmental management (IEM). Her responsibilities for environmental studies include project management, review and integration of specialist studies, identification and assessment of

potential negative environmental impacts and benefits, and the identification of mitigation measures, and compilation of reports in accordance with applicable environmental legislation.
»

» **Nicolene Venter** – holds a Higher Secretarial Diploma and has over 20 years of experience in public participation, stakeholder engagement, awareness creation processes and facilitation of various meetings (focus group, public meetings, workshops, etc.). She is responsible for project management of public participation processes for a wide range of environmental projects across South Africa and neighbouring countries.

Curricula Vitae (CVs) detailing Savannah Environmental team's expertise and relevant experience are provided in **Appendix A**.

In order to adequately identify and assess potential impacts associated with the project, a number of independent specialist consultants have provided specialist input into the EIA process. The specialists have prepared assessment reports, which have informed and are appended to the EIA Report (Refer **Appendices D – J**).

Following comment received from the DFFE on the draft EIA report review, and in addition to the undertaking under oath and affirmation by the EAP (refer **Appendix M**), the following is hereby confirmed that this report (and associated appendices) contain:

(i) The correctness of the information provided in the reports;
(ii) The inclusion of comments and inputs from stakeholders an I&APs;
(iii) The inclusion of inputs and recommendations from the specialist reports where relevant; and
(iv) Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties.

# CHAPTER 2 PROJECT DESCRIPTION

This Chapter provides a description of the Vrede Solar PV Facility and associated infrastructure proposed for development. It must be noted that the project description presented in this Chapter may change to some extent based on the outcomes and recommendations of detailed engineering and other technical studies, the findings and recommendations of this EIA Report and supporting specialist studies, and any licencing, permitting, and legislative requirements.

## 2.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter of the EIA Report includes the following information required in terms of Appendix 3: Scope of Assessment and Content of the Environmental Impact Assessment Report:

| Requirement | Relevant Section |
|---|---|
| (d) a description of the proposed activity, including (ii) a description of the associated structures and infrastructure related to the development | A description of the associated structures and infrastructure is included in **Section 2.5**. Activities to be undertaken during the various project development phases is included in **Section 2.6**. |
| (h) a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including: (i) details of the development footprint alternatives considered; | Refer to **Section 2.3** for a description of the selection of the proposed project site and development area. |

## 2.2 Project Site Overview

The Vrede Solar PV Facility is to be developed on the Remaining extent of the Farm Vrede No. 1152 and Portion 1 of the Farm Uitval No. 1104, located approximately 13km south-west of the town of Kroonstad in the Free State Province. The project site falls in Ward 7 of the Moqhaka Local Municipality, within the greater Fezile Dabi District Municipality.

From a technical perspective, the Kroonstad area is considered favourable for the development of commercial solar energy facilities by virtue of the prevailing climatic conditions (primarily as the economic viability of a solar energy facility is directly dependent on the annual solar irradiation values for a particular area), relief and aspect, the extent of the project site and development area, the availability of a direct grid connection (i.e. point of connection to the national Eskom grid), and the availability of land on which development can take place.

During the Scoping Phase, the full extent of the project site (i.e. ~ 538ha) was considered, within which the development area for the project (~263ha) was appropriately located from a technical perspective. The purpose of assessing the full extent of the development area during the Scoping Phase was to determine the suitability from an environmental and social perspective, and identify areas that should be avoided in development planning. Based on the existing information, areas of environmental sensitivity were identified within the development area.

In order to avoid these areas of potential sensitivity identified during the Scoping Phase and to ensure that potential detrimental environmental impacts are minimised as far as possible, the developer identified a suitable development area within the broader development site, and planned the PV infrastructure for the project to be located within this area (that is the project development footprint, ~217ha in extent).

**Table 2.1** provides a summary of the footprints for the Vrede Solar PV Facility considered within this EIA process.

**Table 2.1** A description of footprints for the Vrede Solar PV Facility.

| Footprint | Description and Extent |
|---|---|
| Project site | The project site is defined as the remaining extent of the Farm Vrede No. 1152 and Portion 1 of the Farm Uitval No. 1104, which combined have the extent of ~ 538ha. |
| Development area | The development area is that identified area (located within the project site) where the Vrede Solar PV Facility is planned to be located. This area has been selected as a practicable option for the facility, considering technical preference and constraints. The development area is ~263ha in extent. |
| Development footprint | The development footprint is the defined area (located within the development area) where the PV panel array and other associated infrastructure for the Vrede PV facility is planned to be constructed. This is the anticipated actual footprint of the facility, and the area which would be disturbed. The exact size of this area is subject to finalisation of the layout, however following initial layout optimisation is ~217ha. |

The development footprint includes the following:

- Solar Arrays:
  - Solar Panel Technology - Mono and Bifacial Photovoltaic (PV) Modules;
  - Mounting System Technology – single axis tracking, dual axis tracking or fixed axis tracking PV;
  - Underground cabling (up to 33kV)
  - Centralised inverter stations or string inverters; Power Transformers;
- Building Infrastructure
  - Offices;
  - Operational control centre;
  - Operation and Maintenance Area / Warehouse / workshop;
  - Ablution facilities;
  - Battery Energy Storage System;
  - Substation building.
- Electrical Infrastructure
  - 33/132kV Independent Power Producer (IPP) onsite substation including associated equipment and infrastructure
  - Underground cabling and overhead power lines (up to 33kV)
  - Associated Infrastructure:
  - Access roads and Internal gravel roads;
  - Fencing and lighting;
  - Lightning protection
  - Permanente laydown area;
  - Temporary construction camp and laydown area;
  - Telecommunication infrastructure;
  - Batching Plant (if required);

- Stormwater channels; and
- Water pipelines.

**Table 2.2** provides information regarding the proposed project site identified for the Vrede Solar PV facility (refer also to **Figure 2.1**).

**Table 2.2:** A description of the project site identified for Vrede Solar PV facility.

| | | |
|---|---|---|
| **Province** | Free State Province | |
| **District Municipality** | Fezile Dabi District Municipality | |
| **Local Municipality** | Moqhaka Local Municipality | |
| **Ward Number(s)** | No. 7 | |
| **Nearest Town(s)** | Kroonstad (~13km north-east) | |
| **Farm Portion(s), Name(s) and Number(s) associated with the Facility** | Remaining extent of the Farm Vrede No. 1152; and<br>Portion 1 of the Farm Uitval No. 1104. | |
| **SG 21 Digit Code (s)** | F02000000000115200000 (Vrede) | F02000000000110400001 (Uitval) |
| **Current Zoning** | Agricultural | |
| **Current land use** | The properties both currently lie fallow, having been used historically for agriculture | |
| **Development Footprint** | ~ 217 ha | |
| **Site Co-ordinates** | The centre of the development area is located at the following co-ordinate:<br><br>• Latitude: 27°44'42.84"S;<br>• Longitude: 27° 8'11.34"E<br><br>Please also refer to **Appendix Q** for a complete listing of the relevant coordinates relating to the proposed project infrastructure. | |

## 2.3 Summary of Site Selection Process and Pre-Feasibility Analysis

The broader study area (i.e. the greater Kroonstad area) was identified by Mainstream as having the potential for the installation of PV panels on the basis of key technical criteria being met. The site selection process was informed by the following:

» Solar resource availability;
» Accessibility of the site;
» Suitable development space;
» Landowner agreements possible; and
» Accessibility to the Eskom grid, and local site topography.

The project site was identified and considered acceptable through preceding environmental considerations, land availability and technical investigations. The development area was then sited within the project site through consideration and avoidance of the environmental sensitivities identified from desktop datasets available, including consideration of known freshwater features, as well as the most recent Free State Provincial conservation data (including conservation targets), such as Critical Biodiversity Areas and wetlands.

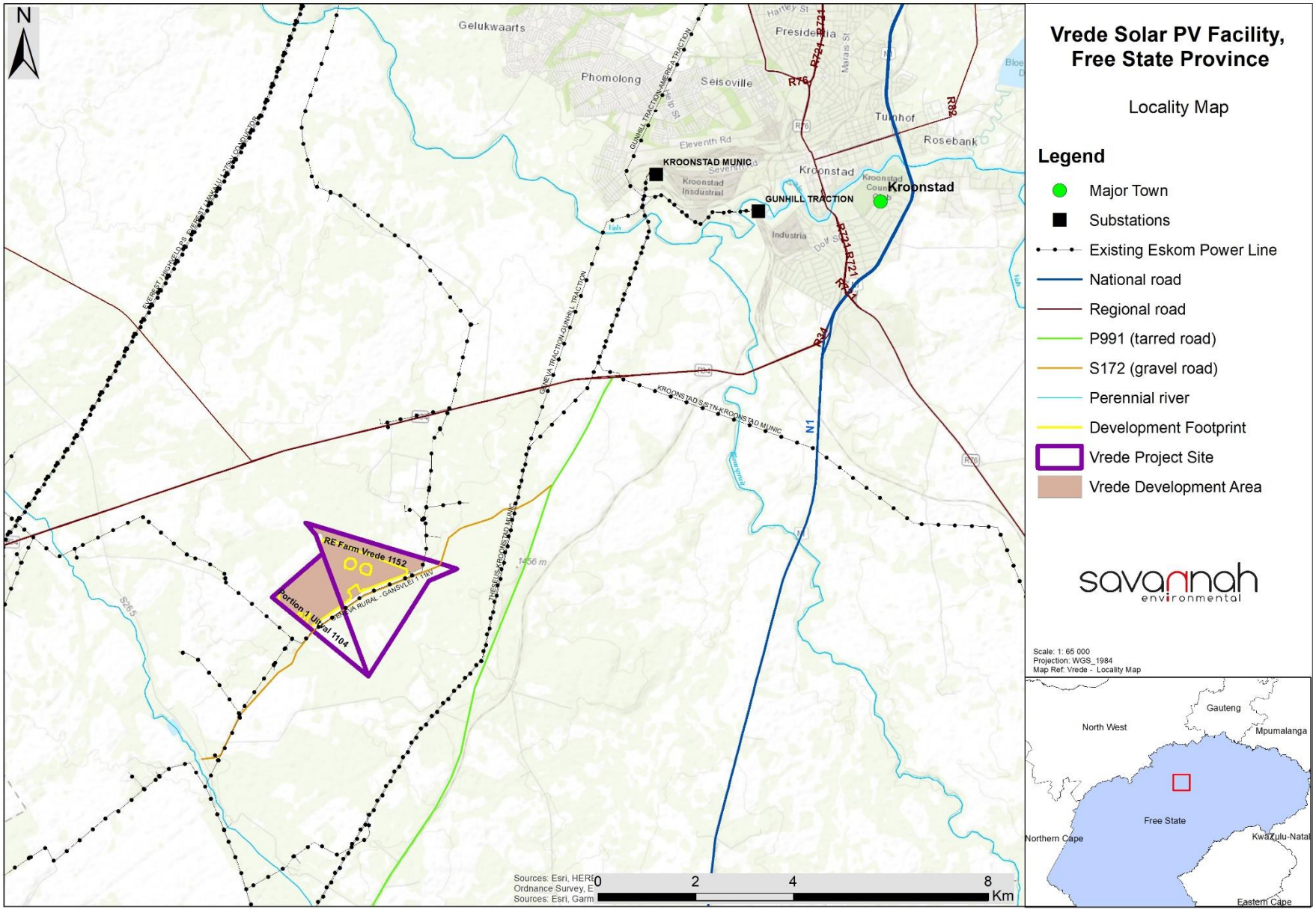


**Figure 2.1:** Map illustrating the development area within the project site for the Vrede Solar PV project.

A development footprint has been sited within the development area through consideration and avoidance of the environmental sensitivities identified in the Scoping phase, during the EIA process of the project as well as the most provincial conservation data (including conservation targets), such as Critical Biodiversity Areas and Wetlands. The proposed layout is located within this development footprint (refer to **Figure 2.2**).

The detail regarding site-specific characteristics, and how these provide further motivation for the selection of the specific site for this project is provided below:

*Project site extent, conditions and land availability:* Availability of relatively level land of sufficient extent can be a restraining factor to PV development, as a 100 MW solar PV development and associated infrastructure requires sufficient land space. The development area (within which the project development footprint will be located) is ~263ha. This area is considered to be sufficient for the planned 100MWac PV facility, and provides an opportunity for the avoidance of sensitive environmental features and areas.

The following are key considerations in this regard:

- The project site and development area conditions are optimal for a development of this nature, with the site being of a suitable gradient for the development of a PV facility.
- The region within which the development footprint is located can be described flat and homogenous. Elevation across the area ranges from 1402m above sea level in the west to 1419m above sea level in the east. There are no prominent hills within the project site with the highest areas of elevation situated to the east of the project site.
- The property is larger than the area planned for the PV facility. The project site is ~ 538ha in extent, within which the smaller development area of approximately 263ha was determined. This development area is approximately 50% of the project site, allowing for consideration and avoidance of identified environmental sensitivities.

*Site access:* The site can be readily accessed via an existing gravel access road (the S172). Controlled access to the site can be provided without significant improvements to this road. In addition, the readily accessible nature of the site largely reduces the need for additional project-related access and internal roads, reducing the overall road and clearance requirement of the development site.

*Land use considerations:* There is no currently cultivated agricultural land in the project site which could be impacted upon by the proposed development. The farm portions are not currently being utilised for cultivation and remain fallow, due to the poor economic yield as determined by the landowners. As such, the development provides opportunity for an alternative land use which will not be in conflict with the existing land use, and which will provide a productive and economically viable solution. In addition, landowner agreements are in place towards the use of these properties for the solar PV development.

*Grid connection considerations:* Ease of access into the Eskom national electricity grid is vital to the viability of a solar energy facility, and addresses Eskom's concerns for lower cost connection alternatives given current funding constraints. The facility will loop into the existing Eskom 132kV Kroonstad Municipality – Theseus 1 power line. This line is ~3km from the proposed project site, reducing the grid connection requirements in order to allow for connection with the national grid.

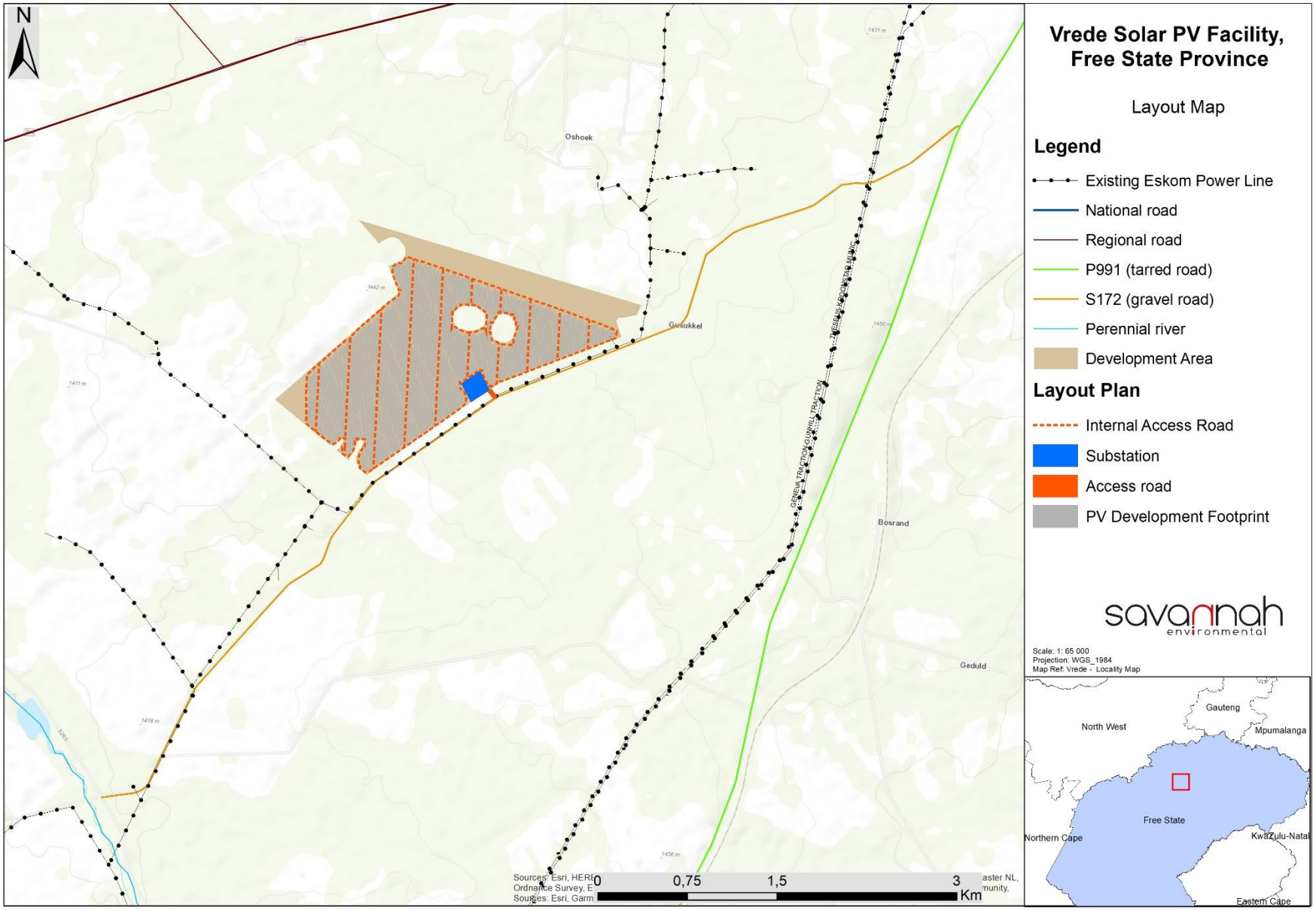


**Figure 2.2** Layout of Vrede Solar PV Facility development assessment within this EIA Report.

## 2.4 Technology considered for the Solar Energy Facility and the Generation of Electricity

The Vrede Solar PV Facility will have a contracted capacity of 100MWac and will make use of PV technology. Solar energy facilities, which utilise PV technology, use the energy from the sun to generate electricity through a process known as the Photovoltaic Effect. This effect refers to photons of light colliding with electrons, and therefore placing the electrons into a higher state of energy to create electricity (refer to **Figure 2.3**).

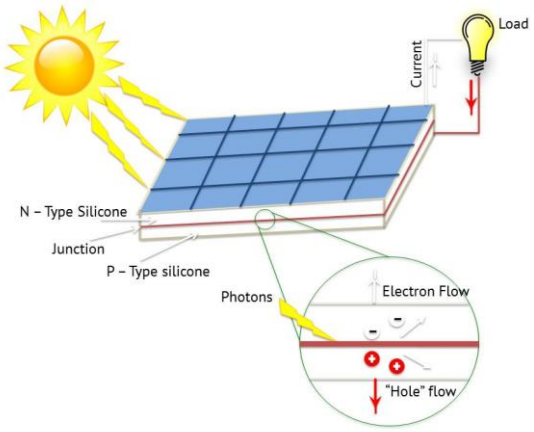


**Figure 2.3:** Diagram illustrating the Photovoltaic Effect (Source: Centre for Sustainable Energy)

The Photovoltaic Effect is achieved through the use of the following components:

**Photovoltaic Cells**

A PV cell is made of silicone that acts as a semi-conductor used to produce the Photovoltaic Effect. PV cells are arranged in multiples / arrays and placed behind a protective glass sheet to form a PV panel (refer to **Figure 2.4**). Each PV cell is positively charged on one side and negatively charged on the opposite side, with electrical conductors attached to either side to form a circuit. This circuit captures the released electrons in the form of an electric current (i.e. Direct Current (DC[6])).

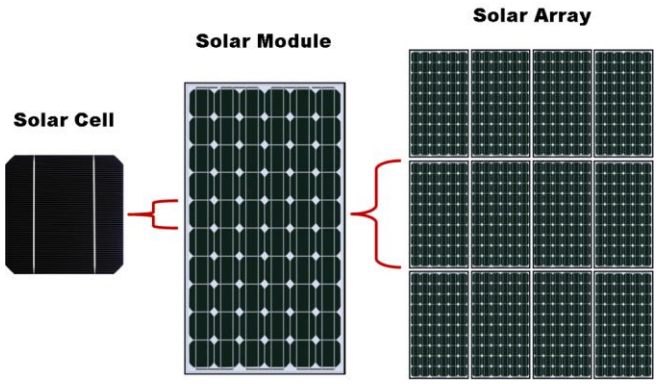


**Figure 2.4:** Overview of a PV cell, module and array / panel (Source: pveducation.com)

[6] DC (direct current) is the unidirectional flow or movement of electric charge carriers (which are usually electrons). The intensity of the current can vary with time, but the general direction of movement stays the same at all times. In a DC circuit, electrons emerge from the negative, or minus, pole and move towards the positive, or plus, pole (sourced from https://whatis.techtarget.com/definition/DC-direct-current).

**Support Structures**

PV panels will be fixed to a support structure. PV panels can either utilise fixed/static support structures, or single or double axis tracking support structures (refer to **Figure 2.5**). PV panels which utilise fixed/static support structures are set at an angle (fixed-tilt PV system) so as to optimise the amount of solar irradiation. With fixed/static support structures the angle of the PV panel is dependent on the latitude of the proposed development and may be adjusted to optimise for summer and winter solar radiation characteristics. PV panels which utilise tracking support structures track the movement of the sun throughout the day so as to receive the maximum amount of solar irradiation.

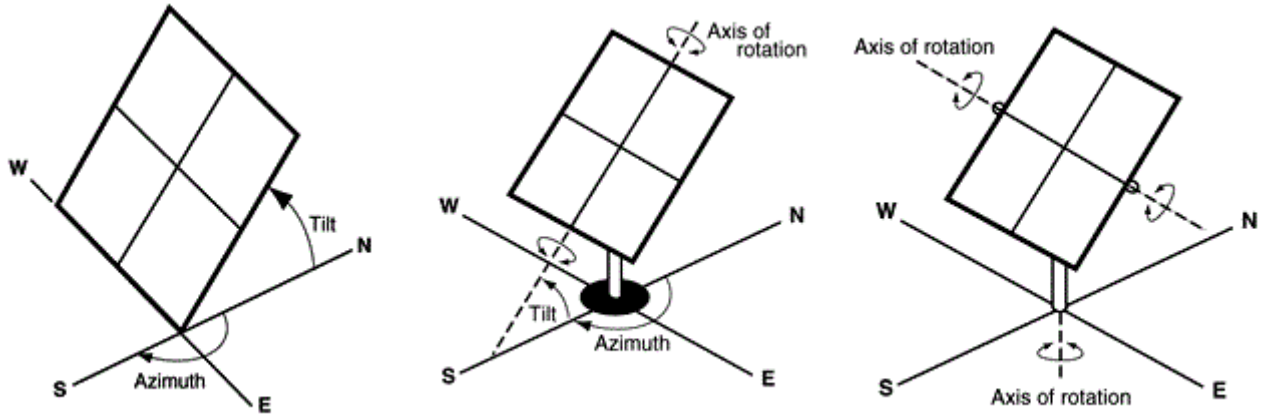


**Figure 2.5:** Overview of different PV tracking systems (from left to right: fixed-tilt, single-axis tracking, and double-axis tracking (Source: pveducation.com)).

PV panels are designed to operate continuously for more than 20 years, mostly unattended and with low maintenance.

## 2.5 Description of the Project Components

A summary of the planned infrastructure proposed as part of the Vrede Solar PV facility is provided in **Table 2.3**, and described in more detail under the sub-headings below.

**Table 2.3:** Planned infrastructure proposed as part of the Vrede Solar PV facility.

| Infrastructure | Dimensions/ Details |
|---|---|
| Solar Facility | » 100MWac photovoltaic (PV) technology utilising solar photovoltaic (PV) modules.<br>» Solar Arrays:<br>* Solar Panel Technology - Mono and Bifacial Photovoltaic (PV) Modules up to 2.5m in height;<br>* Mounting System Technology – single axis tracking, dual axis tracking or fixed axis tracking PV;<br>* Underground cabling (up to 33kV);<br>* Centralised inverter stations or string inverters; Power Transformers (Minimum of 60 inverters (subject to final design layout)). |
| Contracted capacity of the facility | 100MW ac |
| Supporting Infrastructure | » Building Infrastructure |

| Infrastructure | Dimensions/ Details |
|---|---|
| | ∗ Offices;<br>∗ Operational control centre;<br>∗ Operation and Maintenance Area / Warehouse / workshop;<br>∗ Ablution facilities;<br>∗ Battery Energy Storage System;<br>∗ Substation building.<br>» Electrical Infrastructure<br>∗ 33/132kV Independent Power Producer (IPP) onsite substation including associated equipment and infrastructure;<br>∗ Underground cabling and overhead power lines (up to 33kV).<br>» Associated Infrastructure:<br>∗ Access roads and Internal gravel roads;<br>∗ Fencing and lighting;<br>∗ Lightning protection<br>∗ Permanente laydown area;<br>∗ Temporary construction camp and laydown area;<br>∗ Telecommunication infrastructure;<br>∗ Batching plant (if required);<br>∗ Stormwater channels; and<br>∗ Water pipelines. |
| On-site substation | » 33/132kV.<br>» 3.3 ha in extent including associated equipment, cabling and associated infrastructure. |
| BESS | » Modules within shipping containers; inverters and temperature control equipment. |
| Grid Connection[7] | » 132kV power line.<br>» Up to 3km from tie-in point (depending on which grid connection alternative is approved). |
| Construction laydown areas | » Construction laydown areas to be placed within the area of the onsite substation and areas cleared for the PV facility (where required). |
| Access road | » The use of the existing S172, with minor horizontal alignment upgrades required where the S172 intersects with the P99/1.<br>» Access to the site will be via a 7m wide road to be established within a 40m corridor adjacent to the existing farm roads to the site. |
| Internal roads | » Up to 5m wide.<br>» Up to 17km in extent. |
| Services required | » Refuse material disposal - all generated refuse material will be collected by a private contractor and will be disposed of at a licensed waste disposal site off site. This service will be arranged with the municipality when required.<br>» Sanitation – due to the location of the site it is proposed that the project will construct and utilise its own sanitation services as Municipal services do not service the project site. All sewage/effluent water will be managed utilising temporary portable chemical toilets and conservancy/septic tanks. These facilities will be maintained and serviced regularly by an appropriate waste contractor.<br>» Water supply – due to the location of the site it is proposed that the project will utilise and develop its own water provision services based on the fact that these services do not reach the project site. Accordingly, construction |

[7] The power line is to be assessed through a separate Basic Assessment process.

| Infrastructure | Dimensions/ Details |
|---|---|
| | water may need to be sourced from municipal supply (by truck); or from groundwater abstraction.<br>» Electricity supply - it is proposed that this power be sourced from the existing power lines and/or diesel generators during the construction period. The necessary applications for the connection to the grid will be submitted to Eskom for approval. |

The type of technology selected for implementation, outcomes of the EIA process, and the completion of additional technical studies (e.g. geotechnical and other surveys) to be conducted as part of the detailed design phase will ultimately influence the final project layout and development footprint. The extent of the project site under investigation allows for layout design and site-specific alternatives to be identified considering the environmental sensitivities present. The final facility design is required to be approved by the DFFE prior to any construction activities commencing on-site. Should any substantive changes or deviations from the original scope or layout of the project reflected in the EIA process occur, DFFE would need to be notified thereof, and where applicable additional approval may need to be obtained.

### *2.5.1 Details of the proposed project infrastructure*

The Vrede Solar PV facility will be designed to have a contracted capacity of up to 100MW ac. The project will make use of fixed-tilt, single-axis tracking, and/or double-axis tracking PV technology. Monofacial or bifacial panels are both considered. PV technology forms part of the energy mix as indicated in the latest IRP for South Africa.

The project will comprise solar panels which, once installed, will stand less than 5m above ground level. The solar panels will include centralised inverter stations, or string inverters mounted above ground. If centralised inverter stations are used, mega volt (MV) distribution transformers are located internally, whereas string inverters are containerised with switchgear. The main transformer capacity varies according to detailed design and project-specific requirements.

### *2.5.2 Water Supply*

Vrede Solar PV facility will utilise water during both the construction and operation phases of development. Water is required during construction for dust suppression, and potable water will be required on site for the construction crew. During operations, water is required to clean the PV panels, for human consumption, and for use in the auxiliary buildings (i.e. for use in the office building, ablutions, and canteen). Approximately 400 000 litres of water will be required for the construction civil works, with 225 000 litres/month for drinking and sanitation. During operation, 15,750 litres/month will be required for drinking and sanitation, whereas 275 000 litres/cycle will be required for module cleaning, with four cleaning cycles occurring annually (1100 000 litres/annum).

Due to the location of the site, it is proposed that the project will utilise and develop its own water provision services based on the fact that these services provided by the municipality do currently not reach the project site. Accordingly, construction water may need to be sourced from municipal supply (by truck) or groundwater abstraction. Two suitable boreholes exist on site for which water use agreements and permits will be obtained for such use.

### *2.5.3 Battery Energy Storage System (BESS)*

A Battery storage facility will be constructed for the solar facility adjacent to the on-site substation or office building of up to 2 ha in size, of 200MWh capacity currently envisaging the use of the Solid-State Lithium-Ion technology. The need for a Battery Energy Storage Facility stems from the fact that electricity is only produced by the solar field while the sun is shining, while the peak demand may not necessarily occur during the daytime. Therefore, the storage of electricity and supply thereof during peak-demand will mean that the facility is more efficient, reliable and electricity supply more constant. Currently, the battery technologies being considered are Solid State Batteries (please refer to Chapter 3 for a detailing of the technology types).

### *2.5.4 On site Independent Power Producer (IPP) substation*

The Vrede Solar PV Facility will include an on-site IPP substation to facilitate the connection between the solar PV facility and the Eskom electricity grid. The development area of the onsite IPP substation is ~3.3 ha and will include the following associated infrastructure:

» Underground cabling and overhead power lines (up to 33kV).
» Substation buildings; and
» BESS.

The construction of the onsite substation will require a survey of the site, site clearing and levelling and construction of access road/s (where required), construction of a level terrace and foundations, assembly, erection, installation and connection of equipment, and rehabilitation of any disturbed areas and protection of erosion sensitive areas. The exact location of the onsite substation has been determined based on the initial layout refinements and is depicted in Figure 2.2.

### *2.5.5 Panel Cleaning*

It is anticipated that the PV panels will be washed four time a year during operation (approximately 275 000 litres/cycle will be required for module cleaning, with four cleaning cycles occurring annually (1 100 000 litres/annum)). Only clean water (i.e. with no cleaning products), or non-hazardous biodegradable cleaning products will be utilised for the washing of panels. Wastewater generated by washing panels will either be collected and recycled for future use, or alternatively, in the event that an environmentally friendly non-hazardous biodegradable cleaning product is utilised, wastewater can be allowed to run-off under the panels.

### *2.5.6 Effluent and Wastewater*

During construction, chemical toilets and conservancy tanks will be used. These will be serviced regularly and effluent will be disposed of at a registered wastewater treatment works. Any other effluent discharge during construction will be collected in sealed containers/tanks and collected by a registered service provider (i.e. the Local Municipality/Contractor) to be disposed of at an approved facility off-site.

Due to the location of the site it is proposed that the project will construct and utilise its own sanitation services as Municipal services do not service the project site. All sewage/effluent water will be managed utilising temporary portable chemical toilets and conservancy tanks, which will be maintained and serviced regularly by an appropriate waste contractor.

### *2.5.7 Waste*

Solid waste generated during construction will mainly be in the form of construction material, excavated substrate and domestic solid waste. Cardboard waste will be produced from panel packaging, which will be compacted on site prior to removal. Other wastes include rubber caps on panel edges, wooden pallets, plastic wrapping (all related to the panel packaging). Where possible, waste will be recycled. Non-recyclable solid construction waste will be temporarily stored in skips or other appropriate waste containers to be disposed of at an appropriately licensed landfill site. Hazardous and general waste will be stored separately. Any waste and excess material will be removed once construction is complete and disposed of at a registered waste facility.

During construction, use of the following hazardous substances are anticipated: paint, grease, petrol / diesel for trucks, cranes, bulldozers etc. Limited amounts of transformer oils and chemicals. Dangerous goods required to be stored during construction (e.g. limited quantities of fuel, oil, lubricants etc.) will be stored in compliance with relevant legislation (i.e. stored on covered and bunded areas / bin, and disposed of at a registered hazardous waste site). Hazardous waste will be appropriately stored and disposed of.

## 2.6 Activities during the Project Development Stages

A series of activities are proposed as part of the design, pre-construction, construction, operation, and decommissioning phases. These are discussed in more detail under the respective sub-headings below.

### *2.6.1 Design and Pre-Construction Phase*

**Planning:** Several post-authorisation factors are expected to influence the final design of the solar energy facility and could result in small-scale modifications of the PV array and/or associated infrastructure. An objective of the Engineering, Procurement and Construction (EPC) Contractor, who will be responsible for the overall construction of the project, will be to comply with the approved facility design as far as possible. It should be understood however, that the construction process is dynamic and that unforeseen changes to the project specifications may take place. This EIA Report therefore describes the project in terms of the best available knowledge at the time. The final facility design is required to be approved by the DFFE. Importantly, should there be any substantive changes or deviations from the original scope or layout of the project, the DFFE will need to be notified and where relevant, environmental approval obtained.

**Conduct Surveys:** Prior to initiating construction, a number of surveys will be required including, but not limited to, confirmation of the micro-siting footprint (i.e. the precise location of the PV panels, on-site facility substation and the associated infrastructure) and a geotechnical survey. Geotechnical surveys acquire information regarding the physical characteristics of soil and rocks underlying a proposed project site and informs the design of earthworks and foundations for structures.

### *2.6.2 Construction Phase*

The construction phase will take approximately 18 - 24 months to complete, and will entail a series of activities including:

**Procurement and employment**

At the peak of construction, the project is likely to create a maximum of 250 - 300 employment opportunities. These employment opportunities will be temporary and will last for a period of approximately 18 - 24 months (i.e. the length of construction). Employment opportunities generated during the construction phase will include low skilled, semi-skilled, and skilled opportunities. Solar PV projects make use of high levels of unskilled and semi-skilled labour so there will be good opportunity to use local labour, where available. Employment opportunities will peak during the construction phase and significantly decline during the operation phase. The injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area.

The majority of the labour force is expected to be sourced from the surrounding towns. No on-site housing is envisaged with daily commute to and from site expected of construction staff.

**Establishment of an Access Road**

Access to the development area will be established for the construction and operation of the proposed development. Access to the project site is possible through the use of the existing S172 gravel road. Minor improvements to the horizontal alignment at the intersection of the S172 with the P99/1 will be required. Within the development footprint itself, access will be required from new/existing roads for construction purposes (and limited access for maintenance during operation).

**Undertake Site Preparation**

Site preparation activities will include clearance of vegetation. These activities will require the stripping of topsoil which will need to be stockpiled, backfilled and/or spread on site.

**Transport of Components and Equipment to Site**

The national, regional, secondary and proposed internal access roads will be used to transport all components and equipment required during the construction phase. Some of the components (i.e. substation transformer) may be defined as abnormal loads in terms of the National Road Traffic Act (No. 93 of 1996) (NRTO)[8] by virtue of the dimensional limitations. Typical civil engineering construction equipment will need to be brought to the project site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.) as well as components required for the mounting of the PV support structures, construction of the on-site facility substation and site preparation.

**Establishment of Laydown Areas on Site**

Laydown and storage areas will be required for typical construction equipment. Once the required equipment has been transported to site, a dedicated equipment construction camp and laydown area will need to be established adjacent to the workshop area. The equipment construction camp serves to confine activities and storage of equipment to one designated area, to limit the potential ecological impacts associated with this phase of the development. The laydown area will be used for the assembly of the PV panels, and the general placement/storage of construction equipment. It is anticipated that the temporary laydown area will be included within development footprint of the solar energy facility, and will be ~1 ha in size.

[8] A permit will be required in accordance with Section 81 of the National Road Traffic Act (No. 93 of 1996) (NRTA) which pertains to vehicles and loads which may be exempted from provisions of Act.

**Erect PV Panels and Construct Substation and Invertors**

The construction phase involves installation of the PV solar panels, structural and electrical infrastructure required for the operation of the Vrede Solar PV facility. In addition, preparation of the soil and improvement of the access roads are likely to continue for most of the construction phase. For array installations, vertical support posts will be driven into the ground. Depending on the results of the geotechnical report, a different foundation method, such as screw pile, helical pile, micropile or drilled post/piles could be used. The posts will hold the support structures (tables) on which the PV modules would be mounted. Brackets will attach the PV modules to the tables. Trenches are to be dug for the underground AC and DC cabling, and the foundations of the inverter enclosures and transformers will be prepared. While cables are being laid and combiner boxes are being installed, the PV tables will be erected. Wire harnesses will connect the PV modules to the electrical collection systems. Underground cables and overhead circuits will connect the Power Conversion Stations (PCS) to the on-site AC electrical infrastructure, and ultimately the on-site facility substation.

The construction of the on-site facility substation will require a survey of the footprint, site clearing and levelling and construction of access road(s) (where applicable), construction of a level terrace and foundations, assembly, erection, installation and connection of equipment, and rehabilitation of any disturbed areas, and protection of erosion sensitive areas.

**Establishment of Ancillary Infrastructure**

The establishment of the ancillary infrastructure and support buildings will require the clearing of vegetation and levelling of the development footprint, and the excavation of foundations prior to construction. Laydown areas for building materials and equipment associated with these buildings will also be required.

**Undertake Site Rehabilitation**

Once construction is completed and all construction equipment has been removed, the development footprint will be rehabilitated where practical and reasonable. In addition, on full commissioning of the facility, any access points which are not required during operation must be closed and rehabilitated accordingly.

### *2.6.3 Operation Phase*

The Vrede Solar PV Facility is expected to operate for a minimum of 20 years. The facility will operate continuously, seven days a week, and will include battery storage. While the solar facility will be largely self-sufficient, monitoring and periodic maintenance activities will be required. Key elements of the Operation and Maintenance (O&M) plan include monitoring and reporting the performance of the solar energy facility, conducting preventative and corrective maintenance, receiving visitors, and maintaining security.

The operation phase will create approximately 20 full-time equivalent employment positions which will include low-skilled, semi-skilled and skilled personnel. Employees that can be sourced from the local municipal area include the less skilled and semi-skilled personnel (such as safety and security staff and certain maintenance crew). Highly skilled personnel may need to be recruited from outside the local area where these resources are not available within the area.

### *2.6.4 Decommissioning Phase*

Depending on the continued economic viability of Vrede Solar PV facility following the initial 20-year operation lifespan, the solar energy facility will either be decommissioned, or the operation phase will be extended. If it is deemed financially viable to extend the operation phase, existing components would either continue to operate or be dissembled and replaced with new, more efficient technology / infrastructure available at the time. If the decision is made to decommission the facility, the following decommissioning activities will take place:

**Site Preparation**

Site preparation activities will include confirming the integrity of the access to the site to accommodate the required decommissioning equipment.

**Disassembly and removal of existing components**

When the solar energy facility is ultimately decommissioned, the equipment to be removed will depend on the land use proposed for the project site at the time. All above ground facilities that are not intended for future use will be removed. Much of the above ground wire, steel, and PV panels of which the system is comprised are recyclable materials and would be recycled to the extent feasible. The components of the solar energy facility would be de-constructed and recycled, or disposed of in accordance with applicable regulatory requirements. Where concrete footings were removed with the panels, these will be covered with soil to a depth sufficient for the re-growth of natural vegetation. The site will be rehabilitated where required and can potentially be returned to a beneficial land-use. Since it is not currently known which disposal facilities will be available at the time of disposal (i.e. in 20 years time), it is not possible to identify specific landfill facilities at this stage. When the time comes for decommissioning, the nearest facilities registered to receive waste and recycled material from the solar facility will be identified and utilised.

**Future plans for the site and infrastructure after decommissioning**

Should it be decided not to extend the operational lifespan of the project beyond 20 years, the project will be decommissioned. Decommissioning involves removing the solar panels and associated infrastructures and covering the concrete footings with soil to a depth sufficient for the re-growth of natural vegetation. Components that may be reused by the landowner may remain in place, however any other supporting infrastructure no longer in use will be removed from the site and either disposed of at the registered local municipal disposal facility or recycled if possible.

# CHAPTER 3 CONSIDERATION OF ALTERNATIVES

This Chapter provides an overview of the various alternatives considered for the Vrede Solar PV Facility as part of the EIA Process.

## 3.1 Legal Requirements as per the EIA Regulations, 2014 (as amended) for the undertaking of an Impact Assessment Report

This chapter of the EIA Report includes the following information required in terms of Appendix 3: Scoping of Assessment and Content of the Environmental Impact Assessment Report:

| Requirement | Relevant Section |
|---|---|
| (h) a full description of the process followed to reach the proposed development footprint within the approved site, including (i) details of the development footprint alternatives considered | The details of the alternatives considered as part of the Vrede Solar PV Facility and as part of the EIA Phase have been included in **Section 3.2**. |
| (h)(ix) if no alternative development locations for the activity were investigated, the motivation for not considering such | The details of the alternatives considered as part of the Vrede Solar PV Facility and as part of the EIA Phase have been included in **Section 3.2**. Where no alternatives are being considered a motivation has been included |

## 3.2 Alternatives Considered during the EIA Process

In accordance with the requirements of Appendix 3 of the 2014 Environmental Impact Assessment (EIA) Regulations (GNR 326), reasonable and feasible alternatives including, but not limited to site and technology alternatives, as well as the "do-nothing" alternative should be considered.

The DFFE Guideline for determining alternatives states that the key criteria for consideration when identifying alternatives are that they should be "practicable", "feasible", "relevant", "reasonable" and "viable". Essentially there are two types of alternatives:

» Incrementally different (modifications) alternatives to the project.
» Fundamentally (totally) different alternatives to the project.

In this instance, 'the project' refers to the Vrede Solar PV Facility, a solar PV facility with capacity of up to 100MWac and associated infrastructure proposed to be developed by an Independent Power Producer (IPP) and intended to form part of the DMRE's REIPPP Programme, or similar suitable procurement programmes under the Integrated Resource Plan (IRP 2019, and any updates thereto).

### *3.2.1 Consideration of Fundamentally Different Alternatives*

Fundamentally different alternatives are usually assessed at a strategic level and, as a result, project-specific EIAs are therefore limited in scope and ability to address fundamentally different alternatives. At a strategic level, electricity generating alternatives have been addressed as part of the DMRE's current Integrated

Resource Plan for Electricity 2010 – 2030 (IRP)[9], and will continue to be addressed as part of future revisions. In this regard, the need for renewable energy power generation from solar PV facilities has been identified as part of the technology mix for power generation in the country for the next 20 years. Of particular relevance to the proposed project is the allocation of 6000MW of new capacity to large scale PV included in the IRP 2019. The site is considered most suitable for the development of a PV solar energy facility as a result of local irradiation. Therefore, fundamentally different alternatives to the proposed project are not considered within this EIA process.

### *3.2.2 Consideration of Incrementally Different Alternatives*

Incrementally different alternatives relate specifically to the project under investigation. "Alternatives", in relation to a proposed activity, means different ways of meeting the general purposes and requirements of the activity, which may include alternatives for:

- The property on which, or location where the activity is proposed to be undertaken.
- The type of activity to be undertaken.
- The design or layout of the activity.
- The technology to be used in the activity.
- The operational aspects of the activity.

In addition, the option of not implementing the activity (i.e. the "do-nothing" alternative) must also be considered.

These alternatives are discussed under the respective sub-headings below and where no alternatives are applicable, a motivation has been included.

i. Property or Location Alternatives

One other solar farm, the Rondavel Solar PV Facility, is currently planned for development within the broader Kroonstad area, supporting the suitability of the broader study area for similar developments. The placement of a solar PV facility is, however, also dependent on several other factors including land suitability, climatic conditions (solar irradiation levels), topography, the location and extent of the study area, availability of grid connection infrastructure and the need and desirability of the project. As discussed in Chapter 2, a number of technical criteria were considered in identifying a suitable site for the proposed Vrede Solar PV Facility. Based on the technical investigation of site-specific attributes, Mainstream considers the development area located within the study area as highly preferred for the development of a solar PV facility. No feasible location/property alternatives have been identified for investigation as part of this EIA process.

- **Land suitability:** The development area is currently lying fallow, with historical farming of the region having proven uneconomical for the landowner. Furthermore, sites that facilitate easy construction conditions (i.e. relatively flat topography, lack of major outcrops etc.) are also favoured due to the reduced construction activities. Based on the suitability of the development area, no alternative locations are considered.

[9] The Integrated Resource Plan (IRP) is legislated policy which regulates power generation planning.

» **Solar resource**: The economic viability of a solar PV facility is directly dependent on the annual direct solar irradiation values of the area within which it will operate. The Global Horizontal Irradiation (GHI) for the study area is between ~1972 - 2118 kWh/m$^2$/annum. While the Free State province does not have a reputation for high solar irradiation values, these values are comparable with values for Bloemfontein and Beaufort West, and therefore enables the development of solar energy projects and the successful operation thereof. Based on the solar resource available, no alternative locations are considered.

» **Topography**: The region within which the project site is located can be described flat and homogenous. Elevation across the development area ranges from 1402m above sea level in the west to 1419m above sea level in the east. There are no prominent hills within the project site with the highest areas of elevation situated to the east of the project site. The flat topography of the development area under investigation is considered as beneficial in terms of the construction activities that will be required. Based on the suitable and preferable topography present, no location alternatives are considered for the development.

» **Site extent:** The affected properties (i.e. Remaining extent of the farm Vrede No. 1152 and Portion 1 of the farm Uitval No. 1104) is approximately 538ha in extent, which is sufficient for the installation of a solar PV facility with a contracted capacity of up to 100MW$_{AC}$, while allowing for the avoidance of environmental site sensitivities. A development area of ~263ha has been identified within the project site within which the solar PV facility will be located. The site extent is sufficient for the proposed development and therefore eliminates the need to consider alternative locations for the development. The size of the development footprint within the development envelope is approximately ~217ha.

» **Site access**: The site can be readily accessed via an existing gravel access road (S172) branching off of the P99/1 between Kroonstad and Henneman, with only minor improvements to the intersection between the S172 and P99/1 required (horizontal alignment adjustments). Based on the sufficient access available for the development no alternative locations are considered.

» **Grid access:** A key factor in the siting of any energy generation project, is a viable grid connection. The anticipated grid connection solution (subject to a separate environmental assessment and authorisation process) is a 132kV distribution line. Two alternative routes are being considered for the Vrede Grid Connection solution. Both alternatives for the Vrede Grid Connection will loop into the Kroonstad Municipality – Kroonstad SW STN 1 132kV power line located approximately 3km from the Vrede Solar PV facility site, to connect to the national grid. Based on the nearby location and suitability of the anticipated grid connection solution, no further grid access alternatives are considered in this application.

» **Geographic location**: The proposed project site is located within close proximity to Kroonstad, which will allow for material and labour, as well as waste servicing for the proposed facility. The development area is also currently fallow, and previously disturbed by virtue of past agricultural practices, and therefore compliments the proposed land use by repurposing previously disturbed land with an economically viable land use.

» **Landowner support**: The selection of a site where the landowner is supportive of the development of renewable energy is essential for ensuring the success of the project. The landowner does not view the development as a conflict with their current land use practices. The support from the landowner for the development to be undertaken on the affected property has been solidified by the provision of consent

for the project to proceed on the property through the signing of a land lease agreement with the proponent as well as a landowners consent as per the requirements of the EIA Regulations, 2014. Therefore, with the affected landowner in support of the development, no location alternatives are considered.

Based on above site-specific attributes, the proponent considers the development area located within the study area as highly preferred in terms of the development of a solar PV facility, and expects that the Vrede Solar PV facility will be able to draw on synergies with the other project (Rondavel Solar PV Facility) proposed within the vicinity of the study area and the benefits obtained from the close proximity to that of Kroonstad. As a result, no property/location alternatives are proposed as part of this EIA process.

ii. Design and Layout Alternatives

The full extent of the affected properties (i.e. Remaining extent of the Farm Vrede No. 1152 and Portion 1 of the Farm Uitval No. 1104) are ~538ha in extent, which is sufficient for the installation of a solar PV facility with a contracted capacity of up to 100MWac, while allowing for the avoidance of environmental site sensitivities. A development area of ~263ha has been identified within the project site within which the solar PV facility will be located. A development footprint has been demarcated as an area of ~217ha, which is equivalent to 50% of the extent of the development area. The location of the development area and footprint were informed by the findings of specialist investigations undertaken during the EIA process.

Areas to be avoided by the development were identified, specifically relating to ecological and hydrological features and avifaunal sensitivities present within the project site. The identified sensitivities were utilised as a tool by the developer to identify and locate the development footprint of the PV facility (~217ha) within the development area (~263ha). This was undertaken with the aim of avoiding possible sensitive areas within the project site as far as possible so as to limit impacts associated with the development which would result in unacceptable loss.

Only one feasible layout was provided for investigation within the EIA process (refer to **Figure 2.2**). This layout was however be optimised considering the findings of the specialist studies and EIA process.

### *3.2.3 Technology Alternatives*

**i) Solar Energy Facility**

Solar energy has been identified by Mainstream as the preferred technology for implementation on the site as a result of environmental resource, land availability and technical considerations. Few technology options are available for solar facilities, and the use of those that are considered are usually differentiated by weather and temperature conditions that prevail in the area, so that optimality is obtained by the final site selection. Solar energy is considered to be the most suitable renewable energy technology for this area, based on the site location, ambient conditions and energy resource availability. Solar PV was therefore determined as the most suitable option for further assessment.

The IRP (2019), excludes the procurement of power from CSP facilities until 2030, whereas new additional capacity of approximately 6 000MW will be required from solar PV facilities. Therefore, PV technology was identified as being the preferred option for the study area and consists of a lower visual profile and limited water requirements when compared to the CSP technology alternative. Given the allocations in the IRP

(2019), solar PV is considered as the most appropriate technology option. Furthermore, the development of the Vrede Solar PV Facility provides an opportunity to optimally use a site that is currently fallow with no agricultural or economic use, but with reduced visual intrusion and/or impacts and reduced water use requirements.

Therefore, considering the above, no other technology alternatives are being assessed for the development of Vrede Solar PV Facility. The development of the solar PV facility on the site is considered as the best option for the area considering the nature and extent of the site, as well as the solar resource available.

Several solar PV technology alternatives are available, including *inter alia*:

- Bifacial PV panels
- Monofacial PV panels
- Fixed mounted PV systems (static / fixed-tilt panels).
- Single-axis tracking or double-axis tracking systems (with solar panels that rotate around a defined axis to follow the sun's movement).
- Monocrystalline modules, polycrystalline modules or thin film modules.

The primary difference between PV technologies available relate to the extent of the facility, as well as the height of the facility, however the potential for environmental impacts remain similar in magnitude. Fixed mounted PV systems are able to occupy a smaller extent and have a lower height when compared to tracking PV systems, which require both a larger extent of land, and are taller in height. However, both options are considered to be acceptable for implementation from an environmental perspective. Bifacial solar PV panels offer many advantages over monofacial PV panels, as power can be produced on both sides of the module, increasing total energy generation. Monocrystalline modules, polycrystalline modules or thin film modules differ mainly in their cost and efficiency values, but do not represent a fundamentally different panel design type from an environmental perspective. The preference will, therefore, be determined on the basis of technical considerations and the site conditions.

The PV panels are designed to operate continuously for more than 20 years, mostly unattended and with low maintenance. The impacts associated with the construction, operation, and decommissioning of the facility are anticipated to be the same irrespective of the PV panel selected for implementation.

**ii) Battery Energy Storage Systems**

The general purpose and utilisation of the Battery Energy Storage System (BESS) will be to save and store excess electrical output from the facility as it is generated, allowing for a timed release to the national grid when the capacity is required. The BESS will, therefore, provide flexibility in the efficient operation of the electricity grid through decoupling of the energy supply and demand and will allow for longer generating periods of the solar PV facility. Furthermore, the development of the BESS for the project is of importance as the system will ensure that electricity is fed into the national grid when required and excess amounts stored. This will allow for extended hours of generation from the 100MWac solar energy facility. The BESS will be contained within insulated containers and will connect to the on-site facility substation via underground cabling which will follow the internal access roads of the facility. **Figure 2.6** provides a general illustration of a BESS.


**Figure 2.6:** Example of battery storage units installed by Tesla (Source: fastcompany.com)

A battery storage facility will be constructed for the solar facility adjacent to or in close proximity to the on-site substation or office building. The need for a BESS stems from the fact that electricity is only produced by the solar field while the sun is shining, while the peak demand may not necessarily occur during the day-time. Therefore, the storage of electricity and supply thereof during peak-demand will mean that the facility is more efficient, reliable and electricity supply more constant. Battery technologies considered included Solid-State Batteries or Redox Flow Batteries.

Given appropriate controls, the impacts associated with the construction, operation, and decommissioning of the facility are anticipated to be similar irrespective of the BESS technology type selected for implementation.

Solid State Batteries

These energy storage units come in a range of containerised systems with size categories from 500 KWh to 4MWh. The total footprint area required for the containerised systems to accommodate a 100MW project with a 300MWh system would have a footprint of up to 2 ha. The figure below provides a visual representation of the difference between conventional battery system and the solid-state battery as well as the advantages of using the solid-state battery technology.

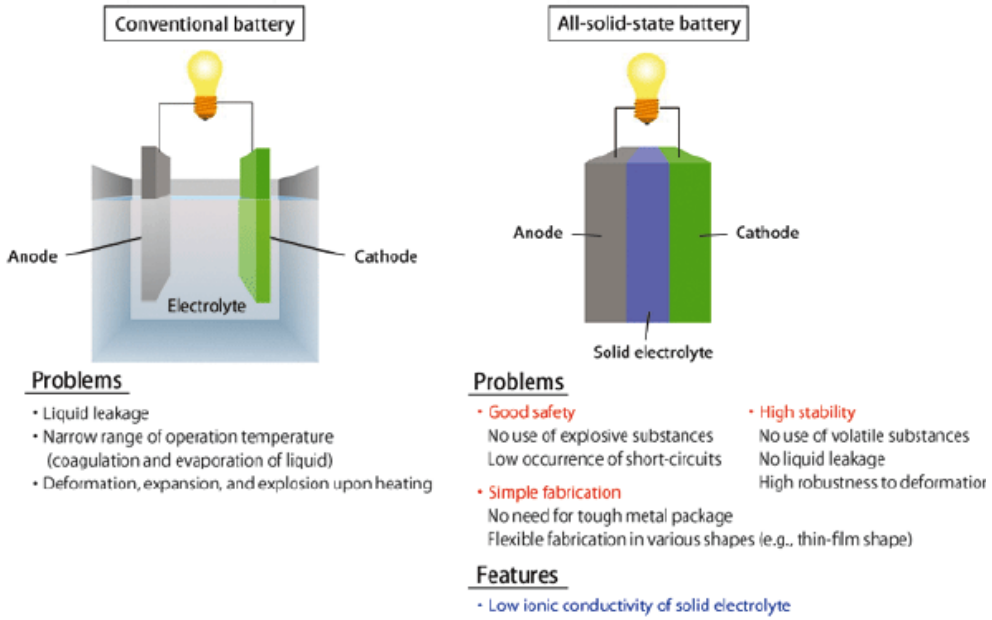


**Figure 2.7:** Illustration of the difference between conventional battery system and the solid-state battery (Source: South Africa Mainstream Renewable Power Developments (Pty) Ltd).

Solid state batteries consist of multiple battery cells that collectively form modules. Each cell contains an anode, cathode and a solid electrolyte. Modules are usually assembled within shipping containers and delivered to the project site. Multiple containers will be required. The container unit dimensions are approximately 12.2-17 m long, 2.4-3.5 m wide, and 4 m high. Containers will be placed on raised concrete plinths (30 cm) and may be stacked on top of each other to a maximum height of approximately 15 m. Additional instrumentation, including inverters and temperature control equipment, may be positioned between the battery containers. The typical layout of such a facility is presented below.

**Figure 2.8:** Typical layout of a BESS (Source: South Africa Mainstream Renewable Power Developments (Pty) Ltd).

Redox Flow Batteries

Flow-battery technologies are also being considered as an alternative for power smoothing purposes. For this technology, energy is stored as an electrolyte in the flow cells. Options include Sodium polysulfide/bromine (PSB) flow batteries, Vanadium Redox (VRB) flow batteries, and Zinc-Bromine (ZNBR) flow batteries which would be contained in small bunded areas. Redox Flow Batteries (RFB) generally consist of two half-cells containing liquid electrolyte systems. Once supplied with electrical energy a reduction-oxidation (redox) reaction between ions of the two electrolytes, separated by a membrane, charge the electrodes with energy (anode [-] and cathode [+]). Energy discharge from a RFB is achieved by a reversed redox reaction between ions resulting in the potential for electrical energy to be drawn from the electrodes. The footprint of a RFB system is approximately 150 x 100 m, with a height of 15 m. The system consists of two electrolyte storage tanks that are contained within a 2.5 m high berm wall which prevents leakage of the electrolyte into the surrounding environment. A conceptual layout of a RFB system is presented below.

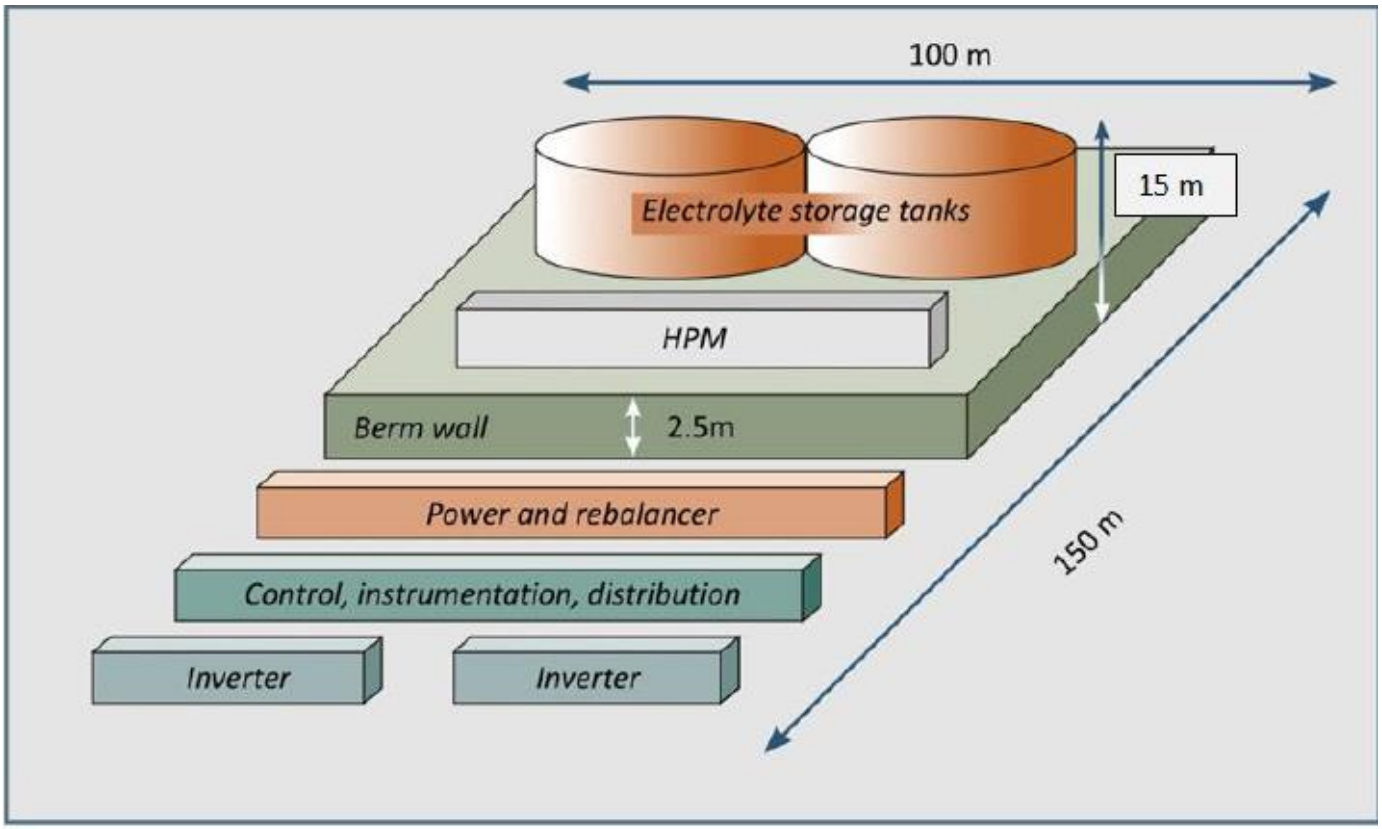


**Figure 2.9:** conceptual layout of a Redox-Flow Battery system (Source: South Africa Mainstream Renewable Power Developments (Pty) Ltd).

Currently, the battery technologies being considered are either Solid State Batteries or Redox Flow Batteries. Solid State Batteries are typically low in cost, able to operate at subfreezing temperatures and do not require active cooling. The lack of electrolyte use also limits the potential for electrolyte loss to the environment. These batteries do however suffer from a rapid voltage drop on discharge.

Flow batteries are a technology of battery which requires mechanical systems (pumps, pipes, and tanks) and are therefore inherently more complex than a solid-state battery. The greatest advantage these batteries exhibit is their scalability and their longer duration discharge cycles which are more cost efficient

when compared to solid-state batteries. The most successful and widespread of these batteries use vanadium and zinc-bromine chemistries.

Preferred technology considered in this EIA:
Solid-State Batteries have been selected as the preferred technology for implementation.

Solid state batteries are mainly associated with clearance of natural habitats for the placement of these features, and handling of wastes from spent or decommissioned systems, whereas flow batteries may be associated with larger quantities of land clearance required, and the potential for electrolyte or associated chemical spills, however they do not produce significant waste during operation and maintenance as the storage system has the capability to indefinitely perform discharge cycles.

### *3.2.4 The 'Do-Nothing' Alternative*

The 'Do-Nothing' alternative is the option of not constructing the Vrede Solar PV Facility. Should this alternative be selected, there would be no environmental impacts or benefits as a result of construction and operation activities associated with a solar PV facility. The 'do-nothing' alternative will therefore likely result in minimising the cumulative impact on the land associated with renewable energy development, although it is expected that pressure to develop the site for renewable energy purposes will be actively pursued due to the same factors which have contributed to its current selection for investigation. The current land use practices would continue. The 'do-nothing alternative has been assessed as part of the EIA Phase (refer to **Chapter 8** and **Chapter 10** of this EIA Report).

# CHAPTER 4 POLICY AND LEGISLATIVE CONTEXT

This Chapter provides an overview of the policy and legislative context within which the development of a solar PV facility, such as the Vrede Solar PV Facility, is proposed. It identifies environmental legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process which may be applicable to or have bearing on the proposed project.

## 4.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter of the EIA Report includes the following information required in terms of Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Report:

| Requirement | Relevant Section |
|---|---|
| (e) a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context | Chapter 4, as a whole, provides an overview of the policy and legislative context which is considered to be associated with the development of the solar energy facility. The regulatory and planning context has been considered at national, provincial and local levels. A description of the policy and legislative context within which Vrede Solar PV Facility is proposed is included in **sections 4.3, 4.4, 4.5** and **4.6.** |

## 4.2 Strategic Electricity Planning in South Africa

The need to expand electricity generation capacity in South Africa is based on national policy and informed by on-going strategic planning undertaken by the Department of Mineral Resources and Energy (DMRE). The hierarchy of policy and planning documentation that support the development of renewable energy projects such as a solar energy facility is illustrated in **Figure 4.1**. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the development of the Vrede Solar PV Facility.

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and Local levels. As solar energy developments are a multi-sectoral issue (encompassing economic, spatial, biophysical, and cultural dimensions) various statutory bodies are likely to be involved in the approval process of a solar energy project and the related statutory environmental assessment process.

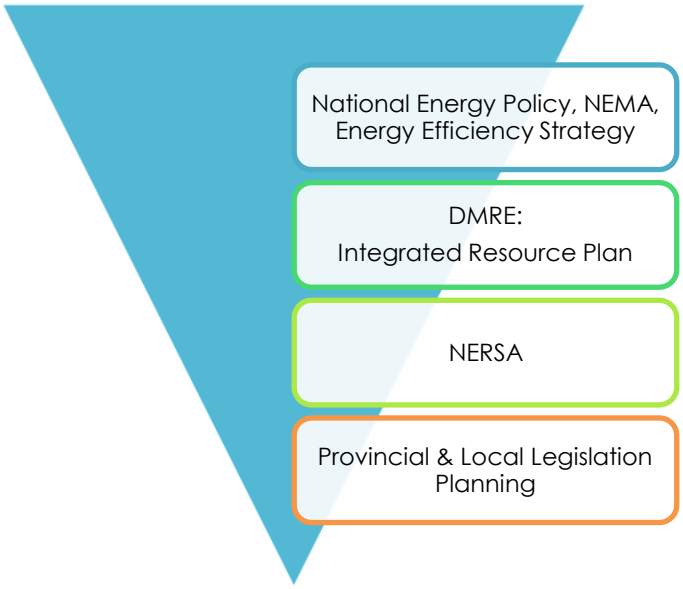


**Figure 4.1: Hierarchy of electricity and planning documents**

At **National Level**, the main regulatory agencies are:

- **Department of Mineral Resources and Energy (DMRE):** This Department is responsible for policy relating to all energy forms and for compiling and approving the Integrated Resource Plan (IRP) for electricity. Furthermore, the Department is also responsible for granting approvals for the use of land which is contrary to the objects of the Mineral and Petroleum Resource Development Act (Act No. 28 of 2002) (MPRDA) in terms of Section 53 of the Act. Therefore, in terms of the Act, approval from the Minister is required to ensure that proposed activities do not sterilise mineral resources that may occur within the project site and development area.
- **National Energy Regulator of South Africa (NERSA):** NERSA is responsible for regulating all aspects of the electricity sector and will ultimately issue licenses for IPP projects to generate electricity.
- **Department of Forestry, Fisheries and the Environment (DFFE):** This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations, 2014 (GN R326) as amended. DFFE is the Competent Authority for this project (as per GN R779 of 01 July 2016), and is charged with granting the EA for the project under consideration.
- **South African Heritage Resources Agency (SAHRA):** SAHRA is a statutory organisation established under the National Heritage Resources Act (No. 25 of 1999) (NHRA), as the national administrative body responsible for the protection of South Africa's cultural heritage.
- **South African National Roads Agency Limited (SANRAL):** This Agency is responsible for the regulation and maintenance of all national road routes.
- **Department of Department of Human Settlements, Water and Sanitation (DHSWS):** This Department is responsible for effective and efficient water resources management to ensure sustainable economic and social development. This Department is also responsible for evaluating and issuing licenses pertaining to water use (i.e. Water Use Licenses (WUL) and General Authorisation).
- **The Department of Department of Agriculture, Rural Development and Land Reform:** This Department is the custodian of South Africa's agricultural resources and is primarily responsible for the formulation and implementation of policies governing the agriculture sector. Furthermore, the Department is also responsible for issuing permits for the disturbance or destruction of protected tree species listed under Section 15 (1) of the National Forest Act (No. 84 of 1998) (NFA).

At **Provincial Level**, the main regulatory agencies are:

» **Provincial Government of the Free-State – Department of Economic Development, Tourism and Environmental Affairs (DEDTEA):** This Department is the commenting authority for the EIA process for the project and is responsible for issuing of biodiversity and conservation-related permits.
» **Free State Department: Police, Roads and Transport:** This Department provides effective co-ordination of crime prevention initiatives, provincial police oversight, traffic management and road safety towards a more secure environment.
» **Free State Heritage Resources Authority (FSPHRA):** This Department identifies, conserves and manages heritage resources throughout the Free State Province.

At the **Local Level,** the local and district municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Free State Province, both the local and district municipalities play a role. The project falls within the Moqhaka Local Municipality, which forms part of the Fezile Dabi District Municipality. In terms of the Municipal Systems Act (No. 32 of 2000), it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.

### 4.3 International Policy and Planning Context

A brief review of the most relevant international policies relevant to the establishment of the Vrede Solar PV Facility are provided below in **Table 4.1**. The Vrede Solar PV Facility is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor.

**Table 4.1: International policies relevant to the Vrede Solar PV Facility**

| Relevant policy | Relevance to the Vrede Solar PV Facility |
|---|---|
| United Nations Framework Convention on Climate Change (UNFCCC) and Conference of the Party (COP) | Following COP24 held in Katowice, Poland, and Chile's announcement that they could not host the next COP, nearly 27 000 delegates met in Madrid, Spain for COP25 with the intention to finalise the 'rulebook' of the Paris Agreement. The Conference also intended to communicate to the global community that the efforts of the United Nations (UN) to curb climate change remained relevant and that the UN recognised the yawning gap between current progress and global goals to limit global warming. The UNFCCC Secretariat announced[10] on 29 May 2020 that COP 26, originally scheduled for 9 – 19 November 2020 was postponed for 1 – 12 November 2021 and will be held in Glasgow, Scotland. In the previous COP, talks between the parties were unable to reach consensus in many areas, with a lot of issues being postponed to COP26 in 2021. Although COP26 has been postponed, the provision in the 2015 Climate Treaty that each Party must take a more ambitious commitment in 2020 to reduce greenhouse emissions has not been postponed.<br><br>The UN at COP25 expressed their dissatisfaction with the results of the Conference and that the global community lost out on an opportunity to show increased ambition on mitigation, adaptation and finance to tackle the climate crisis [11]. |

[10] https://cei.org/blog/cop-26-un-climate-conference-delayed%C2%A0until-november-2021
[11] https://www.carbonbrief.org/cop25-key-outcomes-agreed-at-the-un-climate-talks-in-madrid

| Relevant policy | Relevance to the Vrede Solar PV Facility |
|---|---|
| | The policy provides support for the Vrede Solar PV Facility which will contribute to managing climate change impacts, supporting the emergency response capacity, as well as assist in reducing GHG emissions in a sustainable manner. |
| The Equator Principles (July 2020) | The Equator Principles (EPs) (July 2020) constitute a financial industry benchmark used for determining, assessing, and managing project's environmental and social risks. The EPs are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. The EPs are applicable to large infrastructure projects (such as the Vrede Solar PV project) and apply globally to all industry sectors.<br><br>Such an assessment should propose measures to minimise, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature and scale of Vrede Solar PV. In terms of the EPs, South Africa is a non-designated country, and as such the assessment process for projects located in South Africa evaluates compliance with the applicable IFC Performance Standards on Environmental and Social Sustainability, and Environmental Health and Safety (EHS) Guidelines.<br><br>The Vrede Solar PV Facility is currently being assessed in accordance with the requirements of the EIA Regulations, 2014 as amended (GN R326), published in terms of Section 24(5) of the National Environmental Management Act (No. 107 of 1998) (NEMA), which is South Africa's national legislation providing for the authorisation of certain controlled activities. Through this assessment, all potential social and environmental risks are identified and assessed, and appropriate mitigation measures proposed. |
| International Finance Corporation (IFC) Performance Standards and Environmental and Social Sustainability (January 2012) | The International Finance Corporation's (IFC) Performance Standards (PSs) on Environmental and Social Sustainability were developed by the IFC and were last updated on 1 January 2012.<br><br>Performance Standard 1 requires that a process of environmental and social assessment be conducted, and an ESMS appropriate to the nature and scale of the project, and commensurate with the level of its environmental and social risks and impacts, be established and maintained. The above-mentioned standard is the overarching standard to which all the other standards relate. Performance Standard 2 through to 8 establish specific requirements to avoid, reduce, mitigate or compensate for impacts on people and the environment, and to improve conditions where appropriate. While all relevant social and environmental risks and potential impacts should be considered as part of the assessment, the standards 2 and 8 describe potential social and environmental impacts that require particular attention specifically within emerging markets. Where social or environmental impacts are anticipated, the developer is required to manage them through its ESMS consistent with Performance Standard 1.<br><br>Given the nature of the Vrede Solar PV Facility, it is anticipated (at this stage of the process) that Performance Standards 1, 2, 3, 4, 6, and 8 may be applicable to the project. |

## 4.4 National Policy

Further to the South African government's commitment in August 2011 to support the development of renewable energy capacity, the DMRE initiated the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) to procure renewable energy from the private sector in a series of rounds. To date, the Department has procured 6 422MW of renewable energy capacity from 102 independent power producers (IPPs), with 3 876MW operational and made available to the grid[12]. National policies have to be considered for the construction and operation of the solar PV facility to ensure that the development is in line with the planning of the country.

A brief review of the most relevant national policies is provided below in **Table 4.2**. The development of the Vrede Solar PV Facility is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor.

**Table 4.2: Relevant national legislation and policies for the Vrede Solar PV Facility**

| Relevant legislation or policy | Relevance to the Vrede Solar PV Facility |
|---|---|
| Constitution of the Republic of South Africa, 1996 | Section 24 of the Constitution pertains specifically to the environment. It states that everyone has the right to an environment that is not harmful to their health or well-being, and to have the environment protected, for the benefit of 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.<br><br>The Constitution outlines the need to promote social and economic development. Section 24 of the Constitution therefore requires that development be conducted in such a manner that it does not infringe on an individual's environmental rights, health, or well-being. This is especially significant for previously disadvantaged individuals who are most at risk to environmental impacts. |
| National Environmental Management Act (No. 107 of 1998) (NEMA) | This piece of legislation is South Africa's key piece of environmental legislation and sets the framework for environmental management in South Africa. NEMA is founded on the principle that everyone has the right to an environment that is not harmful to their health or well-being as contained within the Bill of Rights.<br><br>The national environmental management principles state that the social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment.<br><br>The need for responsible and informed decision-making by government on the acceptability of environmental impacts is therefore enshrined within NEMA. |
| White Paper on the Energy Policy of the Republic of South Africa (1998) | The White Paper on Energy Policy places emphasis on the expansion of energy supply options to enhance South Africa's energy security. This can be achieved through increased use of RE and encouraging new entries into the generation market.<br><br>The policy states that the advantages of RE include, minimal environmental impacts during operation in comparison with traditional supply technologies, generally lower |

[12]https://www.cliffedekkerhofmeyr.com/en/news/publications/2019/Corporate/energy-alert-22-october-The-Integrated-Resource-Plan-2019-A-promising-future-roadmap-for-generation-capacity-in-South-Africa.html

| Relevant legislation or policy | Relevance to the Vrede Solar PV Facility |
|---|---|
| | running costs, and high labour intensities. Disadvantages include, higher capital costs in some cases, lower energy densities, and lower levels of availability, depending on specific conditions, especially with sun and wind-based systems. Nonetheless, renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future. |
| White Paper on the Renewable Energy Policy of the Republic of South Africa (2003) | The White Paper on Renewable Energy Policy supplements Government's predominant policy on energy as set out in the White Paper on the Energy Policy of the Republic of South Africa (DME, 1998). The policy recognises the potential of RE and aims to create the necessary conditions for the development and commercial implementation of RE technologies.<br><br>The White Paper on RE sets out Government's vision, policy principles, strategic goals, and objectives for promoting and implementing RE in South Africa. The country relies heavily on coal to meet its energy needs due to its abundant, and fairly accessible and affordable coal resources. However, massive RE resources that can be sustainable alternatives to fossil fuels, have so far remained largely untapped.<br><br>The White Paper on Renewable Energy of 2003 set a target of 10 000GWh to be generated from RE by 2013 to be produced mainly from biomass, wind, solar and small-scale hydro. The target was subsequently reviewed in 2009 during the RE summit of 2009. The policy supports the investment in RE facilities as they contribute towards ensuring energy security through the diversification of energy supply, reducing GHG emissions and the promotion of RE sources. |
| National Energy Act (No. 34 of 2008) | The purpose of the National Energy Act (No. 34 of 2008) is to ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, while taking environmental management requirements into account. In addition, the Act also provides for energy planning, and increased generation and consumption of Renewable Energies (REs).<br><br>The Act provides the legal framework which supports the development of RE facilities for the greater environmental and social good and provides the backdrop against which South Africa's strategic planning regarding future electricity provision and supply takes place. |
| The Electricity Regulation Act (No. of 2006) | The Electricity Regulation Act of 2006, replaced the Electricity Act (No. 41 of 1987), as amended, with the exception of Section 5B, which provides funds for the energy regulator for the purpose of regulating the electricity industry. The Act establishes a national regulatory framework for the electricity supply industry and introduces the National Energy Regulator (NERSA) as the custodian and enforcer of the National Electricity Regulatory Framework. The Act also provides for licences and registration as the manner in which the generation, transmission, distribution, trading, and import and export of electricity are regulated. |
| Integrated Energy Plan (IEP), 2015 | The Integrated Energy Plan (IEP) (which was developed under the National Energy Act (No. 34 of 2008)), recognises that energy is essential to many human activities, and is critical to the social and economic development of a country. The purpose of the IEP is essentially to ensure the availability of energy resources, and access to energy services in an affordable and sustainable manner, while minimising associated adverse environmental impacts. Energy planning therefore needs to balance the need for continued economic growth with social needs, and the need to protect the natural environment. |

| Relevant legislation or policy | Relevance to the Vrede Solar PV Facility |
|---|---|
| Integrated Resource Plan for Electricity (IRP) 2010-2030 (2019) | The Integrated Resource Plan (IRP) for Electricity 2010 – 2030 is a subset of the IEP and constitutes South Africa's National electricity plan. The primary objective of the IRP is to determine the long-term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing and cost. The IRP also serves as input to other planning functions, including amongst others, economic development and funding, and environmental and social policy formulation.<br><br>On 27 August 2018, the then Minister of Energy published a draft IRP which was issued for public comment. The lengthy public participation and consultation process has culminated in the issue of the overdue IRP 2019 which updates the energy forecast from the current period to the year 2030. Since the promulgated IRP 2010, the following capacity developments have taken place:<br><br>» A total of 6 422MW has been procured thus far under the REIPPP Programme, with 3 876MW being currently operational and made available to the grid. In addition, IPPs have commissioned 1005MW from two (2) Open Cycle Gas Turbines (OCGT) peaking plants;<br>» 2000MW has been procured from 8 IPPs through the Risk Mitigation IPP Procurement Programme (RMIPPPP); and<br>» Under the Eskom Build Programme, 1 332MW has been procured from the Ingula Pumped Storage Project, 1 588MW and 800MW from the Medupi and Kusile power stations and 100MW from the Sere Wind Farm.<br><br>Provision has been made for the following new capacity by 2030:<br>» 1 500MW of coal;<br>» 2 500MW of hydro;<br>» 6 000MW of solar PV;<br>» 14 400MW of wind;<br>» 1 860MW of nuclear;<br>» 2 088MW of storage;<br>» 3 000MW of gas/diesel; and<br>» 4 000MW from other distributed generation, co-generation, biomass and landfill technologies.<br><br>Based on the IRP 2019, 1 474MW has been installed for solar PV facilities, whereas, 814MW has already been procured. In addition, an annual allocation of 1 000MW has been allocated for solar PV facilities from 2022 to 2030. This will bring the total installed capacity of solar PV facilities by 2030 to 8 288MW. Therefore, the development of the Vrede Solar PV Facility is supported by the IRP 2019. |
| National Development Plan 2030 (2012) | The National Development Plan (NDP) 2030 is a plan prepared by the National Planning Commission in consultation with the South African public which is aimed at eliminating poverty and reducing inequality by 2030.<br><br>In terms of the Energy Sectors role in empowering South Africa, the NDP envisages that, by 2030, South Africa will have an energy sector that promotes:<br><br>» Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates, while supporting economic growth through job creation. |

| Relevant legislation or policy | Relevance to the Vrede Solar PV Facility |
|---|---|
| | » Social equity through expanded access to energy at affordable tariffs and through targeted, sustainable subsidies for needy households.<br>» Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change.<br><br>The NDP aims to provide a supportive environment for growth and development, while promoting a more labour-absorbing economy. The development of the Vrede Solar PV Facility supports the NDP through the development of energy-generating infrastructure which will not lead to the generation of GHGs and will result in economic development and growth of the area surrounding the development area. |
| Strategic Integrated Projects (SIPs) | The Presidential Infrastructure Coordinating Commission (PICC) is integrating and phasing investment plans across 18 Strategic Integrated Projects (SIPs) which have 5 core functions, including to unlock opportunity, transform the economic landscape, create new jobs, strengthen the delivery of basic services and support the integration of African economies.<br><br>SIP 8 of the energy SIPs supports the development of RE projects as follows:<br>*Green energy in support of the South African economy: Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010) and supports bio-fuel production facilities.*<br><br>The development of the Vrede Solar PV Facility is aligned with SIP 8 as it constitutes a green energy initiative that would contribute clean energy in accordance with the IRP 2010 – 2030. Should the project be selected as a preferred bidder, application can be made for it to be registered as a SIP project. |
| National Climate Change Response Policy, 2011 | The Conference of the Parties (COP) 21 was held in Paris from 30 November to 12 December 2015. From this conference, an agreement to tackle global warming was reached between 195 countries. This Agreement is open for signature and subject to ratification, acceptance or approval by States and regional economic integration organisations that are Parties to the Convention from 22 April 2016 to 21 April 2017. Thereafter, this Agreement shall be open for accession from the day following the date on which it is closed for signature. The agreement can only be sanctioned once it has been ratified by 55 countries, representing at least 55% of emissions.<br><br>South Africa signed the Agreement in April 2016 and ratified the agreement on 01 November 2016. The Agreement was assented to by the National Council of Provinces on 27 October 2016, and the National Assembly on 1 November 2016. The Agreement was promulgated on 04 November 2016, thirty days after the date on which at least 55 Parties to the Convention, which account for at least 55% of the total global greenhouse gas emissions have deposited their instruments of ratification, acceptance, approval or accession with the Depositary.<br><br>South Africa's National Climate Change Response Policy (NCCRP) establishes South Africa's approach to addressing climate change, including adaptation and mitigation responses. The NCCRP formalises Government's vision for a transition to a low carbon economy, through the adoption of the 'Peak, Plateau and Decline' (PPD) GHG emissions trajectory whereby South Africa's emissions should peak between 2020 and 2025, plateau for approximately a decade, and then decline in absolute terms |

| Relevant legislation or policy | Relevance to the Vrede Solar PV Facility |
|---|---|
| | thereafter, and based on this the country has pledged to reduce emissions by 34% and 42% below Business As Usual (BAU) emissions in 2020 and 2025, respectively.<br><br>The policy provides support for the Vrede Solar PV Facility, which will contribute to managing climate change impacts, supporting the emergency response capacity, as well as assist in reducing GHG emissions in a sustainable manner. |
| Climate Change Bill, 2018 | On 08 June 2018, the Minister of Environmental Affairs published the Climate Change Bill ("the Bill") for public comment. The Bill provides a framework for climate change regulation in South Africa aimed at governing South Africa's sustainable transition to a climate resilient, low carbon economy and society. The Bill provides a procedural outline that will be developed through the creation of frameworks and plans.<br><br>The Vrede Solar PV Facility consists of a renewable energy generation facility and would not result in the generation or release of emissions during its operation. |

## 4.5 Provincial Planning and Context

A brief review of the most relevant provincial policies is provided below in **Table 4.3**. The proposed development is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor.

**Table 4.3: Relevant provincial legislation and policies for the Vrede Solar PV Facility**

| Relevant policy | Relevance to the Vrede Solar PV Facility |
|---|---|
| Free State Provincial Growth and Development Strategy (FSGDS) (2005 – 2014) | The overarching goal of the Free State Growth and Development Strategy (FSGDS) is to align the provincial and national policies and programmes and to guide development in terms of effective and efficient management and governance to achieve growth and development. The strategy is a living document that uses the latest business planning and evaluation tools in order to maximise the effect of all spending.<br><br>Based on the social and economic development challenges of the Province, the Strategy identifies a few primary objectives, including stimulating economic development and developing and enhancing the infrastructure for economic growth and social development, poverty alleviation through human and social development, ensuring a safe and secure environment for all and the promotion of effective and efficient governance and administration.<br><br>The development of the Vrede Solar PV Facility supports the overall objective of stimulating economic development and infrastructure investment towards growth and social development, by contributing to the energy mix, supply and infrastructure of the province. The development of the facility will also contribute (albeit limited) to the alleviation of poverty through the creation of direct and indirect employment opportunities and well as skills development. |
| Free State Provincial Growth and Development Strategy (FSGDS), Revised October 2007 | The revised FSGDS refers to specific imperatives which sets the tone and pace for shared growth and development in the Province. These include:<br><br>» The need to effectively use scarce resources within the Province, while addressing the real causes of development challenges.<br>» The need to accelerate service delivery based on a common provincial development agenda as the basis for provincial strategic direction. |

| Relevant policy | Relevance to the Vrede Solar PV Facility |
|---|---|
| | » The need to identify investment opportunities and provide an environment of certainty critical for private-sector investment.<br>» The need to promote intergovernmental coordination between the three spheres of government.<br>» The need to facilitate facilitates the implementation of the People's Contract within the Province.<br>» The need to provide a common vision as the basis for common action amongst all stakeholders, both inside and outside government.<br>» The need to provide a framework for budgets, implementation, performance management and spatial development.<br><br>The development of the Vrede Solar PV Facility will assist with the need to effectively use scarce resources and the need to identify investment opportunities, including private sector-investment. The development of a solar facility reduces the need to make use of non-renewable resources for the generation of electricity and opens up the Province to further future solar energy development. |
| Free State Provincial Spatial Development Framework (PSDF) - Executive Summary (Inception Report) | The Free State PSDF is a provincial spatial and strategic planning policy that responds to and complies with, in particular, the National Development Plan Vision 2030 and the National Spatial Development Perspective (NSDP). The latter encourages all spheres of government to prepare spatial development plans and frameworks (such as the PSDF) that promote a developmental state in accordance with the principles of global sustainability as is advocated by, among others, the South African Constitution and the enabling legislation.<br><br>The Free State Provincial Growth and Development Strategy states that sustainable economic development is the only effective means by which the most significant challenge of the Free State, namely poverty, can be addressed. The PSDF gives practical effect to sustainable development, which is defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.<br><br>The PSDF is prepared in accordance with bioregional planning principles that were adapted to suit the site-specific requirements of the Free State. It incorporates and complies with the relevant protocols, conventions, agreements, legislation and policy at all applicable levels of planning, ranging from the international to the local.<br><br>The Vrede Solar PV Facility will contribute to sustainable and economic development goals of the Free State PSDF, once completed and formally adopted. |
| Free State Green Economy Strategy (2014) | This Green Economy Strategy for Free State Province (FSGES) was developed in alignment with the national green economy strategy elaborated in the National Green Economy Framework and Green Economy Accord, as well the Free State Provincial Growth and Development Strategy. The development process was spearheaded by the Department of Economic Development, Tourism and Environmental Affairs (DETEA).<br><br>The objective was to develop a green economy strategy to assist the Province to, amongst others, improve environmental quality and economic growth, and to develop green industries and energy efficiency within the Province.<br><br>The Vrede Solar PV Facility will contribute to the aim of energy efficiency and green industry while promoting economic growth, and is therefore consistent with this strategy. |

| Relevant policy | Relevance to the Vrede Solar PV Facility |
|---|---|
| Free State Investment Prospectus (2019) | The Premier of the Free State considers providing access to individual investors to accurate and pertinent information makes it easier for investors to glean investor ready opportunities that are currently available in the Free State.<br><br>Opportunity of the development of renewable energy is considered in the key sectors overview. The prospectus states that opportunities are opening up in the Province for the energy sector, including renewable energy. Rezoning for the development of multiple solar energy facilities has already been undertaken in the Province. The development of a Solar Park in the Xhariep region is seen as a driver of growth along the banks of the Orange (Gariep) River.<br><br>Considering the future opportunities available for the development of renewable energy facilities (including solar PV facilities) the development of the Vrede Solar PV Facility is considered to be in-line with the Investment Prospectus of the Province. |

## 4.6 Local Policy and Planning Context

The local tiers of government relevant to the Vrede Solar PV Facility are the Moqhaka Local Municipality and the Fezile Dabi District Municipality (**Table 4.4**). Instruments and/or policies at both the district and local level contain objectives which align with the development of the Vrede Solar PV Facility. These include, economic growth, job creation, community upliftment and poverty alleviation.

**Table 4.4: Relevant district and local legislation and policies for the Vrede Solar PV Facility**

| Relevant policy | Relevance to the Vrede Solar PV Facility |
|---|---|
| Fezile Dabi District Municipality Integrated Development Plan (IDP) 2020/2021 (Draft) | The Vision of the Municipality is "Improving the lives of citizens and progressively meeting their basic, social and economic needs, thereby restoring the community confidence and trust in government". The Mission of the Municipality is to "…strive to be a more responsive and accountable municipality towards sustainable development."<br><br>The IDP identifies Local Economic Development as a Key Performance Area (KPA4).<br><br>Based on the fact that the proposed development is considered to be sustainable with little resource use required and that the development will encourage local economic development it is considered that the Vrede Solar Facility is in-line with the objectives of the IDP. |
| Fezile Dabi District Municipality Climate Change Vulnerability Assessment and Response Plan (2016) | The Vrede Solar PV Facility indirectly contributes to the overall climate change response plan of the district municipality by providing energy without reliance on fossil fuels and therefore exacerbating climate change at ta provincial and national level. |
| Moqhaka Local Municipality Integrated Development Plan IDP (2017 – 2022) | The Moqhaka Local Municipality IDP has, under the local economic development goal, the following aims:<br><br>» Create an environment that promotes the development of the local economy and facilitate job creation<br>» To expand the electrification programme to any remaining areas and roll out solar energy in any identified areas at prescribes standards. |

| Relevant policy | Relevance to the Vrede Solar PV Facility |
|---|---|
| | In addition, the IDP also indicates that an Energy Master Plan is currently being developed, with the primary aim of ensuring enough energy is available to support existing and developmental needs.<br><br>The Vrede Solar PV Facility development thus directly addresses various aims of the Moqhaka Local Municipality IDP. |
| Moqhaka Local Municipality Spatial Development Framework (SDF) (2019/2020) | The SDF identifies ten spatial related directives and objectives. Directive number 8 refers to Surface Infrastructure. The objectives of this directive specifically refers to the promotion of development of renewable energy supply schemes. The SDF also identifies the need for new bulk transmission lines based on the envisaged new development in the area.<br><br>Considering the above, the development of the Vrede Solar Facility is in line with the SDF. |

# CHAPTER 5 NEED AND DESIRABILITY

Appendix 3 of the 2014 EIA Regulations (GNR 326, as amended) requires that an EIA Report include a motivation for the need and desirability of the proposed development, including the need and desirability of the activity in the context of the preferred location. The need and desirability of the development needs to consider whether it is the right time and the right place for locating the type of land-use/activity being proposed. The need and desirability of a proposed development is, therefore, associated with the wise use of land, and should be able to respond to the question such as, but not limited to, what the most sustainable use of the land may be.

This Chapter provides an overview of the projected suitability of the Vrede Solar PV Facility being developed at the preferred project location from an international, national, regional, and site-specific perspective. It provides an overview of the need and desirability, and perceived benefits of the project specifically.

## 5.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter includes the following information required in terms of Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Report:

| Requirement | Relevant Section |
|---|---|
| (f) a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location | The need and desirability for the development the Vrede Solar PV Facility is included and discussed within this chapter. The need and desirability for the development of the solar PV facility has been considered from an international, national, regional and site-specific perspective. |

## 5.2 Need and Desirability from an International Perspective

The need and desirability of the Vrede Solar PV Facility, from an international perspective, can be described through the project's alignment with internationally recognised and adopted agreements, protocols and conventions. South Africa is a signatory to a number of international treaties and initiatives, including the United Nation's Development Programme's (UNDP's) Sustainable Development Goals (SDGs). The SDGs address global socio-economic challenges such as poverty, hunger, health, education, climate change, gender equality, water, sanitation, energy, urbanisation, environment and social justice. The SDGs consist of 17 global goals set by the United Nations. The 17 SDGs are characterised by 169 targets, and 304 indicators.

Goal 7 of the SDGs relates to "Affordable and Clean Energy", with the aim of the goal being to ensure access to affordable, reliable, sustainable and modern energy for all. The following targets and indicators have been set for Goal 7:

| Targets | Indicators |
|---|---|
| 7.1 By 2030, ensure universal access to affordable, reliable and modern energy services. | 7.1.1 Proportion of population with access to electricity. |

| Targets | | Indicators | |
|---|---|---|---|
| | | 7.1.2 | Proportion of population with primary reliance on clean fuels and technology. |
| 7.2 | By 2030, increase substantially the share of renewable energy in the global energy mix. | 7.2.1 | Renewable energy share in the total final energy consumption. |
| 7.3 | By 2030, double the global rate of improvement in energy efficiency. | 7.3.1 | Energy intensity measured in terms of primary energy and GDP. |
| 7.A | By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology. | 7.A.1 | Mobilised amount of United States dollars per year starting in 2020 accountable towards the $100 billion commitment. |
| 7.B | By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support. | 7.B.1 | Investments in energy efficiency as a percentage of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services. |

The development of the Vrede Solar PV Facility would contribute positively towards Goal 7 of the SDGs through the following:

- By generating up to 100MWac of affordable and clean energy.
  - A study published by the CSIR on 14 October 2016 ("Cost of new power generators in South Africa Comparative analysis based on recent Independent Power Producer (IPP) announcements", Dr Tobias Bischof-Niemz and Ruan Fourie) which took into consideration the results of the cost prices bid successfully under the Department of Mineral Resources and Energy's Renewable Energy (RE) IPP and Coal Baseload IPP Procurement Programmes, found that solar PV and wind were 40% cheaper than new baseload coal (i.e. R0.62/kWh for PV and wind vs R1.03 for coal).
  - PV technology is one of the cleanest electricity generation technologies, as it does not result in the release of emissions during its operation.
- By contributing towards South Africa's total generation capacity, specifically through the utilisation of renewable energy resources.

The Kyoto Protocol (1997) is also relevant to the need of the development of PV1 from an international perspective. The protocol calls for the reduction of South Africa's greenhouse gas emissions through actively cutting down on using fossil fuels, or by utilising more renewable resources. The development of the Vrede Solar PV Facility will add capacity to the renewable energy sector of the country and strengthen the commitment and action plan to achieve the requirements, as set out in the protocol, through the generation of energy without the emission of greenhouse gasses.

### 5.3 Need and Desirability from a National Perspective

The Vrede Solar PV Facility is proposed in specific response to the requirement for diversification of the country's energy mix to include renewable energy such as solar PV as detailed in the IRP 2019. As a result, the need and desirability of the Vrede Solar PV Facility from a national perspective can largely be linked

from the project's alignment with national government policies, plans, and programmes which have relevance to energy planning and production (as discussed in detail in **Chapter 4**). The following key plans have been developed by National Government to consider South Africa's current energy production, projected future demands, and provides the necessary framework within which energy generation projects can be developed:

» Integrated Energy Plan (IEP).
» Integrated Resource Plan (IRP).

The above-mentioned energy plans have been extensively researched and are updated on an on-going basis to take into consideration changing scenarios, new information, developments in new technologies, and to reflect updated demands and requirements for energy production within the South African context. These plans form the basis of South Africa's energy generation sector and dictate national priorities for energy production.

The IEP is intended to provide a roadmap of South Africa's future energy landscape and guide future energy infrastructure investments and policy development (**Figure 5.1)**. The Plan considered the three pillars of sustainable development, and lists the following as the eight key energy planning objectives:

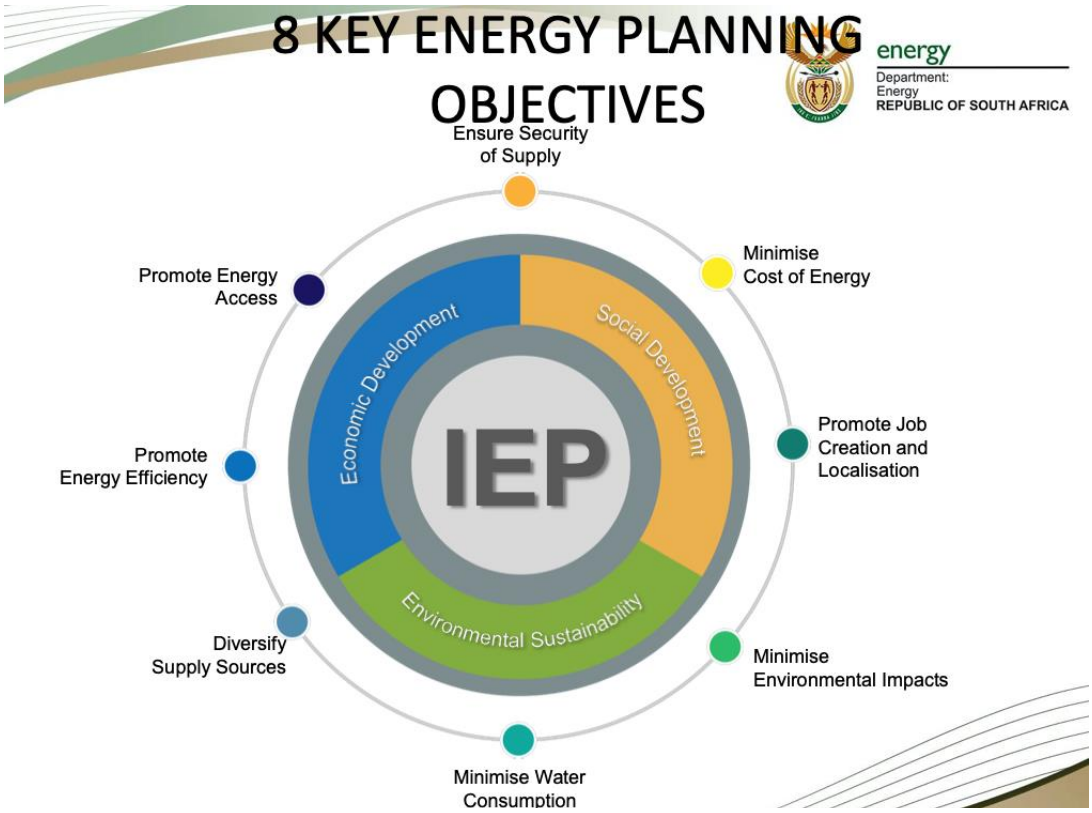


**Figure 5.1:** Eight key energy objectives as listed in the IEP, 2016 (extract from DOE presentation, December 2016)

The latest iteration of the IEP (25 November 2016) contained the following statement regarding solar power in South Africa:

"*South Africa experiences some of the highest levels of solar radiation in the world and this renewable resource holds great potential for the country. The daily solar radiation in South Africa varies between 4.5 and 6.5 kilowatt hours per square meter (kWh/m²) (16 and 23 mega joules per square meter [MJ/m²]) (Stassen, 1996), compared to about 3.6 kWh/m² in parts of the United States and about 2.5 kWh/m² in Europe and the United Kingdom. The total area of high radiation in South Africa amounts to approximately 194 000 km², including the Northern Cape, which is one of the best solar resource areas in the world. With electricity production per square kilometre of mirror surface in a solar thermal power station being 30.2 MW, and just 1% of the high radiation area in the country being made available for solar power generation, the generation potential is approximately 64 GW. Solar energy has the potential to contribute quite substantially to South Africa's future energy needs. This would, however, require large investments in transmission lines from the areas of high radiation to the main electricity consumer centres*."

In terms of electricity generation, the IEP states that South Africa should continue to pursue a diversified energy mix which reduces reliance on a single or a few primary energy sources, and includes the following statement regarding solar energy's contribution to the diversified energy mix:

- *Solar should play a much more significant role in the electricity generation mix than it has done historically and constitutes the greatest share of primary energy (in terms of total installed capacity) by 2050. The contribution of solar in the energy mix comprises both CSP and solar PV. Solar PV includes large scale installations for power generation which supply to the grid and individual, off-grid solar home systems and rooftop panels.*
- *Several interventions which could enhance the future solar energy landscape are recommended as follows: –Large scale CSP projects with proven thermal storage technologies and hybridisation / industrial steam application projects should be incentivised in the short to medium term. In the long term, the existing incentives could be extended to promote locally developed CSP technology storage solutions and large-scale solar fuel projects.*
- *A thorough solar resource assessment for South Africa should continue to be undertaken in the Northern Cape Province and extended to other provinces deemed to have high solar radiation levels.*
- *Investments should be made to upgrade the grid in order to accommodate increasing solar and other renewable energy contributions.*

The IRP for Electricity 2010 – 2030 is a subset of the IEP and constitutes South Africa's current gazetted energy plan. The purpose of the plan is to ensure sustainable electricity development which takes into consideration technical, economic, and social constraints, and identifies investments in the electricity sector which are required to meet the country's forecasted electricity demands at minimum costs. The consideration of GHG emissions in the determination of the energy generation mix indicates government's commitment to international obligations under the Paris Agreement.

A number of IPP Procurement Programmes have been initiated to secure electricity generated from a range of resources from the private sector (i.e. from Independent Power Producers, or IPPs). Under these Programmes, IPPs are invited to submit proposals for the finance, construction, operation, and maintenance of electricity generation facilities for the purpose of entering into an Implementation Agreement with the DMRE and a Power Purchase Agreement (PPA) with Eskom as the buyer. Provision has been made for new additional capacities in the IRP 2019 (refer to **Table 5.1**).

**Table 5.1:** Overview of the total installed capacity expected by 2030

| IPP Procurement Programme | Technology | MW | Total |
|---|---|---|---|
| Renewables | Wind | 17 742MW | 31 320MW |
| | Solar CSP | 600MW | |
| | Solar Photovoltaic | 8 288MW | |
| | Hydro | 4 600MW | |
| Coal | Coal | 33 364MW | 33 364MW |
| Nuclear | Nuclear | 1 860MW | 1 860MW |
| Gas & Diesel | Gas & Diesel | 3 000MW | 3 000MW |
| Other (Distributed Generation, CoGen, Biomass, Landfill) | Other (Distributed Generation, CoGen, Biomass, Landfill) | 4 000MW | 4 000MW |

Renewable resources are valuable in contributing towards electricity generation and diversifying South Africa's electricity mix, while contributing towards South Africa's response to Climate Change. Under the REIPPPP, the DMRE intends to secure 14 725MW of electricity from renewable energy generation facilities utilising either onshore wind, concentrated solar thermal, solar photovoltaic (PV), biomass, biogas, landfill gas, or hydro across a number of bidding windows, while simultaneously contributing towards socio-economic development. A total of 1 474MW[13] of PV generated electricity has been awarded to preferred bidders across four (4) rounds of bidding to date, with 4 526MW still remaining to be allocated in subsequent bidding rounds (targeted up to 2030). An additional 2000MW of capacity has been awarded to various technologies through the recent Risk Mitigation IPP Procurement Programme (RMIPPPP). Preferred bidders identified under any IPP Procurement Programmes are required to satisfy a number of economic development requirements, including amongst others, job creation, local content, skills development, enterprise and supplier development, and socio-economic development. In addition to electricity generation and supply, IPP Procurement Programmes also contribute positively towards socio-economic development of a region, over and above job creation.

In addition to the policy considerations detailed above, Government has prioritised post COVID-19 turnaround plans in terms of renewable energies within the Just Energy Transition (JET), coupled with key development objectives of the various spheres of government. These policies share the same ideals, such as:

- The utilisation, application and investment in renewable energy resources in South Africa is considered to be an essential means of reducing the carbon footprint of the country,
- Diversifying the national economy,
- Reducing poverty, and
- Providing critical additional energy to that provided by Eskom.
- Government has compiled an Economic Reconstruction and Recovery Plan which was presented to Parliament in October 2020. According to this plan, the economic survey will rely on a massive investment in infrastructure, including energy, telecommunications, ports and rail. The core elements of the Economic Reconstruction and Recovery Plan are as follows:

1. Priority interventions for economic recovery: the plan sets out eight priority interventions that will ignite South Africa's recovery and reconstruction effort. These are the flagship initiatives that all of society will rally around to build a new economy (refer to Figure 5.2).

[13] https://www.cliffedekkerhofmeyr.com/en/news/publications/2019/Corporate/energy-alert-22-october-The-Integrated-Resource-Plan-2019-A-promising-future-roadmap-for-generation-capacity-in-South-Africa.html

2. Enabling conditions for growth: these are growth-enhancing reforms and other preconditions for an inclusive, competitive and growing economy.
3. Macroeconomic framework: economic reconstruction and recovery requires careful mobilisation of resources to ensure fiscal sustainability.
4. Institutional arrangements: the plan focuses on execution, and is supported by enhanced institutional arrangements to ensure implementation and accountability.

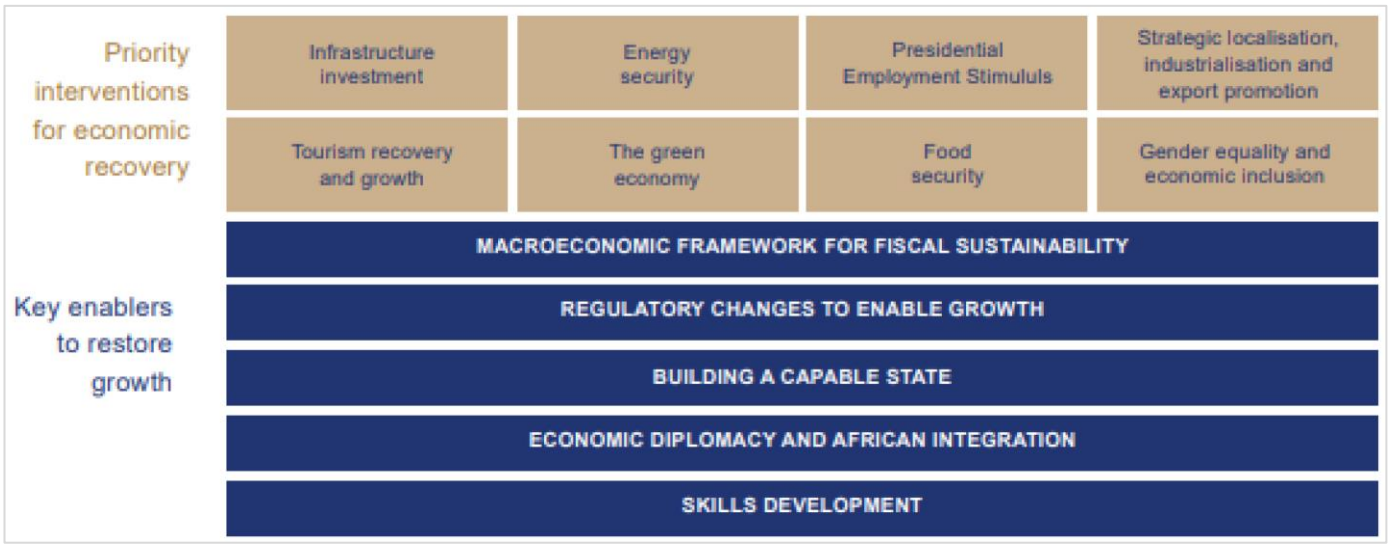


**Figure 5.2** Core elements of the Economic Reconstruction and Recovery Plan (source: Building a new economy - Highlights of the Reconstruction and Recovery Plan, Presidency of the Republic of South Africa)

The plan recognises energy security as the most important prerequisite for the recovery agenda and states that renewed investment in a diversified energy mix can be achieved within a short time horizon, while alleviating a crippling energy crisis and facilitating a necessary transition to a less carbon-intensive economy. One of the key commitments of the plan is, therefore, to implement the IRP 2019 without delay to provide a substantial increase in the contribution of renewable energy sources by 2030, alongside other sources including battery storage, gas and clean coal. The transition to green energy is recognised as contributing towards the realisation of the low-carbon, climate-resilient and inclusive economy envisaged by the National Development Plan. The development of the Vrede Solar PV Facility is identified as a mechanism for securing additional power generation capacity as part of the REIPPP programme or for private off-takers, reducing the reliance for electricity on Eskom.

The need for new power generation from solar PV facilities has been identified and assessed by government at a national scale considering the national energy requirements as well as international commitments under the Paris Agreement; therefore, provision has been made for the inclusion of new PV power generation capacity in South Africa's energy mix. The implementation of the Vrede Solar PV Facility has the potential to contribute positively towards the identified need, while simultaneously contributing to job creation and socio-economic development, identified as a need for the country within the National Development Plan (NDP). In addition, given bid round 5 has been announced for August 2021, along with future suitable and similar procurement programmes under the IRP (2019, or as updated in the future) expected be announced, contribution of this project new PV power generation capacity may be possible.

The Vrede Solar PV Facility will make use of renewable energy technology and would contribute positively towards reducing South Africa's GHG emissions and ensure compliance with all applicable legislation and

permitting requirements. In addition, by making use of PV technology, the Vrede Solar PV Facility would have reduced water requirements when compared with some other generation technologies in alignment with one of the vision 2030 themes of the then-Department of Water and Sanitation's (now the Department of Human Settlements, Water and Sanitation) National Water Resource Strategy 2 (2013) (i.e. transitioning to a low carbon economy through stimulating renewable energy and retrofitting buildings).

### 5.4 Need and Desirability of the project from a Regional Perspective

South Africa's electricity generation mix has historically been dominated by coal. However, up to 2030 a new capacity demand will be driven by the decommissioning of existing coal-fired power stations. A further 24 100MW (**Figure 5.3**) of coal power is expected to be decommissioned in the period 2030 to 2050. Therefore, additional capacity will be required from renewable energy sources, particularly solar with 6 000MW being allocated for the period up to 2030. In addition, the development of projects such as the Vrede Solar PV Facility in regions where grid connection is more constrained, in order to promote investment and growth into the regional connectivity and grid.

| | Coal | Coal (Decommis-sioning) | Nuclear | Hydro | Storage | PV | Wind | CSP | Gas & Diesel | Other (Distributed Generation, CoGen, Biomass, Landfill) |
|---|---|---|---|---|---|---|---|---|---|---|
| Current Base | 37,149 | | 1 860 | 2,100 | 2 912 | 1 474 | 1 980 | 300 | 3 830 | 499 |
| 2019 | 2,155 | -2,373 | | | | | 244 | 300 | | Allocation to the extent of the short term capacity and energy gap. |
| 2020 | 1,433 | -557 | | | | 114 | 300 | | | |
| 2021 | 1,433 | -1403 | | | | 300 | 818 | | | |
| 2022 | 711 | -844 | | | 513 | 400 1,000 | 1,600 | | | |
| 2023 | 750 | -555 | | | | 1000 | 1,600 | | | 500 |
| 2024 | | | 1,860 | | | | 1,600 | | 1000 | 500 |
| 2025 | | | | | | 1000 | 1,600 | | | 500 |
| 2026 | | -1,219 | | | | | 1,600 | | | 500 |
| 2027 | 750 | -847 | | | | | 1,600 | | 2000 | 500 |
| 2028 | | -475 | | | | 1000 | 1,600 | | | 500 |
| 2029 | | -1,694 | | | 1575 | 1000 | 1,600 | | | 500 |
| 2030 | | -1,050 | | 2,500 | | 1000 | 1,600 | | | 500 |
| TOTAL INSTALLED CAPACITY by 2030 (MW) | 33,364 | | 1,860 | 4,600 | 5,000 | 8,288 | 17,742 | 600 | 6,380 | |
| % Total Installed Capacity (% of MW) | 43 | | 2.36 | 5.84 | 6.35 | 10.52 | 22.53 | 0.76 | 8.1 | |
| % Annual Energy Contribution (% of MWh) | 58.8 | | 4.5 | 8.4 | 1.2* | 6.3 | 17.8 | 0.6 | 1.3 | |

Installed Capacity
Committed/Already Contracted Capacity
Capacity Decommissioned
New Additional Capacity
Extension of Koeberg Plant Design Life
Includes Distributed Generation Capacity for own use

- 2030 Coal Installed Capacity is less capacity decommissioned between years 2020 and 2030.
- Koeberg power station rated/installed capacity will revert to 1,926MW (original design capacity) following design life extension work.
- Other/ Distributed generation includes all generation facilities in circumstances in which the facility is operated solely to supply electricity to an end-use customer within the same property with the facility.
- Short term capacity gap is estimated at 2,000MW.

**Figure 5.3:** A snapshot of the updated Energy Mix as per the IRP 2019

Although the majority of South Africa's electricity generation infrastructure (coal-fired power stations) is currently located within Mpumalanga due to the location of coal resources within this province, the location of the Vrede Solar PV Facility is in a region with moderate to high solar irradiation values, and therefore in an area where electricity generation from solar energy facilities is both a feasible and viable option. The

location of the study area and project site is therefore considered to support the Province/Region's generation targets, from a regional perspective.

The overarching objective for the solar energy facility is to maximise electricity production through exposure to the solar resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts. From a regional site selection perspective, this region is considered to be preferred for solar energy development by virtue of its annual solar irradiation values. The GHI for the area derived from the World Bank Group's Global Solar Atlas is approximately between 1972 and 2118kWh/m$^2$/annum, comparable with values for Bloemfontein and Beaufort West, therefore enabling the successful development of solar energy projects within the region (refer to **Figure 5.4**).

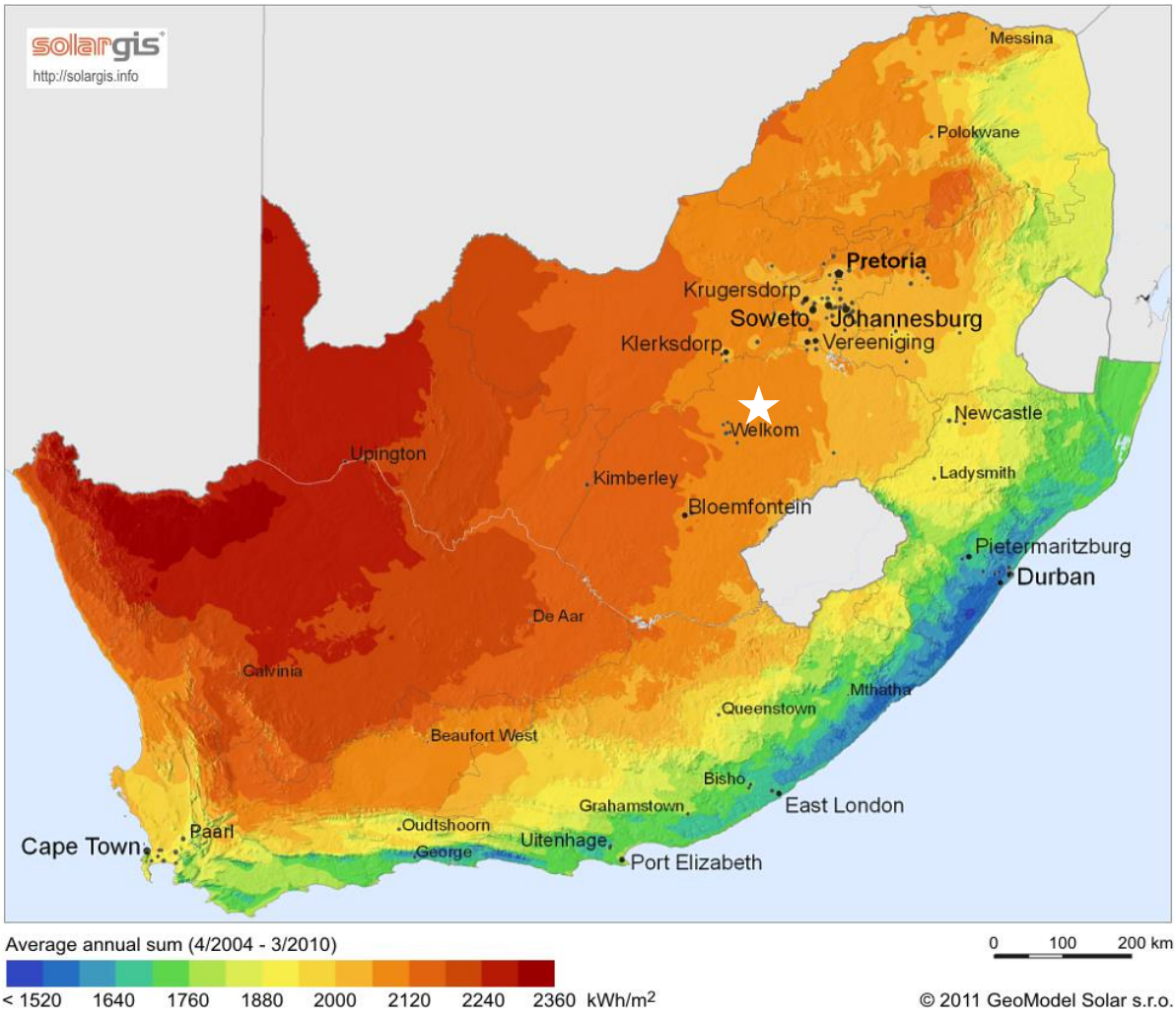


**Figure 5.4:** Solar irradiation map for South Africa, with the position of the Vrede Solar PV Facility shown by the white star (Source: GeoModel Solar).

## 5.5 Receptiveness of the proposed development area for the establishment of Vrede Solar PV Facility

The placement of a solar PV facility is strongly dependent on several factors including climatic conditions (solar irradiation levels), topography, the location of the site, and in particular the location in a node for renewable projects, availability of grid connection, the extent of the site and the need and desirability for the project. From a local level perspective, the project site and development area have specifically been identified by the proponent as being highly desirable from a technical perspective for the development of a solar PV facility due to the following site characteristics:

| Characteristic | Description |
|---|---|
| Solar resource | The Global Horizontal Irradiation (GHI) for this geographic location is approximately 2 240 kWh/m2/annum, which is considered favourable for the development of a solar PV facility. |
| Typography | the Vrede Solar PV Facility consists of a flat and homogenous area, suitable to the construction and operation of a solar PV facility |
| Site extent and land availability | The extent of land available for the construction and operation of the Vrede Solar PV Facility, and the opportunity provided for the avoidance of environmental sensitivities contributes to the need and desirability of the development of the Vrede Solar PV Facility in the proposed location. |
| Access to Road Infrastructure and Site access: | The site can be readily accessed via an existing gravel access road (the S172). The S172 road connects with the P99/1, which further connects with the R34 leading south-west out of the town of Kroonstad. The close proximity of the development area to the R34 road (refer to **Figure 5.5**) |
| Grid access | The facility will loop into the existing Eskom Kroonstad Municipality – Theseus 1 132kV power line (refer to **Figure 5.6**). This line is ~3km from the proposed project site, reducing the grid connection requirements in order to allow for connection with the national grid. |
| Land suitability and land use activities | The current land use of the project site and development area is an important consideration in site selection in terms of limiting disruption to existing land use practices. The project site is currently used for grazing, which is generally preferred for developments of this nature as the grazing activities can continue on the project site in tandem with the operation of the solar PV facility. There is no recent cultivated agricultural land in the project site or directly adjacent to it which could be impacted upon by the proposed development and traces of historical cultivation is evident only towards the west of the development area. This area is, however, no longer actively being cultivated and represents highly modified, fallow land. The landowner is currently considering alternative land uses based on the challenges and limitations experienced within farming the project site economically. Other land uses present within the vicinity of the development area include game and cattle farming, power line servitudes (including the Eskom Kroonstad Municipality – Theseus 1 power line into which the Vrede Solar PV facility is planned to connect to, as well as the Gansvlei 1 (11kV) line traversing the project site), and potential future development of another renewable solar energy facility (Rondavel Solar PV Facility) which is currently also subject to an environmental authorisation process. As such, the development provides opportunity for an alternative land use which will not be in conflict with the existing land use, and which will provide a productive and economically viable solution. In addition, landowner agreements are in place towards the use of these properties for |

| Characteristic | Description |
|---|---|
| | the Solar PV development. The proposed development is compatible with the surrounding land uses and does not present a conflicting land use. |
| Landowner Support | The selection of a site where the landowner is supportive of the development of renewable energy is essential for ensuring the success of the project. The landowner does not view the development as a conflict with their current land use practices. The support from the landowner for the development to be undertaken on the affected properties has been solidified by the provision of consent for the project to proceed on the property through the signing of a land option to lease agreement with the proponent. |

Taking into consideration the solar resource, grid access, land suitability, landowner support, access to road infrastructure, the current land use of the project site and development area, in conjunction with other large-scale solar PV projects planned within the vicinity of the project site, the development of the Vrede Solar PV Facility is, therefore, considered to be desirable and will ultimately contribute to, and further develop the successful power generation activities already being undertaken within the area.

Therefore, the development of the Vrede Solar PV Facility within the project site and development area is considered to be desirable considering the characteristics of the area.


**Figure 5.5:** Existing road infrastructure within the vicinity of the development area for the Vrede Solar PV Facility. This infrastructure will primarily be used to gain access to the development area.

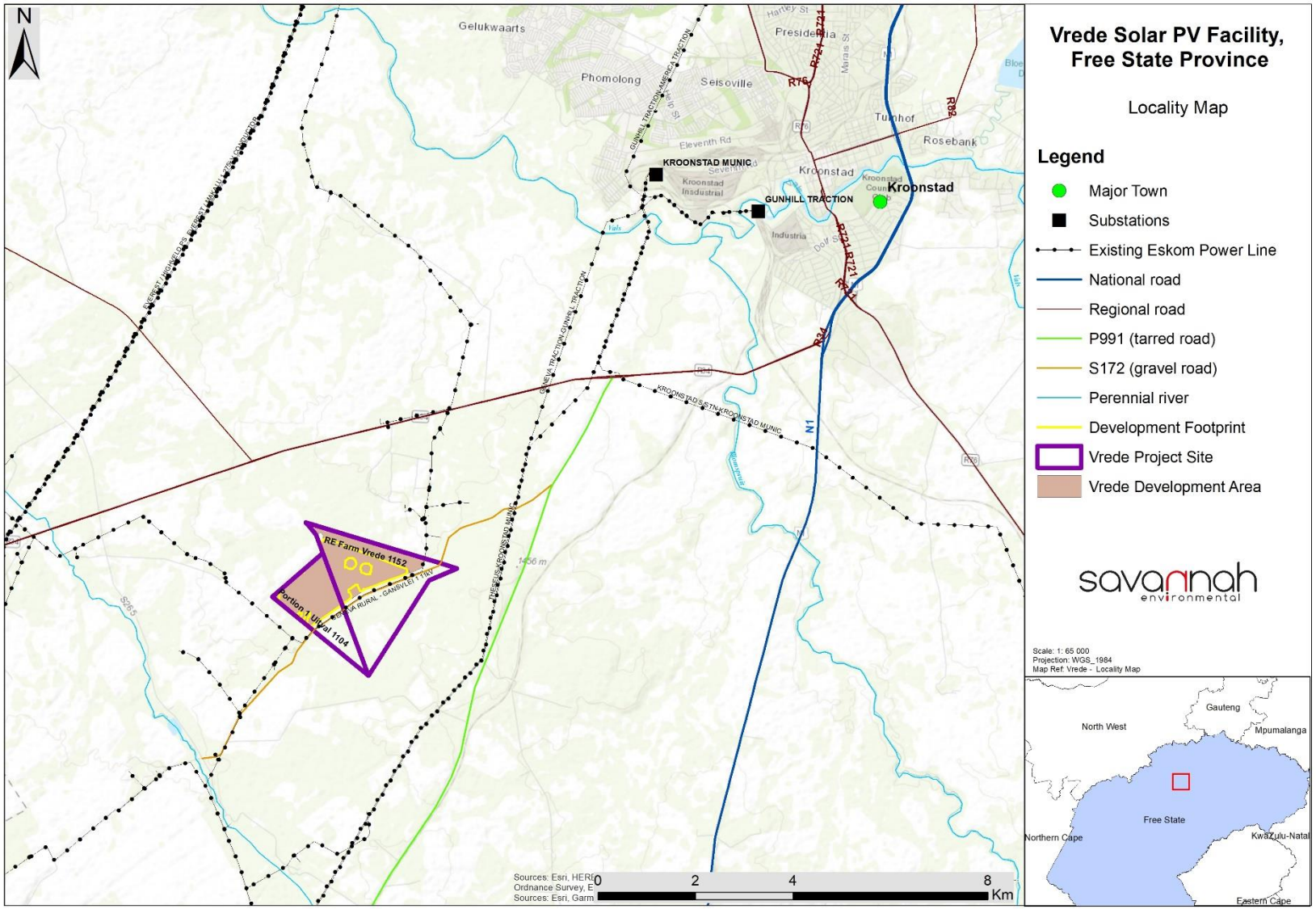


**Figure 5.6:** The Vrede Solar PV Facility project site in relation to the Eskom Kroonstad Municipality – Theseus 1 132kV power line (south-east) into which the facility will loop in, loop out in order to evacuate the energy to the national grid. (Refer **Appendix L** for A3 maps)

## 5.6 Benefits of Renewable Energy and the Need and Desirability

The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa; these include:

**Socio-economic upliftment of local communities:** The Vrede Solar PV Facility has the potential to create much needed employment for unskilled locals during the construction phase. Training opportunities will also be afforded to qualified local people who can be upskilled to undertake certain roles during the construction and operation phases. In terms of the needs of the local community, the Local and District municipality IDPs identified the need to facilitate economic development by creating an environment that is conducive for business development, economic growth, sustainable employment opportunities and growth in personal income levels of communities; unlock opportunities to increase participation amongst all sectors of society in the mainstream economy to create decent job opportunities; promote Local Economic Development; and enhance rural development and agriculture. A study undertaken by the Department of Mineral Resource and Energy (DMRE), National Treasury and the Development Bank of Southern Africa (DBSA) in June 2017 found that employment opportunities created during the construction phase of the projects implemented to date had created 40% more jobs for South African citizens than anticipated. The study also found that significantly more people from local communities were employed during construction than was initially planned, confirming the potential benefits for local communities associated with the implementation of renewable energy projects.

The Vrede Solar PV Facility also has the potential to make a positive contribution towards the identified community needs. In terms of the economic development requirements of the REIPPPP, the project will commit benefits to the local community in the form of job creation, localisation, and community ownership. In accordance with the DMRE's bidding requirements of the REIPPP, a percentage of the revenue generated per annum during operation will be made available to local communities through a social beneficiation scheme. Therefore, the potential for creation of employment and business opportunities, and the opportunity for skills development for local communities is significant. Secondary social benefits can be expected in terms of additional spend in nearby towns due to the increased demand for goods and services. These socio-economic benefits would include an increase in the standard of living for local residents within the area as well as overall financial and economic upliftment. Other procurement programmes under the IRP 2019 (or as updated in the future) is expected to also have similar bidding requirements and therefore the same relative contribution is anticipated for the Vrede Solar PV facility should the project be bid into future power procurement programmes.

***Increased energy security:***
Load shedding presents a challenge with regards to reliability and security of supply. Given that renewables can often be deployed in a short timeframe and in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality in the short-term, while reducing expensive distribution losses. According to the Council for Scientific and Industrial Research's (CSIR) latest published latest annual statistics on power generation in South Africa for the period 2020, load shedding occurred for 859 hours of the year (9.8%) with an upper limit of 1,798 GWh relative to actually achieved energy shed of 1,269 GWh. An urgent response is therefore necessary to ensure adequate short-term electricity supply and to set South Africa on a path towards long-term adequacy in the 2020s. Eskom's energy availability factor has been on a declining trend since 2001, and after a brief spike in 2016, has continued down this path over the last year (2019-2020).

According to the DoE IPPPP Overview (March 2019), 35669GWh of energy has been generated by renewable energy sources procured under the REIPPPP since the first project became operational. Renewable energy IPPs have proved to be very reliable. Of the 64 projects that have reached COD 9as at March 2019), 62 projects have been operational for longer than a year. The energy generated over the period 2018 -2019 for these 62 projects is 10648GWh, which is 96% of their annual energy contribution projections (P50) of 11146GWh over a 12-month delivery period. Twenty eight (28) of the 62 projects (45%) have individually exceeded their P50 projections.

***Resource saving:*** It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres per annum. As an already water-stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly due to the detrimental effects of climate change on water availability. Renewable energy also translates into revenue savings, as fuel for renewable energy facilities is free, while compared to the continual purchase of fuel for conventional power stations. According to the DoE IPPPP Overview (March 2019), water savings of 42.8 million kilolitres has been realised by the programme from inception until the end of March 2019.

***Exploitation of significant renewable energy resource:*** At present, valuable renewable resources including biomass by-products, solar irradiation and wind power remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio in South Africa.

By the end of March 2019, the REIPPPP had made the following significant impacts in terms of energy supply:

- 6 422MW of electricity had been procured from 112 Renewable Energy Independent Power Producers (IPPs) in seven bid rounds;
- 2 000MW of generating capacity (comprising various technologies) has been awarded to 8 Independent Power Producers under the recent RMIPPPP;
- 3 976MW of electricity generation capacity from 64 IPP projects has been connected to the national grid;
- 35 669 GWh of energy has been generated by renewable energy sources procured under the REIPPPP since the first project became operational. Renewable energy IPPs have proved to be very reliable. Of the 64 projects that have reached commercial operation, 62 projects have been operational for longer than a year. The energy generated over the 12 month period (as at 31 March 2019) for these 62 projects is 10 648 GWh , which is 96% of their annual energy contribution projections of 11 146 GWh over a 12 month delivery period. Twenty eight (28) of the 62 projects (45%) have individually exceeded their projections.

***Economics:*** As a result of the available renewable energy resources and the competitive renewable energy procurement process, both wind power and solar PV power have now been proven as cheaper forms of energy generation in South Africa than fossil fuel (coal) generated power. The IRP 2019 gazetted by the Minister of Mineral Resources and Energy in October 2019, updates the energy forecast for South Africa from the current period until the year 2030 and has made an allocation of 6000MW in addition to the already installed/committed capacity of 2 288MW from solar PV facilities which will be developed from 2022 – 2030.

The following has been achieved by the IPP programme (March 2019) in terms of investment and economics:

- Investment (equity and debt) to the value of R209.7 billion10, of which R41.8 billion (20%) is foreign investment, was attracted;

- Socio-economic development contributions of R860.1 million to date, of which R81.1 million was spent in this 2019 reporting quarter; and
- Enterprise development contributions of R276.7 million to date, of which R26.5 million was spent in this 2019 reporting quarter.

***Pollution reduction:*** The release of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation. The use of solar irradiation or wind for power generation is a non-consumptive use of a natural resource which produces zero emissions during its operation.

***Climate friendly development:*** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of GHG emissions. South Africa is estimated to currently be responsible for approximately 1% of global GHG emissions (and circa half of those for which Africa is responsible) and is currently ranked 9th worldwide in terms of per capita carbon dioxide emissions. Since its inception, the REIPPPP has achieved carbon emission reductions[14] of 25.3 million tonnes of $CO_2$ (IPP Office, March 2018). The overview of the Independent Power Producers Procurement Report (March 2019) indicates that carbon emission reductions of 36.2 Mton $CO_2$ has been realised by the IPP programme from inception to end of March 2019. The development of the Vrede Solar PV Facility, and the associated electricity generated as a result of the facility, will result in additional savings on tons of $CO_2$ emissions associated with power generation.

***Support for international agreements:*** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under and for cementing its status as a leading player within the international community.

***Investment, economic and social impacts:*** The development, procurement, installation, maintenance and management of renewable energy facilities have significant potential for job creation and skills development in South Africa. The overview of the Independent Power Producers Procurement Report (March 2019) indicates that all IPP projects, as at 31 March 2019, have created 40 134 job years for South African citizens.

The overview of the Independent Power Producers Procurement Report (March 2019) indicates the following contributions from the REIPPPP projects in terms of investment, socio-economic development and contributions to enterprise development:

- Investment (equity and debt) to the value of R209.7 billion, of which R41.8 billion (20%) is foreign investment, was attracted
- Socio-economic development contributions of R860.1 million to date.
- Enterprise development contributions of R276.7 million to date.

***Acceptability to society:*** Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.

[14] Carbon emission reduction is calculated based on a displacement of power, from largely coal-based to more environmentally friendly electrical energy generation, using a gross Eskom equivalent emissions factor of 1.015 tons $CO_2$/MWh.

***Support to a new industry sector:*** The development of renewable energy offers the opportunity to establish a new industry within the South African economy, which will create jobs and skill local communities which have potential for further renewable energy projects.

***Protecting the natural foundations of life for future generations:*** Actions to reduce our disproportionate carbon footprint can play an important part in ensuring our role in preventing dangerous anthropogenic climate change, thereby securing the natural foundations of life for generations to come; this is the basis of sustainable development. The development of renewable energy facilities contributes to the protection of the foundations.

## 5.7 Cumulative impact considerations relating to need and desirability

Specialist studies conducted for the EIA phase of this assessment included consideration of the cumulative impacts, including rating thereof, in terms of their respective disciplines. The results are briefly summarised below.

| Specialist assessment | Overall significance of impact of the proposed project considered in isolation | Cumulative significance of impact of the project and other projects in the area |
|---|---|---|
| Ecology | Low | Low |
| Avifauna | Medium | Low |
| Freshwater | Low | Low |
| Heritage | Low | Low |
| Socio-Economic | Low (Negative)<br>Low (Negative)<br>High (Positive) | Medium (Negative)<br>Low (Negative)<br>High (Positive) |
| Visual | Medium | Medium |
| Agriculture potential and soil | Low<br>Medium<br>Low | Medium<br>Medium<br>Medium |

Based on the results of the cumulative assessments conducted by the specialist, it is evident that all negative cumulative impacts are rated medium in significance considered in the broader context. One High significance positive (social) impact was also determined by the specialists. Given no high or very high negative cumulative impacts are anticipated for the proposed project, the development type and location is supported in terms of need and desirability as it relates to cumulative impact, with impact significance remaining acceptable following implementation of mitigation.

# CHAPTER 6 APPROACH TO UNDERTAKING THE EIA PROCESS

In terms of the EIA Regulations of December 2014 (as amended) published in terms of the NEMA (Act No. 107 of 1998) as amended, the construction and operation of the Vrede Solar PV Facility is a listed activity requiring Environmental Authorisation (EA). The application for EA is required to be supported by an Environmental Impact Assessment (EIA) process based on the contracted capacity of the facility being 100MWac and Activity 1 of Listing Notice 2 (GN 325, as amended).

An EIA process refers to the process undertaken in accordance with the requirements of the relevant EIA Regulations (the 2014 EIA Regulations (GNR 326, as amended)), which involves the identification and assessment of direct, indirect, and cumulative environmental impacts associated with a proposed project or activity. The EIA process comprises two main phases: i.e. **Scoping** and **EIA Phase**. The EIA process culminates in the preparation and submission of a final EIA Report (including an EMPr) to the competent authority for decision-making. In order to ensure that a comprehensive assessment is provided to the competent authority and I&APs regarding the impacts of the facility, detailed independent specialist studies were undertaken as part of this S&EIA process.

The EIA process is illustrated in **Figure 6.1**.


**Figure 6.1:** The Phases of an Environmental Impact Assessment (EIA) Process.

South Africa is subject to the enforcement of Government Gazette 43096 which places the country in a national state of disaster limiting the movement of people to curb the spread of the COVID-19 virus. Considering the limitations in place, a comprehensive consultation process was designed and implemented to cater for the undertaking of a full-scale, innovative public participation process which included I&APs, the competent authority, directly impacted landowners/occupiers, adjacent landowners/occupiers, relevant Organs of State departments, ward councillors and other key stakeholders, while remaining within the limits as stipulated by the National Government. This chapter outlines the process that was followed during the EIA process.

## 6.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter includes the following information required in terms of Appendix 3: Scoping of Assessment and Content of Environmental Impact Assessment Report:

| Requirement | Relevant Section |
|---|---|
| (d) a description of the scope of the proposed activity, including (i) all listed and specified activities triggered and being applied for and (ii) a description of the associated structures and infrastructure related to the development. | All listed activities triggered and applied for are included in **Section 6.2**. The specific project activity relating to the relevant triggered listed activity has also been included in **Table 6.1**. |
| (h)(ii)details of the public participation process undertaken in terms of Regulation 41 of the Regulations, including copies of the supporting documents and inputs. | A public participation plan was prepared and approved by the DFFE (Refer **Appendix C9**). The public participation process followed throughout the EIA process of the Vrede Solar PV Facility is included in **Section 6.5.2** and copies of the supporting documents and inputs are included in **Appendix C**. |
| (h)(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them. | All comments received from the commencement of the EIA process has been included and responded to in the Comments and Responses (C&R) Report (**Appendix C8**). All comments raised during the 30-day review and comment period of the EIA Report and through on-going consultation with I&APs will be included and responded to as part of a C&R report (**Appendix C8** to be submitted as part of the Final EIA Report to DFFE for decision-making. |
| (h)(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks. | The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives are included in **Section 6.5.3**. |

## 6.2 Relevant legislative permitting requirements

The legislative permitting requirements applicable to the Vrede Solar PV Facility, as identified at this stage in the process and considered within this EIA process, are described in more detail under the respective sub-headings below.

### *6.2.1 National Environmental Management Act (No. 107 of 1998) (NEMA)*

NEMA (No. 107 of 1998) is South Africa's key piece of national environmental legislation that provides for the authorisation of certain controlled activities known as "listed activities". In terms of Section 24(1) of NEMA, the potential impact on the environment associated with listed activities must be considered, investigated, assessed and reported on to the Competent Authority (the decision-maker) charged by NEMA with granting of the relevant Environmental Authorisation (EA). Due to the fact that the Vrede Solar PV Facility is a power generation project and therefore relates to the IRP for Electricity 2010 – 2030, the National Department of Forestry, Fisheries and Environment, (DFFE) has been determined as the Competent Authority (CA) in terms of GNR 779 of 01 July 2016. The Free State Provincial Department of Economic Development, Tourism and Environmental Affairs (DEDTEA) is a Commenting Authority on the project.

The need to comply with the requirements of the EIA Regulations published under NEMA ensures that developers are provided the opportunity to consider the potential environmental impacts of their activities early in the project development process, and also allows for an assessment to be made as to whether environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the EIA Regulations to provide the Competent Authority with sufficient information in order for an informed decision to be taken regarding the Application for EA.

The EIA process being conducted for the Vrede Solar PV Facility is undertaken in accordance with Section 24(5) of the NEMA, which defines the procedure to be followed in applying for EA, and requires that the potential consequences for, or impacts of, listed or specified activities on the environment be considered, investigated, assessed, and reported on to the competent authority. Listed Activities are activities identified in terms of Section 24 of the NEMA which are likely to have a detrimental effect on the environment, and which may not commence without an EA from the competent authority subject to the completion of an environmental assessment process (either a Basic Assessment (BA) or full Scoping and EIA).

**Table 6.** contains all the listed activities identified in terms of NEMA, the 2014 EIA Regulations (GNR 326, as amended), and Listing Notice 1 (GNR 327, as amended), Listing Notice 2 (GNR 325, as amended), and Listing Notice 3 (GNR 327, as amended) which may be triggered by the proposed development the Vrede Solar PV Facility, and for which EA has been applied.

**Table 6.1:** Listed activities identified in terms of the Listing Notices (as per GNR 327, 325 and 324).

| Notice Number | Activity Number | Description of listed activity |
|---|---|---|
| Listing Notice 1<br>(GNR 327)<br>08 December 2014 (as amended) | 11 (i) | The development of facilities or infrastructure for the transmission and distribution of electricity –<br>(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275kV or more.<br><br>***Internal distribution electrical infrastructure required to connect the Vrede Solar PV Facility components, as well as the onsite IPP substation and cabling (buried or overhead) will be between 33kV and 275kV.***<br><br>***The on-site IPP substation will be rated 33/132kV whereas internal cabling will be up to 33kV.*** |
| Listing Notice 1<br>(GNR 327)<br>08 December 2014 (as amended) | 12(ii)(a)(c) | The development of—<br>(ii) or infrastructure or structures with a physical footprint of 100 square metres or more;<br><br>where such development occurs—<br>(a) within a watercourse;<br>(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;<br><br>***The physical footprint of internal access roads and electrical cabling required to connect the various PV facility infrastructure and components will be confirmed once final designs have been provided. However, these will be located within 32m of delineated watercourses on site.*** |

| Notice Number | Activity Number | Description of listed activity |
|---|---|---|
| Listing Notice 1 (GNR 327) 08 December 2014 (as amended) | 19 | The infilling or depositing of any material of more than 10 $m^3$ into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 $m^3$ from a watercourse.<br><br>***Internal access roads and electrical cabling required to connect the various PV facility infrastructure and components will collectively require the excavation, infilling or removal of soil exceeding 10$m^3$ (exact values to be determined following layout finalisation).*** |
| Listing Notice 1 (GNR 327) 08 December 2014 (as amended) | 24(ii) | The development of a road—<br>(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;<br><br>**Access roads (of up to 12m wide) and internal roads (up to 5m wide and up to 11km long) will be developed for the Vrede Solar PV Facility during construction, and will be located outside of urban areas.** |
| Listing Notice 1 (GNR 327) 08 December 2014 (as amended) | 28 (ii) | Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:<br>(ii) will occur outside an urban area, where the total land to be developed is bigger than 1ha.<br><br>***The total area of land to be developed for the solar PV facility will be ~273 ha on a site which was historically (after 1 April 1998) used for agricultural purposes.*** |
| Listing Notice 1 (GNR 327) 08 December 2014 (as amended) | 56(i)(ii) | The widening of a road by more than 6 m, or the lengthening of a road by more than 1 km –<br>(i) where the existing reserve is wider than 13.5 m; or<br>(ii) where no reserve exists, where the existing road is wider than 8m.<br><br>***The existing access roads will not exceed the 1km threshold, however widening of a road will exceed 6m for the transport of the transformers and BESS infrastructure.*** |
| Listing Notice 2 (GNR 325) 08 December 2014 (as amended) | 1 | The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20MW or more.<br><br>***The project comprises a renewable energy generation facility, which will utilise photovoltaic (PV) technology and will have a contracted capacity of up to 100MW. The development is located outside of an urban area.*** |
| Listing Notice 2 (GNR 325) 08 December 2014 (as amended) | 15 | The clearance of an area of 20ha or more of indigenous vegetation[15].<br><br>***The facility is located on fallow land historically used for livestock grazing and other agricultural activities and is therefore likely to*** |

[15] "Indigenous vegetation" as defined by the 2014 EIA Regulations (GNR 982, as amended) refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.

| Notice Number | Activity Number | Description of listed activity |
|---|---|---|
| | | ***comprise indigenous vegetation. In addition, the project is anticipated to require clearing of up to ~273ha and would therefore result in the clearance of an area of land greater than 20ha of indigenous vegetation.*** |
| Listing Notice 3<br>(GNR 324)<br>08 December 2014 (as amended) | 2(b)(ii)(dd) | The development of reservoirs, excluding dams, with a capacity of more than 250 cubic metres.<br><br>b. Free-State<br>ii. Outside urban areas:<br>(dd) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;<br><br>***The development of the Vrede Solar PV Facility includes storage tanks for water abstracted from the two boreholes within the development area, to be used during construction and operation.***<br><br>***The capacity of this storage facility will not exceed ~ 250 m³, and will be located within CBA1, ESA 1 and ESA 2 classified land.*** |
| Listing Notice 3<br>(GNR 324)<br>08 December 2014 (as amended) | 4(b)(i)(ee) | The development of a road wider than 4 m with a reserve less than 13.5m.<br><br>b. Free State<br>i. Outside urban areas:<br>(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;<br><br>***Access roads (up to 12m wide and internal roads (up to 5m wide and up to 11km long)) will be developed for the Vrede Solar PV Facility during construction. The development area is also located within CBA and ESA areas.*** |
| Listing Notice 3<br>(GNR 324)<br>08 December 2014 (as amended) | 10(b)(i)(ee) | The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres.<br><br>b. Free State<br>i. Outside urban areas:<br>(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;<br><br>**Dangerous goods such as fuel will be required to be stored and handled on site. The combined capacity of storage containers (fuel, oils, etc) will be less than 80m³.** |
| Listing Notice 3<br>(GNR 324)<br>08 December 2014 (as amended) | 12(b)(ii) | The clearance of an area of 300 m² or more of indigenous vegetation within:<br>b. Free State<br>ii. Within critical biodiversity areas identified in bioregional plans;<br>iv. Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland. |

| Notice Number | Activity Number | Description of listed activity |
|---|---|---|
| | | **The Vrede Solar PV Facility development will require clearance in excess of 300m² of indigenous vegetation within Critical Biodiversity Areas (CBA). In excess of 10ha of the project footprint (anticipated to be ~273ha) will comprise CBA areas, subject to change following final layout confirmation. In addition, the development will comprise clearing in excess of 300m² of indigenous vegetation within 100m from the edge of a watercourse or wetland.** |
| Listing Notice 3<br>(GNR 324)<br>08 December 2014 (as amended) | 14(ii)(a)(c) | The development of —<br>(ii) infrastructure or structures with a physical footprint of 10 m² or more; where such development occurs —<br>(a) within a watercourse;<br>(c) if no development setback has been adopted, within 32 m of a watercourse, measured from the edge of a watercourse;<br><br>***Internal access roads and electrical cabling required to connect the various PV facility infrastructure and components will collectively comprise more than 10m² and be located within 32m of delineated watercourses on site. Exact values will be determined following layout finalisation.*** |
| Listing Notice 3<br>(GNR 324)<br>08 December 2014 (as amended) | 18(b)(ee) | The widening of a road by more than 4 m, or the lengthening of a road by more than 1 km.<br><br>b. Free State<br>i. Outside urban areas:<br>(ee) Critical biodiversity areas as identified in systematic biodiversity plans<br><br>**Access roads needed for the facility will require widening roads up to 8m which will be constructed within CBA 1 areas. Access roads (of up to 12m wide) and internal roads (up to 5m wide and up to 11km long) will be developed for the Vrede Solar PV Facility during construction in areas comprised of CBA areas, subject to change following final layout confirmation.** |

### *6.2.2 National Water Act (No. 36 of 1998) (NWA)*

In accordance with the provisions of the National Water Act (No. 36 of 1998) (NWA), all water uses must be licensed with the Competent Authority (i.e. the Regional Department of Water and Sanitation (DWS) or the relevant Catchment Management Agency (CMA)). Water use is defined broadly, and includes taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation.

**Table 6.** lists the Water Uses associated with the proposed project and identified in terms of the NWA which require licensing either in the form of a General Authorisation (GA), or in the form of a Water Use License (WUL). The table also includes a description of those project activities which relate to the applicable Water Uses.

**Table 6.2: List of Water Uses published under Section 21 of NWA, as amended.**

| Notice No. | Activity No. | Description of Water Use |
|---|---|---|
| NWA (No. 36 of 1998) | Section 21 (a) | Taking water from a water resource<br><br>***Two boreholes are currently in use within the project site, and water for construction and O&M may be utilised from these sources. Water obtained from these sources must however be appropriately licenced/registered as per the requirements of the National Water Act.*** |
| NWA (No. 36 of 1998) | Section 21 (b) | Storing of Water<br><br>***There is the potential that up to 250m³ of water could be stored on site in reservoirs.*** |
| NWA (No. 36 of 1998) | Section 21 (c) | Impeding or diverting the flow of water in a watercourse<br><br>***Infrastructure associated with the Vrede Solar PV Facility will be located within the GN 509 regulated area of a watercourse (100m zone surrounding the identified ephemeral drainage line or 500m from a natural wetland).*** |
| NWA (No. 36 of 1998) | Section 21 (i) | Altering the bed, banks, course or characteristics of a watercourse.<br><br>***Infrastructure associated with the Vrede Solar PV Facility will be located within the GN 509 regulated area of a watercourse (100m zone surrounding the identified ephemeral drainage line or 500m from a natural wetland).*** |

Due to the development area of the Vrede Solar PV Facility being located within the regulated area of a drainage line located along the south-eastern boundary, and the intention to use water from two existing boreholes within the project site, an application for a water use authorisation in accordance with the requirements of the Regulations Regarding the Procedural Requirements for Water Use License Applications and Appeals (GN R267), or a General Authorisation (GA) registered in accordance with the GN R509 of 2016. The water use authorisation process for the Vrede Solar PV Facility will only be completed once a positive EA has been received and the project selected as Preferred Bidder. This is line with the requirements of the Department of Human Settlements, Water and Sanitation.

### *6.2.3 National Heritage Resources Act (No. 25 of 1999) (NHRA)*

The National Heritage Resources Act (No. 25 of 1999) (NHRA) provides an integrated system which allows for the management of national heritage resources, and to empower civil society to conserve heritage resources for future generations. Section 38 of NHRA provides a list of activities which potentially require the undertaking of a Heritage Impact Assessment.

Section 38: Heritage Resources Management

*1). Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as –*

*a. the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;*

*b. the construction of a bridge or similar structure exceeding 50m in length;*

*c. any development or other activity which will change the character of a site –*

*i). exceeding 5 000m² in extent; or*

*ii). involving three or more existing erven or subdivisions thereof; or*

*iii). involving three or more erven or divisions thereof which have been consolidated within the past five years; or*

*iv). the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;*

*Must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.*

In terms of Section 38(8), approval from the heritage authority is not required if an evaluation of the impact of such development on heritage resources is required in terms of any other legislation (such as NEMA), provided that the consenting authority ensures that the evaluation of impacts fulfils the requirements of the relevant heritage resources authority in terms of Section 38(3) and any comments and recommendations of the relevant resources authority with regard to such development have been taken into account prior to the granting of the consent. However, should heritage resources of significance be affected by the proposed development, a permit is required to be obtained prior to disturbing or destroying such resources as per the requirements of Section 48 of the NHRA, and the South African Heritage Resources Agency (SAHRA) Permit Regulations (GNR 668).

### 6.3 Overview of the Scoping Phase

The Scoping Phase aimed to:

- Identify, describe and evaluate potential environmental (biophysical and social) impacts and benefits of all phases of the proposed facility (including design, construction, operation and decommissioning) within the site through a desk-top review of existing baseline data and desk-top specialist studies.
- Identify potentially sensitive environmental features and areas within the broader site in order to inform the design process of the facility.
- Define the scope of studies to be undertaken within the EIA process.
- Provide the authorities with sufficient information in order to make a decision regarding the scope of issues to be addressed in the EIA process, as well as regarding the scope and extent of specialist studies that will be required to be undertaken as part of the EIA Phase of the process.

Within this context, the objectives of the Scoping Phase were to, through a consultative process:

- Identify the policies and legislation relevant to the project.
- Motivate the need and desirability of the proposed project, including the need and desirability of the activity in the context of the preferred location.
- Identify and confirm the preferred project and technology alternative.
- Identify and confirm the preferred site.
- Identify the key issues to be addressed in the EIA phase.
- Agree on the level of assessment to be undertaken, including the methodology to be applied, the expertise required as well as the extent of further consultation to be undertaken to determine the impacts and risks the project will impose on the preferred site through the life of the project, including

the nature, significance, consequence, extent, duration and probability of the impacts to inform the location of the development footprint within the preferred site.

» Identify suitable measures to avoid, manage or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

The Scoping Study considered an estimated contracted capacity of 100MWac for the Vrede Solar PV Facility. The broader development area was considered during the Scoping Study to identify and delineate any environmental fatal flaws, "no-go" or sensitive areas which should be avoided. The preparation and release of the Scoping Report for a 30-day public review period provided stakeholders and I&APs with an opportunity to verify that the issues they had raised during the Scoping process had been captured and adequately considered and provided a further opportunity for additional key issues to be raised for consideration. The Final Scoping Report and Plan of Study for EIA was submitted to DFFE on 15 January 2021, and acceptance was received on 24 February 2021, marking the start of the EIA Phase (refer to **Appendix B**). Additional information requested by the DFFE in the Acceptance of the Scoping Report and the location of the requested information in this EIA Report is detailed in **Table 6..**

**Table 6.3: DFFE requirements and reference to Section in the EIA Report**

| DFFE Requirements for EIA | Response / Location in this EIA Report |
|---|---|
| Listed Activities:<br>The listed activities represented in the EIAR and the application form must be the same and correct | Minor modifications have were made to the descriptions of the listed activities (specifications added in response to DFFE requirements). As such, a revised application form was submitted along with the draft EIAR which has corresponding descriptions and listed activities as that captured in the EIA Report. |
| Note that for every activity, a sub-activity must be selected, i.e. Listing Notice 1, Activity 12(ii)(a). The EIAR must assess the correct sub listed activity for each listed activity applied for. | Minor modifications have were made to the descriptions of the listed activities (specifications added as per DFFE requirements). As such, a revised application form was submitted along with the draft EIAR which have corresponding descriptions and listed activities as that captured in the EIA Report.<br><br>Please refer to the Listed activities detailed in this Chapter 6 of the final EIAR, which include specification and consideration of the sub-activity applicable to each triggered activity. |
| The EIAr must provide an assessment of the impacts and mitigations measures for each of the listed activities. | An assessment of impacts and recommended mitigation measures was included in **Chapter 8** of this report |
| Kindly include the proposed threshold for each activity. For each listed activity, where possible, provide the proposed threshold/footprint associated with the listed activity, i.e. the footprint of infrastructure in $m^2$, the removal of material in $m^3$, the clearance of land in $m^2$, number of BESS per site (each individual unit, if applicable), the storage of hazardous goods in $m^3$, road dimensions, etc. | Please refer to the Listed activities detailed in Chapter 6 of the EIAR, which specify the threshold where possible for each listed activity triggered. |
| If the activities applied for in the application form differ from those mentioned in the final SR, an amended | Minor modification were made to the descriptions of the listed activities contained in the EIA report in |

| DFFE Requirements for EIA | Response / Location in this EIA Report |
|---|---|
| application form must be submitted. Please note that the latest version of the Department's application form template can be downloaded from the following link: https://www.environment.gov.za/documents/forms. | response to the comments raised by DFFE, and therefore an amended application form was compiled for the project and submitted as part of the draft EIA report. |
| Public Participation:<br>Please ensure that comments from all relevant stakeholders are submitted to the Department with the EIAr. This includes but is not limited to the Free State Department of Small Business Development, Tourism and Environmental Affairs (DESTEA), the Department of Transport, The Moqhaka Local Municipality, The Fezile Dabi District Municipality, the Department of Water and Sanitation (DWS), the South African National Roads Agency limited (SNARAL), the South African Heritage Resources Agency (SAHRA), the Endangered Wildlife Trust (EWT), Birdlife SA, the department of Mineral Resources & Energy, Department of Agriculture and Rural Development and the Department of Environmental, Forestry and Fisheries: Directorate Biodiversity Conservation. | All comments received from the Organs of State on the process have been included within the Comments and Responses Report (C&RR) (Refer Appendix C8), and have been responded to, as required.<br><br>Copies of all written comments received from Organs of State are included in Appendix C6 of the EIAr. |
| Please ensure that all issues raised and comments received during the circulation of the draft SR and draft EIAr from registered I&APs and organs of state which have jurisdiction in respect of the proposed activity are adequately addressed in the final EIAr. Proof of correspondence with the various stakeholders must be included in the final EIAR. Proof of correspondence with the various stakeholders must be included in the final EIAR. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments. | All comments received during the EIA process to date have been included within the C&RR, and have been responded to, as required.<br><br>Copies of all written comments received from registered I&APs and Organs of State are included in Appendix C6 of the EIAr.<br><br>Proof of attempts to obtain comments on the EIAr has been included in Appendices C4 and C5 and included in this final EIAr.<br><br>Proof of correspondence with the various stakeholders is included in Appendices C4 and C5 and included in the EIAr. |
| A Comments and Response trail report (C&R) must be submitted with the final EIAr. The C&R report must incorporate all comments for this development. The C&R report must be a separate document from the main report and the format must be in table format as indicated in Appendix 1 of this letter. Please refrain from summarising comments made by I&APs. All comments from I&APs must be copies verbatim and responded to clearly. Please note that a response such as "noted" is not regarded as an adequate response to I&APs' comments. | All written comments received from I&APs and Organs of State during the EIA process have been included within the C&RR (Refer Appendix C8), and have been responded to, as required.<br><br>Comments submitted have been captured verbatim, as received, and have not been summarized. |
| Comments from I&APs must not be split and arranged into categories. Comments from each submission must be responded to individually. | Comments received from I&APs and Organs of State captured in the C&RR have not been spit and arranged into categories and appropriate responses have been included for all comments. |

| DFFE Requirements for EIA | Response / Location in this EIA Report |
|---|---|
| The Public Participation Process must be conducted in terms of Regulation 39, 40, 41, 42, 43 and 44 of the EIA Regulations, 2014, as amended. | The Public Participation Process has been conducted in terms of Regulation 39, 40, 41, 42, 43 & 44 of the EIA Regulations 2014, as amended (GNR 326), as well as in accordance with the approved Public Participation Plan (**Appendix C9**). The below provides a summary of the process:<br><br>**<u>Scoping Phase</u>**<br>I&APs and OoS were notified of the commencement of the EIA process as follows:<br>• The BID, accompanied by a cover letter notifying I&APs of the project and EIA process was distributed via email to those I&APs identified and the relevant organs of state on 18 November 2020 (refer to **Appendices C4** & **C5** of the final Scoping Report.)<br>• An advertisement notifying I&APs of the project and EIA process was placed in 'die Volksblad' newspaper on 20 November 2020 (tearsheet included in **Appendix C2** of the final Scoping Report)<br>• Placement of site notices announcing the EIA process at visible points along the boundary of the development area (i.e. the boundaries of the affected property), in accordance with the requirements of the EIA Regulations on 17 November 2020 (**Appendix C2** of the final Scoping Report).<br><br>The Scoping Report was made available for a 30-day review and comment period from 20 November 2020 to 11 January 2021, the availability of which was announced through the means below. The Scoping Report was available for download from Savannah Environmental's website and could also be sent via other file transfer services (i.e. We Transfer, Dropbox, etc.) or on CD, on request. Opportunity for consultation was also provided during the 30-day review and comment period.<br><br>• The details of the availability of the report were included in the advertisement placed in 'die Volksblad' newspaper on 20 November 2020 (tearsheet included in **Appendix C2** of the final Scoping Report).<br><br>• A notification letter was sent to all registered I&APs on 18 November 2020 and Organs of State on the project database (**Appendix C1** of the final Scoping Report) informing them of the availability of the Scoping Report for review and comment and the details of where the report could be accessed for review. |

| DFFE Requirements for EIA | Response / Location in this EIA Report |
|---|---|
| | Virtual Focus Group Meetings were held with various key stakeholder groups on 6 January 2021. Notes of the meetings were included in **Appendix C7** of the final Scoping Report.<br><br>**<u>Impact Assessment Phase</u>**<br>I&APs and OoS were notified of the acceptance of the Scoping Report and approval of the Plan of Study for the Environmental Impact Assessment on 16 April 2021 (refer to **Appendices C4** & **C5** of the final EIAr.)<br><br>The EIAr has been made available for a 30-day review and comment period from Friday, 30 April until Tuesday 1 June 2021. The availability of the report was announced through the means below. The EIA Report was available for download from Savannah Environmental's website and could also be sent via other file transfer services (i.e. We Transfer, Dropbox, etc.) or on CD, on request. Opportunity for consultation meetings using an appropriate forum has been provided during the 30-day review and comment period.<br><br>• The details of the availability of the EIAr were included in the advertisement placed in Die Volksblad on 30 April 2021 (tearsheet included in **Appendix C2** of the final EIAr).<br><br>• A notification letter was sent to all registered I&APs and OoS on the project database (**Appendix C1** of the final EIAr) on 28 April 2021, informing them of the availability of the EIAr for review and comment and the details of where the report could be accessed for review. Proof of notification is included in **Appendices C4** and **C5** of the final EIAr.<br><br>• Details of the report review period were included within a live read on OFM on Friday, 30 April 2021 and Monday 24 May 2021 (proof of log sheets included in **Appendix C2** of the final EIAr). Live recording is available on request.<br><br>Virtual Focus Group Meetings (FGM) were conducted with the Ward Councillor and his Ward Committee Members in which the proposed development site is located and the MFP on 18 May 2021. A meeting was scheduled with the Moqhaka Local Municipality but due to technical constraints at their Offices, the meeting could not be facilitated. Proof of attempts to secure a meeting with DESTEA and the follow-up attempts with Moqhaka Local Municipality are included in **Appendix C5** of the final EIAr. |

| DFFE Requirements for EIA | Response / Location in this EIA Report |
|---|---|
| | A public participation process meeting was held with community members of Moqhaka on 20 May 2021.<br><br>Notes of the meetings held have been included in **Appendix C7** of the final EIAr).<br><br>An email reminder to all registered I&APs and OoS on the project database regarding the review and comment period of the EIAr was distributed on 30 May 2021. |
| Alternatives<br>Please provide a description of each of the preferred alternative type and provide detailed motivation on why it is preferred. | A description of the alternative types available, as well as the motivation for the preferred options is contained in Chapter 3 of the EIA report. |
| The applicant must determine the need for decommissioning of existing facilities, structures or infrastructure. This information must inform whether there is a need to update the application form and/or to amend the terms of reference for the specialist studies. | Land use agreements with the landowner are ongoing and all decommissioning of infrastructure which may be necessary will be in accordance with the agreement between the proponent and the landowner. No amendment to the specialists ToR was required as the need to decommission existing infrastructure was considered as part of the layout and development area assessed. In addition, decommissioning of the PV facility will be considered in terms of the relevant legislation at the time of decommissioning. |
| Layout and Sensitivity Maps<br>The EIAr must provide the four coordinate points for proposed development site (note that if the site has numerous bend points, at each bend point coordinates must be provided) as well as the start, middle and end point of all linear activities. Coordinates must be in the format as prescribed in the 2014 NEMA Regulations, as amended. | Please refer to Appendix Q of the EIA report for the project coordinates. |
| The EIAR must provide the following: | |
| Clear indication of the envisioned area for the proposed solar and BESS facility, i.e. placing of the BESS, PV panels and all associated infrastructure should be mapped at an appropriate scale. | A detailed Layout Map indicating the proposed infrastructure is included in Appendix L. Coordinate points of the development site are provided in Appendix Q of the EIA Report. |
| » Clear indication of all associated infrastructure. This description must include, but is not limited to the following:<br>• Power lines<br>• Internal roads and infrastructure; and<br>• All supporting onsite infrastructure such as laydown area, guard house and control room etc. | |
| A copy of the final preferred layout map. All available biodiversity information must be used in the finalisation of the layout map. Existing infrastructure must be used as far | |

| DFFE Requirements for EIA | Response / Location in this EIA Report |
|---|---|
| as possible e.g. Roads. The layout map must indicate the following:<br><br>• Permanent laydown area footprint;<br>• Internal roads indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible);<br>• Wetlands, drainage lines, rivers, stream and water crossings of roads and cables indicating the type of bridging structures that will be used;<br>• The location of sensitive environmental features on site, e.g. CBAs, heritage sites, wetlands, drainage lines etc. that will be affected by the facility and its associated infrastructure;<br>• Location of access and service roads;<br>• All existing infrastructure on the site, especially railway lines and roads;<br>• Buffer Areas;<br>• Buildings, including accommodation; and<br>• All "no-go" areas. | |
| An environmental sensitivity map indicating environmental sensitive areas and features identified during the assessment process | An Environmental Sensitivity Map indicating all environmentally sensitive features is included in **Appendix L**. |
| A map combining the final layout map superimposed (overlain) on the environmental sensitivity map. | A combined Layout and Environmental Sensitivity Map indicating all environmentally sensitive features and proposed infrastructure is included in **Appendix L**. |
| Google maps will not be accepted. | No google maps were used for layout and sensitivity mapping. |
| Specialist Assessments<br>The EAP must ensure that the terms of reference for all identified specialist studies include the following:<br>Detailed description of the study's methodology; indication of the locations and descriptions of the development footprint, and all other associated infrastructure that they have assessed and are recommending for authorisations. | The methodologies and assessments undertaken by specialists are detailed in the relevant specialist studies (**Appendix D** to **Appendix J**). |
| Provide a detailed description of all limitations to the studies. All specialist studies must be conducted in the right season and providing that as a limitation will not be allowed. | The limitations and assumptions of specialists are detailed in the relevant specialist studies (**Appendix D** to **Appendix J**). |
| Please note that the Department considers a 'no-go' areas, as an area where no development of infrastructure is allowed; therefore, no development of associated infrastructure including access roads is allowed in the 'no-go' areas. | No-go areas have been identified for freshwater features (amongst others) delineated within the development area. An optimised layout map avoiding these No-Go areas is included in Appendix L. |
| Should the specialist definition of 'no-go' area differ from the Department's definition; this must be clearly indicted. | The definition of 'no-go' used in the specialist reports as well as the EIAr does not differ from the Department's definition with the exception of the avifaunal specialist. |

| DFFE Requirements for EIA | Response / Location in this EIA Report |
|---|---|
| The specialist must also indicate the 'no-go' area's buffer if applicable. | This specialist determined a no-go area to be an area of exclusion for panels only, but allows for other associated infrastructure to be placed therein. This has been clearly identified in the avifaunal specialist report. |
| All specialist studies must be final, and provide detailed/practical mitigation measures for the preferred alternative and recommendations, and must not recommend further studies to be completed post EA. | All specialist studies are final and provide detailed/practical mitigation measures for the preferred alternative and recommendations. No additional studies are recommended. |
| Should a specialist recommend specific mitigation measures, these must be clearly indicated. | Specialist mitigation measures have been incorporated verbatim into the Environmental Management Programmes (EMPRs) (Appendix K and R) and this EIAr. |
| Outcomes regarding the radiological study must be clearly explained in the subsequent reports. It must be illustrated whether the findings of the previous radiological study or a new study will be commissioned. | The Vrede Solar PV Facility is not located within any sensitive regions in terms of RFI and therefore no study is deemed necessary. Comments from the South African Radio Astronomy Observatory (SARAO) and Sentech were however requested during the course of the assessment process to determine any requirement for further study (Refer Appendix C).<br><br>No comments have been received from SARAO or Sentech to date regarding the need for these studies and therefore no radiological study has been conducted. |
| Regarding cumulative impacts:<br>Clearly defined cumulative impacts and where possible the size of the identified impacts must be quantified and indicated, i.e. hectares of cumulatively transformed land. | Please refer to Chapter 9 of this report for a complete assessment of the cumulative impacts associated with the proposed development. Where possible, these impacts have been quantified. |
| A detailed process flow to indicate how the specialist's recommendations, mitigation measures and conclusions from the various similar developments in the area were taken into consideration in the assessment of cumulative impacts and when the conclusion and mitigation measures were drafted for this project. | All similar renewable energy project within a 30km radius of the project were considered in relation to cumulative impacts in the respective specialist reports and the EIA report. Please refer to Chapter 9 of this report for a complete assessment of the cumulative impacts associated with the proposed development. |
| Identified cumulative impact associated with the proposed development must be rated with the significance rating methodology used in the process. | Impact ratings were derived using the impact assessment methodology defined for the process for all cumulative impacts identified by specialists. |
| The significance rating must also inform the need and desirability of the proposed development. | Please refer to Section 5.7 of the EIA report (Chapter 5) for a discussion on the cumulative impact considerations in relation to need and desirability. |
| A cumulative impact environmental statement on whether the proposed development must proceed. | Please refer to Chapter 9 of the EIA report for a complete assessment of the cumulative impacts associated with the proposed development, including a cumulative impact statement. |
| Should the appointed specialists specify contradicting recommendations, the EAP must clearly indicate that most reasonable recommendation and substantiate this with defendable reasons and where necessary, include further expert advice. | Chapter 10 of this EIA Report contains a summary of recommendations and conclusions made by specialists. No contradicting recommendations have been made. |
| The following specialist assessments will form part of the EIAR: | Please refer to Appendices D – J for the respective listed specialist studies. |

| DFFE Requirements for EIA | Response / Location in this EIA Report |
|---|---|
| » Agricultural Impact Assessment<br>» Terrestrial Ecological Study<br>» Heritage Impact Assessment<br>» Socio-Economic Impact Assessment<br>» Visual Impact Assessment | |
| General<br>The proposed development must consider the requirements of the custodian/authorities of existing infrastructure on site when designing the layout. | Final design of the layout will be conducted with due consideration by the proponent to custodians/authorities of existing infrastructure. |
| The EIAR must provide the technical details for the proposed facility in a table format as well as their descriptions and/or dimensions. A sample for the minimum information required is listed under Annexure 2 below. | Please refer to Chapter 2 (Project Description), Table 2.2 and 2.3 for a detailing of the information requested. |
| Should a water use licence be required, proof of application for a licence must be submitted. | The water use authorisation process for the Vrede Solar PV Facility will only be completed once a positive EA has been received and the project selected as Preferred Bidder. This is line with the requirements of the Department of Human Settlements, Water and Sanitation. |
| The EAP must provide landowner consent for all farm portions affected by the proposed project, whether the project component is linear or not, i.e. all farm portions where the access road, solar panels and associated infrastructure is to be located. | Please refer to the Landowner Consents attached to the amended application form submitted with the draft EIA report for consents of all infrastructure related to this application for Environmental Authorisation. |
| A construction and operational phase EMPR that includes mitigation and monitoring measures must be submitted with the final EIAR. The EMPr must include a detailed fire management and protection plan. | Please refer to Appendix K of the EIA report for the Environmental Management Programme (EMPr), which includes an Emergency Preparedness & Fire Management Plan, as well as a Plant Rescue & Protection Plan in accordance with this requirement. |
| Should the applicant wish to expand the footprint of the proposed development, implications to public participation, listed activities (application form), scope of the specialist studies and impacts and mitigations must be considered and reflected clearly. | The full extent of the development area was assessed as part of the EIA phase assessment in order to allow for refinement and placement of the proposed infrastructure within the assessed region. The proposed layout is contained within this development area and therefore no expansion of project footprint is required or necessary for the purposes of this assessment. |

## 6.4 Overview of the EIA Phase

As per the EIA Regulations (GNR 326) the objectives of the EIA Phase are to, through a consultative process:

» Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context.
» Describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the development footprint on the approved site as contemplated in the accepted Scoping Report.
» Identify the location of the development footprint within the approved site as contemplated in the accepted Scoping Report based on an impact and risk assessment process inclusive of cumulative

impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment.
» Determine the:
    * Nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
    * Degree to which these impacts:
        - Can be reversed
        - May cause irreplaceable loss of resources
        - Can be avoided, managed or mitigated
» Identify the most ideal development footprint for the activity within the development envelope of the approved site as contemplated in the accepted Scoping Report based on the lowest level of environmental sensitivity identified during the assessment.
» Identify, assess, and rank the impacts the activity will impose on the development footprint on the approved site as contemplated in the accepted Scoping Report through the life of the activity;
» Identify suitable measures to avoid, manage or mitigate identified impacts.
» Identify residual risks that need to be managed and monitored.

This EIA Report assesses potential positive and negative, direct, indirect, and cumulative impacts associated with all phases of the project life cycle including pre-construction, construction, operation and decommissioning. In this regard the EIA Report aims to provide the relevant authorities with sufficient information to make an informed decision regarding the proposed project.

The following subsections outline the activities within the EIA process that have been undertaken to date.

### *6.4.1 Authority Consultation and Application for Authorisation in terms of the 2014 EIA Regulations (as amended)*

Consultation with relevant authorities has been undertaken during the Scoping Phase and has continued throughout the EIA process. To date, this consultation has included the following:

» Holding of a Pre-application Meeting with the DFFE on 07 August 2020 (via the Microsoft Teams Platform) during which the project details, progress and proposed Public Participation Plan was presented. Following submission of the plan, the DFFE provided approval of the submitted Plan via email on 06 October 2020.
» Submission of the Application for Environmental Authorisation to the DEFF via the use of the DFFE Novell Filr System.
» Submission of the Scoping Report for review and comment on 20 November 2020; and submission of the Final Scoping report on 15 January 2021.
» Receipt of the Acceptance of Scoping on 24 February 2021.

The following steps were undertaken as part of this EIA phase of the process:

» Make the EIA Report available for a 30-day public and authority review period.
» Notification and consultation with stakeholders, I&APs and Organs of State that may have jurisdiction over the project, including provincial and local government departments, and State-Owned Enterprises.
» Incorporating comments received during the 30-day public review period to prepare a Final EIA Report.
» Submission of the Final EIA Report to DFFE for decision making.

» Provide an opportunity for DFFE and DESTEA representatives to visit and inspect the proposed site and project area.

The submissions, as listed above, were undertaken electronically, as required by the DFFE (in line with the directions for new Applications for Environmental Authorisations provided for in GNR650 of 05 June 2020).

A record of all authority correspondence undertaken prior to and within the EIA Phase is included in **Appendix C4** and **Appendix C5**.

### *6.4.2 Public Participation Process*

Public participation is an essential and regulatory requirement for an environmental authorisation process and is guided by Regulations 41 to 44 of the EIA Regulations 2014 (GN R326) (as amended). The purpose of public participation is clearly outlined in Regulation 40 of the EIA Regulations 2014 (GN R326) (as amended) and is being followed for this proposed project.

The Public Participation Process undertaken for the Vrede Solar PV Facility considers the restrictions and limitations imposed by Government through section 27 (2) of the Disaster Management Act (Act No. 57 of 2002) of 2002 and the Directions issued by the Minister of Forestry, Fisheries and Environment (DFFE) in terms of consultations with I&APs. A Public Participation Plan was prepared and submitted to DFFE for approval. Approval of the Plan was provided by the DEFF Case Officer via email on 06 October 2020 (**Appendix B**).

The alternative means of undertaking consultation have been designed and implemented by Savannah Environmental to ensure that I&APs are afforded sufficient opportunity to access project information and raise comments on the project through an interactive web-based platform (i.e. online stakeholder engagement platform) readily available and accessible to any person registering their interest in the project, and ensures that the public participation process is undertaken in line with Regulations 41 to 44 of the EIA Regulations, 2014 as amended. The Public Participation Plan (**Appendix C9**) considers the limitations applied by the Disaster Management Act Regulations prohibiting the gathering of people, as well as limitations which certain I&APs may have in terms of access to computers and internet as well as access to public spaces currently not open for operation that inhibits access to hard copy documentation. The online stakeholder engagement platform implemented by Savannah Environmental for the project allowed the EAP to visually present details regarding the project as well as consultation documentation, including project maps and plans, presentations and posters. The platform also contains the Scoping Report available for review. The use of an online tool enables stakeholders and I&APs to explore the project-specific content in their own time, and still enables them to participate in a meaningful way in the consultation process.

The sharing of information forms the basis of the public participation process and offers the opportunity for I&APs to become actively involved in the EIA process from the outset. The public participation process is designed to provide sufficient and accessible information to I&APs in an objective manner. The public participation process affords I&APs opportunities to provide input into and receive information regarding the EIA process via the following:

» During the **Scoping Phase**:
  * providing an opportunity to submit comments regarding the project;
  * assisting in identifying reasonable and feasible alternatives, where required;

- assisting in identifying issues of concern and suggestions for enhanced mitigation or management of the activity;
- contribute relevant local information and knowledge to the environmental assessment;
- allowing registered I&APs to verify that their comments have been recorded, considered and addressed, where applicable, in the environmental investigations;
- fostering trust and co-operation;
- generating a sense of joint responsibility and ownership of the environment;
- allowing comment on the findings of the Scoping Phase results; and
- Identify issues of concern and suggestions for enhanced benefits.

» During the **EIA Phase**:
- contributing relevant local information and knowledge to the environmental assessment;
- allowing for verification that issues have been considered in the environmental investigations as far as possible as identified within the Scoping Phase;
- comment on the findings of the environmental assessments; and
- Conducting an electronic/virtual Focus Group Meeting to be conducted for the project.

» During the **decision-making phase**:
- to advise I&APs of the outcome of the competent authority's decision, and how and by when the decision can be appealed.

The Public Participation process therefore aims to ensure that:
» Information containing all relevant facts in respect of the application is made available to potential stakeholders and I&APs for their review;
» The information presented during the public participation process is presented in such a manner, i.e. local language and technical issues, that it avoids the possible alienation of the public and prevents them from participating;
» Public participation is facilitated in such a manner that I&APs are provided with a reasonable opportunity to comment on the project;
» A variety of mechanisms are provided to I&APs to correspond and submit their comments i.e. fax, post, email, telephone, text message (SMS and WhatsApp); and
» An adequate review period is provided for I&APs to comment on the findings of the Scoping and EIA Reports.

In compliance with the requirements of Chapter 6: Public Participation of the EIA Regulations, 2014 (as amended), and the approved Public Participation Plan, the following summarises the key public participation activities implemented. The schematic below provides an overview of the tools that are available to I&APs and stakeholders to access project information and interact with the public participation team to obtain project information and resolve any queries that may arise, and to meet the requirements for public participation.

| | |
|---|---|
| i. Stakeholder identification and register of I&APs | •Register as an I&AP on the online platfrom via completion of a form and provison of contact information, by responding to an advert, or sending a 'please call me' which will be responded to<br>•State interest in the project<br>•Receive all project related information via email |
| ii. Advertisments and notifications | •Advertisements and site notices provide information and details on where to access project information<br>•Notifications regarding the EIA proceses and availability of project reports for public review to be sent via email, post or SMS notifications |
| iii. Public Involvement and consultation | •Distribution of a BID providing details on the project and how I&APs can become involved in the process<br>•Submission of comments or queries via email, fax or post to the PP team<br>•Availability of project information via the online platform<br>•An opportunity for I&APs and stakeholders to request virtual meetings with the project team. |
| iv. Comment on the Scoping and EIA Reports | •Availability of the project reports via the online platform for 30-day comment period<br>•Submission of comments via email, fax or post to the PP team<br>•Comments recorded and responded to, as part of the process |
| v. Identification and recording of comments | •Comments and Responses Report, including all comments received, and included within the final Report for decision-making |

## i. Advertisements and Notifications

| | |
|---|---|
| 40.(2)(a) | Fixing a notice board at a place conspicuous to and accessible by the public at the boundary, on the fence or along the corridor of – |
| | (i) The site where the activity to which the application or proposed application relates is or is to be undertaken; and |
| | (ii) Any alternative site. |
| 40.(2)(b) | Giving written notice, in any of the manners provided for in section 47Dof the Act, to – |
| | (i) The occupiers of the site and, if the proponent or applicant is not the owner or person in control of the site on which the activity is to be undertaken, the owner or person in control of the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken; |

(ii) Owners, persons in control of, and occupiers of land adjacent to the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken;
(iii) The municipal councillor of the ward in which the site and alternative site is situated and any organisation of ratepayers that represent the community in the area;
(iv) The municipality which has jurisdiction in the area;
(v) Any organ of state having jurisdiction in respect of any aspect of the activity; and
(vi) Any other party as required by the competent authority.

40.(2)(c) Placing an advertisement in –
(i) One local newspaper; or
(ii) Any official Gazette that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations;

40.(2)(d) Placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or district municipality in which it is or will be undertaken: Provided that this paragraph need not be complied with if an advertisement has been placed in an official Gazette referred to in paragraph (c)(ii); and

40.(2)(e) Using reasonable alternative methods, as agreed to by the competent authority, in those instances where a person is desirous of but unable to participate in the process due to –
(i) Illiteracy;
(ii) Disability; or
(iii) Any other disadvantage.

The EIA process and the availability of the EIA Report for comment was announced to the Organs of State, potentially affected and neighbouring landowners and general public to register as I&APs and to actively participate in the process. This was achieved through the following:

- A letter advising registered parties of the Acceptance of Scoping received from DFFE and the commencement of the EIA process distributed on 19 April 2021.
- Notification letter distributed to all registered parties advising them of the availability of the EIA Report for review and comment on 26 April 2021.
- An advertisement announcing the availability of and inviting comment on the EIA Report in the die Volksblad newspaper on 30 April 2021. The tearsheet of the newspaper advert will be included in **Appendix C2** of the Final EIA Report.
- A radio announcement (live read) on OFM on 30 April 2021 and Monday 24 May at the commencement of the 30-day review and comment period (**Appendix C3**).
- The EIA Report was made available for review by I&APs for a 30-day review and comment period from **28 April – 31 May 2021**. The EIA Report was made available on the Savannah Environmental website and all registered I&APs were notified of the availability on 19 April 2021 via email which included the link to access the report on the Savannah Environmental website. The evidence of distribution of the EIA Report was included in the final Report, which will be submitted to DFFE. I&APs were encouraged to view the EIA Report and submit written comment. The EIA Report has been circulated to Organs of State via electronic transfer (Dropbox, WeTransfer, etc), or CD and/or hardcopy as per individual request. The evidence of distribution of the EIA Report has been included in this EIA Report (refer to **Appendix C**).
- Virtual Focus Group Meetings (FGM) were conducted with the Ward Councillor and his Ward Committee Members in which the proposed development site is located and the MFP on 18 May 2021. A meeting was scheduled with the Moqhaka Local Municipality but due to technical constraints at their Offices, the meeting could not be facilitated. Proof of attempts to secure a meeting with DESTEA and the follow-up attempts with Moqhaka Local Municipality are included in **Appendix C5** of this final EIAr.

» A public participation process meeting was held with community members of Moqhaka on 20 May 2021. Notes of the meetings held have been included in **Appendix C7** of this final EIAr.
» An email reminder to all registered I&APs and OoS on the project database regarding the review and comment period of the EIAr was distributed on 30 May 2021.

### ii. Public Involvement and Consultation

In order to accommodate the varying needs of stakeholders and I&APs within the study area, as well as capture their views, issues and concerns regarding the project, various opportunities are being provided to I&APs in the EIA phase of the process to note their issues and comments. I&APs are being consulted through the following means:

» Opportunity for review of the EIA report for a 30-day period from **30 April – 1 June 2021**. Comments received during this review period have been captured in within a Comments and Responses Report (refer **Appendix C**), which were included within this Final EIA Report.
» Focus group meetings: Virtual focus group meetings wereheld with key government departments, stakeholders and landowners during the review period for the EIA Report. The purpose of these focus group meetings is to provide an overview of the findings of the EIA studies in order to facilitate comments on the EIA process and EIA Report, as well as to record any issues or concerns raised by stakeholders regarding the project. As per the approved public participation plan, these meetings were held via virtual platform. The minutes of these meetings have been included in the final EIA Report for review and acceptance by the DFFE.
» Telephonic consultation sessions.
» Written, faxed or e-mail correspondence.
» Consultation with ward councillor and relevant community forum/s to ensure that occupiers of affected and surrounding properties are informed of the project.

All comments received during the 30-day review period were included in **Appendix C6** and minutes of all meetings held during the review period were included in **Appendix C7** within this Final EIA report.

**Table 6.4:** Public involvement for Vrede Solar PV Facility (during Scoping and EIA Phases)

| Activity | Date |
|---|---|
| Distribution of the BID, process notification letters and stakeholder reply form announcing the EIA process and inviting I&APs to register on the project database. The BID and electronic reply form was also made available on the online stakeholder engagement platform. | 18 November 2020 |
| Placement of site notices | 17 November 2020 |
| Advertising of the availability of the Scoping Report for a 30-day review and comment period in the 'die Volksblad' newspaper, including details on how to access the Scoping Report via the online stakeholder engagement platform. | 20 November 2020 |
| Distribution of notification letters announcing the availability of the Scoping Report for a 30-day review and comment period. These letters were distributed to Organs of State, Government Departments, Ward Councillors, landowners within the surrounding area (including neighbouring landowners) and key stakeholder groups. | 18 November 2020 |
| 30-day review and comment period of the Scoping Report. | 20 November 2020 to 11 January 2021 |

| Activity | Date |
|---|---|
| Virtual meetings through the use of virtual platforms as determined through discussions with the relevant stakeholder group:<br>» Landowners<br>» Authorities and key stakeholders (including Organs of State, local municipality and official representatives of community-based organisations).<br>» Where an I&AP does not have access to a computer and/or internet to participate in a virtual meeting telephonic discussions (including WhatsApp video call) will be set-up and minuted for inclusion. The preferred language of the I&AP has been considered when setting up these discussions.<br>» Direct in-person consultation will only take place in limited numbers and where sanitary conditions can be maintained at all times. | 6 January 2021 |
| Radio Live Read by OFM regarding the EIA Report comment period, and the details of how to get involved and how contact with Savannah Environmental can be made. | 30 April 2021 and 24 May 2021 |
| Distribution of notification letters announcing the availability of the EIA Report for a 30-day review and comment period. These letters were distributed to Organs of State, Government Departments, Ward Councillors, landowners within the surrounding area (including neighbouring landowners) and key stakeholder groups. | 26 April 2021 |
| 30-day review and comment period of the EIA Report. | 30 April – 1 June 2021 |
| Virtual meetings through the use of virtual platforms as determined through discussions with the relevant stakeholder group:<br>» Landowners<br>» Authorities and key stakeholders (including Organs of State, local municipality and official representatives of community-based organisations).<br>» Where an I&AP does not have access to a computer and/or internet to participate in a virtual meeting telephonic discussions (including WhatsApp video call) will be set-up and minuted for inclusion. The preferred language of the I&AP has been considered when setting up these discussions.<br><br>Direct in-person consultation will only take place in limited numbers and where sanitary conditions can be maintained at all times. | 18 and 24 May 2021 |
| Public participation process meeting (Constantia hall, Kroonstad) | 20 May 2021 |
| On-going consultation (i.e. telephone liaison; e-mail communication) with all I&APs. | Throughout the EIA process |

### iii. Registered I&APs entitled to Comment on the EIA Report

43.(1) A registered I&AP is entitled to comment, in writing, on all reports or plans submitted to such party during the public participation process contemplated in these Regulations and to bring to the attention of the proponent or applicant any issues which that party believes may be of significance to the consideration of the application, provided that the interested and affected party discloses any direct business, financial, personal or other interest which that party may have in the approval or refusal of the application.

(2) In order to give effect to section 24O of the Act, any State department that administers a law relating to a matter affecting the environment must be requested, subject to regulation 7(2), to comment within 30 days.

44.(1) The applicant must ensure that the comments of interested and affected parties are recorded in reports and plans and that such written comments, including responses to such comments and records of meetings, are attached to the reports and plans that are submitted to the competent authority in terms of these Regulations.

(2) Where a person desires but is unable to access written comments as contemplated in subregulation (1) due to –

(a) A lack of skills to read or write;
(b) Disability; or
(c) Any other disadvantage;

Reasonable alternative methods of recording comments must be provided for.

I&APs registered on the database were notified via notification letter of the release of the EIA Report for a 30-day review and comment period, invited to provide comment on the EIA Report, and informed of the manner in which, and timeframe within which such comment must be made. The report was made available in soft copies to I&APs due to restrictions and limitations on public spaces during the national state of disaster related to COVID-19. No hard copies of the report have was made available for review and comment in accordance with the approved public participation plan.

The EIA Report was made available on the Savannah Environmental website (i.e. online stakeholder engagement platform) (https://www.savannahsa.com/public-documents/energy-generation/). The notification was distributed on **19 April 2021.** Where I&APs were not able to provide written comments (including SMS and WhatsApp), other means of consultation, such as telephonic discussions were used to provide the I&APs with a platform to verbally raise their comments on the proposed development.

All comments raised as part of the discussions and written comments submitted during the 30-day review and comment period were recorded and included in **Appendix C8** of the EIA Report.

#### iv. Identification and Recording of Comments

Comments raised by I&APs to were collated into a Comments and Responses (C&R) Report which is included in **Appendix C8** of the EIA Report. The C&R Report includes detailed responses from members of the EIA project team and/or the project proponent to the issues and comments raised. The C&R Report will consist of written comments received.

Meeting notes of all consultation meetings and discussions undertaken during the 30-day review and comment period were included in **Appendix C7** of the final EIA Report.

The C&R Report were updated with all comments received during the 30-day review and comment period, included as **Appendix C8** in this final EIA Report, submitted to the DEFF for decision-making.

### 6.5 Outcomes of the DEA Web-Based Screening Tool

In terms of GN R960 (promulgated on 5 July 2019) and Regulation 16(1)(b)(v) of the 2014 EIA Regulations (as amended), the submission of a Screening Report generated from the national web based environmental screening tool is compulsory for the submission of applications in terms of Regulations 19 and 21 of the EIA Regulations.

The requirement for the submission of a Screening Report (**Appendix N**) for the Vrede Solar PV Facility is applicable as it triggers Regulation 21 of the EIA Regulations, 2014 (as amended). **Table 6.2** provides a summary of the specialist assessments identified in terms of the screening tool and responses to each assessment from the project team considering the development area under consideration.

**Table 6.2:** Sensitivity ratings from the DEFF's web-based online Screening Tool associated with the development of the Vrede Solar PV Facility and associated infrastructure

| Specialist Assessment | Sensitivity Rating as per the Screening Tool (relating to the need for the study) | Project Team Response |
|---|---|---|
| Agricultural Impact Assessment | High | An Agricultural Impact Assessment was undertaken for the project. |
| Visual Impact Assessment | Very High | A Visual Impact Assessment was undertaken for the project. |
| Archaeological and cultural heritage impact assessment | High | A Heritage Assessment Report was undertaken for the project to comply with the requirements of the Heritage Resources Act. This report also considers archaeology and cultural heritage. |
| Palaeontological impact assessment | High | A Heritage Assessment Report was undertaken for the project to comply with the requirements of the Heritage Resources Act. This report also considers palaeontology. |
| Terrestrial biodiversity impact assessment | Very high | An Ecological Impact Assessment (including flora and fauna) was undertaken for the project. |
| Aquatic biodiversity impact assessment | Very high | A Freshwater Resource Study & Assessment was undertaken for the project. |
| Avian impact assessment | High | An avifaunal impact assessment was undertaken for the project. |
| Civil Aviation Assessment | Low | As per GNR 320 (of 20 March 2020), no requirement for a Civil Aviation Assessment is required where a low sensitivity is determined. |
| Defence Assessment | Low | As per GNR 320 (of 20 March 2020), no requirement for a Defence Assessment is required where a low sensitivity is determined. |
| RFI Assessment | Low | The Vrede Solar PV Facility is not located within any sensitive regions in terms of RFI and therefore no study is deemed necessary. Comments from the South African Radio Astronomy Observatory (SARAO) and Sentech were however be requested during the course of the assessment process to determine the requirement for further |

| Specialist Assessment | Sensitivity Rating as per the Screening Tool (relating to the need for the study) | Project Team Response |
|---|---|---|
| | | study. No comments were received from either of these authorities requiring an RFI assessment. |
| Geotechnical Assessment | The Screening Report did not include a rating for this theme; | An in-depth geotechnical investigation will be conducted by the proponent to inform the final site layout. The geotechnical status of the site, however, informs only the design efforts and do not contribute to any environmental impact, and as such does not form part of the EIA suite of studies for this project. |
| Socio-economic Assessment | The Screening Report did not include a rating for this theme; however, the specialist assessment was identified based on the technology proposed. | A Social Impact Assessment was undertaken for the project. |
| Plant species assessment | Low | Government Notice 1150 of 30 October 2020, specific to animal and plant species protocols, indicated that:<br><br>"The requirement of these protocols will apply from the date of publication, except where the applicant provides proof to the competent authority that the specialist assessment affected by these protocols had been commissioned by the date of publication of these protocols in the Government Gazette, in which case Appendix 6 of the Environmental Impact Assessment Regulations, 2014, as amended, will apply to such applications."<br><br>Please refer to **Appendix P** for proof that the specialist studies for this application were commissioned prior to the date of publication in the Government Gazette (30 October 2020), and that therefore Appendix 6 requirements apply. This assessment is addressed by the biodiversity specialist study conducted for the project. |
| Animal species assessment | Medium | |

As part of the EIA Phase, these specialist studies considered the development area proposed for the Vrede Solar PV Facility and associated infrastructure (excluding the grid connection, which is being assessed under a separate process), as well as feasible and reasonable alternatives identified for the project.

### 6.6 Assessment of Issues Identified through the EIA Process

Issued which required investigation during the EIA phase, as well as the specialist consultants involved in the assessment of these impacts are indicated in **Table 6.3** below.

**Table 6.3:** Specialist Studies undertaken as part of the EIA Phase

| Specialist Study | Specialist Company | Specialist Name | Appendix |
|---|---|---|---|
| Ecological impact assessment | Nkurenkuru Ecology & Biodiversity | Gerhard Botha | **Appendix D** |
| Avifaunal Impact Assessment | Chis Van Rooyen consulting | Chris Van Rooyen | **Appendix E** |
| Wetland delineation and impact assessment | Nkurenkuru Ecology & Biodiversity | Gerhard Botha | **Appendix F** |
| Soil and agricultural potential assessment | TerraAfrica | Mariné Pienaar | **Appendix G** |
| Heritage – Archaeological and paleontological impact assessments | CTS Heritage | Jenna Lavin | **Appendix H** |
| Visual impact assessment | Logis | Lourens du Plessis | **Appendix I** |
| Social impact assessment | Tony Barbour Consulting | Tony Barbour | **Appendix J** |

Specialist studies considered direct and indirect environmental impacts associated with the development of all components of the facility. Identified impacts are assessed in terms of the following criteria:

- The **nature**, a description of what causes the effect, what will be affected, and how it will be affected.
- The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high).
- The **duration**, wherein it is indicated whether:
  - The lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1.
  - The lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2.
  - Medium-term (5–15 years) – assigned a score of 3.
  - Long term (> 15 years) - assigned a score of 4.
  - Permanent - assigned a score of 5.
- The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  - 0 is small and will have no effect on the environment.
  - 2 is minor and will not result in an impact on processes.
  - 4 is low and will cause a slight impact on processes.
  - 6 is moderate and will result in processes continuing but in a modified way.
  - 8 is high (processes are altered to the extent that they temporarily cease).
  - 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:

- Assigned a score of 1–5, where 1 is very improbable (probably will not happen).
- Assigned a score of 2 is improbable (some possibility, but low likelihood)
- Assigned a score of 3 is probable (distinct possibility)
- Assigned a score of 4 is highly probable (most likely)
- Assigned a score of 5 is definite (impact will occur regardless of any prevention measures)

» The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high
» The **status**, which is described as either positive, negative or neutral
» The degree to which the impact can be reversed
» The degree to which the impact may cause irreplaceable loss of resources
» The degree to which the impact can be mitigated

The **significance** is determined by combining the criteria in the following formula:

S = (E+D+M) P; where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

» **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area)
» **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
» **60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area)

Specialist studies also considered cumulative impacts associated with similar developments within a 30km radius of the proposed project. The purpose of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e. whether the addition of the proposed project in the area will increase the impact). In this regard, specialist studies considered whether the construction of the proposed development will result in:

» Unacceptable risk
» Unacceptable loss
» Complete or whole-scale changes to the environment or sense of place
» Unacceptable increase in impact

A conclusion regarding whether the proposed development will result in any unacceptable loss or impact considering all the projects proposed in the area is included in the respective specialist reports.

As the developer has the responsibility to avoid or minimise impacts and plan for their management (in terms of the requirements of NEMA and the 2014 EIA Regulations (GNR 326)), the mitigation of significant impacts

is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. An Environmental Management Programme (EMPr) that includes all the mitigation measures recommended by the specialists for the management of significant impacts is included as **Appendix K** to this EIA Report.

## 6.7 Assumptions and Limitations of the EIA Process

The following assumptions and limitations are applicable to the EIA Phase of the Vrede Solar PV Facility:

- All information provided by the Applicant and I&APs to the environmental team was correct and valid at the time it was provided.
- It is assumed that the development area for the solar PV facility identified by the Applicant represents a technically suitable site for the establishment of the Vrede Solar PV Facility which is based on the design undertaken by technical consultants for the project.
- The development footprint (the area that will be affected during the operation phase) will include the footprint for the PV facility and associated infrastructure (i.e. internal access roads, BESS and project ancillaries).
- Conclusions of specialist studies undertaken and this overall Impact Assessment assume that any potential impacts on the environment associated with the proposed development will be avoided, mitigated, or offset.
- The grid connection solution which the Vrede Solar PV Facility will employ is being subject to a separate Basic Assessment process and is, therefore, not included in this application and assessment. It is assumed that a suitable, authorised grid connection solution will be available for the Vrede Solar PV Facility.
- This report and its investigations are project-specific, and consequently the environmental team did not evaluate any other power generation alternatives.

## 6.8 Legislation and Guidelines that have informed the preparation of this EIA Report

The following legislation and guidelines have informed the scope and content of this EIA Report:

- National Environmental Management Act (Act No. 107 of 1998);
- EIA Regulations of December 2014, published under Chapter 5 of NEMA (as amended);
- Department of Environmental Affairs (2017), Public Participation guidelines in terms of NEMA EIA 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, when applying for environmental authorisation; and
- International guidelines – the Equator Principles, the International Finance Corporation (IFC) Performance Standards, the Sustainable Development Goals, World Bank Environmental and Social Framework, and the and World Bank Group Environmental, Health, and Safety Guidelines (EHS Guidelines).

Several other Acts, standards or guidelines have also informed the project process and the scope of issues addressed and assessed in this EIA Report. A review of legislative requirements applicable to the proposed project is provided in **Table 6.7.**

**Table 6.7:** Relevant legislative permitting requirements applicable to the Vrede Solar PV Facility

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| **National Legislation** | | | |
| Constitution of the Republic of South Africa (No. 108 of 1996) | In terms of Section 24, the State has an obligation to give effect to the environmental right. The environmental right states that:<br><br>"*Everyone has the right –*<br>» *To an environment that is not harmful to their health or well-being, and*<br>» *To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:*<br>∗ *Prevent pollution and ecological degradation,*<br>∗ *Promote conservation, and*<br>∗ *Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*." | Applicable to all authorities | There are no permitting requirements associated with this Act. The application of the Environmental Right however implies that environmental impacts associated with proposed developments are considered separately and cumulatively. It is also important to note that the "right to an environment clause" includes the notion that justifiable economic and social development should be promoted, through the use of natural resources and ecologically sustainable development. |
| National Environmental Management Act (No 107 of 1998) (NEMA) | The 2014 EIA Regulations have been promulgated in terms of Chapter 5 of NEMA. Listed activities which may not commence without EA are identified within the Listing Notices (GNR 324, GNR 325 and GNR 327) which form part of these Regulations (GNR 326, as amended).<br><br>In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority | DFFE – Competent Authority<br><br>Free State Department of Economic Development, Tourism and Environmental Affairs – Commenting Authority (DEDTEA) | The listed activities triggered by the proposed project have been identified and are being assessed as part of the EIA process currently underway for the project. The EIA process will culminate in the submission of a Final EIA Report to DFFE for approval. |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | charged by NEMA with granting of the relevant environmental authorisation.<br><br>Considering the capacity of the proposed the Vrede Solar PV Facility (i.e. contracted capacity of 100MW) and the triggering of Activity 1 of Listing Notice 2 (GNR 984) a full Scoping and EIA process is required in support of the Application for EA. | | |
| National Environmental Management Act (No 107 of 1998) (NEMA) | In terms of the "Duty of Care and Remediation of Environmental Damage" provision in Section 28(1) of NEMA every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.<br><br>In terms of NEMA, it is the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts. | DFFE & Free State DEDTEA | While no permitting or licensing requirements arise directly by virtue of the proposed project, this section finds application through the consideration of potential cumulative, direct, and indirect impacts. It will continue to apply throughout the life cycle of the project. |
| Environment Conservation Act (No. 73 of 1989) (ECA) | The Noise Control Regulations in terms of Section 25 of the ECA contain regulations applicable for the control of noise in the Provinces of Limpopo, North West, Mpumalanga, Northern Cape, Eastern Cape, and KwaZulu-Natal Provinces. | DFFE & Free State DEDTEA<br><br>Moqhaka Local Municipality | Noise impacts are expected to be associated with the construction phase of the project. Considering the location of the development area in relation to residential areas and provided that appropriate mitigation measures are implemented, construction noise is unlikely to present a significant |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | The Noise Control Regulations cover the powers of a local authority, general prohibitions, prohibitions of disturbing noise, prohibitions of noise nuisance, use of measuring instruments, exemptions, attachments, and penalties.<br><br>In terms of the Noise Control Regulations, no person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof (Regulation 04). | | intrusion to the local community. There is therefore no requirement for a noise permit in terms of the legislation. |
| National Water Act (No. 36 of 1998) (NWA) | A water use listed under Section 21 of the NWA must be licensed with the Regional DWS, unless it is listed in Schedule 1 of the NWA (i.e. is an existing lawful use), is permissible under a GA, or if a responsible authority waives the need for a licence.<br><br>Water use is defined broadly, and includes consumptive and non-consumptive water uses, taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation.<br><br>Consumptive water uses may include taking water from a water resource (Section 21(a)) and storing water (Section 21(b)). | Regional Department of Water and Sanitation | The proposed development area is located within the regulated area of a drainage line present within the development area to the south-west. In addition, construction water is proposed to be obtained from two boreholes present within the project site. As a result, a water use authorisation for the project will be required from DHSWS for water uses 21(a),21(c)&21(i); however, the process will only be completed once a positive EA has been received and the project selected as Preferred Bidder by the DMRE. This is in line with the requirements from DWS. |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | Non-consumptive water uses may include impeding or diverting of flow in a water course (Section 21(c)), and altering of bed, banks or characteristics of a watercourse (Section 21(i)). | | |
| Minerals and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA) | In accordance with the provisions of the MPRDA a mining permit is required in accordance with Section 27(6) of the Act where a mineral in question is to be mined, including the mining of materials from a borrow pit. | Department of Mineral Resources and Energy (DMRE) | Any person who wishes to apply for a mining permit in accordance with Section 27(6) must simultaneously apply for an Environmental Authorisation in terms of NEMA. No borrow pits are expected to be required for the construction of the project, and as a result a mining permit or EA in this regard is not required to be obtained. |
| | Section 53 of the MPRDA states that any person who intends to use the surface of any land in any way which may be contrary to any object of the Act, or which is likely to impede any such object must apply to the Minister for approval in the prescribed manner. | | In terms of Section 53 of the MPRDA approval is required from the Minister of Mineral Resources and Energy to ensure that the proposed development does not sterilise a mineral resource that might occur on site. |
| National Environmental Management: Air Quality Act (No. 39 of 2004) (NEM:AQA) | The National Dust Control Regulations (GNR 827) published under Section 32 of NEM:AQA prescribe the general measures for the control of dust in all areas, and provide a standard for acceptable dustfall rates for residential and non-residential areas.<br><br>In accordance with the Regulations (GNR 827) any person who conducts any activity in such a way as to give rise to dust in quantities and concentrations that may exceed the dustfall standard set out in Regulation 03 must, upon receipt of a notice from the air quality officer, implement a dustfall monitoring programme. | DFFE & Free State DEDTEA or Fezile Dabi District Municipality | In the event that the project results in the generation of excessive levels of dust the possibility could exist that a dustfall monitoring programme would be required for the project, in which case dustfall monitoring results from the dustfall monitoring programme would need to be included in a dust monitoring report, and a dust management plan would need to be developed. |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | Any person who has exceeded the dustfall standard set out in Regulation 03 must, within three months after submission of the dustfall monitoring report, develop and submit a dust management plan to the air quality officer for approval. | | |
| National Heritage Resources Act (No. 25 of 1999) (NHRA) | Section 07 of the NHRA stipulates assessment criteria and categories of heritage resources according to their significance.<br><br>Section 35 of the NHRA provides for the protection of all archaeological and palaeontological sites, and meteorites.<br><br>Section 36 of the NHRA provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority.<br><br>Section 38 of the NHRA lists activities which require developers or any person who intends to undertake a listed activity to notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of the proposed development.<br><br>Section 44 of the NHRA requires the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction. | South African Heritage Resources Agency (SAHRA)<br><br>Free State Heritage Resources Authority (FSHRA) | A Heritage Impact Assessment was undertaken for the project as per the requirements Section 38 of the NHRA (Refer Appendix H). No heritage resources of significance were identified within the development area.<br><br>Should a heritage resource be impacted upon, a permit may be required from SAHRA or Free State Heritage Resources Authority (FSHRA) in accordance with of Section 48 of the NHRA, and the SAHRA Permit Regulations (GN R668). |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA) | Section 53 of NEM:BA provides for the MEC / Minister to identify any process or activity in such a listed ecosystem as a threatening process.<br><br>Three government notices have been published in terms of Section 56(1) of NEM:BA as follows:<br><br>» Commencement of TOPS Regulations, 2007 (GNR 150).<br>» Lists of critically endangered, vulnerable and protected species (GNR 151).<br>» TOPS Regulations (GNR 152).<br><br>It provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), and vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (NEM:BA: National list of ecosystems that are threatened and in need of protection, (Government Gazette 37596, GNR 324), 29 April 2014). | DFFE & Free State DEDTEA | Under NEM:BA, a permit would be required for any activity that is of a nature that may negatively impact on the survival of a listed protected species.<br><br>An Ecological Impact Assessment has been undertaken as part of the EIA Phase (refer to **Appendix D**). No protected species which require a permit under this Act were identified within the development area however, a pre-construction search and for protected flora is recommended. Please note, a few provincially protected species were found within the development area which will require provincial permits prior to removal, destruction or damaging. |
| National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA) | Chapter 5 of NEM:BA pertains to alien and invasive species, and states that a person may not carry out a restricted activity involving a | DFFE & Free State DEDTEA | An Ecological Impact Assessment has been undertaken as part of the EIA Phase to identify the presence of any alien and invasive |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | specimen of an alien species without a permit issued in terms of Chapter 7 of NEM:BA, and that a permit may only be issued after a prescribed assessment of risks and potential impacts on biodiversity is carried out.<br><br>Applicable, and exempted alien and invasive species are contained within the Alien and Invasive Species List (GNR 864). | | species present on site. Some alien invasive species, such as *Paspalum dilatatum*, have been noted in the development area. |
| Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA) | Section 05 of CARA provides for the prohibition of the spreading of weeds.<br><br>Regulation 15 of GN R1048 published under CARA provides for the classification of categories of weeds and invader plants, and restrictions in terms of where these species may occur.<br><br>Regulation 15E of GN R1048 published under CARA provides requirement and methods to implement control measures for different categories of alien and invasive plant species. | Department of Agriculture, Land Reform and Rural Development (DALRD) | CARA will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies need to be developed and implemented. In addition, a weed control and management plan must be implemented.<br><br>In terms of Regulation 15E (GN R1048) where Category 1, 2 or 3 plants occur a land user is required to control such plants by means of one or more of the following methods:<br><br>» Uprooting, felling, cutting or burning.<br>» Treatment with a weed killer that is registered for use in connection with such plants in accordance with the directions for the use of such a weed killer.<br>» Biological control carried out in accordance with the stipulations of the Agricultural Pests Act (No. 36 of 1983), the ECA and any other applicable legislation.<br>» Any other method of treatment recognised by the executive officer that has as its object the control of plants |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | | | concerned, subject to the provisions of sub-regulation 4.<br>» A combination of one or more of the methods prescribed, save that biological control reserves and areas where biological control agents are effective shall not be disturbed by other control methods to the extent that the agents are destroyed or become ineffective. |
| National Forests Act (No. 84 of 1998) (NFA) | According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. Notice of the List of Protected Tree Species under the National Forests Act (No. 84 of 1998) was published in GNR 734.<br><br>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". | DFFE | A licence is required for the removal of protected trees. It is therefore necessary to conduct a survey that will determine the number and relevant details pertaining to protected tree species present in the development footprint for the submission of relevant permits to authorities prior to the disturbance of these individuals.<br><br>The Ecological Impact Assessment undertaken as part of the EIA Phase included a site visit which allowed for the identification of any protected trees which may require a license in terms of the NFA within the project site (refer to Appendix D). Three provincially protected species were recorded, as listed within the Free State Nature Conservation Bill (2007), namely; Aloe davyana, Boophone disticha, Schizocarpus nervosus and Ammocharis coranica. It is recommended that a pre-construction walk-through is done by a registered botanical specialist, prior to the start of the construction phase, during which, these protected plants are identified |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | | | and mapped. This information should then be used to apply for the necessary floral permits (from DESTEA) in order to gain permission for the removal, relocation, disturbance or destruction of these species. |
| National Veld and Forest Fire Act (No. 101 of 1998) (NVFFA) | Chapter 4 of the NVFFA places a duty on owners to prepare and maintain firebreaks, the procedure in this regard, and the role of adjoining owners and the fire protection association. Provision is also made for the making of firebreaks on the international boundary of the Republic of South Africa. The applicant must ensure that firebreaks are wide and long enough to have a reasonable chance of preventing a veldfire from spreading to or from neighbouring land, it does not cause soil erosion, and it is reasonably free of inflammable material capable of carrying a veldfire across it.<br><br>Chapter 5 of the Act places a duty on all owners to acquire equipment and have available personnel to fight fires. Every owner on whose land a veldfire may start or burn or from whose land it may spread must have such equipment, protective clothing and trained personnel for extinguishing fires, and ensure that in his or her absence responsible persons are present on or near his or her land who, in the event of fire, will extinguish the fire or assist in doing so, and take all reasonable steps to alert the owners of adjoining land and the relevant fire protection association, if any. | DFFE | While no permitting or licensing requirements arise from this legislation, this Act will be applicable during the construction and operation of the Vrede Solar PV Facility, in terms of the preparation and maintenance of firebreaks, and the need to provide appropriate equipment and trained personnel for firefighting purposes. |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| Hazardous Substances Act (No. 15 of 1973) (HAS) | This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger, to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products.<br><br>» Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared as Group I or Group II substance<br>» Group IV: any electronic product, and<br>» Group V: any radioactive material.<br><br>The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force. | Department of Health (DoH) | It is necessary to identify and list all Group I, II, III, and IV hazardous substances that may be on site and in what operational context they are used, stored or handled. If applicable, a license would be required to be obtained from the DoH. |
| National Environmental Management: Waste Act (No. 59 of 2008) (NEM:WA) | The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment.<br><br>The Minister may amend the list by – | DFFE – Hazardous Waste<br><br>Free State DEDTEA | No waste listed activities are triggered by proposed project, therefore, no Waste Management License is required to be obtained. General and hazardous waste handling, storage and disposal will be required during construction and operation. |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | » Adding other waste management activities to the list.<br>» Removing waste management activities from the list.<br>» Making other changes to the particulars on the list.<br><br>In terms of the Regulations published in terms of NEM:WA (GNR 912), a BA or EIA is required to be undertaken for identified listed activities.<br><br>Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that:<br><br>» The containers in which any waste is stored, are intact and not corroded or in<br>» Any other way rendered unlit for the safe storage of waste.<br>» Adequate measures are taken to prevent accidental spillage or leaking.<br>» The waste cannot be blown away.<br>» Nuisances such as odour, visual impacts and breeding of vectors do not arise, and<br>» Pollution of the environment and harm to health are prevented. | | The National Norms and Standards for the Storage of Waste (GNR 926) published under Section 7(1)(c) of NEM:WA will need to be considered in this regard. |
| National Road Traffic Act (No. 93 of 1996) (NRTA) | 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" outline the rules and conditions which apply to the transport of abnormal loads and | South African National Roads Agency (SANRAL) – national roads<br><br>Free State Department of Police, Roads and Transport | An abnormal load / vehicle permit may be required to transport the various components to site for construction. These include route clearances and permits required for vehicles carrying abnormally heavy or abnormally dimensioned loads and transport vehicles |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed.<br><br>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.<br><br>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 National Road Traffic Act and the relevant Regulations. | | exceeding the dimensional limitations (length) of 22m. Depending on the trailer configuration and height when loaded, some of the on-site substation and BESS components may not meet specified dimensional limitations (height and width) which will require a permit. |
| Astronomy Geographic Advantage Act (Act No. 21 of 2007) | The Astronomy Geographic Advantage (AGA) Act (No. 21 of 2007) provides for the preservation and protection of areas within South Africa that are uniquely suited for optical and radio astronomy; for intergovernmental co-operation and public consultation on matters concerning nationally significant astronomy advantage areas and for matters connected thereto.<br><br>Chapter 2 of the Act allows for the declaration of astronomy advantage areas whilst Chapter 3 pertains to the management and control of | Department of Science and Technology. | The site proposed for the development is located within the Free State Province and well outside of those areas considered as nationally significant astronomy advantage areas, and therefore the requirements of this legislation are not considered applicable. |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | astronomy advantage areas. Management and control of astronomy advantage areas include, amongst others, the following:<br>* Restrictions on use of radio frequency spectrum in astronomy advantage areas<br>* Declared activities in core or central astronomy advantage area<br>* Identified activities in coordinated astronomy advantage area; and<br>* Authorisation to undertake identified activities. | | |
| Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARS) 1997 | Any structure exceeding 45m above ground level or structures where the top of the structure exceeds 150m above the mean ground level, the mean ground level considered to be the lowest point in a 3km radius around such structure.<br><br>Structures lower than 45m, which are considered as a danger to aviation shall be marked as such when specified.<br><br>Overhead wires, cables etc., crossing a river, valley or major roads shall be marked and in addition their supporting towers marked and lighted if an aeronautical study indicates it could constitute a hazard to aircraft. | South African Civil Aviation Authority (CAA) | This Act will find application during the operation phase of Vrede Solar PV Facility. Appropriate marking of project infrastructure >45m above ground level is required to meet the specifications as detailed in the CAR Part 139.01.33. An obstacle approval would be obtained from the South African CAA. |
| ***Provincial Policies / Legislation*** | | | |
| The Free State Nature Conservation Bill 2007 | The above-mentioned Nature Conservation Bill accompanied by all amendments is regarded by Free State Department of Economic, Small Business Development, Tourism & Environmental Affairs as the legally binding, | Free State Department of Economic, Small Business Development, Tourism & Environmental Affairs | Development of the Vrede Solar PV Facility must be planned with due recognition of protected species that may be present within the development footprint, and the protections afforded these species. |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | provincial documents, providing regulations, guidelines and procedures with the aim of protecting game and fish, the conservation of flora and fauna and the destruction of problematic (vermin and invasive) species. | | An Ecological Impact Assessment has been undertaken as part of the EIA Phase (refer to **Appendix D**). Three provincially protected species were recorded, as listed within the Free State Nature Conservation Bill (2007), namely; Aloe davyana, Boophone disticha, Schizocarpus nervosus and Ammocharis coranica. It is recommended that a pre-construction walk-through is done by a registered botanical specialist, prior to the start of the construction phase, during which, these protected plants are identified and mapped. This information should then be used to apply for the necessary floral permits (from DESTEA) in order to gain permission for the removal, relocation, disturbance or destruction of these species. |
| The Free State Nature Conservation Ordinance (Act 8 of 1969) in its entirety | This Act provides for the sustainable utilisation of wild animals, biota and plants; provides for offences and penalties for contravention of the Act; and provides for the issuing of permits and other authorisations.<br><br>Schedule 1 and 4 of the Free State Nature Conservation Ordinance (Act 8 of 1969) specify protected species and prohibition of alien species requirements. | Free State DEDTEA | An Ecological Impact Assessment has been undertaken as part of the EIA Phase (refer to **Appendix D**). Three provincially protected species were recorded, as listed within the Free State Nature Conservation Bill (2007), namely; Aloe davyana, Boophone disticha, Schizocarpus nervosus and Ammocharis coranica. It is recommended that a pre-construction walk-through is done by a registered botanical specialist, prior to the start of the construction phase, during which, these protected plants are identified and mapped. This information should then be used to apply for the necessary floral permits (from DESTEA) in order to gain permission for |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | | | the removal, relocation, disturbance or destruction of these species. |

### *6.8.1 Best Practice Guidelines Birds & Solar Energy (2017)*

The Best Practice Guidelines Birds & Solar Energy (2017) proposed by the Birds and Renewable Energy Specialist Group (BARESG) (convened by BirdLife South Africa and the Endangered Wildlife Trust) contain guidelines for assessing and monitoring the impact of solar generation facilities on birds in Southern Africa. The guidelines recognise the impact that solar energy may have on birds, through for example the alteration of habitat, the displacement of populations from preferred habitat, and collision and burn mortality associated with elements of solar hardware and ancillary infrastructure; and the fact that the nature and implications of these effects are poorly understood.

The guidelines are aimed at Environmental Assessment Practitioners (EAPs), avifaunal specialists, developers and regulators and propose a tiered assessment process, including:

(i) Preliminary avifaunal assessment – an initial assessment of the likely avifauna in the area and possible impacts, preferably informed by a brief site visit and by collation of available data; also including the design of a site-specific survey and monitoring project should this be deemed necessary.
(ii) Data collection – further accumulation and consolidation of the relevant avian data, possibly including the execution of baseline data collection work (as specified by the preliminary assessment), intended to inform the avian impact study.
(iii) Impact assessment – a full assessment of the likely impacts and available mitigation options, based on the results of systematic and quantified monitoring if this was deemed a requisite at preliminary assessment.
(iv) Monitoring – repetition of baseline data collection, plus the collection of mortality data. This helps to develop a complete before and after picture of impacts, and to determine if proposed mitigation measures are implemented and are effective or require further refinement. Monitoring may only be necessary for projects with the potential for significant negative impacts on birds (i.e. large area affected and / or vulnerable species present).

In terms of the guidelines the quantity and quality of baseline data required to inform the assessment process at each site should be set in terms of the size of the site and the predicted impacts of the solar technology in question, the anticipated sensitivity of the local avifauna (for example, the diversity and relative abundance of priority species present, proximity to important flyways, wetlands or other focal sites) and the amount of existing data available for the area.

Data collection could vary from a single, short field visit (Regime 1, for e.g. at a small or medium sized site with low avifaunal sensitivity), to a series of multi-day survey periods, including the collection of various forms of data describing avian abundance, distribution and movement and spread over 12 months (Regime 3, for e.g. at a large developments located in a sensitive habitat, or which otherwise may have significant impacts on avifauna). **Table 6.8** is taken from the best practise guidelines and provides a summary of the recommended assessment regimes in relation to proposed solar energy technology, project size, and likely risk).

**Table 6.8:** Recommended avian assessment regimes in relation to proposed solar energy technology, project size, and known impact risks.

| Type of technology* | Size** | Avifaunal Sensitivity*** | | |
|---|---|---|---|---|
| | | Low | Medium | High |
| All except CSP power tower | Small (< 30ha) | Regime 1 | Regime 1 | Regime 2 |
| | Medium (30 – 150ha) | Regime 1 | Regime 2 | Regime 2 |
| | Large (> 150ha) | Regime 2**** | Regime 2 | Regime 3 |
| CSP power tower | All | Regime 3 | | |

Regime 1: One site visit (peak season); minimum 1 – 5 days.
Regime 2: Pre- and post-construction; minimum 2 – 3 x 3 – 5 days over 6 months (including peak season); carcass searches.
Regime 3: Pre- and post-construction; minimum 4 – 5 x 4 – 8 days over 12 months, carcass searches.

* Different technologies may carry different intrinsic levels of risk, which should be taken into account in impact significance ratings

** For multi-phased projects, the aggregate footprint of all the phases should be used. At 3ha per MW, Small = < 10MW, Medium = 10 – 50MW, Large = > 50MW.

*** The avifaunal sensitivity is based on the number of priority species present, or potentially present, the regional, national or global importance of the affected area for these species (both individually and collectively), and the perceived susceptibility of these species (both individually and collectively) to the anticipated impacts of development. For example, an area would be considered to be of high avifaunal sensitivity if one or more of the following is found (or suspected to occur) within the broader impact zone:

1) Avifaunal habitat (e.g. a wetlands, nesting or roost sites) of regional or national significance.
2) A population of a priority species that is of regional or national significance.
3) A bird movement corridor that is of regional or national significance.
4) A protected area and / or Important Bird and Biodiversity Area.

An area would be considered to be of medium avifaunal sensitivity if it does not qualify as high avifaunal sensitivity, but one or more of the following is found (or suspected to occur) within the broader impact zone

1) Avifaunal habitat (e.g. a wetland, nesting or roost sites) of local significance.
2) A locally significant population of a priority species.
3) A locally significant bird movement corridor.

An area would be considered to be of low avifaunal sensitivity if it is does not meet any of the above criteria.

**** Regime 1 may be applied to some large sites, but only in instances where there is abundant existing data to support the assessment of low sensitivity.

The site was classified as being of low sensitivity and therefore bird monitoring which was conducted for the Vrede Solar PV Facility was undertaken in line with a Regime 1 classification. Consequently, only a minimum of one site visit of 1 to 5 days in duration was required. The results from the monitoring has been used to inform both the development footprint as well as the Avifauna Impact Assessment report, attached as **Appendix E** of this EIA Report.

### *6.8.2 The IFC Environmental Health and Safety (EHS) Guidelines*

The IFC EHS Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). The following IFC EHS Guidelines have relevance to the proposed project:

» IFC EHS General Guidelines
» IFC EHS Guidelines for Electric Power Transmission and Distribution

The General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines, however no Industry Sector EHS Guidelines have been developed for PV solar power to date. The application of the General EHS Guidelines should be tailored to the hazards and risks associated with a project, and should take into consideration site-specific variables which may be applicable, such as host country context, assimilative capacity of the environment, and other project factors. In instances where host country regulations differ from the standards presented in the EHS Guidelines, whichever is the more stringent of the two in this regard should be applied.

The General EHS Guidelines include consideration of the following:

- Environmental:
  - Air Emissions and Ambient Air Quality
  - Energy Conservation
  - Wastewater and Ambient Water Quality
  - Water Conservation
  - Hazardous Materials Management
  - Waste Management
  - Noise
  - Contaminated Land
- Occupational Health and Safety:
  - General Facility Design and Operation
  - Communication and Training
  - Physical Hazards
  - Chemical Hazards
  - Biological Hazards
  - Radiological Hazards
  - Personal Protective Equipment (PPE)
  - Special Hazard Environments
  - Monitoring
- Community Health and Safety:
  - Water Quality and Availability
  - Structural Safety of Project Infrastructure
  - Life and Fire Safety (L&FS)
  - Traffic Safety
  - Transport of Hazardous Materials
  - Disease Prevention
  - Emergency Preparedness and Response
- Construction and Decommissioning:
  - Environment
  - Occupational Health & Safety
  - Community Health & Safety

### *6.8.3 IFC's Project Developer's Guide to Utility-Scale Solar Photovoltaic Power Plants (2015)*

While no Industry Sector EHS Guidelines have been developed for PV Solar Power, the IFC has published a Project Developer's Guide to Utility-Scale Solar Photovoltaic Power Plants (IFC, 2015). Chapter 8 of the Project Developer's Guide pertains to Permits, Licensing and Environmental Considerations, and states that in order to deliver a project which will be acceptable to international lending institutions, environmental and social assessments should be carried out in accordance with the requirements of the key international standards and principles, namely the Equator Principles and IFC's Performance Standards (IFC PS).

Some of the key environmental considerations for solar PV power plants contained within the Project Developer's Guide include:

- Construction phase impacts (i.e. OHS, temporary air emissions from dust and vehicle emissions, noise related to excavation, construction and vehicle transit, solid waste generation and wastewater generation from temporary building sites and worker accommodation).
- Water usage (i.e. the cumulative water use requirements).
- Land matters (i.e. land acquisition procedures and the avoidance or proper mitigation of involuntary land acquisition / resettlement).
- Landscape and visual impacts (i.e. the visibility of the solar panels within the wider landscape and associated impacts on landscape designations, character types and surrounding communities).
- Ecology and natural resources (i.e. habitat loss / fragmentation, impacts on designated areas and disturbance or displacement of protected or vulnerable species).
- Cultural heritage (i.e. impacts on the setting of designated sites or direct impacts on below-ground archaeological deposits as a result of ground disturbance during construction).
- Transport and access (i.e. impacts of transportation of materials and personnel).
- Drainage / flooding (i.e. flood risk associated with the site).
- Consultation and disclosure (i.e. consultation with key authorities, statutory bodies, affected communities and other relevant stakeholders as early as possible).
- Environmental and Social Management Plan (ESMP) (i.e. compile an ESMP to ensure that mitigation measures for relevant impacts are identified and incorporated into project construction procedures and contracts).

These issues, as well as others identified, have been addressed through this EIA report.

# 7 DESCRIPTION OF THE RECEIVING ENVIRONMENT

This chapter provides a description of the local environment. This information is provided in order to assist the reader in understanding the possible effects of the project on the environment within which it is proposed to be developed. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, Vrede Solar PV Facility have been described. This information has been sourced from both existing information available for the area as well as specialist consultants and aims to provide the context within which this EIA process is being conducted.

## 7.4 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter includes the following information required in terms of Appendix 3: Content of an EIA report:

| Requirement | Relevant Section |
|---|---|
| (h)(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects. | The environmental attributes associated with the development of the Vrede Solar PV Facility is included as a whole within this chapter. The environmental attributes that are assessed within this chapter includes the following: |
| | » The regional setting of the broader project site indicates the geographical aspects associated with the Vrede Solar PV Facility. This is included in **Section 7.2**. |
| | » The climatic conditions for the Kroonstad area have been included in **Section 7.3**. |
| | » The biophysical characteristics of the project site and the surrounding areas are included in **Section 7.4**. The characteristics considered are topography and terrain, geology, soils and agricultural potential and the ecological profile which includes the vegetation patterns, listed plant species, critical biodiversity areas and broad-scale processes, freshwater resources, terrestrial fauna and avifauna. |
| | » The heritage and cultural aspects (including archaeology and palaeontology) has been included in **Section 7.5**. |
| | » The social and socio-economic characteristics associated with the broader study area and the project site has been included in **Section 7.6** |

A more detailed description of each aspect of the affected environment is included in the specialist reports included as **Appendices D to J.**

## 7.5 Regional Setting

The Vrede Solar PV Facility project site is located approximately 13km south west of Kroonstad and 47km north east of Welkom in the Free State Province. Other nearby towns include Hennenman, Edenville, Steynsrus and Odendaalsrus. Kroonstad serves as a stop-over en-route between Johannesburg and Bloemfontein, as it is located approximately halfway between the two towns.

Kroonstad is an important agricultural service centre in the Free State with a predominantly agricultural-orientated economy served by a modern toll-road. Kroonstad is the centre of a rich agricultural district, producing maize, wheat, dairy, meat products and wool. The Bloemhoek Dam lies just east of the town and supplies much of its water needs. Kroonstad is located on the banks of the Vals River, a tributary of the Vaal, and is situated within an area characterised by open spaces and an abundant variety of vegetation.

A regional map of the development area relative to Kroonstad town is provided in **Figure 7.1.**

The closest main access road to the proposed site is the existing gravel access road (the S172), which runs immediately to the south of the development area. The S172 is itself accessible via a turnoff from the P99/1 regional road (a tarred regional road) approximately 3km from the development area. The P99/1 is accessible from the R34 turnoff and road leading westwards out of Kroonstad town. The location of these roads in relation to the development area is provided in **Figure 7.1.**

Land use in the broader study area is predominantly agricultural, with cattle grazing and croplands being the most prevalent. The development area itself is characterised by flat topography, comprised mainly of old, fallow croplands with the remainder of the development area comprising mixed grassland and woodlands.

Currently, no known operational renewable energy facility is located in the broader Kroonstad area, based on the DFFE Renewable Energy database (Q4, 2020. The Vrede Solar PV facility is, however, located very close to the Kroonstad Municipality Substation–Theseus 1 132kV line which is located ~ 3km to the south of the development area. An 11kV line, the Gansvlei 1 power line, traverses the project site immediately to the south of the development area. The Kroonstad Municipality Substation is located ~9km north-east of the development area.

## 7.6 Climatic Conditions

The climate for the development area is expected to be most similar to that of Kroonstad, located approximately 13km north-east of the study area. Kroonstad lies ~1374m above sea level and considered to have a local steppe climate. The area is considered semi-arid with little rainfall during the year, averaging 604mm annually. Over the course of the year, the temperature typically varies from -0°C to 29°C and is rarely below -4°C or above 33°C. Rainfall is greatest in January (average of 99mm), whereas the least precipitation falls within June (average of 8mm).

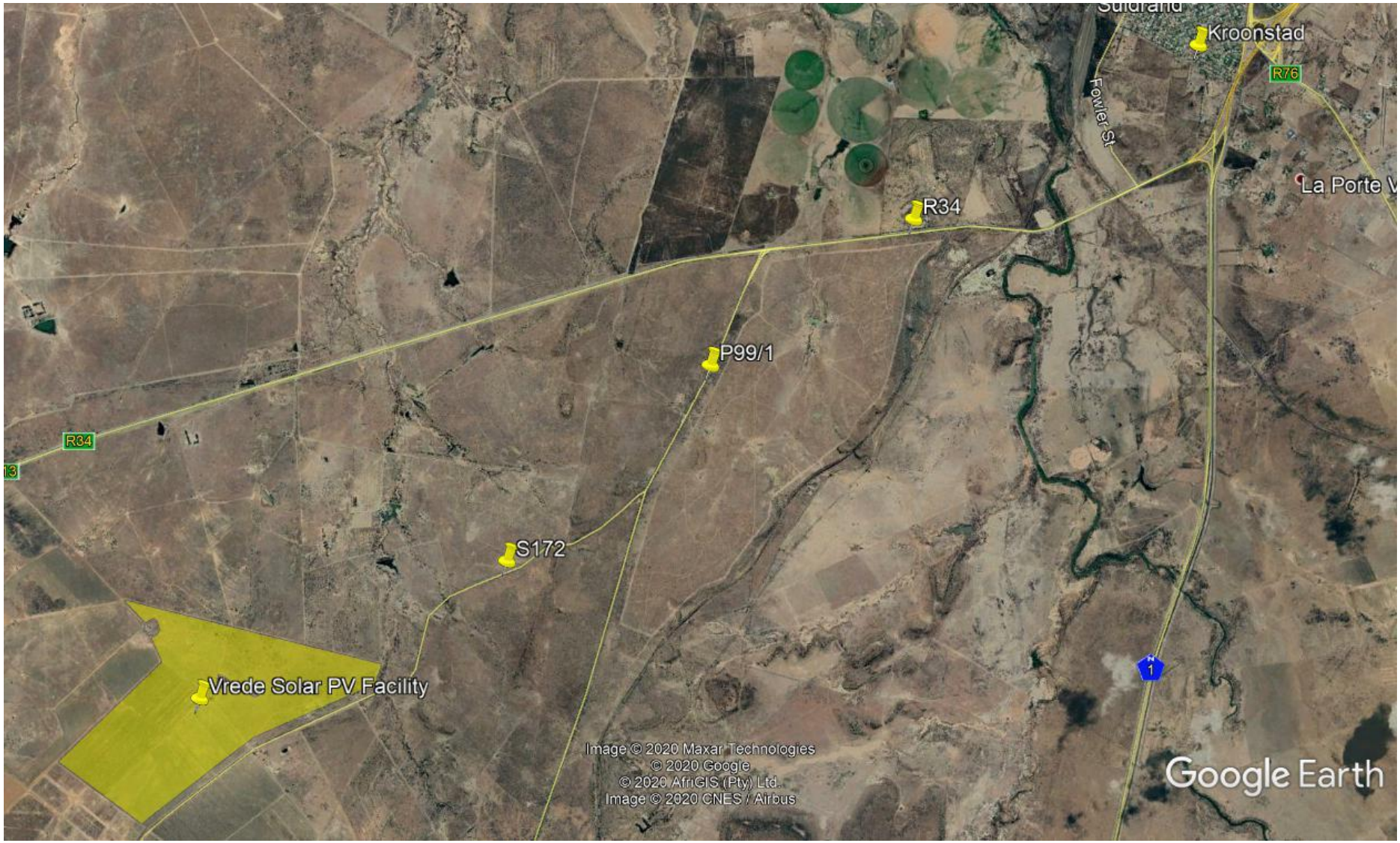


**Figure 7.1:** Regional map showing the location of the development area relative to Kroonstad town and the main roads in the area

## 7.7 Biophysical Characteristics of the Study Area and Development Area

### *7.7.1 Topographical profile*

The region within which the project site is located can be described flat and homogenous. Elevation across the development area ranges from 1402m above sea level in the west to 1419m above sea level in the east. There are no prominent hills within the project site with the highest areas of elevation situated to the east of the project site.

### *7.7.2 Geology, Soils and Agricultural Potential*

The geology of the Kroonstad region is characterised by the Beaufort Group rock, which consists of two subgroups, the Tarkastad subgroup and Adelaide subgroup, and is predominantly mudstone up to the upper sections of the lower Tarkastad subgroup. The Kroonstad region is predominantly Adelaide subgroup, thus giving rise to mudstone in the region. Mudstone is a type of mud rock that consists of fine grain soils. The soil particle sizes for mudstone are no larger than 0.063mm. The development area is comprised primarily of mudrock and subordinate sandstone of the Adelaide Subgroup (Beaufort Group). Occasional dolerite sills may also be present. Soil depth varies from 25mm – 45mm within the development area.

i. Soils and agricultural capability

The Vrede Solar PV Facility area includes five different land capability classes according to the land capability data (DAFF, 2017). **Figure 7.2** indicates the position of the different classes within the development area, which largely consists of land with Moderate (Class 08) to Moderate High (Class 09) land capability. Smaller patches in the centre and south-west consist of land with Low- Moderate (Classes 06 and 07) land capability. Classes 08 and 09 have potential for the production of specific crops under rainfed conditions while classes 06 and 07 are likely to be very marginal arable land that is more suitable for livestock grazing.

Based on the DAFF (2017) dataset, the Vrede Solar PV Facility development area includes areas where field crops have previously been produced. Although the DAFF data layer indicates these areas still as rainfed annual crops (or planted pastures) (refer **Figure 7.3)**, the development area consists only of pasture and planted pastures since 2005. The landowner has confirmed that he could not continue to cultivate grain crops on the farm as it was economically non-viable. As such, no crops are currently in place (and have been since 2005) and all crop cultivation has been ceased by the landowner. Several pivot irrigation fields are located outside the development area, mostly towards the south-west and south. No pivot irrigation fields are located within the development area. Large fields with rainfed crops and/or planted pastures are located to the west and south of the development area with old fields to the north.

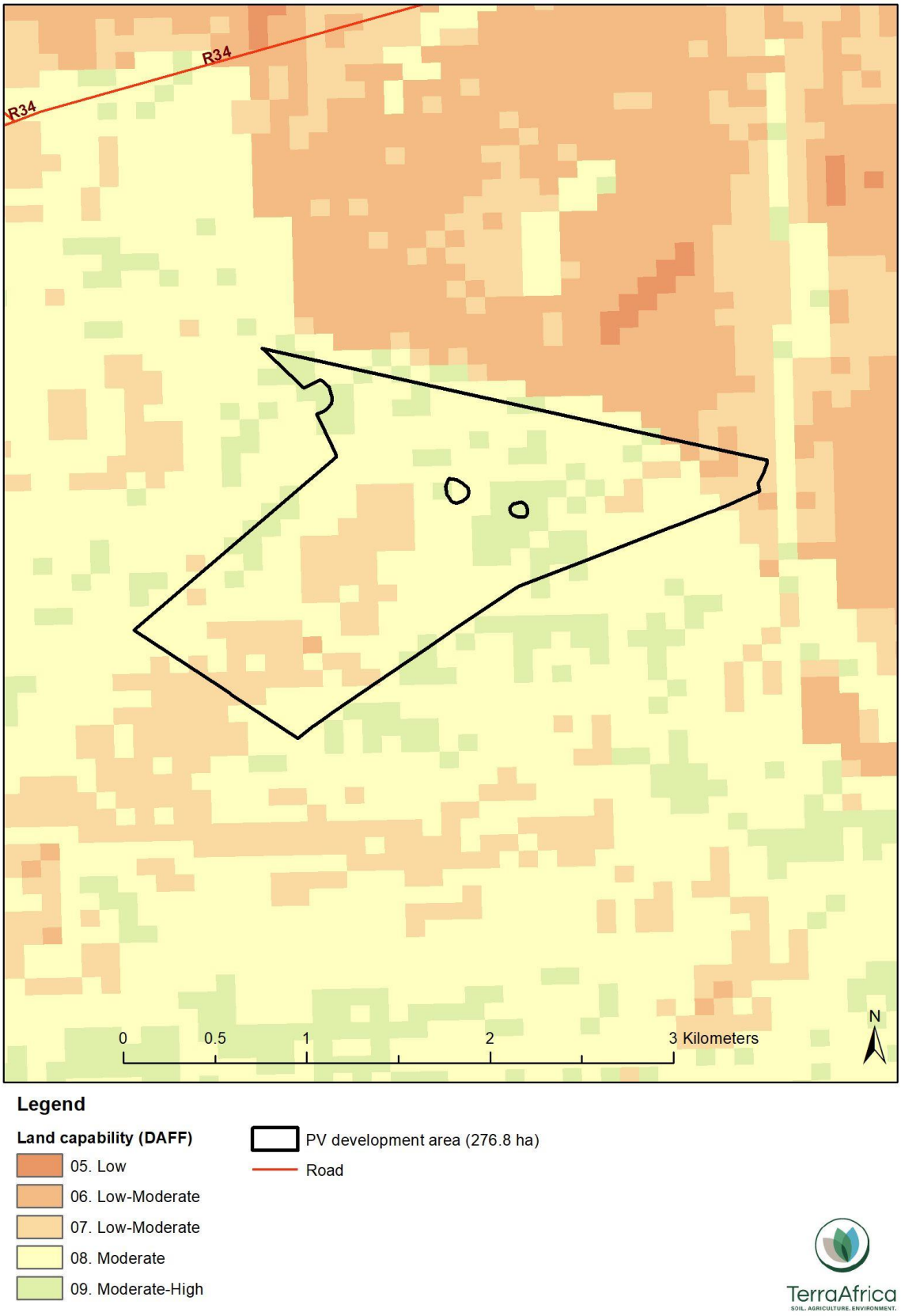


**Figure 7.2:** Land capability classes of the project development area

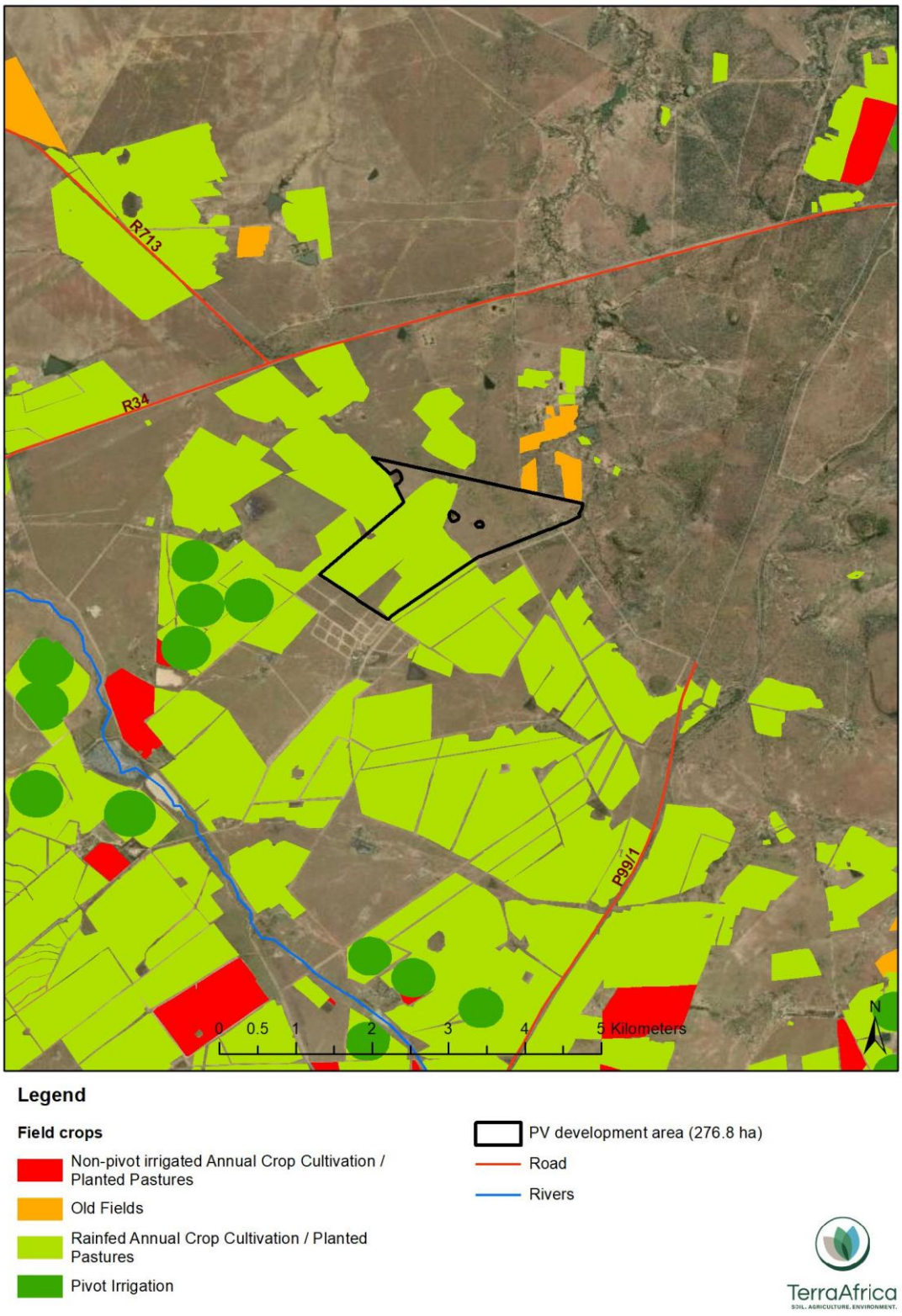


**Figure 7.3:** DAFF (2017) dataset for the development area and broader area. Note, no crop cultivation has been implemented on site since 2005 due to difficulties in profitable cultivation of the development site.

The grazing capacity of the largest section of the development area, is 6 ha/Live Stock Unit (LSU) (refer **Figure 7.4**). A small area in the north-eastern corner of the development area, has grazing capacity of 5 ha/LSU. The ideal grazing capacity is an indication of the long-term production potential of the vegetation layer

growing in an area. More specifically, it relates to its ability to maintain an animal with an average weight of 450 kg (defined as one LSU) with an average feed intake of 10 kg dry mass per day over the period of approximately a year. This definition includes the condition that this feed consumption should also prevent the degradation of the soil and the vegetation. The grazing capacity is therefore expressed in a number of hectares per LSU (ha/LSU).

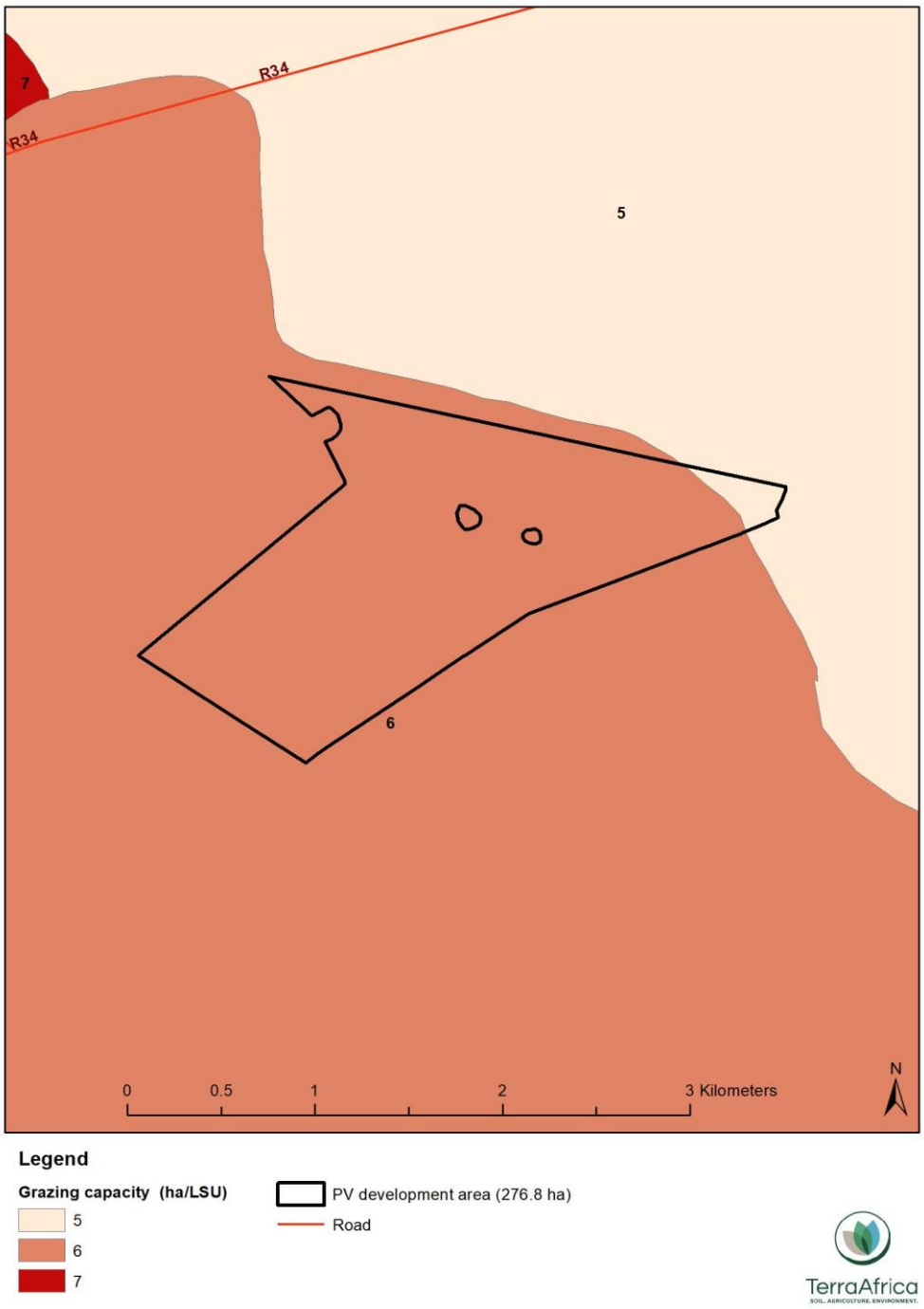


**Figure 7.4:** Long-term grazing capacity of the development area.

Land Types across the development area consist of Land Type Bd21 (refer **Figure 7.5**), with a small section in the north-eastern corner of Land Type Dc10. The characteristics of the land types are described below and their positions in the landscape illustrated in **Figure 7.5**.

Land Type Bd21: consists of four terrain units and the landscape can be described as slightly undulating with slopes ranging between 1 and 3%. The soil formed from sandstone, mudstone and shale. The crest (Terrain unit 1) is dominated by deep Clovelly and Hutton soil forms (0.9 – 1.2m) and shallower Westleigh soil form (0.4 – 0.6m). The texture of soil in this terrain unit is dominated by sand-clay-loam with the clay fraction estimated as 10 - 20%. Terrain unit 3 (mid-slope) forms 50% of land type Bd21. The mid-slopes consist of deep Hutton and Clovelly soil forms (0.9 – 1.2m), Westleigh soil form (0.4 – 0.6m) Valsrivier soil form (0.25 – 0.35m). The toe-slopes (Terrain unit 4) are dominated by the shallow Valsrivier soil form. Sterkspruit, Bonheim and Kroonstad soil forms are also present in the toe slope. Terrain unit 5 (Valley bottom) consists of Dundee, Bonheim, Valsrivier and Sterkspruit soil forms. The soil depth ranges from 0.25m (Valsrivier) to 1.2m (Dundee). The clay content ranges from 20 – 45% and the texture ranges from sand-clay-loam to sand-clay.

Land Type Dc10: comprises five terrain units where Terrain Units 1, 3 and 4 which dominate the landscape (93%) represent an undulating landscape. Terrain Unit 5 are the areas of slight depression at the valley bottoms with a slope of 1 – 2%. Terrain unit 2 (upper slope) has steep slopes of >100% but represent only 1% of the Land Type. Terrain unit 3 (lower slope) has a slope of 4 – 12% while the slopes of the other terrain units (crest and toe slope) range between 1 and 5%. The soil originated on the crests and scarps (upper slopes) from dolerite or sandstone and the mid slopes and toe slopes mainly from mudstone and shale.

The texture of soil in this land type is dominated by sandy clay and clay on the mid slope and toe slope with the clay ranging between 15 and 30%. Terrain units 3 and 4 that represent 71% of this land type mainly consists of rock, shallow soil profiles (0.1 – 0.3m) of the Swartland and Mispah forms with an estimated 7 - 12% of areas in these terrain units consisting of deeper soil profiles (0.3 – 0.58m) of the Bonheim form. The valley bottoms are dominated by deep soil profiles (>1.2m) of the Dundee and Inhoek soil forms.


**Figure 7.5:** Land type classification of the development area.

ii. Land use

According to the Free State Province Land-Cover dataset (2009) (**Figure 7.6)**, approximately 60% of the entire development area is located on cultivated fields (dryland), whist approximately 35% of the project site can be regarded as a natural form of grassland. Furthermore, approximately 4% of the project site is covered by wetlands.

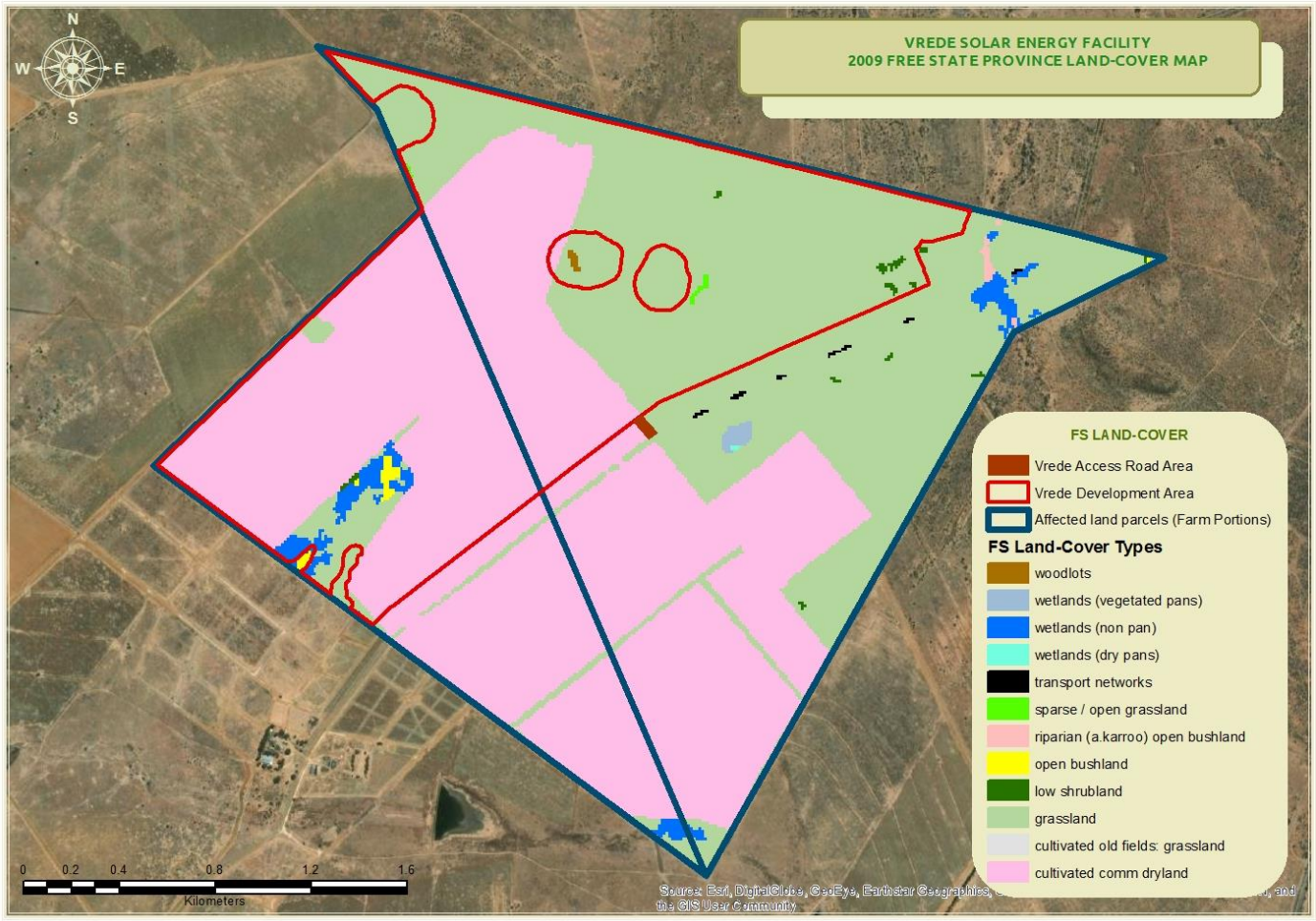


**Figure 7.6:** Free State Land Cover Map (2009) for the development area.

Land cover and land-use changes often indicate major impacts on biodiversity, especially if those changes show the loss of natural habitat due to urban sprawl, cultivation, etc.

The affected properties are predominantly used for agricultural purposes, in the past mainly for dryland cultivation, and to a lesser extent for livestock farming (predominantly cattle). However, cultivation practices have been abandoned within the project area for a relatively long period of time. Game farming have also become much more prominent within the region over the last decade (wide variety of game species including rare antelope and big game such as buffalo).

Currently (and for a long period of time), no cultivation activities are taking place. Approximately 60% of the development area appears to be fallow lands, most recently abandoned (<20 years) and is now used as pastures for cattle (refer Figure 7.7). Historically cultivated land (> 30 years), covers an area of approximately 18% (of the development area) and appears to have been re-established by grasses and

low shrubs (plagioclimax grassland), with the only evidence, from available spatial data, being feint ploughing contour lines . These areas are also now likely being utilised as grazing. Subsequently, approximately 78% of the development area has been, at some point in time, subjected to ploughing (soil and vegetation disturbance) and cultivation. Only approximately 20% natural veld remain comprising of grasslands with varying coverage/density of shrubs.

Furthermore, natural wetland features cover approximately 2% of the project area, comprising mostly of valley-bottom and depression wetlands. Small earth dam structures have been created within some of the wetlands, in an attempt to concentrate and store surface water for longer periods of time within these wetland features.

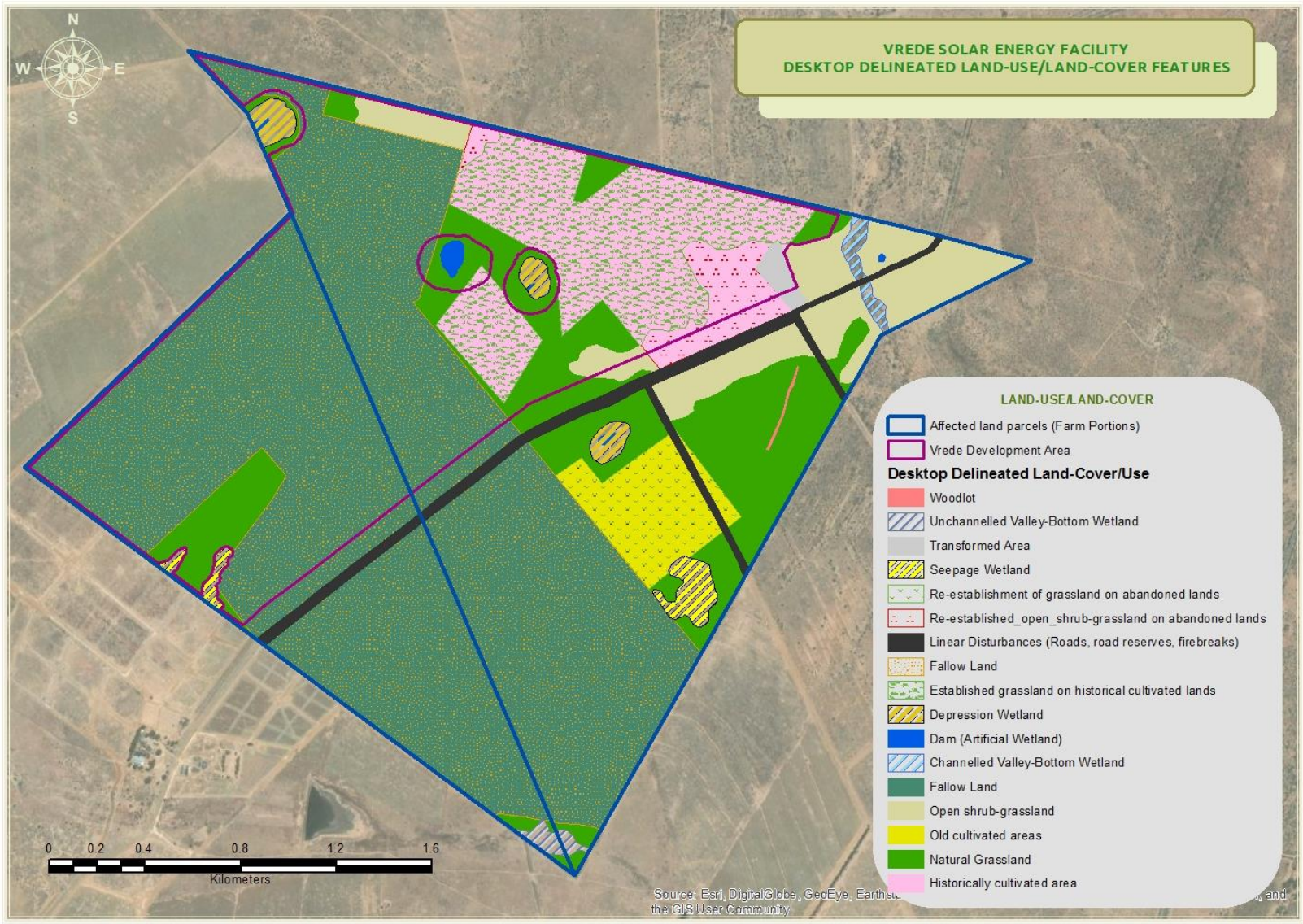


**Figure 7.7:** Desktop delineated land-cover features (these features were confirmed during the field work).

### *7.7.3 Ecological profile of the development area*

i. Vegetation overview

The development area and broader project site is situated within the grassland biome. This biome is centrally located in southern Africa, and adjoins all except the desert, fynbos and succulent Karoo biomes (Mucina & Rutherford, 2006).

Major macroclimatic traits that characterise the grassland biome include:

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

Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. The grassland biome experiences summer rainfall and dry winters with frost (and fire), which are unfavourable for tree growth. Therefore, trees are typically absent, except in a few localised habitats. Geophytes (bulbs) are often abundant. Frosts, fire and grazing maintain the grass dominance and prevent the establishment of trees.

The grassland biome comprises many different vegetation types. The project site is situated within two vegetation types, namely the Vaal-Vet Sandy Grassland (Gh10) and Central Free State Grassland (Gh6) according to Mucina & Rutherford (2006) (refer **Figure 7.8**). The development area is, however, almost solely situated within one vegetation type, the Vaal-Vet Sandy Grassland with only a small portion extending into the Central Free State Grassland.

Vaal Vet Sandy Grassland

The Vaal Vet Sandy Grassland vegetation type is found in North-West and Free State Provinces. This vegetation type typically comprises of plains-dominated landscape with some scattered, slightly irregular undulating plains and hills and mainly low-tussock grasslands with an abundant karroid element. Dominance of *Themeda triandra* is an important feature of this vegetation unit. Locally low cover of *T. triandra* and the associated increase in *Elionurus muticus*, *Cymbopogon pospischilii* and *Aristida congesta* is attributed to heavy grazing and/or erratic rainfall (Mucina & Rutherford, 2006).

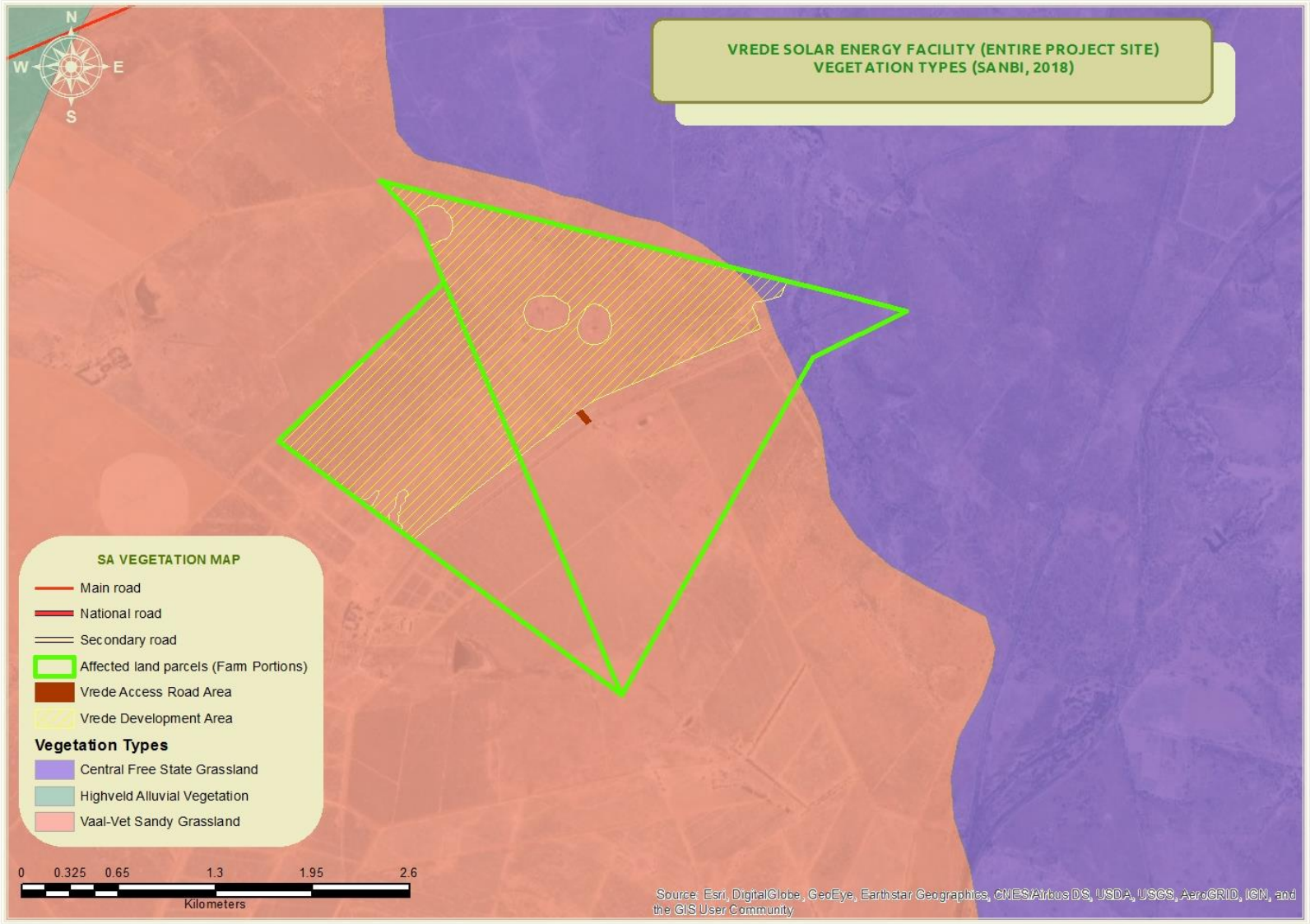


**Figure 7.8:** Vegetation map of the project site and development area (SANBI, 2018).

Important plant taxa are those species that have a high abundance, a frequent occurrence or are prominent in the landscape within a particular vegetation type (Mucina & Rutherford, 2006). The following species are important in the Vaal Vet Sandy Grassland.

- Graminoids: *Anthephora pubescens (d), Aristida congesta (d), Chloris virgata (d), Cymbopogon caesius (d), Cynodon dactylon (d), Digitaria argyrograpta (d), Elionurus muticus (d), Eragrostis chloromelas (d), E. lehmanniana (d), E. plana (d), E. trichophora (d), Heteropogon contortus (d), Panicum gilvum (d), Setaria sphacelata (d), Themeda triandra (d), Tragus berteronianus (d), Brachiaria serrata, Cymbopogon pospischilii, Digitaria eriantha, Eragrostis curvula, E. obtusa, E. superba, Panicum coloratum, Pogonarthria squarrosa, Trichoneura grandiglumis, Triraphis andropogonoides* (Mucina & Rutherford, 2006).
- Herbs: *Stachys spathulata (d), Barleria macrostegia, Berkheya onopordifolia var. onopordifolia, Chamaesyce inaequilatera, Geigeria aspera var. aspera, Helichrysum caespititium, Hermannia depressa, Hibiscus pusillus, Monsonia burkeana, Rhynchosia adenodes, Selago densiflora, Vernonia oligocephala* (Mucina & Rutherford, 2006).
- Geophytic Herbs: *Bulbine narcissifolia, Ledebouria marginata*.
- Succulent Herb: *Tripteris aghillana var. integrifolia* (Mucina & Rutherford, 2006).
- Low Shrubs: *Felicia muricata (d), Pentzia globosa (d), Anthospermum rigidum subsp. pumilum, Helichrysum dregeanum, H. paronychioides, Ziziphus zeyheriana* (Mucina & Rutherford, 2006).
- Endemic Taxon Herb: *Lessertia phillipsiana*.

Central Free State Grassland

The Central Free State Grassland vegetation type is found in the Free State and marginally into Gauteng Province. This vegetation type typically comprises of 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 (Mucina & Rutherford, 2006).

Important plant taxa are those species that have a high abundance, a frequent occurrence or are prominent in the landscape within a particular vegetation type (Mucina & Rutherford, 2006). The following species are important in the Central Free State Grassland.

- 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* (Mucina & Rutherford, 2006).
- 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* (Mucina & Rutherford, 2006).
- Geophytic Herbs: *Oxalis depressa, Raphionacme dyeri* (Mucina & Rutherford, 2006).
- Succulent Herb: *Tripteris aghillana var. integrifolia* (Mucina & Rutherford, 2006).
- Low Shrubs: *Felicia muricata (d), Anthospermum rigidum subsp. pumilum, Helichrysum dregeanum, Melolobium candicans, Pentzia globosa* (Mucina & Rutherford, 2006).

Based on the Plants of Southern Africa (BODATSA-POSA, 2020) database, 491 plant species are expected to occur in the project site. The list of expected plant species is provided in the ecological specialist assessment. Of the 491 plant species, only one species is listed as being a Species of Conservation Concern (SCC), namely *Anacampseros recurvata subsp. buderiana*. It is likely that this individual has been wrongfully identified as this species is Endemic to the quartz plains and outcrops of the Richtersveld. As such the Likelihood of Occurrence for this species within the project area is highly unlikely.

ii. Fauna

**a) Amphibians**

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the AmphibianMap database provided by the Animal Demography Unit (ADU, 2017), twenty (20) amphibian species are expected to occur in the development area. One amphibian species of conservation concern could be present in the project area according to the above-mentioned sources, namely *Pyxicephalus adspersus* (Giant Bullfrog). The Giant Bull Frog is listed as near threatened on a regional scale. It is a species of drier savannahs. It is fossorial for most of the year, remaining buried in cocoons. They emerge at the start of the rains, and breed in shallow, temporary waters in pools, pans and ditches (IUCN, 2017). There appears to be moderate suitable habitat for this species in the development area and, therefore, the likelihood of occurrence is regarded as moderate.

**b) Reptiles**

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the ReptileMap database provided by the Animal Demography Unit (ADU, 2017), twenty-eight (28) reptile species are expected to occur in the development area. Two reptile species of conservation concern are expected to be present in the broader project site (and consequently the development area), namely *Smaug giganteus* (Sungazer or Ouvolk) and *Chamaesaura aenea* (Coppery Grass Lizard).

*Smaug giganteus* (Sungazer or 'Ouvolk') is categorised as Vulnerable on both a regional and an international scale. It is endemic to South Africa, where it is found only in the grasslands of the northern Free State and the southwestern parts of Mpumalanga (IUCN, 2017). Habitat loss due to agriculture is a continuing threat. Large portions of the grassland habitat are underlain by coal beds of varying quality and extent, and exploitation of coal for fuel has and will result in further habitat loss. The likelihood of finding the species in the development area is high.

*Chamaesaura aenea* (Coppery Grass Lizard) is categorised as near threatened on both an international and a regional scale. A population reduction of over 20% in the last 18 years (three generations) is inferred from the transformation of large parts of the Grassland Biome. They are threatened by transformation of land for crop farming and plantations, overgrazing by livestock, infrastructural development, frequent anthropogenic fires and use.

**c) Mammals**

The IUCN Red List Spatial Data lists 73 mammal species that could be expected to occur within the vicinity of the project site. Of these species, 8 are medium to large conservation dependant species, such as

*Ceratotherium simum* (Southern White Rhinoceros) and *Equus quagga* (Plains Zebra) that, in South Africa, are generally restricted to protected areas such as game reserves. These species are not expected to occur in the development area and are removed from the expected Species of Conservation Concern (SCC) list. Of the remaining 65 small to medium sized mammal species, ten (10) are listed as being of conservation concern on a regional or global basis.

The list of potential species includes (refer **Table 7.1**):

- One (1) that is listed as Endangered (EN) on a regional basis;
- Four (4) that are listed as Vulnerable (VU) on a regional basis; and
- Five (5) that are listed as Near Threatened (NT) on a regional scale.

**Table 7.1:** Mammal species of conservation concern with likelihood of occurrence within the development area.

| Species | Common Name | Conservation Status | | Likelihood of Occurrence |
|---|---|---|---|---|
| | | Red Data | IUCN | |
| *Anonyx capensis* | Cape Clawless Otter | NT | NT | Low |
| *Atelerix frontalis* | South African Hedgehog | NT | LC | High |
| *Felis nigripes* | Black-footed Cat | VU | VU | Low |
| *Hydrictis maculicollis* | Spotted-necked Otter | VU | NT | Low |
| *Leptailurus serval* | Serval | NT | LC | High |
| *Lycaon pectus* | African Wild Dog | EN | EN | Low |
| *Mystromys albicaudatus* | White-tailed Rat | VU | EN | High |
| *Panthera pardus* | Leopard | VU | VU | Low |
| *Parahyaena brunnea* | Brown Hyena | NT | NT | Moderate |
| *Poecilogale albinucha* | African Striped Weasel | NT | LC | Moderate |

iii. Critical Biodiversity Areas and Conservation Targets

The Vrede Solar PV Facility development area falls within the planning domain of the Free State Province Biodiversity Conservation Assessment which maps Critical Biodiversity Areas and Ecological Support Areas within the Free State Province. The assessment formed part of the Free State Provincial Spatial Development Plan (PSDP) and was intended to inform and facilitate broad scale land use classification, with the ultimate aim of facilitating land use planning for the entire province. The assessment utilised datasets available at the time of writing, in order to classify and depict areas that are important for the representation and persistence of terrestrial and aquatic species and ecosystems. The following three important classifications are made in the Free State Province Biodiversity Conservation Assessment:

- Critical Biodiversity Area 1: The Critical Biodiversity Area 1 regions constitute the planning units which if not included in the final portfolio (selection of planning units) for the assessment will result in the pre-defined targets not being achieved. In essence, loss of these regions may comprimise achieving provincial conservation targets
- Critical Biodiversity Area 2: Areas that represent areas of high biodiversity significance but will not necessarily result in the target not being achieved if they were excluded from the final portfolio, i.e. they represent areas for which options exist.
- Ecological Support Area (ESA): Areas that are required to support the persistence of species.

The majority of the development area falls within degraded areas, while the north-eastern and north-western portions of the development area is located within CBA1 (refer to **Figure 7.9**).

The CBA1 regions located within the development area, have been classified as such due to fact that these areas are regarded as irreplaceable, as they are essential in meeting the targets set for the conservation of the endangered Vaal-Vet Sandy Grassland. However, during a thorough examination of available satellite imagery (including historical imagery) it was found that large portions of the regions having been classified as CBAs were in fact historical cultivated areas that have been left fallow for an extensive period of time. This allowed for vegetation succession to take place to a stage where these areas are now covered with a relative stable grass and dwarf shrub cover. Subsequently, natural/original Vaal-Vet Sandy Grassland are only confined to a few isolated patches. Due to the small extent and patchy distribution of this endangered vegetation type within the development area, it is unlikely that this development will have an impact on the status of the remaining natural Vaal-Vet Sandy Grassland.

The development area is further not located within any ESA classified region and will subsequently not impact this feature.

iv. National Environment Management: Biodiversity Act (Act No. 10 of 2004) list of threatened ecosystems

The vegetation types of South Africa have been categorized according to their conservation status which is, in turn, assessed according to the degree of transformation and rates of conservation. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. On a national scale these thresholds are determined by the best available scientific approaches. The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36%.

The National List of Ecosystems that are Threatened and in need of protection (GN1002 of 2011), published under the National Environment Management: Biodiversity Act (Act No. 10 of 2004), lists national vegetation types that are afforded protection on the basis of rates of transformation. The threshold for listing in this legislation is higher than in the scientific literature, which means there are fewer ecosystems listed in the National Ecosystem List versus in the scientific literature. The conservation status of the vegetation types occurring in and around the project site (**Figure 7.9**) are indicated below (refer **Table 7.2**).

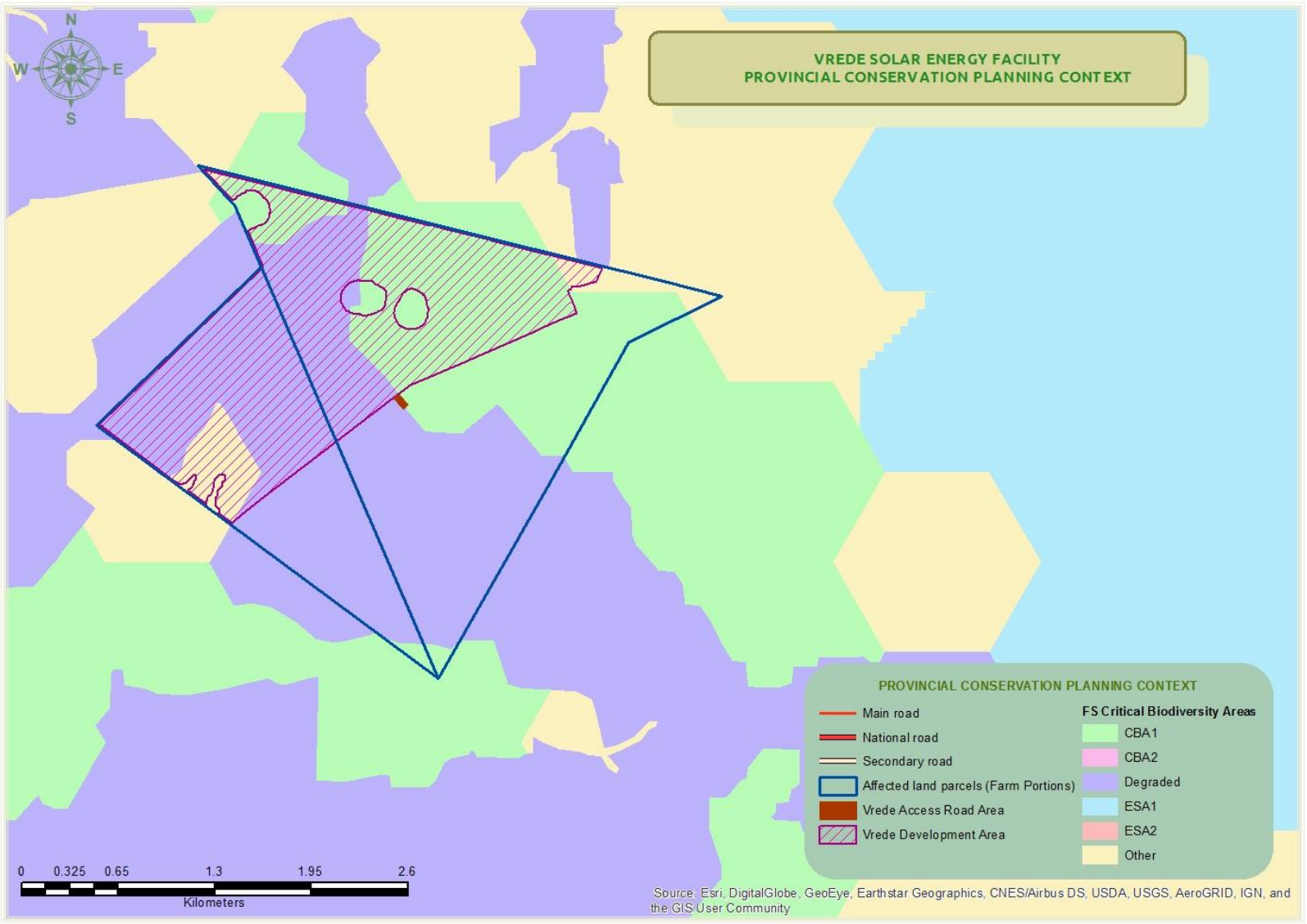


**Figure 7.9:** Provincial Level Conservation Planning Context – CBA Map (Free State Province Biodiversity Conservation Assessment).

**Table 7.2:** Vegetation types represented within the project site.

| Vegetation Type | Target (%) | Conserved (%) | Transformed (%) | Conservation Status | |
|---|---|---|---|---|---|
| | | | | Driver et al., 2005; Mucina & Rutherford, 2006 | National Ecosystem List (NEM:BA) |
| Vaal-Vet Sandy Grassland | 24% | 0.3% | 65.2% | Endangered | Endangered |
| Central Free State Grassland | 24% | 0.8% | 23.5% | Least Concerned | Not Listed |

The bulk of the development area is located within the endangered Vaal-Vet Sandy Grassland (refer to **Figure 7.10**), with only a small portion of the north-eastern corner falling within the Central Free State Grassland. However, as described earlier (Land cover and Land Use Section), the majority of the development area is located within transformed areas, with a small portion of the development area being located in what appears to be grassland largely consistent to that of Vaal-Vet Sandy Grassland.

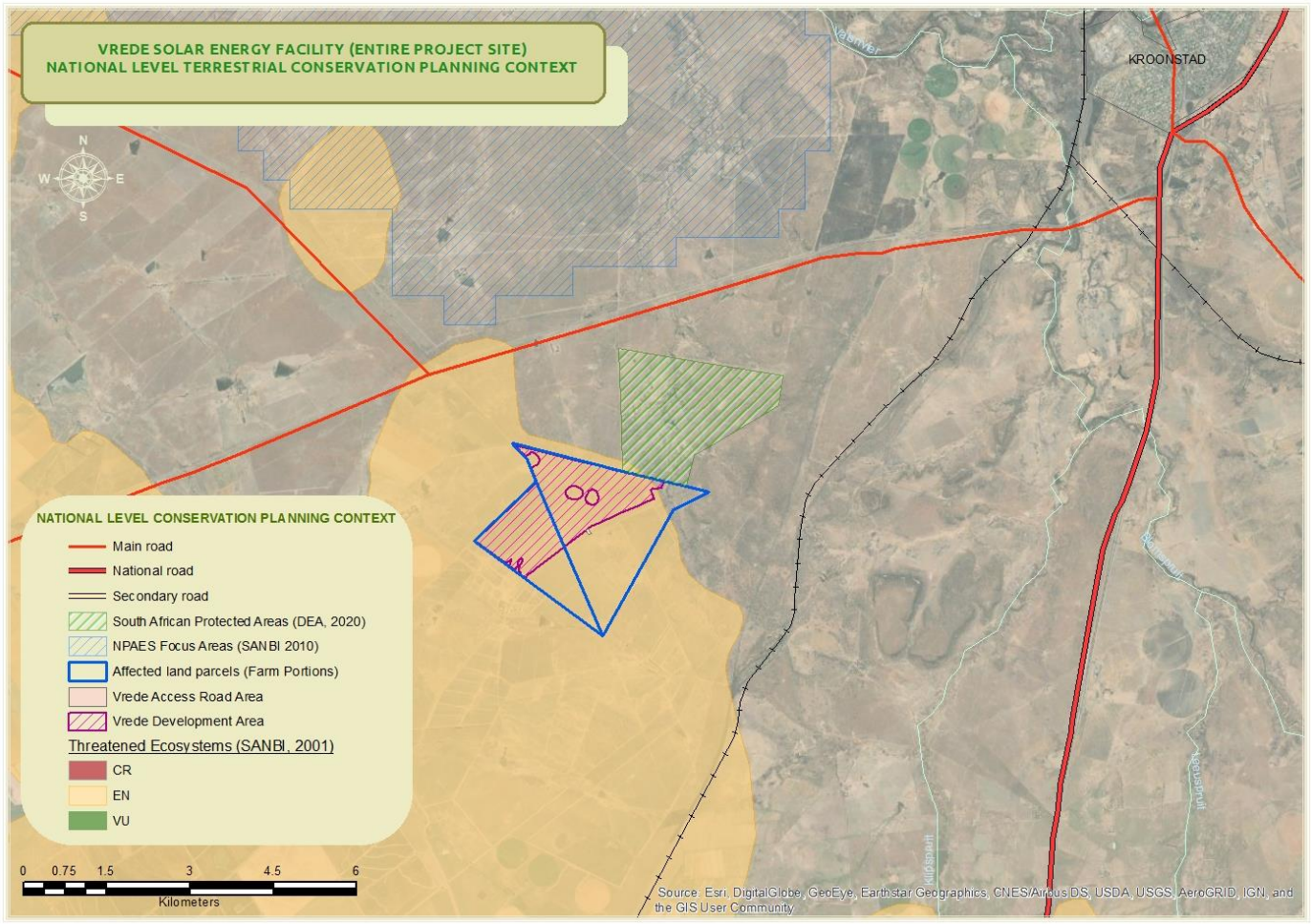


**Figure 7.10:** National Level Terrestrial Conservation Planning Context.

v. Freshwater overview

Strategic Water Source Areas (SWSAs)

Strategic Water Source Areas (SWSAs) are defined as areas of land that:

» supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important;
» have high groundwater recharge and where the groundwater forms a nationally important resource; or
» that meet both criteria mentioned above.

They include transboundary Water Source Areas that extend into Lesotho and Swaziland.

The project site is located outside of any SWSA for surface water but is located within a SWSA for groundwater; namely the Kroonstad SWSA-gw.

Freshwater Features

A desktop mapping exercise wherein all available Geo-spatial resources were closely analysed numerous wetland features were identified within the development area as well as the DWS 500m regulated area (refer **Figure 7.11**). A total of five (5) natural wetland features have been identified, most of which were depression wetlands. The valley-bottom (VB) wetlands appears to be channelled and drains in a northern direction towards the Vals River. This delineated channelled VB wetland can be regarded as the primary drainage feature within the project area

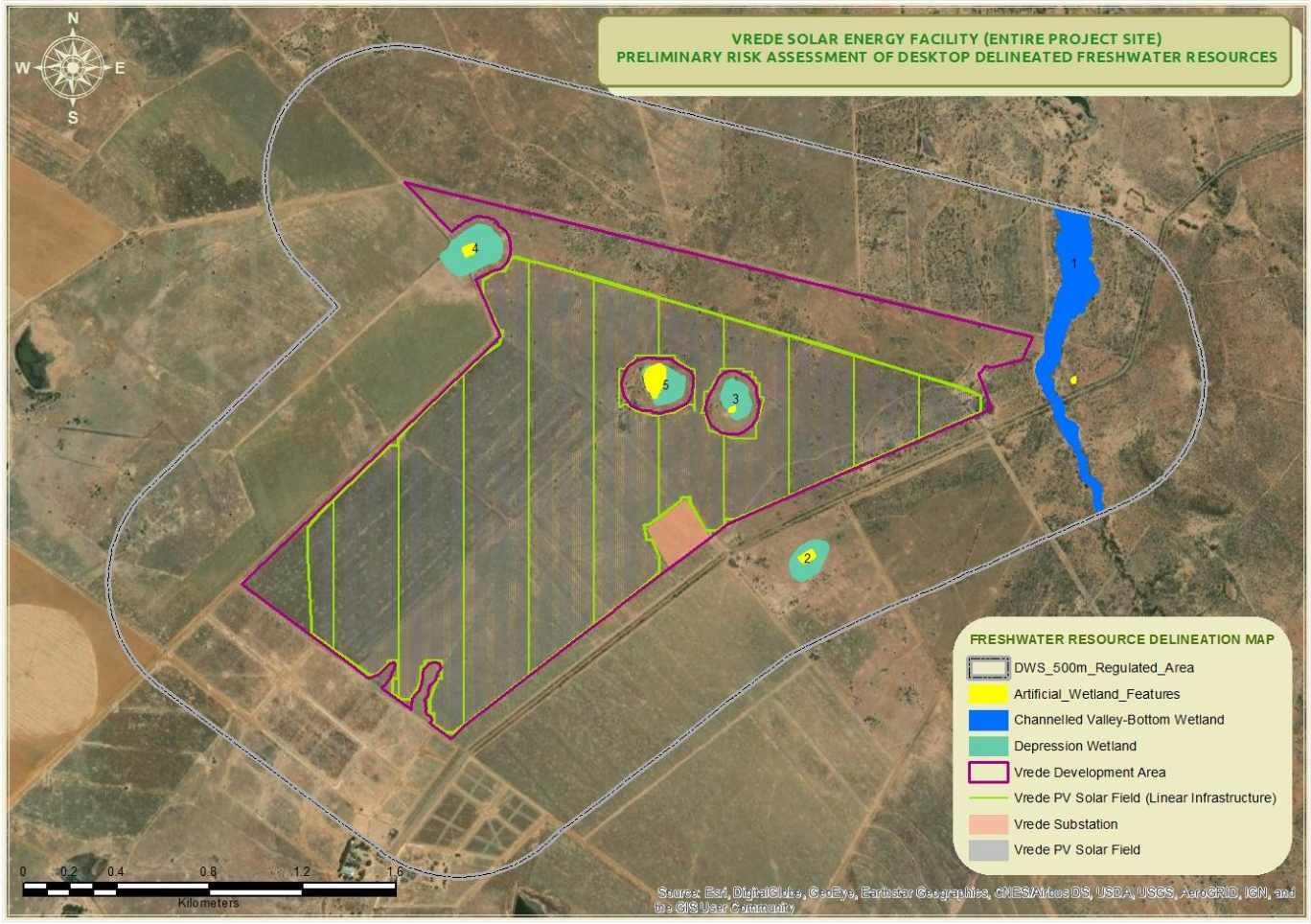


**Figure 7.11:** Desktop wetland delineation within the development area, to be confirmed during the EIA phase assessments.

vi. Avifauna

» ***Supporting avifaunal habitat within the study area***

There are no Important Bird Areas (IBA) within a 60km radius around the Vrede Solar PV Facility. It is therefore highly unlikely that the proposed development will have a negative impact on any IBA.

Species composition, distribution and abundance within the project site is largely influenced by the broad vegetation type, however species behaviour and fine scale distribution is linked to the avifaunal habitats present. The following bird habitats were determined for the development area:

» Woodland: The development area contains scattered areas of thorny shrubs and trees. One small ephemeral drainage line bisects the north-eastern corner of the development area, with a length of approximately 150m situated within the development area. Drainage lines are important corridors for woodland species because the woodland along the banks is a refuge for woodland species. The largest concentration of shrubs and a few small trees in the development area is found along the banks of the drainage line.
» Pans: The development area contains three small pans. When the pans hold water (which is only likely after sustained rainfall events), it may temporarily attract a variety of waterbirds, as well as other birds which use them to drink and bath. Sources of surface water are major attractants to birds.
» Fences: The development area contains a number of fences. Farm fences provide important perching substrate for a wide range of birds, as a staging post for territorial displays by small birds and also for perch hunting by some raptors.

Each of the main habitat types have been surveyed independently for bird species richness and bird abundance as required for Regime 1 development sites.

» ***Avian species richness and red data species***

The SABAP2 data indicates that a total of 192 bird species could potentially occur within the development area and immediate surroundings. The avifaunal specialist study (Refer **Appendix E**) provides a comprehensive list of all the species. Of these, 67 species are classified as priority species and two of these are South African Red Data species. Of the priority species, 11 are likely to occur regularly at the development area, and another 17 could occur sporadically. **Table 7.3** below lists all the priority species and the possible impact on the respective species by the proposed solar energy infrastructure.

Priority species with a high likelihood of occurrence on site included the Amur Falcon (*Falco amurensis*), Black-winged Kite (*Elanus caeruleus*), Lesser Kestrel (*Falco naumanni*), Black-headed Heron (*Ardea melanocephala*), Blacksmith Lapwing (*Vanellus armatus*), Cape White-eye (*Zosterops virens*), Egyptian Goose (*Alopochen aegyptiacus*), Fiscal Flycatcher (*Sigelus silens*), Hadeda Ibis (*Bostrychia hagedash*), Three-banded Plover (*Charadrius tricollaris*), and the Western Cattle Egret (*Bubulcus ibis*). Only these, only the Western Cattle Egret (*Bubulcus ibis*), Fiscal Flycatcher (*Sigelus silens*), Egyptian Goose (*Alopochen aegyptiacus*) and the Blacksmith Lapwing (*Vanellus armatus*) were actually observed during the avifaunal field assessment.

Of the priority species with moderate likelihood of occurrence on site, only the Pale Chanting Goshawk (*Melierax canorus*), Fairy Flycatcher (*Stenostira scita*) and South African Shelduck (*Tadorna cana*) where

observed during the avifaunal field assessment. The habitats within which each priority species is likely to utilise is also detailed in **Table 7.3** below. A strong preference for surface water habitats are shown across the priority species, with roughly equal utilisation of the grassland and woodland habitats.

» ***Species recorded through on-site surveys***

On-site surveys were conducted from 20 - 22 July 2020 by means of transect counts. The Index of Kilometre Abundance (IKA) indicated in **Figure 7.12** expresses the ratio of the total number of individuals (or of signs of presence) observed along a transect by the total transect length covered, and is a common measure used in avifaunal studies as it allows a straightforward comparison of species abundance in different sites or at different times. The species of greatest abundance as determined by on site observations was that of the Egyptian Goose, followed by the Fiscal Flycatcher, following which the South African Shelduck and the Fairy Flycatcher shared equal abundance values. Furthermore, the Egyptian Goose and Fiscal Flycatcher distribution was fairly widespread across the development area. Transect counts recorded the greatest number of Egyptian Goose individuals on site, as compared to all other priority species, which was therefore the most abundant priority species on site. Incidental counts indicated 25 counts of Greater Flamingo in the broader project area, however these were not observed within the development area.

The abundance of avifauna recorded during the transect and incidental counts are displayed below (refer to **Figure 7.12, Figure 7.13** and **Figure 7.14**). The location of all recorded priority species is displayed in **Figure 7.15**.

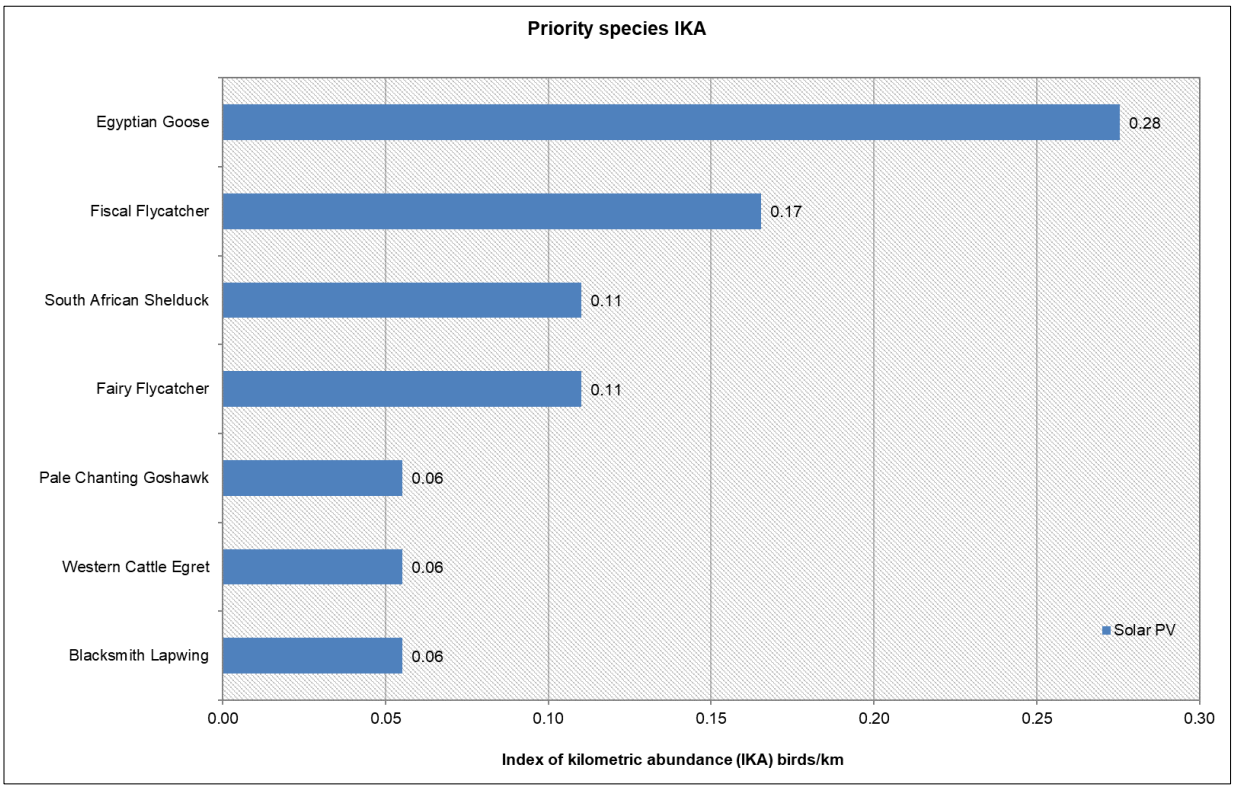


**Figure 7.12:** Index of kilometric abundance (IKA) for all priority species recorded by means of transect counts during the surveys in the study area conducted in July 2020.

**Table 7.3:** Priority species potentially occurring at the site and immediate surroundings (NT = Near threatened; End = South African Endemic; N-End = South African near endemic; H = High; M = Medium; L = Low).

| Species | Taxonomic name | Full protocol | Ad hoc protocol | Solar priority species | Red Data status: International | Red Data status: Regional | Endemic/near endemic - South Africa | Raptor | Waterbird | Possibility of regular occurrence | Recorded during surveys: Vrede | Grassland | Woodland | Surface water | Fences | PV panel collisions | Displacement - disturbance | Displacement - habitat loss | Entrapment in fences | Electrocution on 33kV OHL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amur Falcon | *Falco amurensis* | 28.07 | 4.76 | x | | | | x | | H | | x | | | x | x | | x | | |
| Black-winged Kite | *Elanus caeruleus* | 45.61 | 9.52 | x | | | | x | | H | | x | | | x | x | | x | | |
| Lesser Kestrel | *Falco naumanni* | 35.09 | 1.59 | x | | | x | x | | H | | x | | | x | x | | x | | |
| Black-headed Heron | *Ardea melanocephala* | 47.37 | 6.35 | x | | | | | x | H | | x | | x | | | | | x | x |
| Blacksmith Lapwing | *Vanellus armatus* | 87.72 | 11.11 | x | | | | | x | H | x | | | x | | | | | | |
| Cape White-eye | *Zosterops virens* | 35.09 | 1.59 | x | | | x | | | H | | | x | | | x | x | x | | |
| Egyptian Goose | *Alopochen aegyptiacus* | 49.12 | 1.59 | x | | | | | x | H | x | | | x | | | | | | x |
| Fiscal Flycatcher | *Sigelus silens* | 42.11 | 0.00 | x | | | x | | | H | x | | x | | x | x | x | x | | |
| Hadeda Ibis | *Bostrychia hagedash* | 84.21 | 11.11 | x | | | | | x | H | | | | x | | | | | | x |
| Three-banded Plover | *Charadrius tricollaris* | 26.32 | 0.00 | x | | | | | x | H | | | | x | | | | | | |
| Western Cattle Egret | *Bubulcus ibis* | 77.19 | 19.05 | x | | | | | x | H | x | x | | x | | | | | | x |
| African Fish-eagle | *Haliaeetus vocifer* | 1.75 | 0.00 | x | | | | x | x | L | | | | x | | | | | | x |
| African Harrier-Hawk | *Polyboroides typus* | 3.51 | 0.00 | x | | | | x | | L | | | x | | x | x | | | | x |
| Black Sparrowhawk | *Accipiter melanoleucus* | 1.75 | 0.00 | x | | | | x | | L | | | x | | | | | x | | x |
| Gabar Goshawk | *Melierax gabar* | 1.75 | 0.00 | x | | | | x | | L | | | x | | | x | | x | | |
| Red-footed Falcon | *Falco vespertinus* | 1.75 | 0.00 | x | | | | x | | L | | x | | | x | x | | x | | |
| African Black Duck | *Anas sparsa* | 1.75 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| African Darter | *Anhinga rufa* | 10.53 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| African Openbill | *Anastomus lamelligerus* | 1.75 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| African Snipe | *Gallinago nigripennis* | 7.02 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| African Spoonbill | *Platalea alba* | 7.02 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Black-necked Grebe | *Podiceps nigricollis* | 1.75 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Black-winged Stilt | *Himantopus himantopus* | 12.28 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Blue Korhaan | *Eupodotis caerulescens* | 1.75 | 1.59 | x | NT | LC | x | | | L | | x | | | | | x | | x | |

| Species | Taxonomic name | Full protocol | Ad hoc protocol | Solar priority species | Red Data status: International | Red Data status: Regional | Endemic/near endemic - South Africa | Raptor | Waterbird | Possibility of regular occurrence | Recorded during surveys: Vrede | Grassland | Woodland | Surface water | Fences | PV panel collisions | Displacement - disturbance | Displacement - habitat loss | Entrapment in fences | Electrocution on 33kV OHL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cape Shoveler | *Anas smithii* | 8.77 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Cape Teal | *Anas capensis* | 1.75 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Cape Weaver | *Ploceus capensis* | 1.75 | 0.00 | x | | | x | | | L | | | x | | | x | x | x | | |
| Common Greenshank | *Tringa nebularia* | 1.75 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Common Moorhen | *Gallinula chloropus* | 22.81 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Common Sandpiper | *Actitis hypoleucos* | 1.75 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Fulvous Duck | *Dendrocygna bicolor* | 10.53 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Glossy Ibis | *Plegadis falcinellus* | 12.28 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Goliath Heron | *Ardea goliath* | 1.75 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Greater Flamingo | *Phoenicopterus ruber* | 1.75 | 1.59 | x | LC | NT | | | x | L | | | | x | | | | | | |
| Kittlitz's Plover | *Charadrius pecuarius* | 3.51 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Lesser Flamingo | *Phoenicopterus minor* | 1.75 | 0.00 | x | NT | NT | | | x | L | | | | x | | | | | | |
| Little Stint | *Calidris minuta* | 3.51 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Maccoa Duck | *Oxyura maccoa* | 1.75 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Malachite Kingfisher | *Alcedo cristata* | 15.79 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Marsh Sandpiper | *Tringa stagnatilis* | 1.75 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Melodious Lark | *Mirafra cheniana* | 1.75 | 0.00 | x | | | x | | | L | | x | | | x | x | x | | | |
| Pied Avocet | *Recurvirostra avosetta* | 1.75 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Pied Kingfisher | *Ceryle rudis* | 1.75 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Purple Heron | *Ardea purpurea* | 8.77 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Reed Cormorant | *Phalacrocorax africanus* | 43.86 | 3.17 | x | | | | | x | L | | | | x | | | | | | |
| Southern Pochard | *Netta erythrophthalma* | 10.53 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| Whiskered Tern | *Chlidonias hybrida* | 3.51 | 0.00 | x | | | | | x | L | | | | x | | | | | | |
| White Stork | *Ciconia ciconia* | 1.75 | 0.00 | x | | | | | x | L | | x | | x | | | | | x | x |
| White-breasted Cormorant | *Phalacrocorax carbo* | 28.07 | 1.59 | x | | | | | x | L | | | | x | | | | | | |

| Species | Taxonomic name | Full protocol | Ad hoc protocol | Solar priority species | Red Data status: International | Red Data status: Regional | Endemic/near endemic - South Africa | Raptor | Waterbird | Possibility of regular occurrence | Recorded during surveys: Vrede | Grassland | Woodland | Surface water | Fences | PV panel collisions | Displacement - disturbance | Displacement - habitat loss | Entrapment in fences | Electrocution on 33kV OHL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Common Buzzard | *Buteo vulpinus* | 7.02 | 0.00 | x | | | x | x | | M | | x | | | x | x | | x | | x |
| Greater Kestrel | *Falco rupicoloides* | 3.51 | 0.00 | x | | | | x | | M | | x | | | x | x | | x | | x |
| Marsh Owl | *Asio capensis* | 7.02 | 0.00 | x | | | | x | | M | | x | | | x | x | x | x | | x |
| Pale Chanting Goshawk | *Melierax canorus* | 5.26 | 0.00 | x | | | | x | | M | x | x | x | | x | x | x | x | | x |
| African Sacred Ibis | *Threskiornis aethiopicus* | 26.32 | 0.00 | x | | | | | x | M | | | | x | | | | | | |
| Fairy Flycatcher | *Stenostira scita* | 5.26 | 0.00 | x | | | x | | | M | x | | x | | | x | x | x | | |
| Grey Heron | *Ardea cinerea* | 14.04 | 1.59 | x | | | | | x | M | | | | x | | | | | | x |
| Little Egret | *Egretta garzetta* | 12.28 | 0.00 | x | | | | | x | M | | | | x | | | | | | |
| Little Grebe | *Tachybaptus ruficollis* | 38.60 | 1.59 | x | | | | | x | M | | | | x | | | | | | |
| Pied Starling | *Spreo bicolor* | 5.26 | 1.59 | x | | | x | | | M | | x | | | x | x | | | | |
| Red-billed Teal | *Anas erythrorhyncha* | 28.07 | 0.00 | x | | | | | x | M | | | | x | | | | | | |
| Red-knobbed Coot | *Fulica cristata* | 59.65 | 7.94 | x | | | | | x | M | | | | x | | | | | | |
| South African Cliff-swallow | *Hirundo spilodera* | 26.32 | 6.35 | x | | | x | | | M | | x | | | | x | | | | |
| South African Shelduck | *Tadorna cana* | 7.02 | 0.00 | x | | | x | | x | M | x | | | x | | | | | | |
| Spur-winged Goose | *Plectropterus gambensis* | 24.56 | 3.17 | x | | | | | x | M | | | | x | | | | | | x |
| White-faced Duck | *Dendrocygna viduata* | 33.33 | 0.00 | x | | | | | x | M | | | | x | | | | | | |
| Yellow-billed Duck | *Anas undulata* | 68.42 | 1.59 | x | | | | | x | M | | | | x | | | | | | |

The number of incidental records of priority species within a 10km radius around the development area is listed in **Figure 7.12** below.

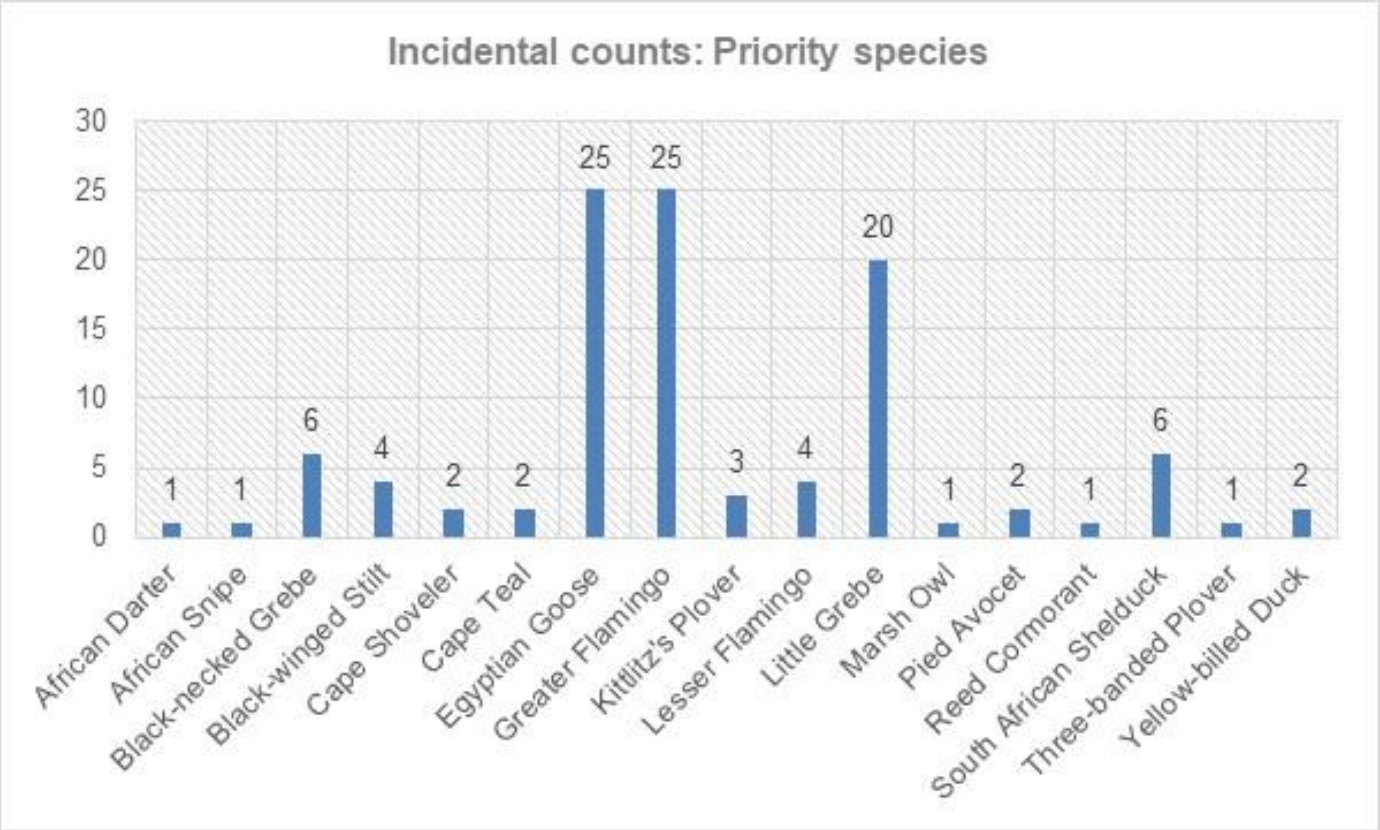


**Figure 7.13:** Incidental counts of priority species within a 10km radius around the development area.

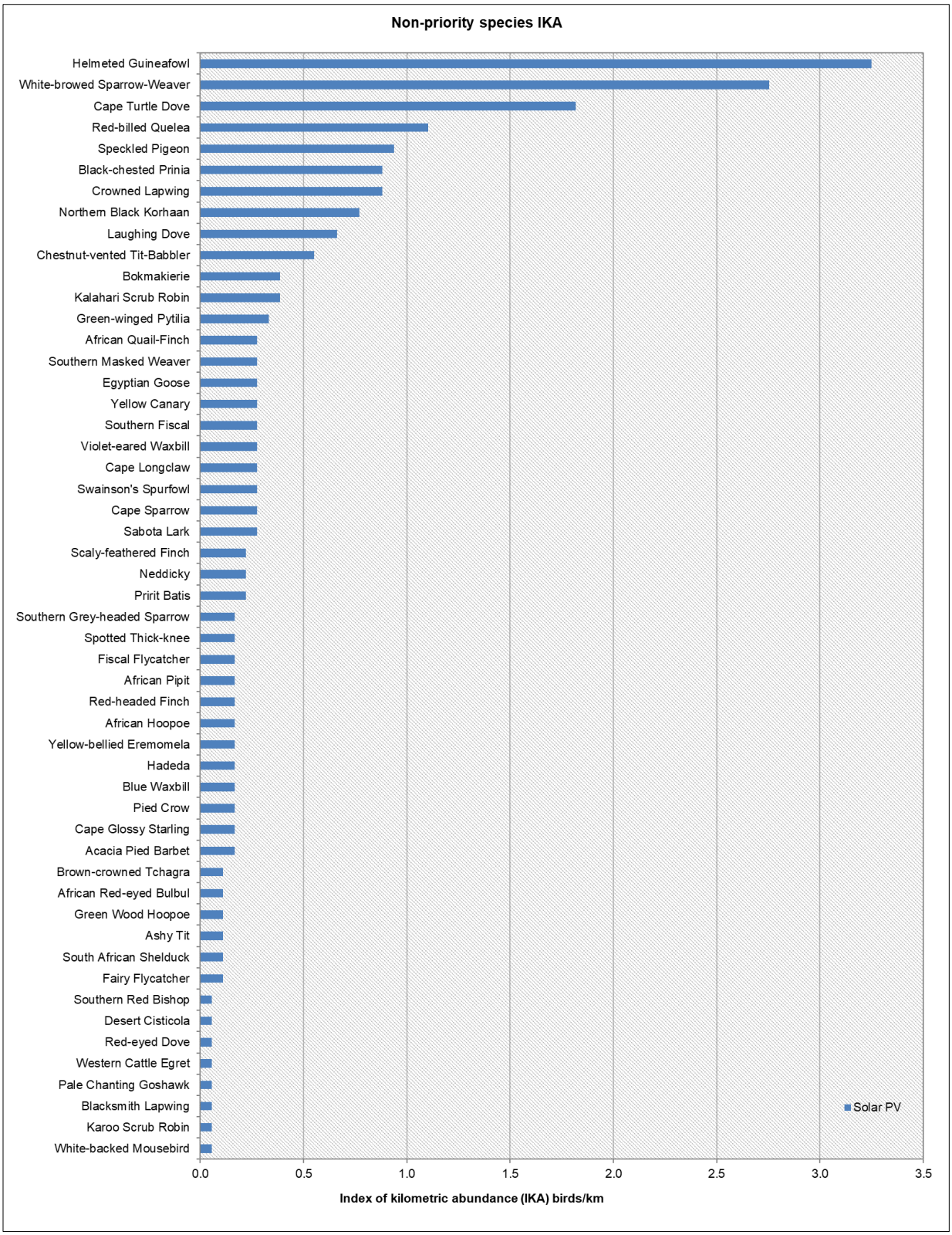


**Figure 7.14:** Index of kilometric abundance (IKA) for all non-priority species recorded by means of transect counts during the surveys, conducted in July 2020.

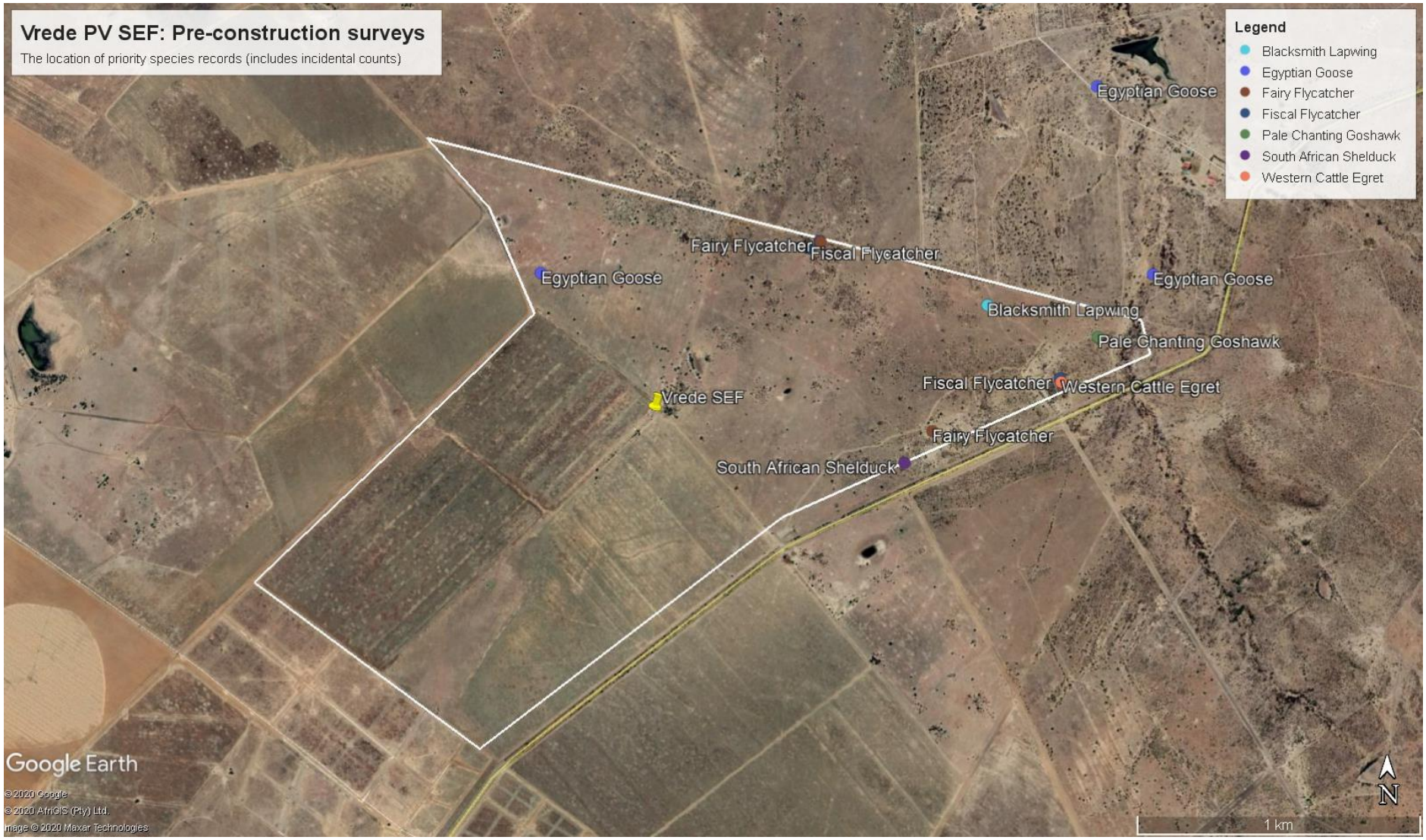


**Figure 7.15:** The location of priority bird species recorded during transect and incidental counts.

## 7.8 Integrated Heritage including Archaeology, Palaeontology and the Cultural Landscape

### *7.8.1 Historical and Archaeological Background*

Known heritage resources within the broader study area were determined as part of the heritage assessment, with no known heritage features being located near the project site (refer to **Figure 7.16**).

Kroonstad was established as a town in 1855. During the Second Boer War, from 13 March to 11 May 1900, the city became the capital of the Orange Free State, and subsequently the site of a British concentration camp to contain Boer women and children. Kroonstad still boasts much of the inherent rugged beauty which led the Voortrekkers to establish the town where they did, and it is situated in an area characterised by open spaces and an abundant variety of vegetation that makes it particularly beautiful. According to Van Schalkwyk (2013), "Most farmsteads were burned down during the Anglo-Boer War, with the result that very little of the built environment dates to the 19th century." According to Matenga (2019), the Black and Coloured townships are significant as landscapes of segregation occupying the north-western fringe of the CBD, while the exclusive white suburbs were located northeast of the town and south of the Valsch River.

The cultural landscape qualities of the region essentially consist of a rural setup. In this the human occupation is made up of a pre-colonial element consisting of limited Stone Age and Iron Age occupation, as well as a much later colonial (farmer) component. This was soon followed by the development of a number of urban centres or towns. Originally these mostly served the surrounding farming communities, but with the discovery of the Free State Gold Fields, they expanded rapidly in order to serve this industry as well. The proposed development is located some distance from the historic core of Kroonstad town. Furthermore, the area proposed for development is located more than 5km away from the site of the Boer War concentration camps and associated burial grounds.

Prior to colonial settlement in 1855, the area proposed for development formed part of a landscape that was occupied by indigenous Khoe herders and San hunter-gatherers. These indigenous communities were displaced by Bantu-speaking people who began to occupy the area in the Iron Age. According to Van Schalkwyk (2013), "Sites dating to the Late Iron Age are known to occur in the region, especially. in the vicinity of the Sandrivier, whereas some are known to occur to the northwest of Ventersburg. These are typical stone walled sites that are linked with Sothospeakers and date to the period after 1600." As such, it is possible that Early, Middle or Later Stone Age artefacts may be located within the proposed development area. Furthermore, it is possible that evidence of Iron Age settlement may also be located within the proposed development area.

Results of the archaeological fieldwork indicated that the Vrede property has been utilised for numerous farming activities (historical cultivation and current grazing) over several generations and so the landscape has been heavily modified by this activity. A combination of historical ploughing and heavy grazing has important detrimental implications on the preservation of in situ surficial cultural features such as stone walling, stone tools, shallow graves and associated cultural remains. It is important to note that despite an extensive foot survey, no cultural heritage remains were identified on the property. However, there remains the possibility that cultural material may be present beneath the ground surface.

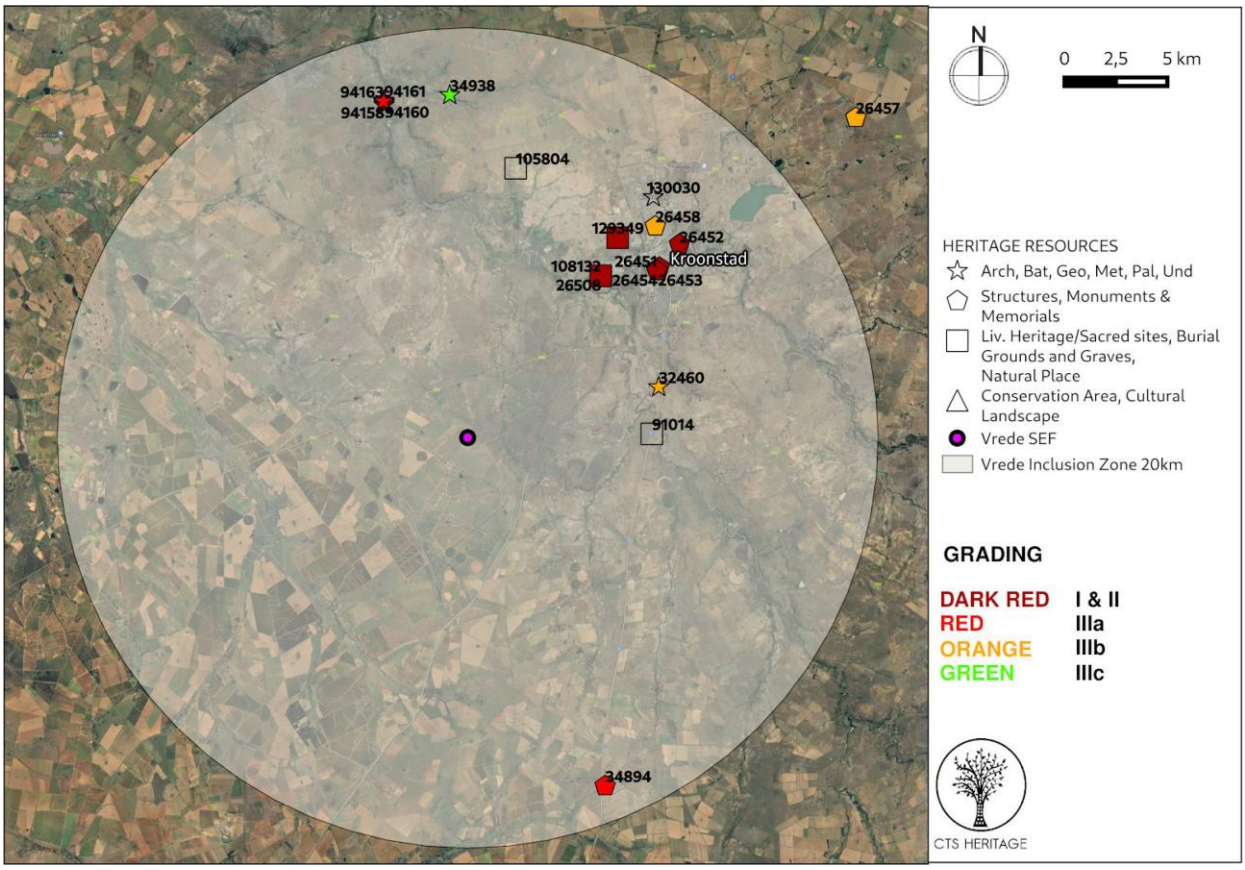


**Figure 7.16:** Heritage Resources previously identified within the study area, with SAHRIS Site IDs indicated in the insets below.

### *7.8.2 Palaeontology*

According to the SAHRIS Palaeosensitivity Map (refer to **Figure 7.17**), the area proposed for development is underlain by sediments of moderate to very high palaeontological sensitivity. According to the Council of GeoScience 2726 Kroonstad Map, the development area for the Vrede Solar PV Facility is underlain by sediments of the Karoo Supergroup including the Adelaide Subgroup (Pa) as well as Jurassic Dolerite (Jd) and Quaternary Sands (Qs). The most palaeontologically sensitive formation underlying the development area is the Adelaide Subgroup of the Beaufort Group. This formation forms part of the Dicynodon and Lystrosaurus assemblage zones and is known to include fossils of fish, amphibians, reptiles, therapsids and vertebrate burrows. Diverse terrestrial and freshwater tetrapods of Pristerognathus to Dicynodon Assemblage Zones (amphibians, true reptiles, synapsids – especially therapsids) have been found in this formation, as well as palaeoniscoid fish, freshwater bivalves, trace fossils (including tetrapod trackways), sparse to rich assemblages of vascular plants (Glossopteris Flora, including spectacular petrified logs) and insects. Based on the known palaeontological sensitivities of the Adelaide Subgroup, it is recommended that a palaeontological assessment of the area proposed for development is completed and anticipated impacts to such resources assessed.

Results of the Palaeontological fieldwork indicated that heavy grazing of cattle and small-scale historical ploughing of fields has impacted the whole property and in particular the northern and western areas, aiding in quick identification of possible fossil bearing rock outcrops. Most areas were surveyed systematically and comprehensively in transects. The size of the property required survey transects to be conducted at 15-20 m intervals. In the west of the property, four large square fields previously ploughed have been left fallow. The

southernmost of these fields has been used for grazing and soil exposure was good, aiding the survey. Tall and dense grasses have grown in the northernmost fields, seriously limited soil exposure and hindering survey coverage. In the eastern areas, dense pockets of *Acacia* trees hindered access, but limited ground cover allowed clear assessment of potential surficial features that are often associated with localised tree growth.

The multi-generation agricultural use of this property limits the potential preservation of fossils. No fresh fossil bearing outcrop was identified on the property. Several large extant burrows show a soil layer of +/-1m thick with no evidence of non-eroded bedrock underneath it ("Large burrow" as detailed in the heritage impact assessment report, refer **Appendix H**). A dolerite dyke was identified in the North-East corner of the property ("East Corner" as detailed in the heritage impact assessment report, refer **Appendix H**) extending North for +/- 15m.

There is very little probability that fossils will be present in the Jurassic dolerites. However, the majority of the Vrede property is underlain by highly fossiliferous sediments (the Adelaide Subgroup and Volksrust Formation) of high palaeontological sensitivity. The land, having been reworked extensively historically (such as visible plough lines on the Vrede property), is covered by a thick layer of soil, making the underlying bedrock and geology difficult to identify. However, the presence of fresh outcropping Adelaide mudstones on a nearby property indicates the high likelihood of these highly fossiliferous layers being disturbed with construction requiring excavation exceeding 1m in depth. It is therefore recommended that palaeontological monitoring of excavations takes place during the construction phase of the proposed development of the Vrede SEF.

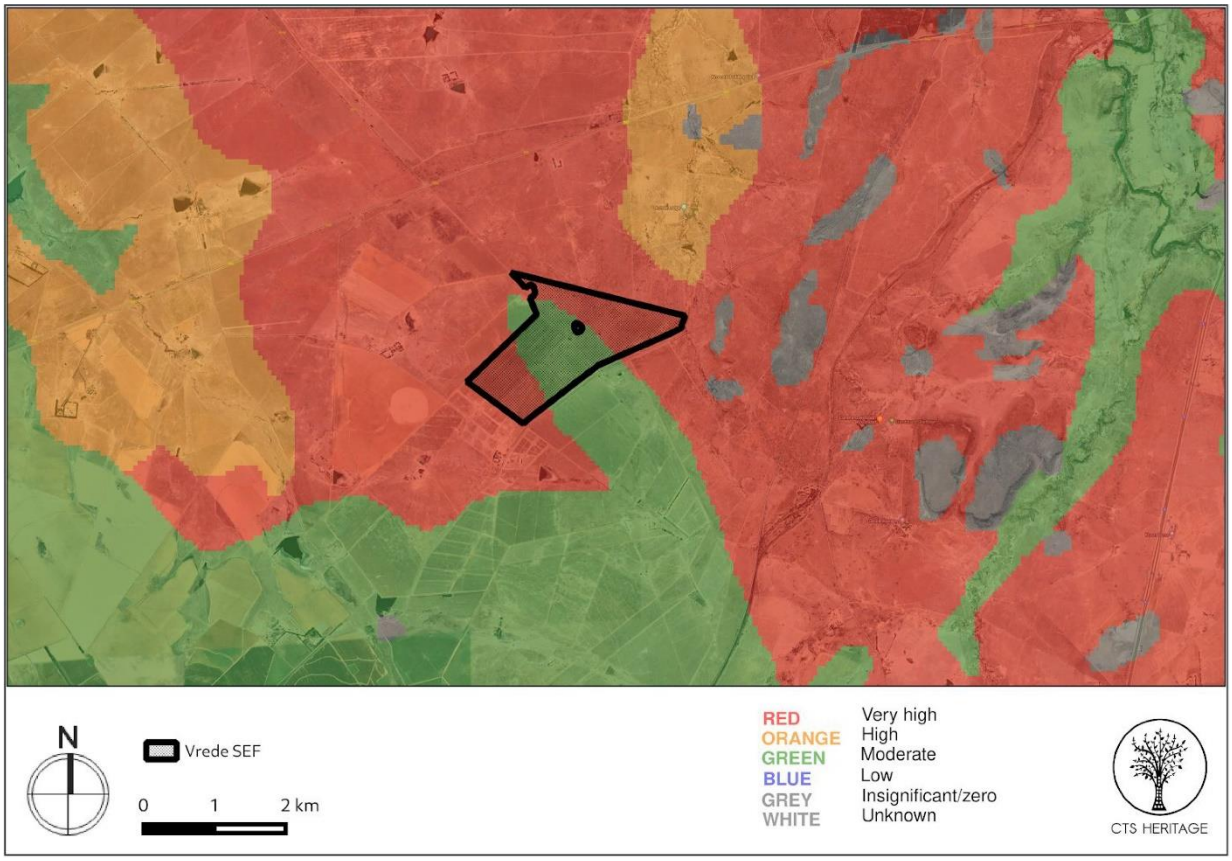


**Figure 7.17:** Heritage Resources previously identified within the study area, with SAHRIS Site IDs indicated in the insets below.

## 7.9 Visual Context

### *7.9.1 Landscape Character*

The entire proposed Solar PV Facility project is located in a rural area, currently zoned as agriculture, at a distance of approximately 9km from the Kroonstad Municipal 132/66kV Substation (at the closest).

The study area has a rural and predominantly natural character and the main land use activity, outside of the Kroonstad city limits, is maize farming. The region is similarly sparsely populated outside of the Kroonstad urban centre, with a population density of less than ten people per $km^2$. Farm residences, or homesteads, dot the landscape at an irregular interval. These homesteads are generally located at great distances from each other (i.e. more than 2.5km apart).

The development area is easily accessible from the N1 national road via the R34 arterial road, the Hennenman road and the S172 secondary (gravel) road.

The only protected area in the study area borders the proposed development area to the north. This is the Boslaagte Private Nature Reserve (farm Oshoek 47) that includes the Lechwe Lodge. This is the only tourist facility or destination identified within the study area (excluding Kroonstad itself). This lodge functions as a venue that can accommodate up to 300 people and provides overnight lodging.

In spite of the rural and natural character of the study area, there is a large number of overhead power lines associated with the Kroonstad Municipal Substation. These include:

» Kroonstad Municipal/Theseus 1 132kV
» Serfontein Traction/Virginia Terminal 1 88kV
» Kroonstad Municipal/Kroonstad SW Station 1 132kV

The former two power lines traverse east of the proposed project site at a distance of approximately 1.5km (at the closest).

Other than these power lines there is also a railway line crossing the study area to the industrial area west of the Kroonstad CBD.

The photographs below aid in describing the general environment within the study area and surrounding the proposed Vrede Solar PV Facility.


**Photograph 5.2.** The project site as seen from the S172 secondary road.


**Photograph 5.3.** Lechwe Lodge. (Photo: Jan Venter).


**Photograph 5.4.** Access road to the Vrede development area.

### 7.10 Social Context

The Free State Province lies in the centre of South Africa, located between the Vaal River in the north and the Orange River in the south. The region is one of flat, rolling grassland and fields of crops, rising to mountains in the north-east. The Province is the granary of South Africa, with agriculture central to its economy, while mining in the goldfield reefs is its largest employer.

Economic towns include Welkom, Kroonstad, Parys, QwaQwa, and Bethlehem. The Free State is the third-largest Province in South Africa, but it has the second-smallest population and the second-lowest population density. The culture is centred on traditional cultures but built on the influences of the early European settlers.

Close to 2.8-million people live in the Free State, with two-thirds speaking Sesotho, followed by Afrikaans, Zulu, Tswana, Xhosa and English.

The Free State is strategically placed to take advantage of the national transport infrastructure. Two corridors are of particular importance: the Harrismith node on the N3 corridor between Gauteng and KwaZulu-Natal, and the N8. The N1 connects Gauteng to the Western Cape. Bram Fischer International Airport in Bloemfontein handles about 250 000 passengers and 221 000 tons of cargo a year. Manufacturing also features in the provincial economic profile. This sector makes up 14% of the provincial output, with petrochemicals (via Sasol) accounting for more than 85% of the output.

The Free State Province comprises four (4) Districts, of which the Vrede Solar PV Facility is located within the Fezile Dabi District Municipality. This is a Category C municipality, formerly known as the Northern Free State District Municipality, situated in the north of the Free State. It is bordered by the North West, Gauteng and Mpumalanga Provinces to the north, Thabo Mofutsanyana District to the south, and Lejweleputswa District to the west. The municipality is the smallest district in the Province, making up 16% of its geographical area. The main attraction site, the Vredefort Dome, being the third-largest meteorite site in the world, is located within the district.

Various towns are situated within the municipal area which includes Cornelia, Deneysville, Edenville, Frankfort, Heilbron, Koppies, Kragbron, Kroonstad, Oranjeville, Parys, Renovaal, Sasolburg, Steynsrus, Tweeling, Vierfontein, Viljoenskroon, Villiers and Vredefort.

The main economic sectors of the area includes trade (22%), community services (20%), manufacturing (13%), households (13%), agriculture (12%), finance (7%), construction (6%) and transport (5%).

Fezile Dabi District comprises four Local Municipalities (LMs) namely, Moqhaka, Metsimaholo, Ngwathe and Mafube LMs, where the project site is located within the Moqhaka Local Municipality.

### *7.10.1 Demographic Profile of the Moqhaka Local Municipality*

The Moqhaka Local Municipality (LM) is a Category B municipality situated within the southern part of the Fezile Dabi District and covers an area of land 7 925km² in extent. It is the largest of four municipalities in the district, making up over a third of its geographical area. The former Kroonstad, Steynsrus and Viljoenskroon Transitional Local Councils and sections of the Riemland, Kroonkop and Koepel Transitional Rural Councils are included in the municipality. The seat of local government is Kroonstad. The Moqhaka LM has a total population of 154 735, with a total of 53 601 households. In terms of the age structure 24.5% of the population is under 15 years of age, 67.8% of the population falls between 15 and 64, with 7.7% of the population being over 65. The Municipality is female dominated, with females comprising approximately 50.49% of the LM population, while the Felize Dabi DM is comprised of 50% males and 50% females. In terms of race, Africans are 87.19% and Coloured 2.865 of the total population. Indian/Asian are 0.33% and whites make out 9.32% of the total population of the Moqhaka LM.

The most spoken language is Setsotho, followed by Afrikaans, Isixhosa, Isizulu, English and Setswana. The Moqhaka LM, Feliz Dabi DM, Free State provincial, and South African national population age structures are all youth dominated. A considerable proportion of the respective populations therefore comprise individuals within the economically active population between the ages of 15 and 64 years of age.

The Moqhaka LM has a dependency ratio of 47.6, which correlates to some extent with the Feliz Dabi District Municipality (DM). Education levels within the Moqhaka LM are low with approximately 31.5% of the population over 20 years of age not having completed Grade 12 / Matric. This means that the majority of the population can be expected to have a relatively low-skill level and would either require employment in low-skill sectors, or skills development opportunities in order to improve the skills level of the area. The unemployment rate of the Moqhaka LM is high (35.2%) which places strain on the municipal services delivery as people cannot afford to pay for municipal services. The unemployment rate of the Feliz Dabi DM is 33.9%. The Moqhaka LM has approximately 39.5% females as household heads, and the primary economic activities within the Moqhaka LM comprise agriculture, commercial transport, business services and mining. The majority of households within the Moqhaka LM comprise formal dwellings (85.9%) and the average household size is 2.9.

### *7.10.2 Economic Profile of the Moqhaka Local Municipality (MLM)*

The Greater Kroonstad area is the centre of a large agricultural community that plays an important role in the economy of the district. Subsequently, industrial activities contribute significantly to the district's economy. The Department of Correctional Services and the School of Engineers military bases are situated

in the town. The urban area is situated adjacent to the N1 National Road and located adjacent to one of the largest and most important four-way railway junctions in South Africa.

The Viljoenskroon/Rammulotsi urban area is located within an area of extreme agricultural significance. The urban area plays a significant role in providing residential opportunities to the adjacent goldfields and mining activities in the North West Province. The Provincial Roads P15/1 and P15/2 from Kroonstad to Klerksdorp in the North West Province extend through the area from north to south and plays a significant role.

The Steynsrus/Matlwangtlwang urban area is situated approximately 45km east of Kroonstad and 92km west of Bethlehem. The major link road between Bethlehem and Kroonstad stretches adjacent to the urban area. The main economic sectors in the area include agriculture, commercial transport, business services and mining.

The population of the MLM in 2016 was 154 731. Of this total, 32% were under the age of 18, 60.3% were between 18 and 64, and the remaining 7.7% were 65 and older. The MLM therefore has a relatively large young population. This creates challenges in terms of creating employment opportunities.

In terms of race groups, Black Africans made up 87.9% of the population on the MLM, followed by Whites, 9.2% and Coloureds, 2.6%. The main first language spoken in the MLM was Sesotho (87.9%) followed by Afrikaans (11.1%) and IsiXhosa (2.2%).

The high percentage of young people also means that a large percentage of the population is dependent on a smaller productive sector. The dependency ratio is the ratio of non-economically active dependents (usually people younger than 15 or older than 64) to the working age population group (15-64). The higher the dependency ratio the larger the percentage of the population dependent on the economically active age group. This in turn translates reduced revenue for local authorities to meet the growing demand for services. The national dependency ratio in 2011 was 52.7%, similar to that of the e Free State Province (52.9%). The dependency ratio for the MLM 2011 was 51%. The traditional approach is based people younger than 15 or older than 64. The 2016 information provided provides information for the age group under 18. The total number of people falling within this age group will therefore be higher than the 0-15 age group. However, most people between the age of 15 and 17 are not economically active (i.e. they are likely to be at school).

Using information on people under the age of 18 is therefore likely to represent a more accurate reflection of the dependency ratio. Based on these figures, the dependency ratio for the MLM (2016) was 65.8%. This figure is significantly higher than the national, provincial, and municipal levels in 2011. The higher dependency ratio reflects the limited employment opportunities in the area and represent a significant risk to the district and local municipality.

Based on the information from the 2011 Census most of the households in the MLM reside in formal houses (77.1%). This figure is similar to the District (76.8%) and Provincial (74.4%) figures. Approximately 13.1% of the households in the MLM reside in informal structures.

Based on the information from the 2016 Community Household Survey and 2011 Census 40.9% of the households in the MLM are headed by females. The high number of female headed households at the local municipal and ward level reflects the lack on formal employment and economic opportunities in the MLM. As a result, job seekers from the MLM need to seek work in the larger centres, specifically Gauteng. The majority of the job seekers are likely to be males. This is due to traditional rural patriarchal societies where the

role of the women is usually linked to maintaining the house and raising the children, while the men tend to be the ones that migrate to other areas in search of employment.

Based on the data from the 2011 Census, 8.6% of the population of the MLM had no formal income, 5% earned less than R 4 800, 7.4% earned between R 5 000 and R 10 000 per annum, 22.6% between R 10 000 and R 20 000 per annum and 23.8% between R 20 000 and 40 000 per annum (2016).

The poverty gap indicator produced by the World Bank Development Research Group measures poverty using information from household per capita income/consumption. This indicator illustrates the average shortfall of the total population from the poverty line. This measurement is used to reflect the intensity of poverty, which is based on living on less than R3 200 per month for an average sized household (~ 40 000 per annum). Based on this measure, in the region of 67.4% of the households in the MLM live close to or below the poverty line. The low-income levels reflect the limited employment opportunities and dependence on the agricultural sector. This is also reflected in the high unemployment rates. The low-income levels are a major concern given that an increasing number of individuals and households are likely to be dependent on social grants. The low-income levels also result in reduced spending in the local economy and less tax and rates revenue for the MLM. This in turn impacts on the ability of the NLM to maintain and provide services.

The official unemployment figures for the MLM was 18.3%. The figures also indicate that the majority of the population are not economically active, namely 44.2%. These figures are similar to the official unemployment rate for the Free State Province (17.5%) and FDDM (18.8%). This reflects the limited employment opportunities in the area, which in turn are reflected in the low income and high poverty levels.

In terms of education levels, the percentage of the population over 20 years of age in the MLM with no schooling was 5.4% in 2011, compared to 3% for the Free State Province. The percentage of the population over the age of 20 with matric was 27.8%, compared to 30.5% for the Province.

### *7.10.3 Settlement and infrastructure*

The study area has a rural and predominantly natural character, and the main land use activity is dryland maize farming and grazing for livestock and game. The majority of adjacent properties are used for extensive grazing (cattle) or game farming. Stock theft is not currently problematic in the area. This is linked to cattle being farmed instead of more vulnerable small stock, most owners residing in proximity to the properties, and managers or caretaker staff residing on the properties. Lechwe Lodge is currently primarily used for game breeding and hunting. The Properties Uitval and Highlands (Crous) are both primarily used for breeding (antelope, lion), with only limited hunting taking place. A small riding school is located on Oshoek 47/2 (Sharif Arabiere). The facility gains access of the S172 and is located near the south-eastern boundary of the site.

There are two Eskom distribution power lines in the vicinity of the proposed project, namely the 132kV distribution line between Theseus Substation and Kroonstad Municipality Substation and the 88kV Rural/Traction distribution line between Gunhill Traction and Gineva Rural/Traction as well as Gunhill Traction and Amerika Rural/Traction (which is not considered a feasible option for connection). A further 11kV line running parallel to the S172 gravel road is also located near the development area.

In addition, two hospitals are available within the Moqhaka LM, which includes the Boitumelo Hospital and the Kroon Private Hospital. Ten clinics area available within the municipal area .

The majority of households within the Moqhaka LM are well serviced with regards to flush toilets connected to sewage, refuse removal and electricity. However, only 48.6% of households have piped water inside the dwelling.

# 8 ASSESSMENT OF IMPACTS

This chapter serves to assess the significance of the positive and negative environmental impacts (direct and indirect) expected to be associated with the development of the Vrede Solar PV Facility. This assessment has considered the construction of a PV facility with a contracted capacity of up to 100MW with a development footprint of ~217ha in extent. The project will comprise the following infrastructure and components:

» Solar Arrays:
  - Solar Panel Technology - Mono and Bifacial Photovoltaic (PV) Modules;
  - Mounting System Technology – single axis tracking, dual axis tracking or fixed axis tracking PV;
  - Underground cabling (up to 33kV)
  - Centralised inverter stations or string inverters; Power Transformers;
» Building Infrastructure
  - Offices;
  - Operational control centre;
  - Operation and Maintenance Area / Warehouse / workshop;
  - Ablution facilities;
  - Battery Energy Storage System;
  - Substation building.
» Electrical Infrastructure
  - 33/132kV Independent Power Producer (IPP) onsite substation including associated equipment and infrastructure
  - Underground cabling and overhead power lines (up to 33kV)
» Associated Infrastructure:
  - Access roads and Internal gravel roads;
  - Fencing and lighting;
  - Lightning protection
  - Permanente laydown area;
  - Temporary construction camp and laydown area;
  - Telecommunication infrastructure;
  - Batching plant (if required);
  - Stormwater channels;
  - and water pipelines.

A facility development footprint including the associated infrastructure has been proposed by the developer through consideration of the sensitive environmental features and areas identified during the Scoping Phase. The development area, inclusive of the development footprint, has been considered and assessed as part of the EIA Phase by the independent specialists and the EAP (and is illustrated in **Figure 8.1**). On-site sensitivities were identified through the review of existing information, desktop evaluations and field surveys.

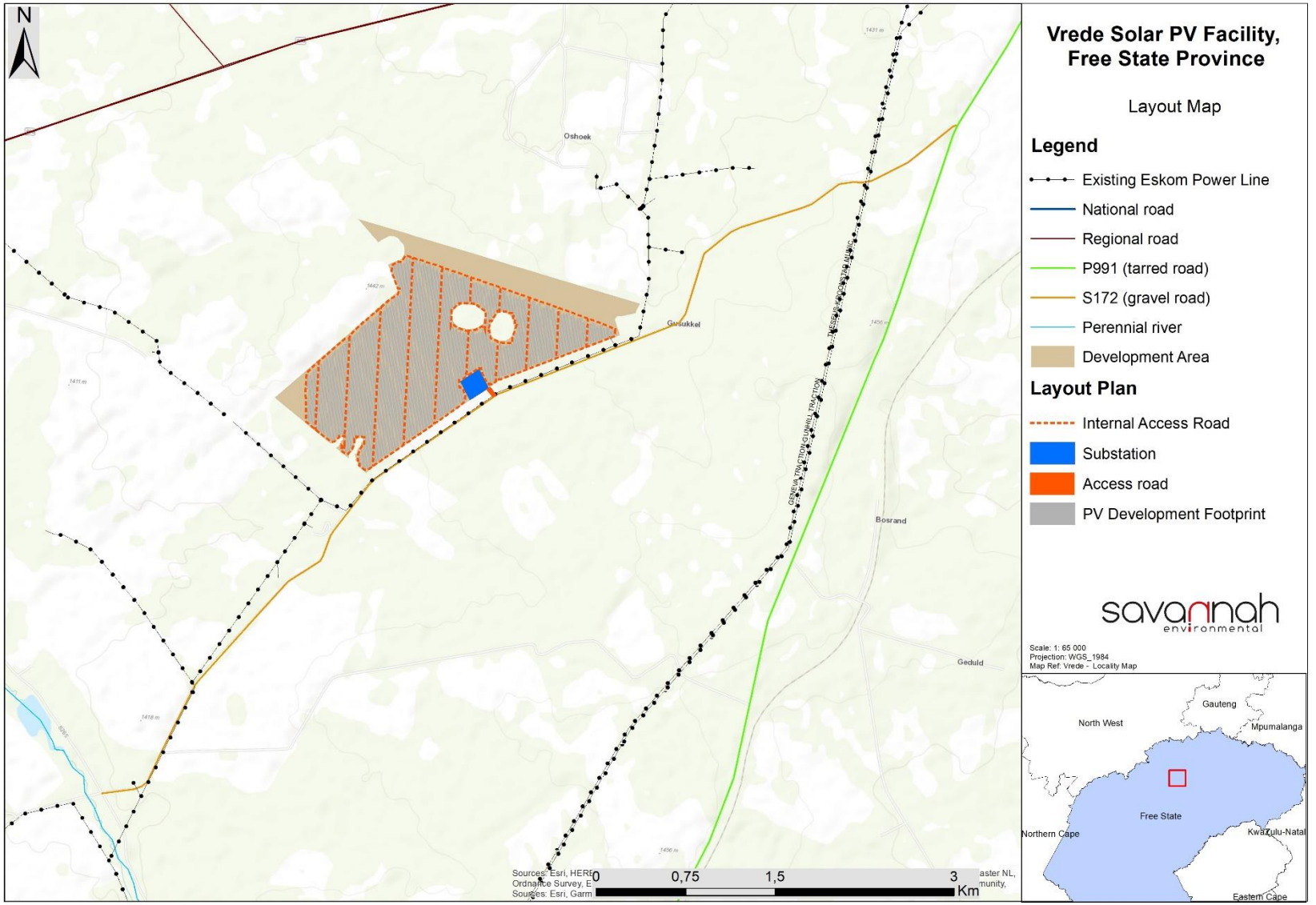


**Figure 8.1:** Map illustrating the facility layout considered for the Vrede Solar PV Facility as assessed in this EIA report.

The development the Vrede Solar PV Facility will comprise the following phases:

- *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of access roads, laydown areas, and facility infrastructure (including PV panels and BESS); construction of foundations involving excavations; the transportation of components/construction equipment to site, manoeuvring and operating vehicles for unloading and installation of equipment; laying cabling; and commissioning of new equipment and site rehabilitation. The construction phase is estimated at 18 - 24 months.
- *Operation* – will include the operation of the facility and the generation and storage of electricity. The electricity generated will be fed into the national grid via the on-site substation along the grid connection solution (subject to a separate application for authorisation). The operation phase is expected to be approximately 20 years (with maintenance).
- *Decommissioning* – depending on the economic viability of the facility, the length of the operation phase may be extended beyond a 20-year period. At the end of the project's life, decommissioning will include site preparation, disassembling of the components of the facility, clearance of the relevant infrastructure at the site and appropriate disposal thereof, and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to those associated with construction activities. Where relevant, these impacts have been assessed separately by some specialists.

Environmental issues associated with construction and decommissioning activities may include, among others, threats to biodiversity and ecological processes, including habitat alteration and impacts to fauna, avifauna and flora, soil contamination and erosion, influx of jobseekers, and nuisance from the movement of vehicles transporting equipment and materials.

Environmental impacts associated with the operation phase includes soil contamination and erosion and potential invasion by alien and invasive plant species. Other impacts associated with the operation phase include visual impacts and night time lighting impacts.

### 8.4 8.1. Quantification of Areas of Disturbance on the Site

Site-specific impacts associated with the construction and operation of the Vrede Solar PV Facility relate to the direct loss of vegetation and species of special concern, disturbance of animals (including avifauna) and loss of habitat, and impacts to freshwater features. In order to assess the impacts associated with the facility, it is necessary to understand the extent of the affected area. The development footprint being assessed for the facility requires an area of approximately 217ha comprising the PV array, BESS and all supporting infrastructure.

## 8.2. Potential Impacts on Ecology (Ecology, Flora and Fauna)

Potential ecological impacts resulting from the proposed development of the Vrede Solar PV Facility and associated infrastructure would stem from a variety of different activities and risk factors associated with the pre-construction, construction and operation phases of the project. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix D** for more details).

### *8.2.1 Results of the Ecological Impact Assessment*

Overall, no significant terrestrial ecological fatal flaws were identified during the EIA phase ecological assessment (**Appendix D**).

The most significant potential impacts expected to occur with the development of the proposed Vrede Solar PV Facility are:

» Reduction of a stable vegetation cover and associated below-ground biomass that currently increases soil surface porosity, water infiltration rates and thus improves the soil moisture availability. Without the vegetation, the soil will be prone to extensive surface capping, leading to accelerated erosion and further loss of organic material and soil seed reserves from the local environment.
» Disturbed vegetation in the study area carries a high risk of invasion by alien invasive plants, which may or may not be present in the study area or nearby. The control and continuous monitoring and eradication of alien invasive plants will form and integral part of the environmental management of the facility from construction up to decommissioning.

The ecological specialist determined the following ecological sensitivities on site (**Figure 8.2**), based on the respective ecological contribution and delineation of the various habitat types present on site. All wetland features were deemed very high ecological sensitivity and a 30m no-go buffer around them is recommended. In addition, natural grassland features that are representative of Vaal-Vet Sandy Grassland (Endangered) and which are located within CBA1 regions were also considered very high sensitivity features, although these were not considered no-go areas. High sensitivity areas (within which development was considered acceptable) was represented by primary grassland. Medium sensitivity (within which development was considered acceptable) included Primary Grassland resembling natural Central Free State Grassland, and Bottom Thornveld, and Re-established grassland on historical cultivated areas. All transformed and disturbed areas were considered low sensitivity.

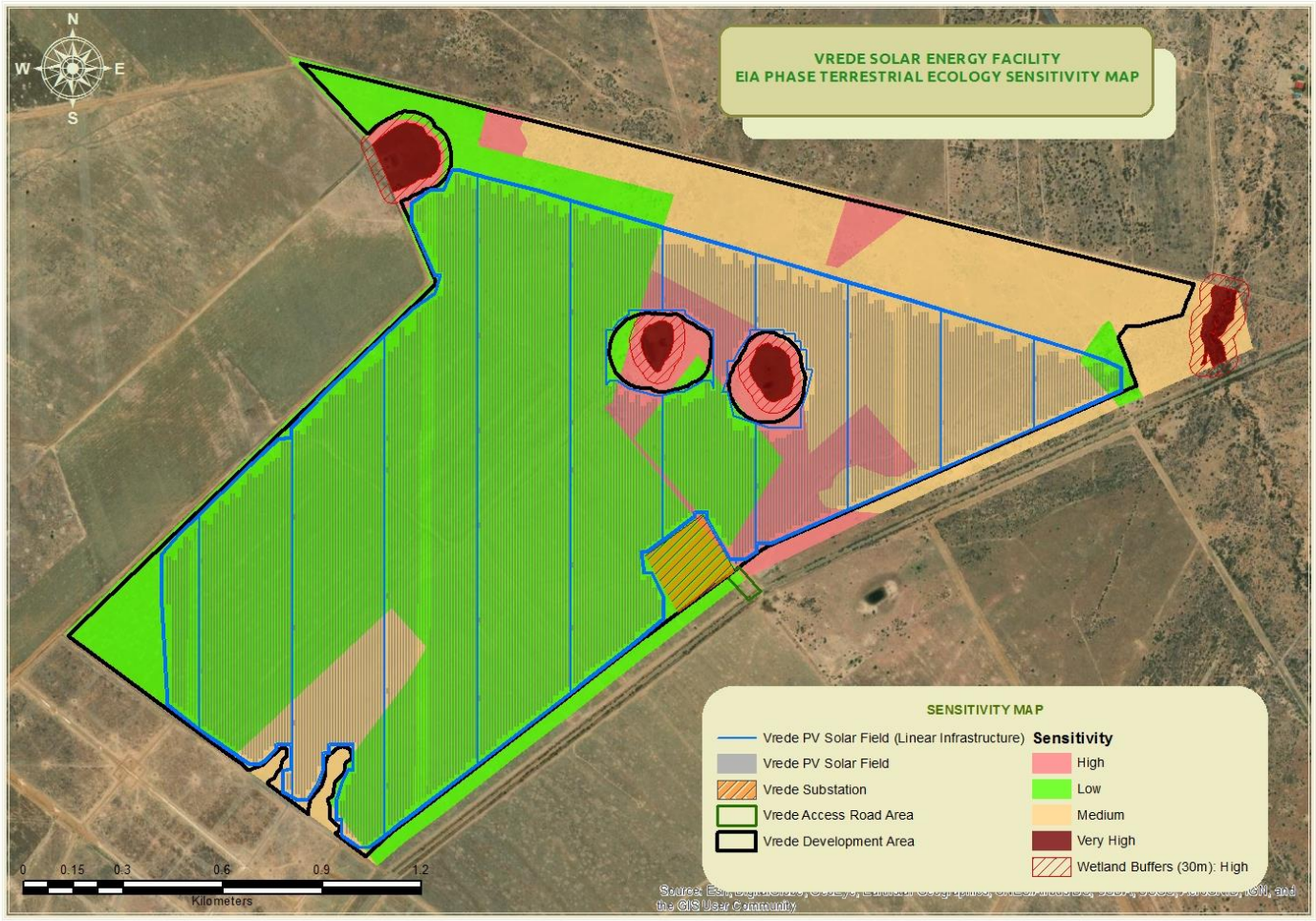


**Figure 8.2:** Sensitivity map for the development footprint and associated infrastructure

### *8.2.2 Description of Ecological Impacts*

The potential impacts associated with the development are explored in context of the features and characteristics of the site and the likelihood that each impact would occur given the characteristics of the site and the extent and nature of the development. No Plant SCC were observed within the development site; however, a few provincially protected species have been observed. Such species are especially vulnerable to infrastructure development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat.

» Impacts on vegetation and protected species
The proposed development may lead to a direct loss of vegetation. Some loss of vegetation is an inevitable consequence of the development. However, the footprint of the development is confined to an area of less than 217 ha, located mostly in an area transformed through historical cultivation practices and overgrazing, and bush encroachment.

» Direct faunal impacts
» Faunal species will primarily be affected by the overall loss of habitat. Increased levels of noise, disturbance, potential pollution and human presence during construction and operation will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species and species confined and dependant on specified habitats would not be able to avoid the construction activities

and might be at risk. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. This impact is highly likely to occur during the construction phase and could also potentially occur with resident fauna within the facility after construction.

» Increased erosion risk and degradation of ecosystems

» Soil erosion is a frequent risk associated with solar facilities on account of the vegetation clearing and disturbance associated with the construction phase of the development and may continue occurring throughout the operation phase. Service roads and installed infrastructure will generate increased direct runoff during intense rainfall events and may exacerbate the loss of topsoil and the effects of erosion. These eroded materials may enter the nearby watercourses and may potentially impact these systems through siltation and change in chemistry and turbidity of the water.

» Alien plant invasion

» The disturbance associated with the construction phase of the project will render the disturbed areas vulnerable to alien plant invasion. The affected farm properties have been invaded by especially herbaceous and dwarf shrubby invasive alien plants, *Opuntia ficus-indica, O. humifusa, Salsola kali, Verbena officinalis, V. bonariensis, Cirsium vulgare, Xanthium spinosum, Datura stramonium* etc. These species will most certainly be a threat during the construction phase and throughout the operation phase and will require regular and careful attention. With affective and meticulous mitigation measures in place this can be achieved. This impact would manifest during the operation phase, although some of the required measures to reduce this impact are required during construction.

» Impacts on critical biodiversity areas and broad-scale ecological processes

» Approximately 30% of the project site is situated within a CBA1, mainly due to its location within the endangered Vaal-Vet Sandy Grassland Ecosystem. However, during this study it was determined that most of these areas identified as Natural Vaal-Vet Sandy Grassland have been historically subjected to cultivation and vegetation transformation, with small patches of remaining natural vegetation, resembling natural, untransformed Vaal-Vet Sandy Grassland.

» It was determined during the field survey that, due to the on-site conditions and the nature of the development, the status of the CBAs as a whole will not be significantly affected by the development within this area due to the current transformed condition of the veld as well as the low diversity and potential for movement of faunal species between the various habitats. As such the landscape encompassing the affected farm properties should rather be classified as an Ecological Support Area (ESA).

### *8.2.3 Impact tables summarising the significance of impacts on ecology during construct, operation, and decommissioning (with and without mitigation)*

**Construction Phase**

| |
|---|
| **Impact:** Potential Impacts on vegetation and listed protected plant species (Construction Phase)<br><br>**Impact Nature:** Impacts on vegetation and listed or protected plant species would occur due to the construction of the facility and associated infrastructure. This impact is regarded as the most likely and significant impact and may lead to direct loss of vegetation including listed and protected species. |

The most likely consequences include:

- local loss of habitat (to an extent as a natural ground covering will be maintained where possible);
- very small and local disturbance to processes maintaining local biodiversity and ecosystem goods and services; and
- a potential loss of a few local protected species.

The development footprint itself is primarily homogenous in terms of habitat types and vegetation cover thus providing for easier and more accurate calculation of potential impacts, more effective recommendations and implementation of management and mitigation measures, and furthermore lowering the impact and beta diversity.

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Local (1) | Local (1) |
| **Duration** | Long-term (4) | Long-term (4) |
| **Magnitude** | Moderate (6) | Low (2) |
| **Probability** | Highly Probable (4) | Probable (3) |
| **Significance** | **Medium (44)** | **Low (21)** |
| **Status** | Negative | Negative |
| **Reversibility** | Low | Moderate |
| **Irreplaceable loss of resources** | No | No |
| **Can impacts be mitigated?** | Yes, to a large extent | |

**Mitigation:**

- Preconstruction walk-through of the final development footprint for protected species that would be affected and that can be translocated.
- Since a large proportion of the identified conservation-worthy species at the site are geophytic and succulent species (e.g. Aloe *davyana, Schizocarphus nervosus* and *Boophone disticha*), the potential for successful translocation is high. Before construction commences individuals of listed species within the development footprint that would be affected, should be counted and marked and translocated where deemed necessary by the ecologist conducting the pre-construction walk-through survey, and according to the recommended ratios. Permits from the relevant provincial authorities, i.e. the Free State Department: Economic, Small Business Development, Tourism and Environmental Affairs, will be required to relocate and/or disturb listed plant species.
- Any individuals of protected species affected by and observed within the development footprint during construction should be translocated under the supervision of the Contractor's Environmental Officer (EO).
- Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimising wildlife interactions, remaining within demarcated construction areas etc.
- Demarcate all areas to be cleared with construction tape or similar material where practical. However, caution should be exercised to avoid using material that might entangle fauna.
- Contractor's EO to provide supervision and oversight of vegetation clearing activities and other activities which may cause damage to the environment, especially at the initiation of the project, when the majority of vegetation clearing is taking place.
- Ensure that laydown areas, construction camps and other temporary use areas are located in areas of low and medium sensitivity and are properly fenced or demarcated as appropriate and practically possible.
- All vehicles to remain within demarcated construction areas and no unnecessary driving in the veld outside these areas should be allowed.
- Regular dust suppression during construction, if deemed necessary, especially along access roads.
- No plants may be translocated or otherwise uprooted or disturbed for rehabilitation or other purpose without express permission from the Contractor's EO.
- No fires should be allowed on-site.

**Residual Impacts:**
Due to the shade effect of the solar panels some transformation of vegetation is likely to occur underneath the panels. As this area is already, to some extent, in a transformed state, further transformation due to the shading effect is not likely to be significant. However, any transformations caused by the development will take a very long time to restore and as such is regarded as a residual impact.

**Impact:** Potential Faunal Impacts (Construction Phase, Decommissioning Phase and during maintenance – Operational Phase).

**Impact Nature:** Increased levels of noise, pollution, disturbance and human presence during construction/operation/decommissioning will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction/operation/decommissioning construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some impact on fauna is highly likely to occur during construction/operation/decommissioning/construction.

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Local (1) | Local (1) |
| **Duration** | Short-term (2) | Short-term (2) |
| **Magnitude** | Low (4) | Minor (2) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Low (21)** | **Low (15)** |
| **Status** | Negative | Negative |
| **Reversibility** | Moderate | Moderate |
| **Irreplaceable loss of resources** | No | No |
| **Can impacts be mitigated?** | Noise and disturbance during the construction, decommissioning and during maintenance phases cannot be avoided but would be transient in nature and with appropriate mitigation; no long-term impacts from the construction phase can be expected. | |

**Mitigation:**

- Site access should be controlled and no unauthorised persons should be allowed onto the site.
- Any fauna directly threatened by the associated activities should be removed to a safe location by a suitably qualified person.
- The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated site.
- Fires should not be allowed on site.
- All hazardous materials 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 as related to the nature of the spill.
- All construction vehicles should adhere to a low speed limit (30km/h) to avoid collisions with susceptible species such as snakes and tortoises.
- Construction vehicles limited to a minimal footprint on site (no movement outside of the earmarked footprint).

**Residual Impacts:**
The altered development area will contain a lower diversity of habitat types and niches for faunal species, however faunal diversity was in any way confirmed to be limited and as such this potential residual impact can be regarded as low.

**Impact:** Potential increased erosion risk during construction operation and decommissioning.

**Impact Nature:** During construction/decommissioning, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion. Erosion is one of the greater risk factors associated with the development and it is therefore critically important that proper erosion control structures are built and maintained over the lifespan of the project.

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Local (1) | Local (1) |
| **Duration** | Medium-term (3) | Short-term (1) |
| **Magnitude** | Minor (3) | Minor (2) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Low (21)** | **Low (12)** |
| **Status** | Negative | Negative |
| **Reversibility** | Low – if erosion has reached severe levels the impacts will not be remedied easily | High |
| **Irreplaceable loss of resources** | Potential loss of important resources. | No |
| **Can impacts be mitigated?** | Yes, to a large extent | |

**Mitigation:**

- Any erosion problems observed along access roads or any hardened/engineered surface should be rectified immediately and monitored thereafter to ensure that they do not re-occur.
- All bare areas due to the project activities should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential where applicable.
- Re-instate as much of the eroded area to its pre-disturbed, "natural" geometry (no change in elevation and any banks not to be steepened) where possible.
- Roads and other disturbed areas should be regularly monitored for erosion problems and problem areas should receive follow-up monitoring by the EO to assess the success of the remediation.
- Topsoil must be removed and stored separately from subsoil. Topsoil must be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas.
- Practical phased development and vegetation clearing must be practiced so that cleared areas are not left un-vegetated and vulnerable to erosion for extended periods of time.

**Residual Impacts:**
The loss of fertile soil and soil capping resulting in areas which cannot fully rehabilitate itself with a good vegetation cover. With appropriate avoidance and mitigation residual impacts will be very low.

**Impact:** Potential increased alien plant invasion during construction

**Impact Nature:** Increased alien plant invasion is one of the greatest risk factors associated with this development. The disturbed and bare ground that is likely to be present at the site during and after construction would leave the site vulnerable to alien plant invasion for some time if not managed. Furthermore, the National Environmental Management Biodiversity Act (Act No. 10 of 2004), as well as the Conservation of Agricultural Resources Act, (Act No. 43 of 1983) requires that listed alien species are controlled in accordance with the Act.

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Local - Regional (3) | Local (1) |
| **Duration** | Permanent (5) | Short-term (1) |
| **Magnitude** | Moderate (6) | Low (4) |
| **Probability** | Definite (5) | Highly Probable (4) |
| **Significance** | **High (70)** | **Low (24)** |
| **Status** | Negative | Neutral – Slightly Negative |
| **Reversibility** | Not Possible | Medium |

| | | |
|---|---|---|
| **Irreplaceable loss of resources** | Potential loss of important resources due to the replacement of natural vegetation by invading alien plants | No |
| **Can impacts be mitigated?** | Yes. | |

**Mitigation:**

- A site-specific eradication and management programme for alien invasive plants must be implemented during construction.
- Regular monitoring by the operation and maintenance team for alien plants at the within the power line servitude must occur and could be conducted simultaneously with erosion monitoring as per Eskom Standards.
- When alien plants are detected, these must be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur and increase to problematic levels.
- Clearing methods must aim to keep disturbance to a minimum.
- No planting or importing any listed invasive alien plant species (all Category 1a, 1b and 2 invasive species) to the site for landscaping, rehabilitation or any other purpose must be undertaken.

**Residual Impacts:**

If the above recommended mitigation measures are strictly implemented and some re-establishment and rehabilitation of natural vegetation is allowed the residual impact will be very low.

### Operation Phase

**Impact:** Potential Faunal Impacts (Construction Phase, Decommission Phase and during maintenance – Operational Phase).

**Impact Nature:** Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some impact on fauna is highly likely to occur during construction.

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Local (1) | Local (1) |
| **Duration** | Short-term (2) | Short-term (2) |
| **Magnitude** | Low (4) | Minor (2) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Low (21)** | **Low (15)** |
| **Status** | Negative | Negative |
| **Reversibility** | Moderate | Moderate |
| **Irreplaceable loss of resources** | No | No |
| **Can impacts be mitigated?** | Noise and disturbance during the construction, decommission and during maintenance phases cannot be avoided but would be transient in nature and with appropriate mitigation; no long-term impacts from the construction phase can be expected. | |

**Mitigation:**

- Site access should be controlled and no unauthorised persons should be allowed onto the site.
- Any fauna directly threatened by the associated activities should be removed to a safe location by a suitably qualified person.
- The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated site.
- Fires should not be allowed on site.

- All hazardous materials 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 as related to the nature of the spill.
- All construction vehicles should adhere to a low speed limit (30km/h) to avoid collisions with susceptible species such as snakes and tortoises.
- Operation vehicles limited to a minimal footprint on site (no movement outside of the earmarked footprint).

**Residual Impacts:**
The altered development area will contain a lower diversity of habitat types and niches for faunal species, however faunal diversity was in any way confirmed to be limited and as such this potential residual impact can be regarded as low.

**Impact:** Altered runoff patterns due to rainfall interception by PV panel infrastructure and compacted areas resulting in high levels of erosion (Operational Phase)

**Impact Nature:** Disturbance created during construction could take several years to fully stabilise and the presence of an extensive area of hardened surface during operation will generate a lot of runoff which will pose a significant erosion risk, if not managed. Erosion is one of the greater risk factors associated with this type of development, and it is therefore essential that proper erosion control structures are built and maintained over the lifespan of the project.

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Local (2) | Local (1) |
| **Duration** | Long-term (4) | Short-term (0) |
| **Magnitude** | High (8) | Low (1) |
| **Probability** | Highly Probable (4) | Improbable (2) |
| **Significance** | Medium (56) | Low (4) |
| **Status** | Negative | Neutral – Slightly Negative |
| **Reversibility** | Low – if erosion has reached severe levels the impacts will not be remedied easily. | High |
| **Irreplaceable loss of resources** | Potential loss of important resources. | No |
| **Can impacts be mitigated?** | Yes, to a large extent | |

**Mitigation**

- Regular monitoring of the site (minimum of twice annually) to identify possible areas of erosion is recommended, particularly after large summer thunder storms have been experienced.
- The higher level of shading anticipated from PV panels may prevent or slow down the re-establishment of some desirable species, therefore re-establishment should be monitored and species composition adapted if vegetation fails to establish sufficiently.
- Alternatively, soil surfaces where no revegetation seems possible will have to be covered with gravel or small rock fragments to increase porosity of the soil surface, slow down runoff and prevent wind- and water erosion.
- Monitor the area below and around the panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro-topography and revegetation efforts accordingly.
- Due to the nature and larger runoff surfaces of the PV panels, the development area should be adequately landscaped and rehabilitated to contain expected accelerated erosion.
- Runoff may have to be specifically channelled or storm water adequately controlled to prevent localised rill and gully erosion.
- Any erosion problems observed should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
- Roads and other disturbed areas should be regularly monitored for erosion problems and problem areas should receive follow-up monitoring to assess the success of the remediation.

**Residual Impacts:**

| |
|---|
| The loss of fertile soil and soil capping resulting in areas which cannot fully rehabilitate itself with a good vegetation cover. With appropriate avoidance and mitigation residual impacts will be very low. |

### Decommissioning Phase

**Impact:** Potential increased erosion risk during construction operation and decommission.

**Impact Nature:** During construction/decommission, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion. Erosion is one of the greater risk factors associated with the development and it is therefore critically important that proper erosion control structures are built and maintained over the lifespan of the project.

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Local (1) | Local (1) |
| **Duration** | Medium-term (3) | Short-term (1) |
| **Magnitude** | Minor (3) | Minor (2) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Low (21)** | **Low (12)** |
| **Status** | Negative | Negative |
| **Reversibility** | Low – if erosion has reached severe levels the impacts will not be remedied easily | High |
| **Irreplaceable loss of resources** | Potential loss of important resources. | No |
| **Can impacts be mitigated?** | Yes, to a large extent | |

**Mitigation:**

- Any erosion problems observed along access roads or any hardened/engineered surface should be rectified immediately and monitored thereafter to ensure that they do not re-occur.
- All bare areas due to project activities should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential where applicable.
- Re-instate as much of the eroded area to its pre-disturbed, "natural" geometry (no change in elevation and any banks not to be steepened) where possible.
- Roads and other disturbed areas should be regularly monitored for erosion problems and problem areas should receive follow-up monitoring by the EO to assess the success of the remediation.
- Topsoil must be removed and stored separately from subsoil. Topsoil must be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas.
- Practical phased development and vegetation clearing must be practiced so that cleared areas are not left un-vegetated and vulnerable to erosion for extended periods of time.

**Residual Impacts:**
The loss of fertile soil and soil capping resulting in areas which cannot fully rehabilitate itself with a good vegetation cover. With appropriate avoidance and mitigation residual impacts will be very low.

**Impact:** Potential Faunal Impacts (Construction Phase, Decommissioning Phase and during maintenance – Operational Phase).

**Impact Nature:** Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some impact on fauna is highly likely to occur during construction.

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Local (1) | Local (1) |

| | | |
|---|---|---|
| **Duration** | Short-term (2) | Short-term (2) |
| **Magnitude** | Low (4) | Minor (2) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Low (21)** | **Low (15)** |
| **Status** | Negative | Negative |
| **Reversibility** | Moderate | Moderate |
| **Irreplaceable loss of resources** | No | No |
| **Can impacts be mitigated?** | Noise and disturbance during the construction, decommission and during maintenance phases cannot be avoided but would be transient in nature and with appropriate mitigation; no long-term impacts from the construction phase can be expected. | |

**Mitigation:**

- Site access should be controlled and no unauthorised persons should be allowed onto the site.
- Any fauna directly threatened by the associated activities should be removed to a safe location by a suitably qualified person.
- The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated site.
- Fires should not be allowed on site.
- All hazardous materials 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 as related to the nature of the spill.
- All construction vehicles should adhere to a low speed limit (30km/h) to avoid collisions with susceptible species such as snakes and tortoises.
- Construction vehicles limited to a minimal footprint on site (no movement outside of the earmarked footprint).

**Residual Impacts:**
The altered development area will contain a lower diversity of habitat types and niches for faunal species, however faunal diversity was in any way confirmed to be limited and as such this potential residual impact can be regarded as low.

### *8.2.4 Implications for Project Implementation*

The majority of impacts associated with the development would occur during the construction phase as a result of the disturbance associated with the operation of heavy machinery at the site and the presence of construction personnel. In addition, the footprint of the development is confined to an area of less than 217 ha, located mostly in an area transformed through historical cultivation practices and overgrazing, and bush encroachment.

Approximately 30% of the project site is situated within a CBA1, mainly due to its location within the Vaal-Vet Sandy Grassland which is classified as an Endangered Ecosystem (Mucina & Rutherford, 2006 and National Ecosystem List, GN1002 of 2011). However, during this study it was determined that most of these areas identified as Natural Vaal-Vet Sandy Grassland have been historically subjected to cultivation and vegetation transformation, with small patches of remaining natural vegetation, resembling natural, untransformed Vaal-Vet Sandy Grassland. These patches of natural grassland, collectively, only cover an area of less than 15% of the proposed project site. Furthermore, most of these patches of natural Vaal-Vet Sandy Grassland along the northern boundary will be avoided, according the development layout. Although the development will impact at a small local scale it is highly unlikely that this development will impact on the status of this vegetation type (impact on a regional scale) as the majority of the development will occur, as mentioned, within mostly transformed habitats.

Sensitive habitat types such as riparian fringes, seepages and other wetland habitat types are avoided (including buffer areas around these habitats) within the current layout and subsequently these areas will not be threatened by the development.

Consequently, there are no highly significant impacts present at the site which cannot be mitigated to a low level and which would represent a red flag for the development, and the development is considered acceptable from an ecological perspective. General Development Recommendations from the specialist assessment include:

- To prevent the onset of accelerated erosion, it is recommended that vegetation clearing be limited where possible to clearing high shrubs, all invasive trees and other alien invasives, even if that means that remaining vegetation will be subjected to vehicle damage (from which it can recover over time). Grading should only be done where absolutely necessary and to mitigate existing erosion channels. If extensive grading will become necessary, it will be advisable to create contour buffer strips to slow down runoff and prevent erosion, which could develop into gully erosion damaging the development in the long run as well.
- It is currently not known which species will be able to persist under the shading of PV arrays, but the establishment of the naturally occurring *Cynodon dactylon* (couch grass), a low creeping grass, should be encouraged. Its dense and deep rooting system will spread to stabilise soil, whilst potentially dense mats could greatly reduce rain splash impact. In addition, its stature and biomass would be too low to present a fire risk.
- All indigenous shrubs that will be cleared should be shredded and added to the soil as mulch.
- Alien species must be removed entirely from site and not used as mulch to prevent the spread of regenerative material.

## 8.3. Assessment of Impacts on Freshwater

The impacts on freshwater features associated with the development was assessed to ascertain the significance of potential impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat, and biota) of these freshwater features. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix F** for more details).

### *8.3.1 Results of the Freshwater Impact Assessment*

Natural wetland features cover approximately 3.27% of the project area, comprising mostly of valley-bottom and depression wetlands. Numerous small earth dam structures have been created within some of the wetlands, in an attempt to concentrate and store surface water for longer periods of time within these wetland features. A total of five (5) natural wetland features have been identified, most of which were depression wetlands. The valley-bottom (VB) wetlands appears to be channelled and drains in a northern direction towards the Vals River. This delineated channelled VB wetland can be regarded as the primary drainage feature within the project area.

All of the freshwater resource features on and around the site are mostly, naturally, ephemeral, however artificial (anthropogenically) modifications to the morphology of most of the wetlands has resulted in portions of these wetland resource features becoming seasonally inundated (for an extended period of time).

The proposed layout avoids all identified wetlands and their associated 30m buffer area. All wetlands and associated buffer are considered to be of high sensitivity and are demarcated as no-go areas (refer to **Figure 8.3**).

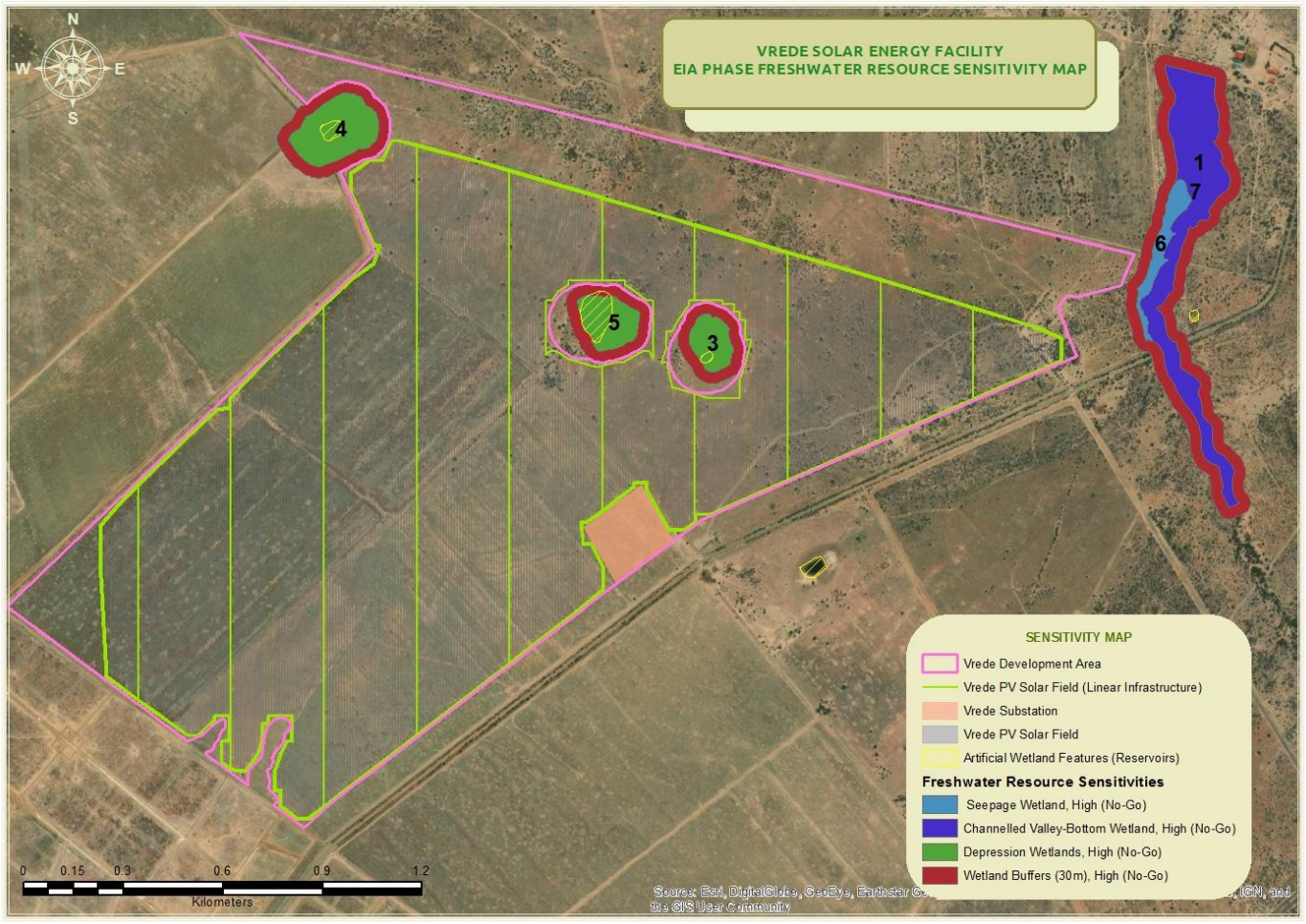


**Figure 8.3:** Aquatic sensitivity map

### *8.3.2 Description of the Impacts to Freshwater Resources*

All freshwater resources as well as their associated buffer areas have been excluded from the development footprint and as such direct impacts during construction, operation and decommission is highly unlikely. However, there is a slight potential for indirect loss of / or damage to some of the freshwater resources. This may potentially lead to localised loss of freshwater resources and may potentially lead to downstream impacts that affect a greater extent of freshwater resources or impact on function and biodiversity. Where these habitats are already stressed due to degradation and transformation, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat. Physical alteration to wetlands can have an impact on the functioning of those wetlands. Consequences may include:

- increased loss of soil;
- loss of/or disturbance to indigenous wetland vegetation;
- loss of sensitive wetland habitats;
- loss or disturbance to individuals of rare, endangered, endemic and/or protected species that occur in wetlands;
- fragmentation of sensitive habitats;

» impairment of wetland function;
» change in channel morphology in downstream wetlands, potentially leading to further loss of wetland vegetation; and
» reduction in water quality in wetlands downstream.

**Impacts during the Construction and Planning Phase**

Solar energy facilities require an initial high intensity disturbance of a fairly large surface area including the clearance of the vegetation cover and the levelling of earth on different terraces where necessary and the compaction of local soil within the development footprint. Concrete foundations for the framework on which the PV panels will be mounted. Soil disturbance, vegetation clearance and hardened surfaces will also be associated with the construction of access and internal roads within the PV solar facility. The internal substation would also need to be constructed within the site. Temporary laydown and storage areas would need to be placed within the site for the construction works.

In terms of the proposed substation, the location of the substation is well located, a fair distance from any freshwater resource feature, and close to the P99/1 route. Subsequently, it is unlikely that the construction of the substation will have any impact of freshwater resources.

In terms of the location of the PV solar field, according to the current layout, the valley-bottom wetland and associated seepage wetland is located outside of the proposed PV solar field (~320m to the south-west) and potential impacts on these wetland features would likely be of an indirect nature. However these impacts are likely to be fairly small due to the distance of the footprint area from these wetlands. Potential impacts on these wetland features include the increase in surface runoff and sediments carried into these wetland features, subsequently potentially impacting local hydrological character of these wetlands (e.g. water quality and hydro-geomorphological character), due to a reduction in roughage, soil compaction/hardening and disturbance within the PV solar footprint area (portion of footprint area falls within the wetland resources' catchment areas).

In terms of the delineated depression wetland, the current layout of the PV solar field will avoid construction within all of these wetland features, however the development will still none the less occur in relative close proximity to these wetlands. Subsequently, according to the current layout, potential impacts on these wetlands will mostly be of an indirect nature and may include:

» The increase in surface runoff and sediments carried into these wetland features, subsequently potentially impacting local hydrological character of these wetlands (e.g. water quality and hydro-geomorphological character).
» Change in vegetation structure and composition due a change in the hydro-geomorphological character (increase in inundated area and the permanent and seasonal saturated zones, to the cost of the temporary saturated zone.
» The potential spread of erosion from the source (within the development footprint area), into the wetland features, subsequently disturbing wetland soils, vegetation cover and local biota.

Direct impacts on these wetland features may include:

» A direct loss of terrestrial habitat fringing the wetland resources may lead to the loss of valuable foraging habitat for wetland fauna (amphibians).
» Fracturing and isolation of wetland features.

There is also the potential for some water quality impacts associated with the batching of concrete, from hydrocarbon spills or associated with the other construction activities on the site. Only a limited amount of water is utilised during construction for the batching of cement and other construction activities.

Generally, with mitigation measures in place, including the micro-placing of infrastructure, outside of any sensitive features (freshwater resource features and associated buffer areas), impacts will be localised, short-term and of low intensity and is expected to have a moderate-low to low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

**Impacts during the Operation Phase:**

During the operation phase the facility will operate continuously, mostly unattended and with low maintenance required for the duration of the SEFs life (±20 years). The SEF is likely to be monitored and controlled remotely, with maintenance only taking place when required.

The PV panels as well as the hard surfaces created by the development may lead to increased runoff (reduction in infiltration) and the potential interception and channelling of surface runoff, particular on surfaces with a steeper gradient. This may potentially lead to:

» A modification to the water input characteristic (input in quantity and a change in water input pattern);
» Increased erosion;
» Sedimentation of the downslope areas; and
» Impairment of wetland functions and services

Subsequently, a localised long-term impact (more than 20 years) of low intensity (depending on the distance between the PV panels and the freshwater features) could be expected that would have a very low overall significance post-mitigation in terms of its impact on the identified freshwater resource features in the area.

**Impacts during the Decommissioning Phase:**

During decommissioning, the potential freshwater impacts will be very similar to that of the Construction Phase, although the potential for water quality and flow related risks will be lower.

### *8.3.3 Impact tables summarising the significance of impacts on freshwater features during construction, operation, and decommissioning (with and without mitigation)*

**Impact Nature**: Indirect loss of wetland habitats during the construction, operation and decommissioning phase (applicable to all wetland features).

This refers to the indirect physical destruction or disturbance of wetland habitat caused by vegetation clearing and disturbance of habitat within their catchments. This may result in the formation of erosion features within the catchment area which may potentially spread into the lower lying wetland habitats, or the deposition of sediments within these habitats. This in turn may result in the disturbance/removal of wetland vegetation and soil and expose these areas to the encroachment/colonisation by invasive alien plants and alteration of geomorphological profiles (including stream beds and banks). Possible ecological consequences associated with this impact may include:

» Reduction in representation and conservation of freshwater ecosystem/habitat types;
» Reduction in the supply of ecosystem goods & services;

» Reduction/loss of habitat for aquatic dependent flora & fauna; and
» Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species).

These disturbances will be the greatest during the construction and again in the decommissioning phases as the related disturbances could result in loss and/or damaged vegetation.

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Development footprint as well as neighbouring areas (3) | Local (1) |
| **Duration** | Long-term (4) | Long-term (4) |
| **Magnitude** | Moderate (5) | Small (2) |
| **Probability** | Probable (3) | Improbable (2) |
| **Significance** | **Medium (36)** | **Low (14)** |
| **Status** | Negative | Negative |
| **Reversibility** | Low – Destruction of wetland vegetation will not be remedied easily. | Low – Destruction of wetland vegetation will not be remedied easily. |
| **Irreplaceable loss of resources** | Local loss of resources | No loss of resources |
| **Can impacts be mitigated?** | Yes, to a large extent | |

**Mitigation:**

» All wetland features and their associated buffer areas should be regarded as No-Go areas for all construction activities.
» The recommended buffer areas between the delineated freshwater resource features and proposed project activities should be maintained.
» Vegetation clearing within the development footprint to be kept to a minimum. No unnecessary vegetation to be cleared.
» Vegetation clearing should occur in in a phased manner to minimise erosion and/or run-off.
» Avoid placing any construction camps, laydown areas, or any buildings or storage facilities within the wetland features as well as their buffer areas.
» Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effective as possible and where deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils).
» Existing roads should be used as far as possible.
» Where new roads need to be constructed, the existing road infrastructure should be rationalised and any unnecessary roads decommissioned and rehabilitated to reduce the level of disturbance.
» During the construction and operational /decommissioning phase, monitor the development footprint and wetland areas to see if erosion issues arise and if any erosion control is required.
» Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effective as possible and were deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils).
» All alien plant re-growth must be monitored and should it occur these plants should be eradicated.
» Road infrastructure and cable alignments should coincide as far as possible to minimise the impact.
» During decommissioning, disturbance to the freshwater ecosystems should be avoided as far as possible.
» Disturbed areas may need to be rehabilitated and revegetated.
» Mitigation and follow up monitoring of residual impacts (alien vegetation growth and erosion) may be required.
» An effective storm water management plan should be compiled by a suitable specialist and the effectivity of the plan should be regularly assessed and revised if necessary.

**Residual Impacts**

» Locally altered vegetation structure.
» Without the implementation of mitigation measures, possible impact on the remaining catchment due to changes in run-off characteristics in the development site.

**Impact Nature**: Impact on wetland systems through the increase in surface runoff on wetland form and function during the operational and decommissioning phases

The proposed PV Facility will involve the addition of hardened areas through the establishment of solar panel foundations while some compaction of soils may occur due to site works. Service roads have the potential to further increase areas of hardening as do the temporary construction area. The substation and additional support buildings will increase hardened surfaces. The aforementioned will increase the runoff generated on site due to the addition of areas of hard surfaces and could lead to increased flood peaks downstream with increased flood risk and erosion risk, potentially reducing or disturbing important/sensitive downstream wetland habitats.

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Development footprint as well as neighbouring areas (3) | Local (2) |
| **Duration** | Long-term (4) | Medium-term (3) |
| **Magnitude** | Moderate (5) | Small (2) |
| **Probability** | Highly Probable (5) | Probable (3) |
| **Significance** | **Medium (60)** | **Low (21)** |
| **Status** | Negative | Negative to Neutral |
| **Reversibility** | Low – Destruction of wetland vegetation will not be remedied easily. | Low – Destruction of wetland vegetation will not be remedied easily. |
| **Irreplaceable loss of resources** | Local loss of resources | No loss of resources |
| **Can impacts be mitigated?** | Yes – to a large extent, mainly through avoidance of highly sensitive areas and associated buffers and through the implementation of an effective storm water management plan. | |

**Mitigation:**

- All wetland features and their associated buffer areas should be regarded as No-Go areas for all construction activities.
- The recommended buffer areas between the delineated freshwater resource features and proposed project activities should be maintained.
- Vegetation clearing within the development footprint to be kept to a minimum. No unnecessary vegetation to be cleared.
- Vegetation clearing should occur in in a phased manner to minimise erosion and/or run-off.
- Infrastructure footprint and associated area of disturbance should be minimised as far as practically possible
- Any storm-water within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities
- Stormwater from hard stand areas, buildings and substation must be managed using appropriate channels and swales when located within steeper areas.
- The runoff should be dissipated over a broad area covered by natural vegetation or managed using appropriate channels and swales.
- Storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the Solar PV site.
- The existing road infrastructure should be utilised as far as possible to minimise the overall disturbance
- Where new roads need to be constructed, the existing road infrastructure should be rationalised and any unnecessary roads decommissioned and rehabilitated in order to reduce total area of hardened, bare areas within the property.
- No stormwater runoff must be allowed to discharge directly into freshwater resource features along roads, and flows should thus be allowed to dissipate over a broad area covered by natural vegetation.

**Residual Impacts**

A potential residual impact is the modification to the extent of inundation as well as to the hydro-geomorphological zones (increase in permanent and seasonal saturated zones) resulting in an alteration to the vegetation composition. However, this impact is unlikely.

**Impact Nature**: Increase in sedimentation and erosion during the construction, operational and decommissioning phase

For the construction and decommissioning phases this refers to the alteration in the physical characteristics of freshwater resource features as a result of increased turbidity and sediment deposition, caused by soil erosion and earthworks, within the catchments of the wetland features, that are associated with construction activities. Possible ecological consequences associated with this impact may include:

» Deterioration in freshwater ecosystem integrity; and
» Reduction/loss of habitat for aquatic dependent flora & fauna.

This may furthermore, influence water quality.

The proposed development will require clearing of existing vegetation and disturbance of soils, specifically for the installation of foundations for PV modules, access roads, electrical cabling, substation, buildings and laydown areas. The solar panels will increase shading of the surface and may result in a decrease in vegetation cover. Disturbed or exposed soils will increase the likelihood of soil erosion and subsequent potential sedimentation of downstream water courses during significant rainfall events. The study by Cook and McCuen (2013) found that the runoff from individual solar panels resulted in greater kinetic energy which increased potential soil erosion below panels (this potential erosion may be enhanced by panel maintenance which includes regular washing). The site is, however, located in a low rainfall area of South Africa which will reduce the potential impact with the mild topography also reducing the erosivity of runoff.

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Local & downstream (3) | Local (1) |
| **Duration** | Long-term (4) | Very Short Duration (1) |
| **Magnitude** | Moderate (6) | Minor (4) |
| **Probability** | Highly Probable (4) | Improbable (2) |
| **Significance** | **Medium (52)** | **Low (12)** |
| **Status** | Negative | Slightly negative |
| **Reversibility** | Moderate | High |
| **Irreplaceable loss of resources** | Local and potential loss of downstream resources | Unlikely |
| **Can impacts be mitigated?** | Yes, to a large extent | |

**Mitigation:**

» All wetland features and their associated buffer areas should be regarded as No-Go areas for all construction activities.
» The recommended buffer areas between the delineated freshwater resource features and proposed project activities should be maintained.
» Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.
» Vegetation clearing should occur in in a phased manner to minimise erosion and/or run-off.
» Any erosion problems observed to be associated with the project infrastructure should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
» All bare areas, as a result of the development, should be revegetated with locally occurring species, to bind the soil and limit erosion potential.
» Site rehabilitation should aim to restore surface drainage patterns, natural soil and vegetation as far as is feasible.
» An erosion control management plan should be utilised to prevent erosion

| |
|---|
| » Any storm-water within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities<br>» Stormwater from hard stand areas, buildings and substation must be managed using appropriate channels and swales when located within steep areas.<br>» Erosion control measures such as silt fences (for areas of works) and gravel strips may be considered at the impact zone where water falls from the solar panels onto the soil surface (due to deterioration in natural grassland because of poor maintenance or lack of solar radiation).<br>» Storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the Solar PV site.<br>» The existing road infrastructure should be utilised as far as possible to minimise the overall disturbance created by the proposed Solar PV Facility.<br>» Silt traps should be used where there is a danger of topsoil eroding and entering lower lying wetland resources.<br>» Construction of gabions and other stabilisation features to prevent erosion, if deemed necessary.<br>» No stormwater runoff must be allowed to discharge directly into any wetland feature along roads, and flows should thus be allowed to dissipate over a broad area covered by natural vegetation.<br>» Containers carrying batteries (if present) should be regularly checked for leaks. If leaks are found, these containers should be repaired, replaced immediately with leaked chemicals cleaned up as soon as possible.<br>» Store hydrocarbons off site where possible, or otherwise implement hydrocarbon storage using impermeable floors with appropriate bunding, sumps and roofing.<br>» Handle hydrocarbons carefully to limit spillage.<br>» Ensure vehicles are regularly serviced so that hydrocarbon leaks are limited.<br>» Designate a single location for refuelling and maintenance, outside of any freshwater resource features.<br>» Keep a spill kit on site to deal with any hydrocarbon leaks.<br>» Remove soil from the site which has been contaminated by hydrocarbon spillage. |
| **Residual Impacts**<br>Altered morphology. Due to the extent and nature of the development this residual impact is unlikely to occur. |

### *8.3.4 Implications for Project Implementation*

Solar energy facilities require an initial high intensity disturbance of a fairly large surface area including the clearance of the vegetation cover and the levelling of earth on different terraces where necessary and the compaction of local soil within the development footprint. Concrete foundations for the framework on which the PV panels will be mounted. Soil disturbance, vegetation clearance and hardened surfaces will also be associated with the construction of access and internal roads within the PV solar facility. The internal substation would also need to be constructed within the site. Temporary laydown and storage areas would need to be placed within the site for the construction works.

The Freshwater Resources Assessment identified a number of wetland areas within the development area, and were defined as no-go areas together with their defined 30m buffer zones. As indicated in Figure 8.1, these features have been avoided by the proposed layout. Indirect impacts on wetland features are however still possible during the construction and operational phases of the project. With the implementation of mitigation measures, impacts will be localised, short-term and of low intensity and is expected to have a moderate-low to low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Based on the findings of the Freshwater Resources Impact Assessment there is no objection to the authorisation of the proposed activities.

## 8.4. Potential Impacts on Avifauna

Potential impacts on avifauna and the relative significance of the impacts associated with the construction and operation the Vrede Solar PV Facility are summarised below (refer to **Appendix E** for more details).

### *8.4.1 Results of the Avifauna Impact Assessment*

On-site surveys were conducted from 20 - 22 July 2020 by means of transect counts. The species of greatest abundance as determined by on site observations was that of the Egyptian Goose, followed by the Fiscal Flycatcher, following which the South African Shelduck and the Fairy Flycatcher shared equal abundance values. Furthermore, the Egyptian Goose and Fiscal Flycatcher distribution was fairly widespread across the development area. Transect counts recorded the greatest number of Egyptian Goose individuals on site, as compared to all other priority species, which was therefore the most abundant priority species on site. Incidental counts indicated 25 counts of Greater Flamingo in the broader project area, however these were not observed within the development area.

The Index of Kilometre Abundance (IKA) expresses the ratio of the total number of individuals (or of signs of presence) observed along a transect by the total transect length covered, and is a common measure used in avifaunal studies as it allows a straightforward comparison of species abundance in different sites or at different times. **Figure 8.4** below indicates the IKA results of the avifaunal study.

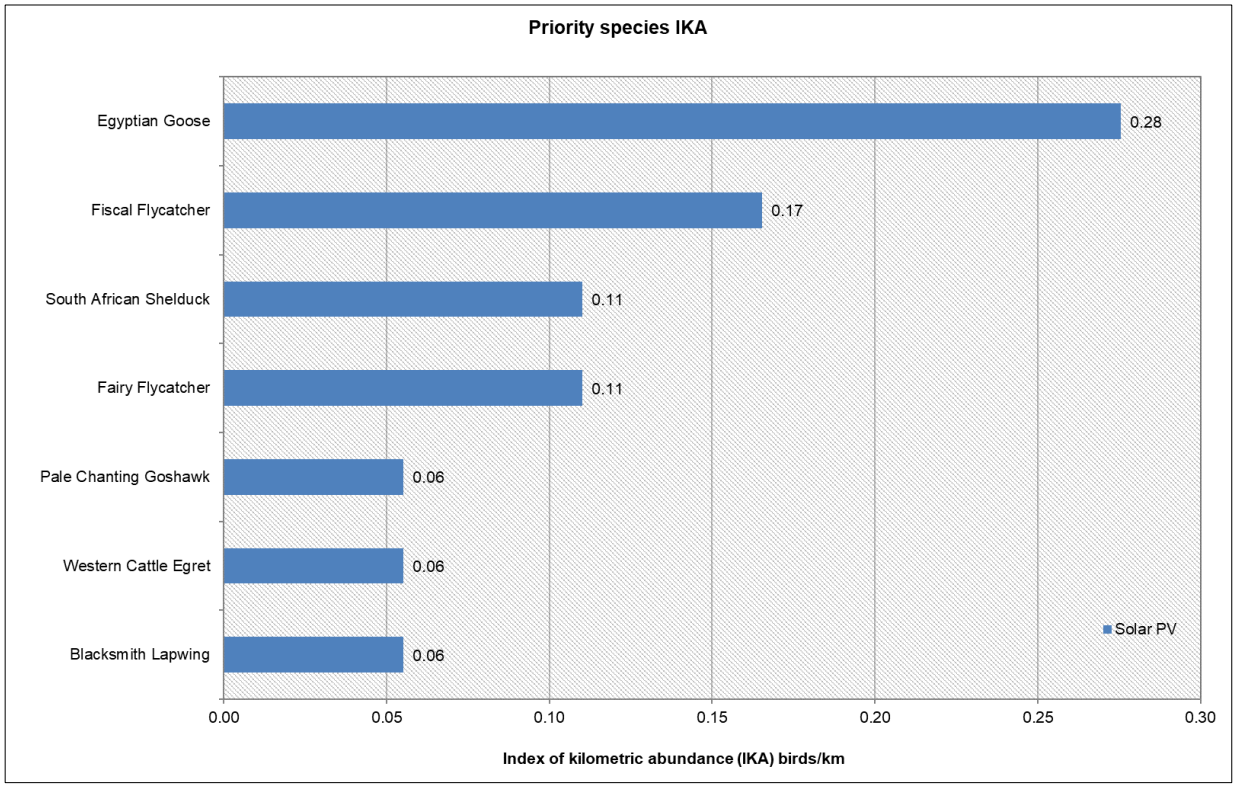


**Figure 8.4.** Index of kilometric abundance (IKA) for all priority species recorded by means of transect counts during the surveys in the study area conducted in July 2020.

The number of incidental records of priority species within a 10km radius around the development area is listed in **Figure 8.5** below. Twenty five sightings of Egyptian Goose and Greater Flamingo was observed, with the second most sightings being that of Little Grebes' at twenty sightings.

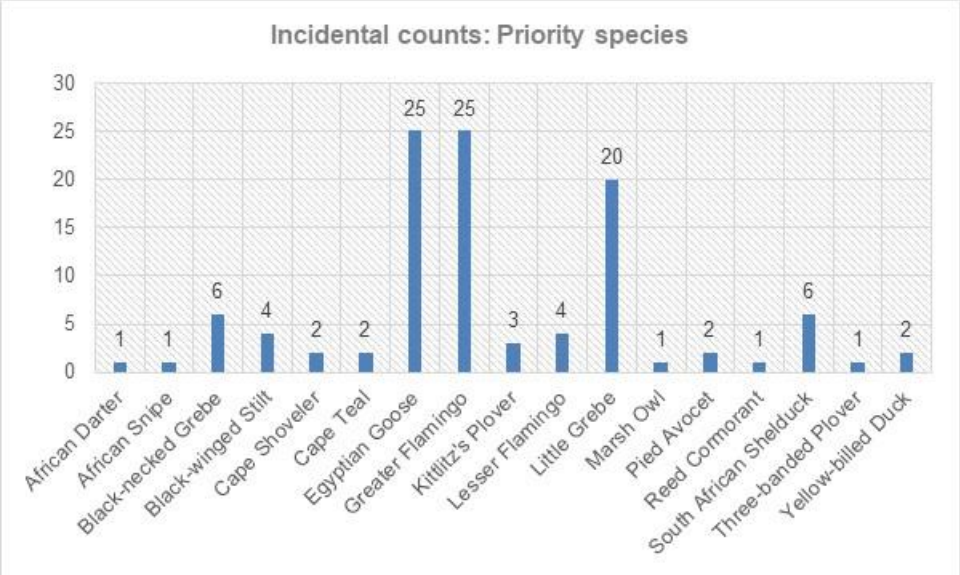


**Figure 8.5.** Incidental counts of priority species within a 10km radius around the development area.

The following environmental sensitivities were identified from an avifaunal perspective:

» Very High sensitivity (No solar panels – other infrastructure allowed): Surface water
» Included are areas within 100m of the pans on the development area. It is important to leave open space for birds to access and leave the surface water area unhindered. Surface water is also an important area for raptors to hunt birds which congregate around water troughs, and they should have enough space for fast aerial pursuit.

» Very High sensitivity (No solar panels – other infrastructure allowed): Drainage line woodland
» Drainage lines are corridors of woodland which provide nesting and foraging opportunities for woodland species which are dependent on this habitat for their survival. The highest density of woodland and trees at the development area is concentrated around the drainage line. A 100m buffer zone should be implemented on both side of the drainage channel.

The 100m buffer zones determined for the very high sensitivity features, within which no solar panels are allowed (but all other infrastructure is allowed), is indicated in **Figure 8.6** below.

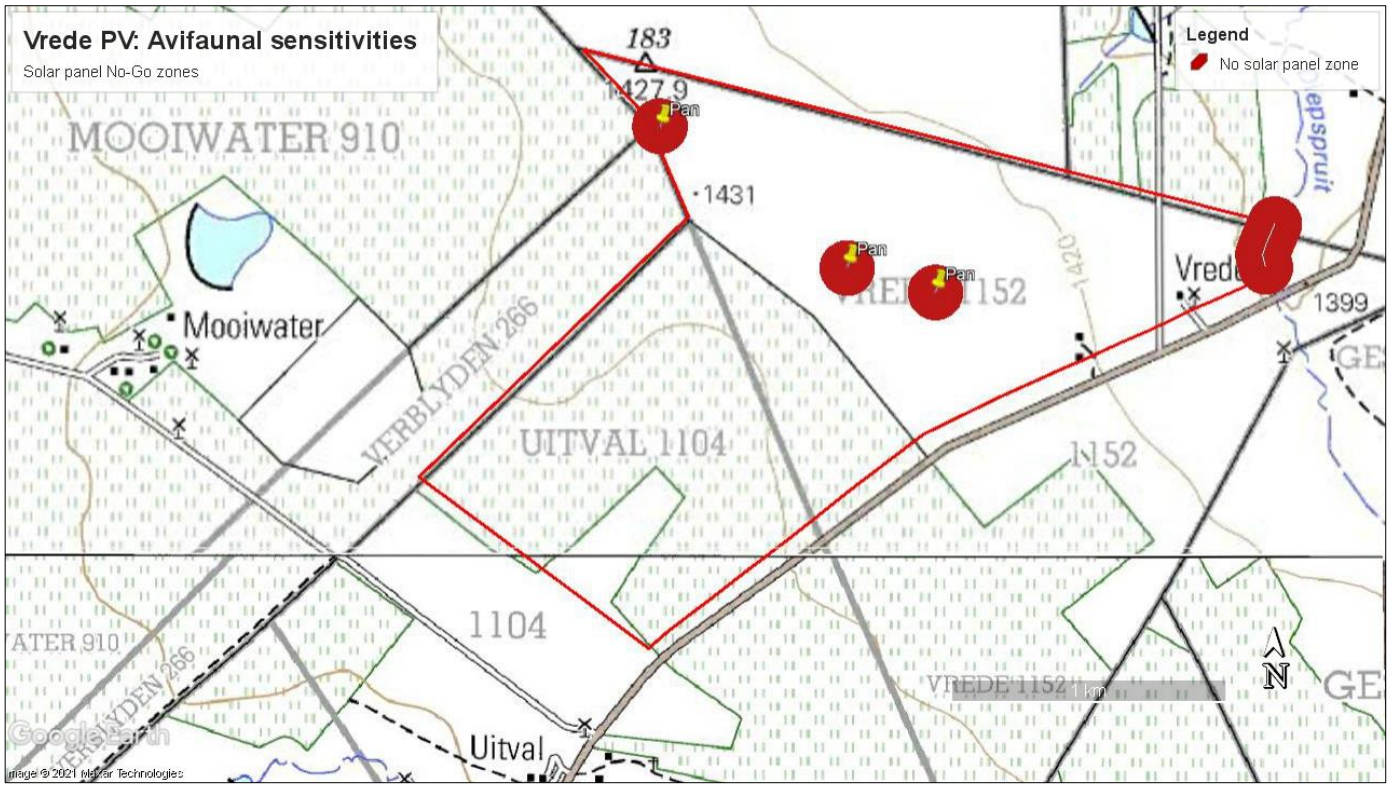


**Figure 8.6.** Avifaunal sensitivity of the Vrede Solar PV Facility, showing 100m panel-free zones around freshwater habitats utilised by avifauna.

### *8.4.2 Description of Avifaunal Impacts*

The main impacts of PV plants on avifauna which have emerged from the avifaunal study include the following:

- Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure
- Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Electrocution of priority species on the internal 33kV reticulation network

### *8.4.3 Impact tables summarising the significance of impacts on avifauna during construction, operation, and decommissioning (with and without mitigation)*

**Construction Phase**

| **Nature:** Displacement of priority species due to disturbance associated with construction of the PV plant and associated infrastructure | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| **Extent** | Local (1) | Local (1) |
| **Duration** | Very Short (1) | Very Short (1) |
| **Magnitude** | High (8) | High (8) |
| **Probability** | Highly probable (4) | Probable (3) |

| | | |
|---|---|---|
| **Significance** | **Medium (40)** | **Medium (30)** |
| **Status (positive or negative)** | Negative | Negative |
| **Reversibility** | Low | Low |
| **Irreplaceable loss of resources?** | Yes | Yes |
| **Can impacts be mitigated?** | To a limited extent | To a limited extent |
| **Mitigation:**<br>» Construction activity should be restricted to the immediate footprint of the infrastructure.<br>» Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.<br>» Measures to control noise and dust should be applied according to current best practice in the industry.<br>» Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. | | |
| **Residual Risks:**<br>The residual risk of displacement will remain at a medium level after mitigation, due to the fact that limited mitigation is available to reduce the impact. | | |

| **Nature:** Displacement of priority species due to habitat transformation associated with construction of the PV plant and associated infrastructure. | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| **Extent** | Local (1) | Local (1) |
| **Duration** | Long Term (4) | Long Term (4) |
| **Magnitude** | High (8) | High (6) |
| **Probability** | Highly Probable (4) | Highly Probable (4) |
| **Significance** | **Medium (52)** | **Medium (44** |
| **Status (positive or negative)** | Negative | Negative |
| **Reversibility** | High | High |
| **Irreplaceable loss of resources?** | Yes | Yes |
| **Can impacts be mitigated?** | To a limited extent | To a limited extent |
| **Mitigation:**<br>» Construction activity should be restricted to the immediate footprint of the infrastructure.<br>» Access to the remainder of the site should be strictly controlled to prevent unnecessary degradation of habitat.<br>» Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.<br>» The mitigation measures proposed by the vegetation specialist must be strictly enforced.<br>» A 100m solar panel free buffer zone must be implemented around the pans (-27.736377° 27.134694°, -27.740910° 27.141575°, -27.741723° 27.144815°) to provide avifauna with unhindered access to the water.<br>» A 100m solar panel free buffer zone must be implemented on both sides of the drainage line on the development area, to maintain a corridor of woodland. | | |
| **Residual Risks:**<br>The residual risk of displacement will remain at a medium level after mitigation, due to the fact that limited mitigation is available to reduce the impact. | | |

### Operation Phase

| **Nature:** Mortality of priority species due to collisions with the solar panels | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| **Extent** | Local (1) | Local (1) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Minor (2) | Minor (2) |
| **Probability** | Probable (3) | Probable (3) |

| | | |
|---|---|---|
| **Significance** | **Low (21)** | **Low (21)** |
| **Status (positive or negative)** | Negative | Negative |
| **Reversibility** | High | High |
| **Irreplaceable loss of resources?** | Yes | Yes |
| **Can impacts be mitigated?** | To a limited extent | To a limited extent |
| **Mitigation:**<br>» No mitigation is required due to the low significance of this impact. | | |
| **Residual Risks:**<br>There will be an ongoing residual risk of collisions with the solar panels, but due to the low significance of this impact, it should not be biologically significant. | | |

| **Nature:** Entrapment of large-bodied birds in the double perimeter fence | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| **Extent** | Local (1) | Local (1) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Minor (2) | Minor (2) |
| **Probability** | Probable (3) | Very Improbable (1) |
| **Significance** | **Low (21)** | **Low (7)** |
| **Status (positive or negative)** | Negative | Negative |
| **Reversibility** | High | High |
| **Irreplaceable loss of resources?** | Yes | Yes |
| **Can impacts be mitigated?** | To a limited extent | To a limited extent |
| **Mitigation:**<br>» It is recommended that a single perimeter fence is used. | | |
| **Residual Risks:**<br>None | | |

| **Nature:** Electrocution of priority species on the internal 33kV reticulation network. | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| **Extent** | Local (2) | Local (1) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | High (8) | High (6) |
| **Probability** | Highly Probable (4) | Very improbable (1) |
| **Significance** | **Medium (56)** | **Low (11)** |
| **Status (positive or negative)** | Negative | Negative |
| **Reversibility** | High | High |
| **Irreplaceable loss of resources?** | Yes | Yes |
| **Can impacts be mitigated?** | Yes | Yes |
| **Mitigation:**<br>» A bird-friendly pole design must be implemented. The pole design must be submitted to the avifaunal specialist for approval. | | |
| **Residual Risks:**<br>The residual risk of electrocution will be negligible if a bird-friendly pole design is implemented. | | |

**Decommissioning Phase**

Decommissioning impacts on avifauna were determined to be identical to that of construction (Refer **Appendix E**). The impact tables are therefore reproduced here.

| **Nature:** Displacement of priority species due to disturbance associated with decommissioning of the PV plant and associated infrastructure | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| **Extent** | Local (1) | Local (1) |
| **Duration** | Very short (1) | Very short (1) |
| **Magnitude** | High (8) | High (8) |
| **Probability** | Highly probable (4) | Probable (3) |
| **Significance** | **Medium (40)** | **Medium (30)** |
| **Status (positive or negative)** | Negative | Negative |
| **Reversibility** | Low | Low |
| **Irreplaceable loss of resources?** | Yes | Yes |
| **Can impacts be mitigated?** | To a limited extent | To a limited extent |
| **Mitigation:**<br>» Construction activity should be restricted to the immediate footprint of the infrastructure.<br>» Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.<br>» Measures to control noise and dust should be applied according to current best practice in the industry.<br>» Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum. | | |
| **Residual Risks:**<br>The residual risk of displacement will remain at a medium level after mitigation, due to the fact that limited mitigation is available to reduce the impact. | | |

### *8.4.5 Implications for Project Implementation*

The avifaunal specialist determined that a 100m solar panel free buffer zone must be implemented around the pans on site (-27.736377° 27.134694°, -27.740910° 27.141575°, -27.741723° 27.144815°) to provide avifauna with unhindered access to the water. In addition, a 100m solar panel free buffer zone must be implemented on both sides of the drainage line on the development area, to maintain a corridor of woodland.

The layout presented in **Figure 8.1** above considers the above sensitives by exclusion of these areas from the development footprint and facility layout.

The proposed facility will have a medium to low negative impact on priority avifauna following mitigation, with no high sensitivity impacts determined. The development is supported provided the mitigation measures listed in this report are strictly implemented. No fatal flaws were discovered in the course of the investigations.

## 8.5. Assessment of Visual Impacts

Impacts on visual receptors will occur during the undertaking of construction activities and the operation of Vrede Solar PV Facility. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix I**).

### *8.5.1 Results of the Visual Impact Assessment*

The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers or if the visual perception of the structure is favourable to all the observers, there would be no visual impact. It is necessary to identify areas of high viewer incidence and to classify certain areas

according to the observer's visual sensitivity towards the proposed solar energy facility and its related infrastructure. It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer: regularity of sighting, cultural background, state of mind, purpose of sighting, etc. which would create a myriad of options.

Viewer incidence is calculated to be the highest along the arterial and secondary roads within the study area. Travellers using these roads may be negatively impacted upon by visual exposure to the PV facility. Additional sensitive visual receptors are located at the farm residences (homesteads) throughout the study area. It is expected that the viewer's perception, unless the observer is associated with (or supportive of) the solar energy facility, would generally be negative.

Due to the generally remote location of the proposed PV facility, there are only a few potential sensitive visual receptors located within a 6km radius of the proposed facility (refer to **Figure 8.7**). These are residents of, or visitors to:

- Uitval
- Mooiwater
- Gesukkel
- Highlands
- Francina
- Wilgerboom
- Toggekry

The Boslaagte Nature Reserve, Lechwe Lodge and other facilities (e.g. lookout points and residences) on this reserve are also flagged as potential sensitive visual receptor sites.

A visual impact index was generated taking into account visual exposure, viewer incidence/perception and visual distance of the proposed Vrede Solar PV Facility (refer to **Figure 8.8**). The index indicates that potentially sensitive visual receptors within a 1km radius of the power plant may experience a very high visual impact. The magnitude of visual impact on sensitive visual receptors subsequently subsides with distance to high within a 1– 3km radius (where/if sensitive receptors are present) and moderate within a 3 – 6km radius (where/if sensitive receptors are present). Receptors beyond 6km are expected to have a low potential visual impact.

The PV facility may have a visual impact of very **high magnitude** on:

- Observers travelling along the S172 secondary road
- Residents of/or visitors to:
  - The Boslaagte Nature Reserve and Lechwe Lodge
  - Uitval
  - Vrede

The facility may have a visual impact of **high magnitude** on:

- Observers travelling along the R34 arterial road
- Residents of/or visitors to:
  - Mooiwater
  - Gesukkel
  - Highlands

The facility may have a visual impact of **moderate magnitude** on:

» Observers travelling along the R713 arterial road
» Residents of/or visitors to:
  * Francina
  * Wilgerboom
  * Toggekry

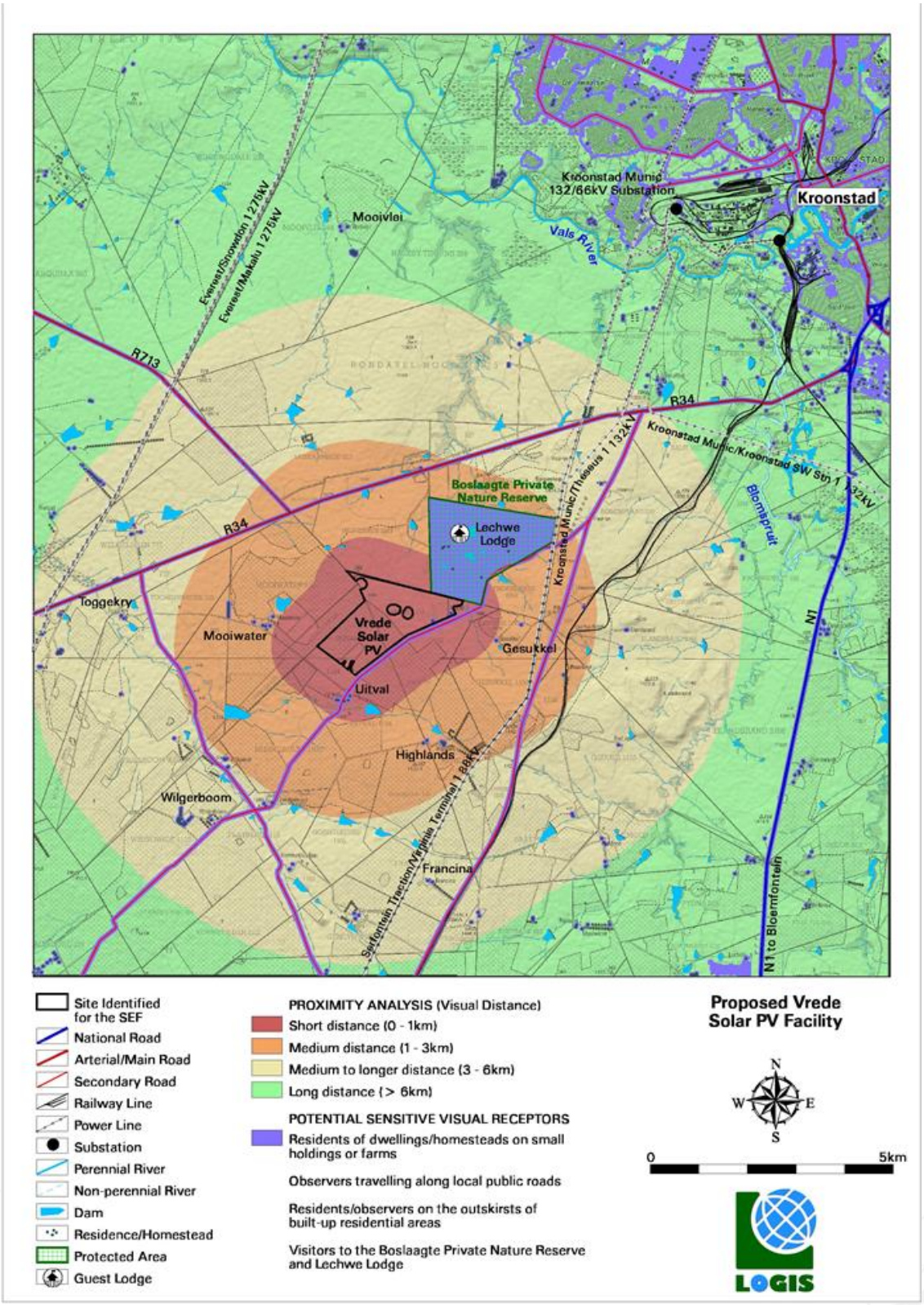


**Figure 8.7:** Proximity analysis and potential sensitive visual receptors.

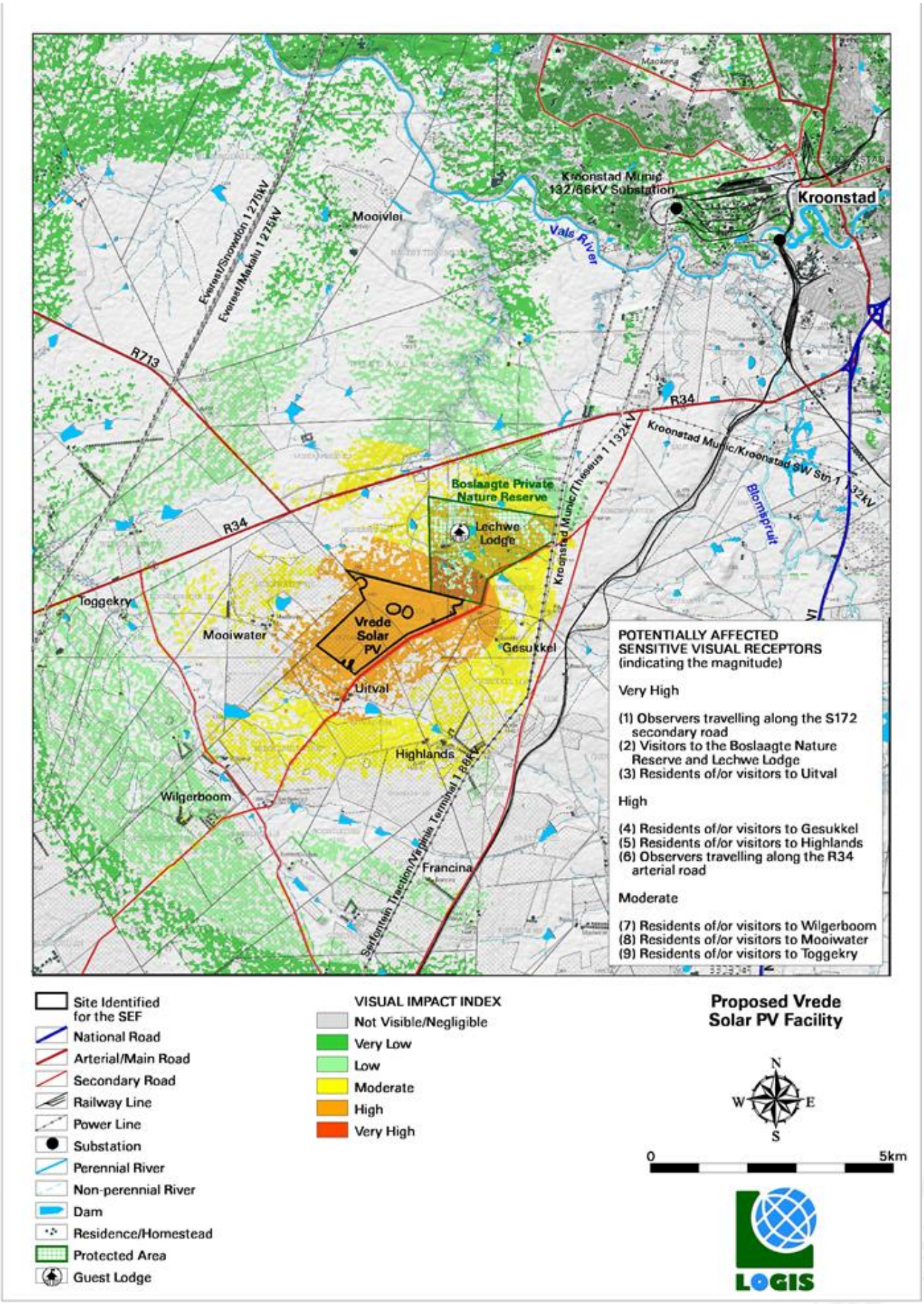


**Figure 8.8:** Visual impact index and potentially affected sensitive visual receptors.

### *8.5.2 Description of Visual Impacts*

Visual impacts will occur during the construction and operation phases of the Vrede Solar PV Facility. The following impacts are assessed in detail in section 8.6.3:

Construction impacts
- Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed PV facility.
- Visual impact on observers travelling along the S172 secondary road and residents at homesteads within a 1km radius of the PV facility structures
- Visual impact on observers travelling along the roads and residents at homesteads within a 1 – 3km radius of the PV facility structures

Operational impacts
- Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed facility.
- The visual impact of solar glint and glare as a visual distraction and possible air travel hazard
- Visual impact of the ancillary infrastructure during the operation phase on observers in close proximity to the structures.
- The potential impact on the sense of place of the region

### *8.5.3 Impact table summarising the significance of visual impacts during construction and operation (with and without mitigation)*

| **Nature of Impact:** Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed PV facility. | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| **Extent** | Local (2) | Local (2) |
| **Duration** | Short term (2) | Short term (2) |
| **Magnitude** | Moderate (6) | Low (4) |
| **Probability** | Highly Probable (4) | Probable (3) |
| **Significance** | **Moderate (40)** | **Low (24)** |
| **Status (positive or negative)** | Negative | Negative |
| **Reversibility** | Reversible (1) | Reversible (1) |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |
| **Mitigation:**<br>Planning:<br>» Retain and maintain natural vegetation immediately adjacent to the development footprint.<br>Construction:<br>» Ensure that vegetation is not unnecessarily removed during the construction phase.<br>» Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.<br>» Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.<br>» Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.<br>» Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).<br>» Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. | | |

| |
|---|
| » Rehabilitate all disturbed areas immediately after the completion of construction works. |
| **Residual impacts:**<br>None, provided rehabilitation works are carried out as specified. |

| **Nature of Impact:**<br>Visual impact on observers travelling along the S172 secondary road and residents at homesteads within a 1km radius of the PV facility structures | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| **Extent** | Local (2) | Local (2) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Very High (10) | Moderate (6) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Moderate (48)** | **Moderate (36)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Reversible (1) | Reversible (1) |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |
| **Mitigation / Management:**<br>Planning:<br>» Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint.<br>» Consult adjacent landowners (if present) in order to inform them of the development and to identify any (valid) visual impact concerns.<br>Operations:<br>» Maintain the general appearance of the facility as a whole.<br>Decommissioning:<br>» Remove infrastructure not required for the post-decommissioning use.<br>» Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications. | | |
| **Residual impacts:**<br>The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain. | | |

| **Nature of Impact:**<br>Visual impact on observers travelling along the roads and residents at homesteads within a 1 – 3km radius of the PV facility structures | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| **Extent** | Regional (3) | Regional (3) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | High (8) | Moderate (6) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Moderate (45)** | **Moderate (39)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Reversible (1) | Reversible (1) |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes, best practice mitigation measures are recommended. | |
| **Mitigation / Management:**<br>Planning:<br>» Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint.<br>Operations: | | |

| |
|---|
| » Maintain the general appearance of the facility as a whole.<br>Decommissioning:<br>» Remove infrastructure not required for the post-decommissioning use.<br>» Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications. |
| **Residual impacts:**<br>The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain. |

| **Nature of Impact:**<br>Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed facility. | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| **Extent** | Local (2) | Local (2) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | High (8) | Moderate (6) |
| **Probability** | Probable (3) | Improbable (2) |
| **Significance** | **Moderate (42)** | **Low (24)** |
| **Status (positive or negative)** | Negative | Negative |
| **Reversibility** | Reversible (1) | Reversible (1) |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |
| **Mitigation:**<br>Planning & operation:<br>» Shield the sources of light by physical barriers (walls, vegetation, or the structure itself).<br>» Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights.<br>» Make use of minimum lumen or wattage in fixtures.<br>» Make use of down-lighters, or shielded fixtures.<br>» Make use of Low Pressure Sodium lighting or other types of low impact lighting.<br>» Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes. | | |
| **Residual impacts:**<br>The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain. | | |

| **Nature of Impact:**<br>The visual impact of solar glint and glare as a visual distraction and possible air travel hazard | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| **Extent** | Local (2) | N.A. |
| **Duration** | Long term (4) | N.A. |
| **Magnitude** | Low (4) | N.A. |
| **Probability** | Improbable (2) | N.A. |
| **Significance** | **Low (20)** | **N.A.** |
| **Status (positive or negative)** | Negative | N.A. |
| **Reversibility** | Reversible (1) | N.A. |
| **Irreplaceable loss of resources?** | No | N.A. |
| **Can impacts be mitigated?** | N.A. | |
| **Mitigation:**<br>» N.A. | | |
| **Residual impacts:** | | |

| |
|---|
| » N.A. |

| **Nature of Impact:** Visual impact of the ancillary infrastructure during the operation phase on observers in close proximity to the structures. | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| **Extent** | Local (2) | Local (2) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Low (4) | Low (4) |
| **Probability** | Improbable (2) | Improbable (2) |
| **Significance** | **Low (20)** | **Low (20)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Reversible (1) | Reversible (1) |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | No, only best practise measures can be implemented | |
| **Generic best practise mitigation/management measures:**<br>Planning:<br>» Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/power line servitude.<br>Operations:<br>» Maintain the general appearance of the infrastructure.<br>Decommissioning:<br>» Remove infrastructure not required for the post-decommissioning use.<br>» Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications. | | |
| **Residual impacts:**<br>The visual impact will be removed after decommissioning, provided the ancillary infrastructure is removed. Failing this, the visual impact will remain. | | |

| **Nature of Impact:** The potential impact on the sense of place of the region. | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| **Extent** | Regional (3) | Regional (3) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Low (4) | Low (4) |
| **Probability** | Improbable (2) | Improbable (2) |
| **Significance** | **Low (22)** | **Low (22)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Reversible (1) | Reversible (1) |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | No, only best practise measures can be implemented | |
| **Generic best practise mitigation/management measures:**<br>Planning:<br>» Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude.<br>Operations:<br>» Maintain the general appearance of the facility as a whole.<br>Decommissioning:<br>» Remove infrastructure not required for the post-decommissioning use.<br>» Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications. | | |

**Residual impacts:**
The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.

### *8.5.4 Implications for Project Implementation*

Overall, the significance of the visual impacts is expected to range from moderate to low as a result of the generally undeveloped character of the landscape and the remote location of the project infrastructure. There are a very limited number of potentially sensitive visual receptors within a 6km radius of the PV facility, although the possibility does exist for visitors to the region to venture in to closer proximity to the solar power generating structures. These observers may consider visual exposure to this type of infrastructure to be intrusive.

Potential mitigation factors for the 100MW PV facility include the fact that the facility utilises a renewable source of energy (considered as an international priority) to generate electricity and is therefore generally perceived in a more favourable light. It does not emit any harmful by-products or pollutants and is therefore not negatively associated with possible health risks to observers.

A number of mitigation measures have been proposed above. Regardless of whether or not mitigation measures will reduce the significance of the anticipated visual impacts, they are considered to be good practice and should all be implemented and maintained throughout the construction, operation and decommissioning phases of the proposed facility.

If mitigation is undertaken as recommended, it is concluded that the significance of most of the anticipated visual impacts will remain at or be managed to acceptable levels. As such, the PV facility would be considered to be acceptable from a visual impact perspective and can therefore be authorised.

## 8.6. Assessment of Impacts on Heritage Resources

Impacts on heritage resources may occur due to loss of archaeological and palaeontological resources during construction activities of Vrede Solar PV Facility. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix I**).

### *8.6.1 Results of the Heritage Impact Assessment (including archaeology and palaeontology)*

*Archaeology and Heritage Resources*

Results of the archaeological fieldwork indicated that the Vrede property has been utilised for numerous farming activities (historical cultivation and current grazing) over several generations and so the landscape has been heavily modified by this activity. A combination of historical ploughing and heavy grazing has important detrimental implications on the preservation of in situ surficial cultural features such as stone walling, stone tools, shallow graves and associated cultural remains. It is important to note that despite an extensive foot survey, no cultural heritage remains were identified on the property (**Figure 8.9**). However, there remains the possibility that cultural material may be present beneath the ground surface.

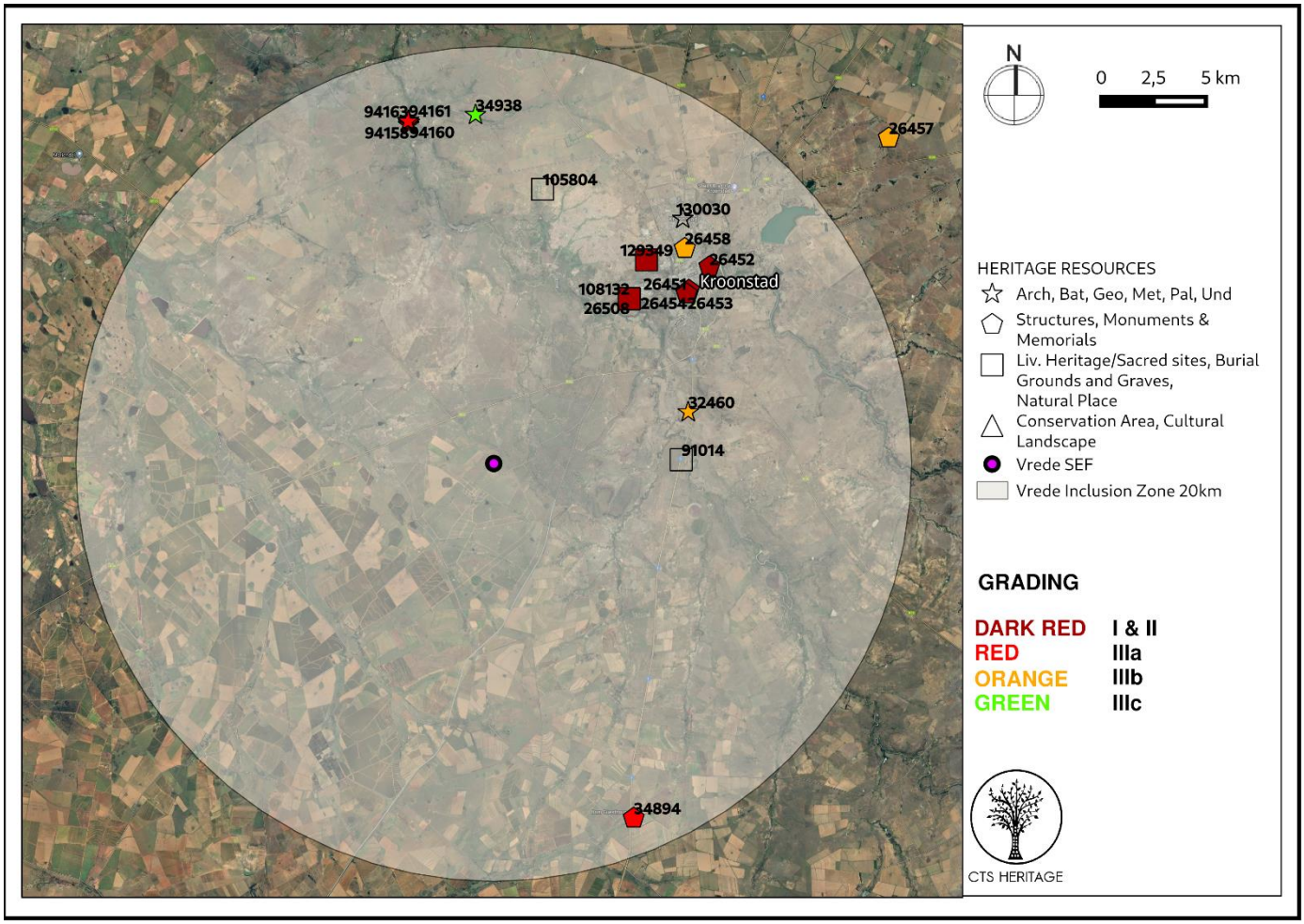


**Figure 8.9:** Heritage Resources previously identified within the study area.

No significant heritage resources were identified within the footprint for the proposed Vrede SEF development.

*Palaeontology*

Results of the Palaeontological fieldwork indicated that heavy grazing of cattle and small-scale historical ploughing of fields has impacted the whole property and in particular the northern and western areas, aiding in quick identification of possible fossil bearing rock outcrops. Most areas were surveyed systematically and comprehensively in transects. The size of the property required survey transects to be conducted at 15-20m intervals. In the west of the property, four large square fields previously ploughed have been left fallow. The southernmost of these fields has been used for grazing and soil exposure was good, aiding the survey. Tall and dense grasses have grown in the northernmost fields, seriously limited soil exposure and hindering survey coverage. In the eastern areas, dense pockets of *Acacia* trees hindered access, but limited ground cover allowed clear assessment of potential surficial features that are often associated with localised tree growth.

The multi-generation agricultural use of this property limits the potential preservation of fossils. No fresh fossil bearing outcrop was identified on the property. Several large extant burrows show a soil layer of +/-1m thick with no evidence of non-eroded bedrock underneath it ("Large burrow" as detailed in the heritage impact assessment report, refer **Appendix H**). A dolerite dyke was identified in the North-East corner of the property ("East Corner" as detailed in the heritage impact assessment report, refer **Appendix H**) extending North for +/- 15m. Please refer to **Figure 8.10** for a depiction of the palaeontological sensitivity of the proposed

development area. **Figure 8.11** further depicts the palaeontological observations made during the field assessments conducted for the Vrede Solar PV Facility.

There is very little probability that fossils will be present in the Jurassic dolerites. However, the majority of the Vrede property is underlain by highly fossiliferous sediments (the Adelaide Subgroup and Volksrust Formation) of high palaeontological sensitivity. The land, having been reworked extensively historically (such as visible plough lines on the Vrede property), is covered by a thick layer of soil, making the underlying bedrock and geology difficult to identify. However, the presence of fresh outcropping Adelaide mudstones on a nearby property indicates the high likelihood of these highly fossiliferous layers being disturbed with construction requiring excavation exceeding 1m in depth. It is therefore recommended that palaeontological monitoring of excavations takes place during the construction phase of the proposed development of the Vrede SEF.

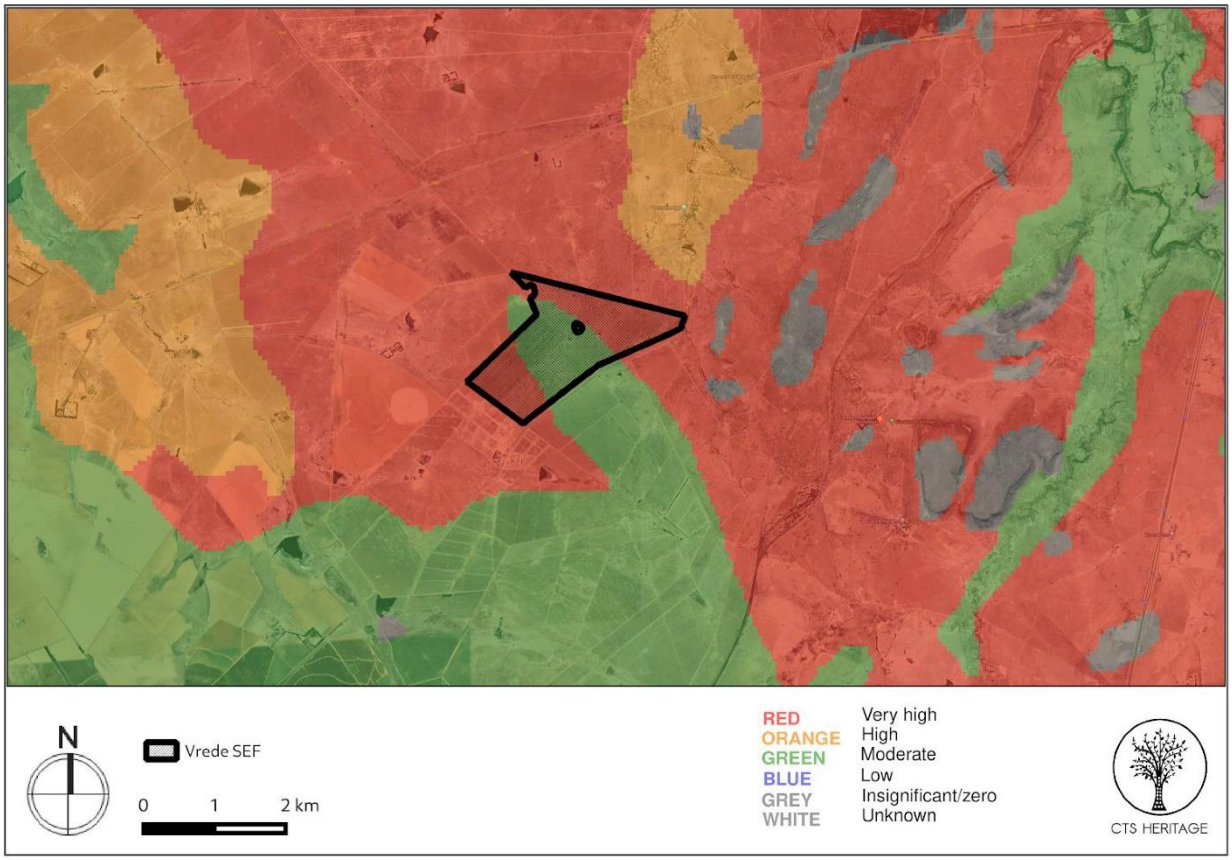


**Figure 8.10:** Palaeontological sensitivity of the proposed development area

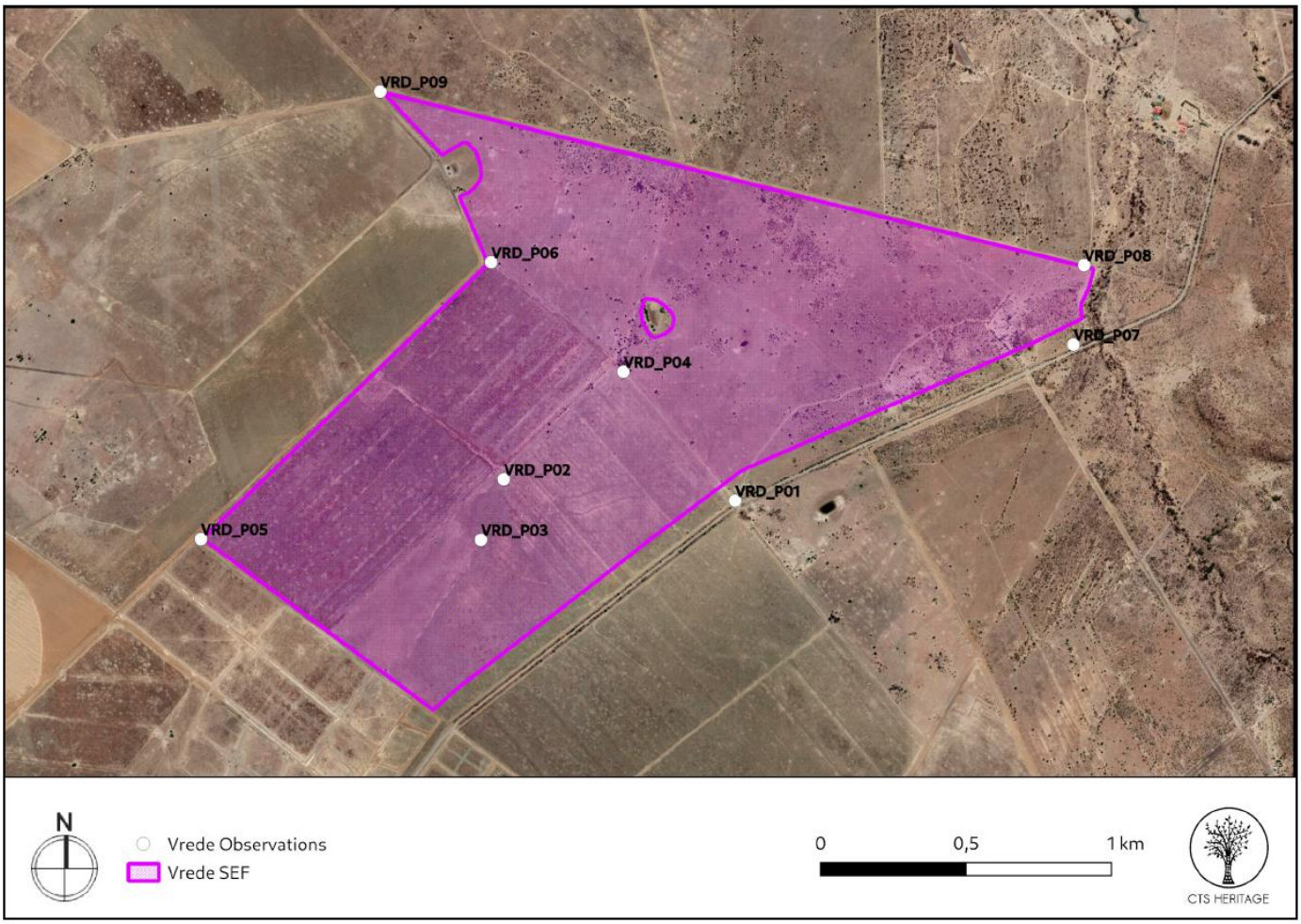


**Figure 8.11:** Observations made during the field assessments conducted for the Vrede Solar PV Facility

### *8.6.2 Description of the Heritage Impacts*

Potential impacts to archaeological and palaeontological resources would occur during the construction phase only and would be in the form of direct impacts.

### *8.6.3 Impact tables summarising the significance of impacts on heritage during construction, operation and decommissioning (with and without mitigation)*

| ***Nature:*** *Impacts on archaeological resources due to the proposed development*<br>It is possible that buried archaeological resources may be impacted by the proposed development | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | Minor (1) | Minor (1) |
| ***Probability*** | Improbable (1) | Improbable (1) |
| ***Significance*** | **Low (7)** | **Low (7)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Irreversible | Irreversible |
| ***Irreplaceable loss of resources?*** | Unlikely | Unlikely |
| ***Can impacts be mitigated?*** | Yes | |
| ***Mitigation:*** | | |

| |
|---|
| » Should any previously unrecorded archaeological resources or possible burials be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward. |
| ***Residual Impacts:***<br>Should any previously unrecorded archaeological resources or possible burials be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward. |

| ***Nature: :*** *Impacts on palaeontological resources due to the proposed development*<br>It is possible that buried palaeontological resources may be impacted by the proposed development | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Local (1) | Local (1) |
| ***Duration*** | Permanent (5) | Permanent (5) |
| ***Magnitude*** | High (8) | High (8) |
| ***Probability*** | Definite (5) | Very Improbable (1) |
| ***Significance*** | **High (70)** | **Low (14)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | Irreversible | Irreversible |
| ***Irreplaceable loss of resources?*** | Likely | Likely |
| ***Can impacts be mitigated?*** | Yes | Yes |
| ***Mitigation:***<br>» All excavations into bedrock are monitored by a suitably qualified palaeontologist and a report on the outcomes of the monitoring activities must be submitted to SAHRA on completion of the development of the facility.<br>» All other excavation activities are subject to the Palaeontological Chance Finds Procedure. | | |
| ***Residual Impacts:***<br>Should any previously unrecorded paleontological resources or possible burials be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward. | | |

### *8.6.4 Implications for Project Implementation*

The area proposed for the development of the Vrede Solar Energy facility was thoroughly assessed in the field assessment described in this report. It was noted that the area proposed for development has been historically disturbed through agricultural activities. Based on the outcomes of this assessment, it is not anticipated that the proposed development of the SEF at Vrede will negatively impact on any archaeological heritage resources. However, due to the nature of archaeological resources, it is possible that significant archaeological heritage may exist below the ground surface and as such, mitigation measures are recommended in this regard below.

The overall palaeontological sensitivity of the areas proposed for the Vrede and Rondavel SEFs and their associated infrastructure is high to very high. The field survey identified a number of areas of possibly fossiliferous outcrops of the underlying bedrock. In addition, examples of fossilised wood were identified on a neighbouring property. Although ex situ, these findings corroborate the high palaeontological sensitivity of the area. In general, it is preferred that excavations take place into fossiliferous bedrock rather than avoiding impact as this allows palaeontologists access to otherwise inaccessible palaeontological resources. The negative impacts of such excavations to palaeontological resources are managed through careful monitoring of excavations into bedrock by a suitably qualified palaeontologist. It is therefore preferable that excavations do indeed take place on condition that these excavations are properly monitored.

There is no objection to the proposed development on heritage grounds on condition that:

» All excavations into bedrock are monitored by a suitably qualified palaeontologist and a report on the outcomes of the monitoring activities must be submitted to SAHRA on completion of the development of the facility.
» All other excavation activities are subject to the Palaeontological Chance Finds Procedure.
» Should any previously unrecorded archaeological resources or possible burials be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.

## 8.7. Assessment of Social Impacts

Impacts on the social environment are expected during both the construction and operation phases. Potential social impacts and the relative significance of the impacts associated with the development of PV1 are summarised below (refer to **Appendix J**).

### *8.7.1 Results of the Social Impact Assessment*

The findings of the SIA (refer to **Appendix J)** indicate that the significance of all the potential negative impacts of construction with mitigation were Low Negative. The potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented. In addition, all negative impact associated with operation of the facility were able to be reduced to medium and low negative respectively following mitigation. Positive impacts of the operational phase included Promotion of renewable energy projects, creation of employment and business opportunities and Establishment of Community Trust which were medium or high positive impacts following enhancement.

The SIA further found that given the relatively small number of people employed during the operational phase (~ 20), the potential negative social impact on the local economy associated with decommissioning will be limited. In addition, the potential impacts associated with the decommissioning phase can also be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be Low (negative). In terms of closure costs, the revenue from the sale of scrap metal from the PV plant should be allocated to cover the costs associated with closure and the rehabilitation of disturbed areas.

### *8.7.2 Description of Social Impacts*

The following positive and negative impacts have been identified and assessed for the Vrede Solar PV Facility:

***Construction phase***

Potential positive impacts

» Creation of employment and business opportunities, and opportunity for skills development and on-site training.

Potential negative impacts

» Impacts associated with the presence of construction workers on local communities.

- Impacts related to the potential influx of jobseekers.
- Increased risks to livestock and farming infrastructure associated with the construction related activities and presence of construction workers on the site.
- Increased risk of grass fires associated with construction related activities.
- Noise, dust and safety impacts associated with construction related activities and vehicles.
- Impact on productive farmland.

***Operational phase***

Potential positive impacts

- The establishment of renewable energy infrastructure.
- Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training.
- Generation of additional income for the landowner.
- Benefits associated with the establishment of a Community Trust.

Potential negative impacts

- The visual impacts and associated impact on sense of place.
- Potential impact on tourism.

***Decommissioning phase***

Potential negative impacts

- Social impacts associated with retrenchment including loss of jobs, and source of income.

### *8.7.3 Impact tables summarising the significance of social impacts during construction, operation and decommissioning (with and without mitigation measures)*

**Construction Phase Impacts**

| **Nature:** Creation of employment and business opportunities during the construction phase | | |
|---|---|---|
| | **Without Mitigation** | **With Enhancement** |
| **Extent** | Local – Regional (3) | Local – Regional (4) |
| **Duration** | Short term (2) | Short term (2) |
| **Magnitude** | Moderate (6) | High (8) |
| **Probability** | Highly probable (4) | Highly probable (4) |
| **Significance** | **Medium (44)** | **Medium (56)** |
| **Status** | Positive | Positive |
| **Reversibility** | N/A | N/A |
| **Irreplaceable loss of resources?** | N/A | N/A |
| **Can impact be enhanced?** | Yes | |
| **Enhancement:**<br>In order to enhance local employment and business opportunities associated with the construction phase the following measures should be implemented:<br><br>Employment | | |

- » Where reasonable and practical, the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area.
- » Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria.
- » Before the construction phase commences the proponent should meet with representatives from the MLM to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase.
- » The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project.
- » Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
- » The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.

Business

- » The proponent should liaise with the MLM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work.
- » Where possible, the proponent should assist local BBBEE companies to complete and submit the required tender forms and associated information.
- » The MLM, in conjunction with the local business sector and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential benefits associated with the project.

**Residual impacts:**
Improved pool of skills and experience in the local area.

**Nature:** Potential impacts on family structures and social networks associated with the presence of construction workers

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Local (2) | Local (1) |
| **Duration** | Short term for community as a whole (2) | Short term for community as a whole (2) |
| **Magnitude** | Moderate for the community as a whole (6) | Low for community as a whole (4) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Medium for the community as a whole (30)** | **Low for the community as a whole (21)** |
| **Status** | Negative | Negative |
| **Reversibility** | No in case of HIV and AIDS | No in case of HIV and AIDS |
| **Irreplaceable loss of resources?** | Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods | Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods |
| **Can impact be mitigated?** | Yes, to some degree. However, the risk cannot be eliminated | |
| **Mitigation:** | | |

The potential risks associated with construction workers can be mitigated. The detailed mitigation measures should be outlined in the Environmental Management Plan (EMP) for the Construction Phase. Aspects that should be covered include:

- Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job categories.
- The proponent should consider the option of establishing a Monitoring Forum (MF) in order to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should be established before the construction phase commences, and should include key stakeholders, including representatives from local communities, local MLM Councillor for Ward 7, farmers and the contractor(s). The MF should also be briefed on the potential risks to the local community associated with construction workers.
- The proponent and the contractor(s) should, in consultation with representatives from the MF, develop a code of conduct for the construction phase. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be dismissed. All dismissals must comply with the South African labour legislation.
- The proponent and the contractor should implement an HIV/AIDS and COVID-19 awareness programme for all construction workers at the outset of the construction phase.
- The construction area should be fenced off before construction commences and no workers should be permitted to leave the fenced off area.
- The contractor should provide transport for workers to and from the site on a daily basis. This will enable the contactor to effectively manage and monitor the movement of construction workers on and off the site.
- Where necessary, the contractors should make the necessary arrangements to enable low and semi-skilled workers from outside the area to return home over weekends and/ or on a regular basis. This would reduce the risk posed to local family structures and social networks.
- The contractor must ensure that all construction workers from outside the area are transported back to their place of residence within 2 days for their contract coming to an end.
- It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.

**Residual impacts:**
Impacts on family and community relations that may, in some cases, persist for a long period of time. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.

**Nature:** Potential impacts on family structures, social networks and community services associated with the influx of job seekers

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Local (2) | Local (1) |
| **Duration** | Permanent (5)<br>(For job seekers that stay on the town) | Permanent (5)<br>(For job seekers that stay on the town) |
| **Magnitude** | Minor (2) | Minor (2) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Low (27)** | **Low (24)** |
| **Status** | Negative | Negative |
| **Reversibility** | No in case of HIV and AIDS | No in case of HIV and AIDS |
| **Irreplaceable loss of resources?** | Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods | Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods |

| | |
|---|---|
| **Can impact be mitigated?** | Yes, to some degree. However, the risk cannot be eliminated |

**Mitigation:**

It is impossible to stop people from coming to the area in search of a job. However, as indicated above, the proponent should ensure that the employment criteria favour local residents in the area. In addition:

- The proponent, in consultation with the MLM, should investigate the option of establishing a MF to monitor and identify potential problems that may arise due to the influx of job seekers to the area. The MF should also include the other proponents of solar energy projects in the area.
- The proponent should implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities.
- The proponent should implement a policy that no employment will be available at the gate.

**Residual impacts:**

Impacts on family and community relations that may, in some cases, persist for a long period of time. Also, in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.

**Nature:** Potential risk to safety of scholars, farmers and farm workers, livestock and damage to farm infrastructure associated with the presence of construction workers on site

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Local (3) | Local (2) |
| **Duration** | Short term (2) | Short term (2) |
| **Magnitude** | Medium (6) | Low (4) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Medium (33)** | **Low (24)** |
| **Status** | Negative | Negative |
| **Reversibility** | Yes, compensation paid for stock losses and damage to farm infrastructure etc. | Yes, compensation paid for stock losses and damage to farm infrastructure etc. |
| **Irreplaceable loss of resources?** | No | No |
| **Can impact be mitigated?** | Yes | |

**Mitigation:**

Key mitigation measures include:

- The construction area should be fenced off prior to the commencement of the construction phase. The movement of construction workers on the site should be confined to the fenced off area.
- The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. The agreement should be signed before the construction phase commences.
- Traffic and activities should be strictly contained within designated areas.
- Strict traffic speed limits must be enforced on the farm.
- All farm gates must be closed after passing through.
- Contractors appointed by the proponent should provide daily transport for low and semi-skilled workers to and from the site. This would reduce the potential risk of trespassing on the remainder of the farm and adjacent properties.
- The proponent should consider the option of establishing a MF (see above) that includes local farmers and develop a Code of Conduct for construction workers. This committee should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent and the contractors before the contractors move onto site.
- The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained

in the Code of Conduct to be signed between the proponent, the contractors' and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities.

- » The Environmental Management Programme (EMPr) must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested.
- » Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.
- » Contractors appointed by the proponent must ensure that construction workers who are found guilty of stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation.
- » It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.

**Residual impacts:**
None, provided losses are compensated for.

**Nature:** Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Local (4) | Local (2) |
| **Duration** | Short term (2) | short term (2) |
| **Magnitude** | Moderate due to reliance on agriculture for maintaining livelihoods (6) | Low (4) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Medium (36)** | **Low (24)** |
| **Status** | Negative | Negative |
| **Reversibility** | Yes, compensation paid for stock and crop losses etc. | Yes, compensation paid for stock and crop losses etc. |
| **Irreplaceable loss of resources?** | No | No |
| **Can impact be mitigated?** | Yes | |

**Mitigation:**
The mitigation measures include:

- » The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc., during the construction phase will be compensated for. The agreement should be signed before the construction phase commences.
- » The option of establishing a fire-break around the perimeter of the site prior to the commencement of the construction phase should be investigated.
- » Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas.
- » Smoking on site should be confined to designated areas.
- » Contractor to ensure that construction related activities that pose a potential fire risk, such as welding, are effectively managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy winter months.
- » Contractor should provide adequate fire-fighting equipment on-site, including a fire fighting vehicle.
- » Contractor to provide fire-fighting training to selected construction staff.No construction staff, with the exception of security staff, to be accommodated on site over night.

| |
|---|
| » As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the fire-fighting costs borne by farmers and local authorities. |
| **Residual impacts:**<br>None, provided losses are compensated for. |

| **Nature:** Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site | | |
|---|---|---|
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local (2) | Local (1) |
| **Duration** | Short Term (2) | Short Term (2) |
| **Magnitude** | Medium (6) | Minor (2) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Medium (30)** | **Low (15)** |
| **Status** | Negative | Negative |
| **Reversibility** | Yes | Yes |
| **Irreplaceable loss of resources?** | No | No |
| **Can impact be mitigated?** | Yes | |
| **Mitigation:**<br>The potential impacts associated with heavy vehicles can be effectively mitigated. The mitigation measures include:<br><br>» The movement of heavy vehicles associated with the construction phase should be timed to avoid times of the week, such as weekends, when the volume of traffic travelling along the R34 arterial road, the Hennenman road and the S172 secondary may be higher.<br>» Construction operations should be planned to minimise the total area cleared at any given time.<br>» Cleared areas should be rehabilitated once the construction phase has been completed.<br>» Dust suppression measures must be implemented on un-surfaced roads, such as wetting on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.<br>» All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits | | |
| **Residual impacts:**<br>If damage to local farm roads is not repaired then this will affect the farming activities in the area and result in higher maintenance costs for vehicles of local farmers and other road users. The costs will be borne by road users who were not responsible for the damage. Dust impacts to vineyards could also impact on future contracts. | | |

| **Nature:** The activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the SEF and power lines may damage farmlands and result in a loss of farmlands for grazing. | | |
|---|---|---|
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local (1) | Local (1) |
| **Duration** | Long term-permanent if disturbed areas are not effectively rehabilitated (5) | Short term if damaged areas are rehabilitated (2) |
| **Magnitude** | Medium (6) | Minor (2) |
| **Probability** | Probable (3) | Highly Probable (4) |
| **Significance** | **Medium (36)** | **Low (20)** |
| **Status** | Negative | Negative |
| **Reversibility** | Yes, disturbed areas can be rehabilitated | Yes, disturbed areas can be rehabilitated |

| | | |
|---|---|---|
| **Irreplaceable loss of resources?** | Yes, loss of farmland. However, disturbed areas can be rehabilitated | Yes, loss of farmland. However, disturbed areas can be rehabilitated |
| **Can impact be mitigated?** | Yes, however, loss of farmland cannot be avoided | |

**Mitigation:**

The potential impacts associated with damage to, and loss of farmland can be effectively mitigated. The aspects that should be covered include:

- The site for the proposed SEF should be fenced off prior to commencement of construction activities.
- The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be minimised.
- An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase.
- All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase.
- The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up by the Environmental Consultants appointed to manage the EIA.
- The implementation of the Rehabilitation Programme should be monitored by the ECO.

**Residual impacts:**

Overall loss of farmland could affect the livelihoods of the affected farmers, their families, and the workers on the farms and their families. However, disturbed areas can be rehabilitated.

### Operation Phase Impacts

| **Nature:** Development of infrastructure to generate clean, renewable energy | | |
|---|---|---|
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local, Regional and National (4) | Local, Regional and National (5) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | High (8) | High (8) |
| **Probability** | Highly Probable (4) | Definite (5) |
| **Significance** | **High (64)** | **High (85)** |
| **Status** | Positive | Positive |
| **Reversibility** | Yes | |
| **Irreplaceable loss of resources?** | Yes, impact of climate change on ecosystems | Reduced $CO_2$ emissions and impact on climate change |
| Can impact be mitigated? | Yes | |

**Enhancement:**

Should the project be approved the proponent should:

- Implement a skills development and training programme aimed at maximising the number of employment opportunities for local community members.
- Maximise opportunities for local content, procurement, and community shareholding.

**Residual impacts:**

Overall reduction in $CO_2$ emission, reduction in water consumption for energy generation, contribution to establishing an economically viable commercial renewables generation sector in the Free State Province and South Africa.

| **Nature:** Creation of employment and business opportunities associated with the operational phase | | |
|---|---|---|
| | **Without Mitigation** | **With Enhancement** |
| **Extent** | Local and Regional (1) | Local and Regional (2) |

| | | |
|---|---|---|
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Low (4) | Low (4) |
| **Probability** | Probable (3) | Definite (5) |
| **Significance** | **Low (27)** | **Medium (50)** |
| **Status** | Positive | Positive |
| **Reversibility** | N/A | N/A |
| **Irreplaceable loss of resources?** | No | No |
| **Can impact be enhanced?** | Yes | |

**Enhancement:**

In order to enhance local employment and business opportunities associated with the operation phase the following measures should be implemented:

Employment

- Where reasonable and practical, the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area.
- Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria.
- Before the operation phase commences the proponent should meet with representatives from the MLM to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase.
- The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the potential job opportunities for locals and the employment procedures that the proponent intends following for the operation phase of the project.
- Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the operation phase.
- The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.

Business

- The proponent should liaise with the MLM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for operation contractors. These companies should be notified of the tender process and invited to bid for project-related work.
- Where possible, the proponent should assist local BBBEE companies to complete and submit the required tender forms and associated information.
- The MLM, in conjunction with the local business sector and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential benefits associated with the project.

**Residual impacts:**

Creation of permanent employment and skills and development opportunities for members from the local community and creation of additional business and economic opportunities in the area

**Nature:** Establishment of a community trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development

| | **Without Mitigation** | **With Enhancement16** |
|---|---|---|
| **Extent** | Local and Regional (2) | Local and Regional (3) |
| **Duration** | Long term (4) | Long term (4) |
| **Intensity** | Low (4) | Moderate (6) |

[16] Enhancement assumes effective management of the community trust

| | | |
|---|---|---|
| **Likelihood** | Probable (3) | Definite (5) |
| **Significance** | **Medium (30)** | **High (65)** |
| **Status** | Positive | Positive |
| **Reversibility** | Yes | Yes |
| **Can impact be enhanced?** | Yes | |
| **Enhancement:**<br>In order to maximise the benefits and minimise the potential for corruption and misappropriation of funds the following measures should be implemented:<br><br>» The MLM should liaise with the proponents of other renewable energy projects in the area to investigate how best the Community Trusts can be established and managed so as to promote and support local, socio-economic development in the region as a whole.<br>» The MLM should be consulted as to the structure and identification of potential trustees to sit on the Trust. The key departments in the MLM that should be consulted include the Municipal Managers Office, IDP Manager and LED Manager.<br>» Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community.<br>» Strict financial management controls, including annual audits, should be instituted to manage the funds generated for the Community Trust from the SEF plant. | | |
| **Residual impacts:**<br>Promotion of social and economic development and improvement in the overall well-being of the community | | |

| **Nature:** Assessment of benefits associated with income generated for the affected farmer. The generation of additional income represents a significant benefit for the local affected farmer(s) and reduces the risks to their livelihoods posed by droughts and fluctuating market prices for sheep and farming inputs, such as feed etc. | | |
|---|---|---|
| | **Without Mitigation** | **With Enhancement** |
| **Extent** | Local (1) | Local (3) |
| **Duration** | Long term (4) | Long term (4) |
| **Intensity** | Low (4) | Moderate (6) |
| **Likelihood** | Probable (3) | Definite (5) |
| **Significance** | **Low (27)** | **Medium (53)** |
| **Status** | Positive | Positive |
| **Reversibility** | Yes | Yes |
| **Can impact be enhanced?** | Yes | |
| **Enhancement:**<br>Implement agreements with affected landowner. | | |
| **Residual impacts:**<br>Support for local agricultural sector and farming | | |

| **Nature:** Visual impact associated with the proposed solar facility and the potential impact on the area's rural sense of place and adjacent land uses. | | |
|---|---|---|
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local (2) | Local (1) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Moderate (6) | Moderate (6) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Medium (36)** | **Medium (33)** |
| **Status** | Negative | Negative |

| | | |
|---|---|---|
| **Reversibility** | Yes, solar facility can be removed. | |
| **Irreplaceable loss of resources?** | No | No |
| **Can impact be mitigated?** | Yes | |
| **Mitigation:**<br>The recommendations contained in the Final VIA should also be implemented. | | |
| **Residual impacts:**<br>Potential impact on current rural sense of place | | |

| **Nature:** Potential impact of the SEF on local tourism operations, specifically the Boslaagte Private Nature Reserve and Lechwe Lodge. The impact will be linked to the potential visual impacts and the perception of people visiting the reserve and lodge. | | |
|---|---|---|
| | **Without Mitigation** | **With Enhancement / Mitigation** |
| **Extent** | Local (2) | Local (1) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Low (4) | Minor (2) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Medium (30)** | **Low (24)** |
| **Status** | Negative | Negative |
| **Reversibility** | Yes, solar facility can be removed. | |
| **Irreplaceable loss of resources?** | No | No |
| **Can impact be mitigated?** | Yes | |
| **Enhancement:**<br>The recommendations contained in the Final VIA should be implemented. | | |
| **Residual impacts:**<br>Potential impact on current rural sense of place. | | |

### Decommissioning Phase

| **Nature:** Social impacts associated with retrenchment including loss of jobs, and source of income | | |
|---|---|---|
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local and regional (2) | Local and regional (1) |
| **Duration** | Medium Term (2) | Very Short Term (1) |
| **Magnitude** | Moderate (6) | Low (4) |
| **Probability** | Highly Probable (4) | Highly Probable (4) |
| **Significance** | **Medium (40)** | **Low (24)** |
| **Status** | Negative | Negative |
| **Reversibility** | Yes, assumes retrenchment packages are paid to all affected employees | |
| **Irreplaceable loss of resources?** | No | No |
| **Can impact be mitigated?** | Yes | |
| **Mitigation:**<br>» The proponent should ensure that retrenchment packages are provided for all staff retrenched when the plant is decommissioned.<br>» All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning.<br>» Revenue generated from the sale of scrap metal during decommissioning should be allocated to funding closure and rehabilitation of disturbed areas | | |
| **Residual impacts:**<br>Loss of jobs and associated loss of income etc. can impact on the local economy and other businesses. However, decommissioning can also create short term, temporary employment opportunities associated with dismantling etc. | | |

### *8.7.4 Implications for Project Implementation*

The findings of the SIA indicated that the development of the proposed 100 MW Vrede SEF will create employment and business opportunities for locals during both the construction and operational phase of the project.

The establishment of a Community Trust will also benefit the local community. The enhancement measures listed in the SIA report (refer to **Appendix J**) should be implemented in order to maximise the potential benefits. The significance of this impact is rated as High Positive. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the negative environmental and socio-economic impacts associated a coal-based energy economy and the challenges created by climate change, represents a significant positive social benefit for society as a whole. The findings of the SIA also indicated that the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has resulted in significant socio-economic benefits, both at a national level and at a local, community level. These benefits are linked to foreign Direct Investment, local employment and procurement and investment in local community initiatives. The establishment of the proposed 100 MW Vrede SEF was therefore supported by the findings of the SIA.

## 8.8. Potential Impacts on soil and agricultural potential

Potential impacts on soil and agricultural potential associated with the Vrede Solar PV Facility are summarised below (refer to **Appendix G** for more details).

### *8.8.1 Results of the Agricultural Agro-Ecosystem Assessment*

The soil and agricultural properties and sensitivities of the proposed Vrede solar PV facility development was the subject of the Agricultural Agro-Ecosystem Assessment conducted. The study found that the area consists of nine different natural soil forms, ranging from 0.55m to 1.5m in effective soil depth. The soil forms identified are Avalon, Bainsvlei, Bloemdal, Gamoep, Glencoe, Palmiet, Pinedene, Rustenburg and Tukulu. The development area is therefore a combination of plinthic catena soils as well as slightly to moderately structure soils. The soil chemical analysis indicate pH levels between severely acidic and moderately acidic and the plant nutrient concentrations provide an indication that fertilizer may have previously been applied in a few areas.

The largest portion of the development area has land with Moderate (Class 08) land capability that is suitable for dryland crop production. A section along the northern boundary of the site has land with Moderate-High (Class 09) land capability. The remaining areas consist of land with Low-Moderate (Class 06) and Low (Class 05) land capability. The sensitivity rating of the site was also based on land capability classification of the site. Approximately 155.3ha has High agricultural sensitivity, 47.8ha has Medium sensitivity and 9.1ha has Low sensitivity (**Figure 8.12**). The development footprint includes areas of all three sensitivity categories. While the development footprint for the Medium and Low sensitivity areas fall within the allowable development limits, the proposed project footprint exceed the limit with 120.3ha for the areas with High sensitivity.

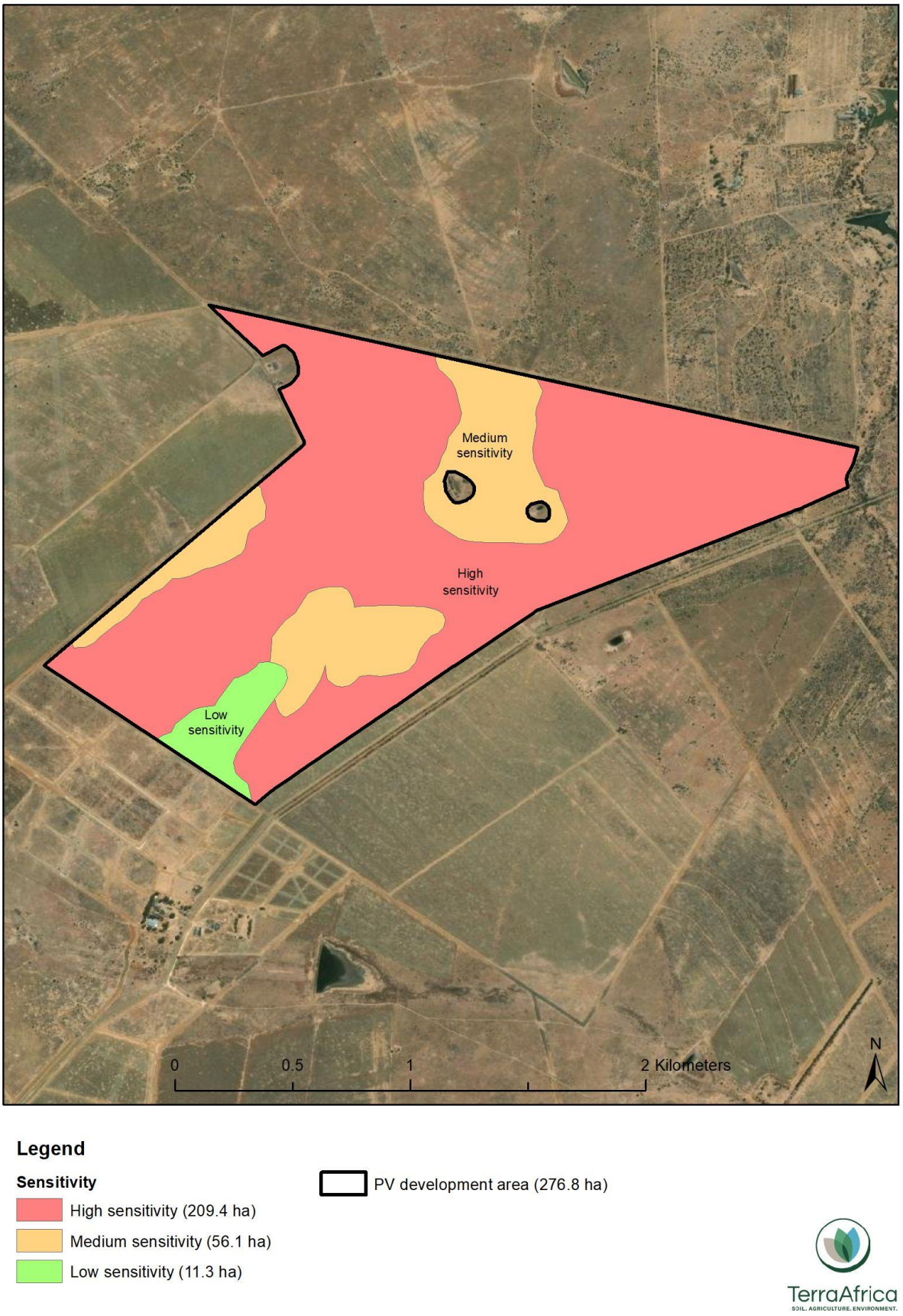


**Figure 8.12.** Sensitivity rating of the Vrede solar PV facility development area.

It is anticipated that the construction and operation of the Vrede Solar PV Facility will have impacts that range from medium to low. Through the consistent implementation of the recommendation mitigation measures, most of impacts can all be reduced to low. Since the area around the development footprint will be fenced off, it is not anticipated that the impact on livestock farming can be mitigated as this area will now be excluded from livestock farming.

The most significant impacts of the proposed Vrede solar PV facility project on soil and agricultural productivity, will occur during the construction phase when the vegetation is removed and the soil surface is prepared for infrastructure commissioning. During the operational phase, the risk remains that soil will be polluted by the waste generated during the operational phase or in the case of a spill incident. During the decommissioning phase, soil will be prone to erosion when the infrastructure is removed from the soil surface. Below follows a rating of the significance of each of the impacts.

### *8.8.2 Description of soils and agricultural potential impacts*

The most significant impacts of the proposed Vrede solar PV facility project on soil and agricultural productivity, will occur during the construction phase when the vegetation is removed and the soil surface is prepared for infrastructure commissioning. During the operational phase, the risk remains that soil will be polluted by the waste generated during the operational phase or in the case of a spill incident. During the decommissioning phase, soil will be prone to erosion when the infrastructure is removed from the soil surface. Below follows a rating of the significance of each of the impacts.

### *8.8.3 Impact tables summarising the significance of impacts on soils and agriculture during construction, operation, and decommissioning (with and without mitigation)*

**Construction Phase**

**Nature:** Change in land use from livestock farming to energy generation

Prior to construction of the solar facility, the area will be fenced off and livestock farming will be excluded from 214ha of land. The area where infrastructure will be constructed will be stripped of vegetation and will no longer be suitable for livestock grazing.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent** | Local (1) | Local (1) |
| **Duration** | Medium duration (3) | Medium duration (3) |
| **Magnitude** | Low (4) | Low (4) |
| **Probability** | Definite (4) | Definite (4) |
| **Significance** | **Medium (32)** | **Medium (28)** |
| **Status (positive or negative)** | Negative | Negative |
| **Reversibility** | Moderate | Moderate |
| **Irreplaceable loss of resources?** | Yes | Yes |
| **Can impacts be mitigated?** | No | N/A |

**Mitigation:**

- Vegetation clearance must be restricted to areas where infrastructure is constructed.
- No materials removed from development area must be allowed to be dumped in nearby livestock farming areas.
- Prior arrangements must be made with the landowners to ensure that livestock and game animals are moved to areas where they cannot be injured by vehicles traversing the area.
- No boundary fence must be opened without the landowners' permission.
- All left-over construction material must be removed from site once construction on a land portion is completed.

| |
|---|
| » No open fires made by the construction teams are allowable during the construction phase. |
| **Residual Impacts:**<br>The residual impact from the construction and operation of the Vrede solar PV facility is considered medium. |

**Nature:** Soil erosion

All areas where vegetation is removed from the soil surface in preparation for the infrastructure construction, will result in exposed soil surfaces that will be prone to erosion. Both wind and water erosion are a risk and even though the project area is in the arid climate, the intensity of single rainstorm may result in soil particles being transported away.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent** | Local (1) | Local (1) |
| **Duration** | Medium-term (3) | Medium-term (3) |
| **Magnitude** | Moderate (6) | Low (4) |
| **Probability** | Probable (3) | Improbable (2) |
| **Significance** | **Medium (30)** | **Low (16)** |
| **Status (positive or negative)** | Negative | Negative |
| **Reversibility** | Low | Low |
| **Irreplaceable loss of resources?** | Yes | No |
| **Can impacts be mitigated?** | Yes | N/A |

**Mitigation:**

» Land clearance must only be undertaken immediately prior to construction activities and only within the development footprint;

» Unnecessary land clearance must be avoided;

» Level any remaining soil removed from excavation pits that remained on the surface instead of allowing small stockpiles of soil to remain on the surface.

» Where possible, conduct the construction activities outside of the rainy season.

**Residual Impacts:**
The residual impact from the construction and operation of the proposed Vrede solar PV facility Thermal Facility on the susceptibility to erosion is considered low.

**Nature:** Soil compaction

The clearing and levelling of land for both the thermal plant infrastructure as well as the access road, will result in soil compaction. In the area where access roads will be constructed, topsoil will be removed and the remaining soil material will be deliberately compacted to ensure a stable road surface.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent** | Local (1) | Local (1) |
| **Duration** | Medium-term (3) | Medium-term (3) |
| **Magnitude** | Moderate (6) | Low (4) |
| **Probability** | Probable (3) | Improbable (2) |
| **Significance** | **Medium (30)** | **Low (16)** |
| **Status (positive or negative)** | Negative | Negative |
| **Reversibility** | Low | Low |
| **Irreplaceable loss of resources?** | Yes | No |
| **Can impacts be mitigated?** | Yes | N/A |

**Mitigation:**

» Vehicles and equipment must travel within demarcated areas and not outside of the construction footprint;

» Unnecessary land clearance must be avoided;

| |
|---|
| » Where possible, conduct the construction activities outside of the rainy season; and<br>» Vehicles and equipment must park in designated parking areas. |
| Residual Impacts:<br>The residual impact from the construction and operation of the proposed Vrede solar PV facility on soil compaction is considered low. |

**Nature:** Soil pollution

The following construction activities can result in the chemical pollution of the soil:

» Petroleum hydrocarbon (present in oil and diesel) spills by machinery and vehicles during earthworks and the removal of vegetation as part of site preparation.
» Spills from vehicles transporting workers, equipment, and construction material to and from the construction site.
» The accidental spills from temporary chemical toilets used by construction workers.
» The generation of domestic waste by construction workers.
» Spills from fuel storage tanks during construction.
» Pollution from concrete mixing.
» Pollution from road-building materials.
» Any construction material remaining within the construction area once construction is completed.
» Containment breaches related to the battery units and any inadvertent chemical exposure therefrom.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent** | Local (1) | Local (1) |
| **Duration** | Short-term (2) | Short-term (2) |
| **Magnitude** | Moderate (6) | Low (4) |
| **Probability** | Low (4) | Improbable (2) |
| **Significance** | **Medium (36)** | **Low (14)** |
| **Status (positive or negative)** | Negative | Negative |
| **Reversibility** | Low | Low |
| **Irreplaceable loss of resources?** | Yes | No |
| **Can impacts be mitigated?** | Yes | N/A |

**Mitigation:**

» Maintenance must be undertaken regularly on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills;
» Any waste generated during construction, must be stored into designated containers and removed from the site by the construction teams.
» Any left-over construction materials must be removed from site.
» Ensure battery transport and installation by accredited staff / contractors.
» Compile (and adhere to) a procedure for the safe handling of battery cells during transport and installation.

**Residual Impacts:**
The residual impact from the construction and operation of the proposed project will be low to negligible.

## Operation Phase

**Nature:** Soil erosion

The areas where vegetation was cleared, will remain at risk of soil erosion, especially during a rainfall event when runoff from the cleared surfaces will increase the risk of soil erosion in the areas directly surrounding the Vrede solar PV facility.

| | **Without mitigation** | **With mitigation** |
|---|---|---|

| | | |
|---|---|---|
| **Extent** | Local (1) | Local (1) |
| **Duration** | Medium-term (3) | Medium-term (3) |
| **Magnitude** | Moderate (6) | Low (4) |
| **Probability** | Probable (3) | Improbable (2) |
| **Significance** | **Medium (30)** | **Low (16)** |
| **Status (positive or negative)** | Negative | Negative |
| **Reversibility** | Low | Low |
| **Irreplaceable loss of resources?** | Yes | No |
| **Can impacts be mitigated?** | Yes | N/A |

**Mitigation:**

» The area around the development footprint must regularly be monitored to detect early signs of soil erosion on-set.

» If soil erosion is detected, the area must be stabilised by the use of geo-textiles and facilitated re-vegetation.

**Residual Impacts:**
The residual impact from the operation of the proposed Vrede solar PV facility on the susceptibility to erosion is considered low.

**Nature:** Soil pollution

During the operational phase, potential spills and leaks from maintenance vehicles and equipment as well as waste generation on site, can result in soil pollution. Also, any failure of the fuel storage containers or equipment can be a source of soil pollution.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent** | Local (1) | Local (1) |
| **Duration** | Short-term (2) | Short-term (2) |
| **Magnitude** | Moderate (6) | Low (4) |
| **Probability** | Low (4) | Improbable (2) |
| **Significance** | **Medium (36)** | **Low (14)** |
| **Status (positive or negative)** | Negative | Negative |
| **Reversibility** | Low | Low |
| **Irreplaceable loss of resources?** | Yes | No |
| **Can impacts be mitigated?** | Yes | N/A |

**Mitigation:**

» Maintenance must be undertaken regularly on all vehicles and maintenance machinery to prevent hydrocarbon spills;

» No domestic and other waste must be left at the site and must be transported with the maintenance vehicles to an authorised waste dumping area.

**Residual Impacts:**
The residual impact from the operation of the proposed project will be low to negligible.

### Decommissioning Phase

The decommissioning phase will have the same impacts as the construction phase i.e. soil erosion, soil compaction and soil pollution. It is anticipated that especially the risk of soil erosion will remain until the vegetation growth has re-established in the area where the Vrede solar PV facility will be decommissioned.

### *8.8.4 Implications for Project Implementation*

The agricultural specialist determined that even though the development footprint includes areas with High agricultural sensitivity, this application may be considered favourably. The area has not been used for crop production since 2005 (according to the land owner) and aerial imagery has confirmed that the area has not been used for annual crops at least the past ten years. The landowner also indicated that crop farming is not a viable option and that he will not return the fields to crop fields again. The farm is currently used for commercial cattle production of 35 head of cattle and can at most provide employment for two farmworkers.

In contrast to that, the proposed Vrede Solar PV Facility will contribute a significant amount of expenditure to the area and employ more than 230 workers during the construction phase and more than 17 workers during the operational phase. In the light of the high number of employment opportunities that will be created per hectare of land, the proposed Vrede solar PV facility is considered an acceptable land use change.

Considering the results of the specialist assessment, the project is considered acceptable on the condition that the mitigation measures stipulated in the report (refer **Appendix G**) are followed to prevent soil erosion and soil pollution and to minimise impacts on the veld quality of the farm portions that will be affected. The project infrastructure should also remain within the proposed footprint boundaries that will be fenced off and the construction corridor around the access road must be as narrow as possible.

## 8.9. Risks Associated with the Battery Energy Storage System

A Battery Energy Storage Systems (BESS) will allow for energy storage for an extended period (of up to 4 hours). The general purpose and utilisation of the BESS will be to save and store excess electrical output from the facility as it is generated, allowing for a timed release to the national grid when the capacity is required. The BESS will be contained within insulated containers on site and will connect to the on-site facility substation via underground cabling which will follow the internal access roads of the facility.

The risks associated with battery technologies are generally well understood and researched. The primary risks relate to fire hazards and the potential for a condition known as 'thermal runaway'. Thermal runaway occurs in situations where an increase in temperature changes the conditions in a way that causes a further increase in temperature, often leading to a destructive result. The risks detailed in the table below considers only the risks associated with on-site use of battery energy storage systems for PV facilities.

Possible risks associated with the construction and operation of the BESS from a technical perspective within the development footprint of Vrede Solar PV Facility are limited to health and safety aspects during the project life cycle of the BESS as well as the solar energy facility. The risks identified for the construction and operation of the BESS are detailed in the table overleaf. Mitigation measures have been included within the project EMPr (refer to **Appendix K**).

| Nature of Risk | Likelihood | Impact | Mitigation / Management of Risk |
|---|---|---|---|
| 1. Mechanical breakdown/ Exposure to high temperatures<br>» Incidents where the batteries are broken or exposed to temperature above room temperature could lead to overheating as well as fires which can affect infrastructure components of the IESS.<br>» Leakages of substances contained within the battery cells (should they not be assembled off-site). | Low | » Fires, electrocutions and spillage of toxic substances into the surrounding environment.<br>» Spillage of hazardous substances into the surrounding environment.<br>» Soil contamination – leachate from spillages which could lead to an impact of the productivity of soil forms in affected areas.<br>» Water Pollution – spillages into surrounding watercourses as well as groundwater.<br>» Health impacts – on the surrounding communities, particularly those relying on watercourses (i.e. rivers, streams, etc) as a primary source of water. | Operators are trained and competent to operate the BESS. Training should include the discussion of the following:<br>* Potential impact of electrolyte spills on groundwater;<br>* Suitable disposal of waste and effluent;<br>* Key measures in the EMPr relevant to worker's activities;<br>* How incidents and suggestions for improvement can be reported.<br>» Training records should be kept on file and be made available during audits.<br>» Battery supplier user manuals safety specifications and Material Safety Data Sheets (MSDS) are filed on site at all times.<br>» Compile method statements for approval by the Technical/SHEQ Manager for the operation and management and replacement of the battery units / electrolyte for the duration of the project life cycle. Method statements should be kept on site at all times.<br>» Provide signage on site specifying the types of batteries in use and the risk of exposure to hazardous material and electric shock. Signage should also specify how electrical and chemical fires should be dealt with by first responders, and the potential risks to first responders (e.g. the inhalation of toxic fumes, etc.).<br>» Firefighting equipment should readily be available at the IESS area and within the site.<br>» Maintain strict access control to the BESS area.<br>» Ensure all maintenance contractors / staff are familiar with the supplier's specifications.<br>» Undertake daily risk assessment prior to the commencement of daily tasks at the BESS. This should consider any aspects which could result in fire or spillage, and appropriate actions should be taken to prevent these.<br>» Standard Operating Procedures (SOPs) should be made available by the Supplier to ensure that the batteries are handled in accordance with required best practices.<br>» Spill kits must be made available to address any incidents associated with the flow of chemicals from the batteries into the surrounding environment.<br>» The assembly of the batteries on-site should be avoided as far as possible. Activities on-site for the BESS should only be limited to the placement of the container wherein the batteries are placed. |

| *Nature of Risk* | *Likelihood* | *Impact* | *Mitigation / Management of Risk* |
|---|---|---|---|
| | | | » Undertake periodic inspections on the BESS to ensure issues are identified timeously and addressed with the supplier where relevant.<br>» The applicant in consultation with the supplier must compile and implement a Leak and Detection Monitoring Programme during the project life cycle of the BESS.<br>» Batteries must be strictly maintained by the supplier or suitably qualified persons for the duration of the project life cycle. No unauthorised personnel should be allowed to maintain the BESS. |
| 2. <u>Generation of hazardous waste</u><br>» The incorrect disposal of the batteries and the associated components could have an adverse impact on the environment. | Medium | » Spillage of hazardous substances into the surrounding environment.<br>» Soil contamination – leachate from the disposed batteries into the soil, which could lead to an impact of the productivity of soil forms in affected areas.<br>» Water pollution – leachate from the disposed batteries spilling into surrounding watercourses as well as groundwater.<br>» Health impacts – on the surrounding communities, particularly those relying on watercourses (i.e. rivers, streams, etc) as a primary source of water. | » Damaged and used batteries must be removed from site by the supplier or any other suitably qualified professional for recycling or appropriate disposal.<br>» The applicant should obtain a cradle to grave battery management plan from the supplier during the planning and design phase of the system. The plan must be kept on site and adhered to. |

## 8.10. Assessment of the 'Do Nothing' Alternative

The 'do-nothing' alternative (i.e. no-go alternative) is the option of not constructing the Vrede Solar PV Facility. Should this alternative be selected, there would be no environmental impacts on the site due to the construction and operation activities of the Vrede Solar PV Facility.

**a) Land use and agriculture**

Although there are some areas of high potential soils present within the development area , the specialist has concluded that the project is considered acceptable on the condition that the mitigation measures stipulated in the specialist report (refer **Appendix G**) are followed to prevent soil erosion and soil pollution and to minimise impacts on the veld quality of the farm portions that will be affected. The landowner also indicated that crop farming is not a viable option and that he will not return the fields to crop fields again. The farm is currently used for commercial cattle production of 35 head of cattle and can at most provide employment for two farmworkers. The proposed Vrede Solar PV Facility will contribute a significant amount of expenditure to the area and employ more than 230 workers during the construction phase and more than 17 workers during the operational phase. In the light of the high number of employment opportunities that will be created per hectare of land, the proposed Vrede solar PV facility is considered an acceptable land use change.

The implementation of the 'do-nothing' alternative would leave the land-use restricted to the current land use (i.e. grazing), losing out on the opportunity to generate renewable energy from solar energy in addition to current land use activities. Therefore, from a land-use perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of a viable and compatible land use for the broader study area which allows the current land-use activities to continue.

**b) Socio-economics**

The project has the potential to make a positive contribution towards the identified community needs. In terms of the economic development requirements of the REIPPP Programme, the project will commit benefits to the local community, in the form of job creation, localisation, and community ownership. In accordance with the DoE bidding requirements of the REIPPP Programme, a percentage of the revenue generated per annum during operation will be made available to local communities through a social beneficiation scheme. Therefore, the potential for creation of employment and business opportunities, and the opportunity for skills development for local communities is significant. Secondary social benefits can be expected in terms of additional spend in nearby towns due to the increased demand for goods and services. These socio-economic benefits would include an increase in the standard of living for local residents within the area as well as overall financial and economic upliftment.

The No-Development option would represent a lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy. Given South Africa's position as one of the highest per capita producer of carbon emissions in the world, this would represent a High negative social cost. The no-development option also represents a lost opportunity in terms of the employment and business opportunities (construction and operational phase) associated with the proposed SEF, and the benefits associated with the establishment of a Community Trust. This also represents a negative social cost.

Foregoing the proposed development would not necessarily compromise the development of renewable energy facilities in South Africa. However, the socio-economic benefits for local communities at this location and within the surrounding area would be forfeited.

Therefore, from a socio-economic perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of socio-economic benefits, when considering the current socio-economic conditions of the area.

**c) Regional scale impacts**

Should the no-go option be considered and implemented, the status quo pertaining to the requirement for additional capacity in the region will remain. As a result, the benefits associated with the introduction of renewable energy would not be realised. The Free State has an adequate solar resource and the Vrede Solar PV Facility is only proposed to contribute a contracted capacity of up to 100MW, which would assist in meeting the electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy and the energy mix. The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits include:

» Increased energy security;
» Resource saving (i.e. fossil fuels and water);
» Exploitation of South Africa's significant renewable energy resource;
» Pollution reduction;
» Climate friendly development;
» Support for international agreements;
» Employment creation;
» Acceptability to society; and
» Support to a new industry sector.

**d) Heritage**

In terms of the no-go option, the anticipated impacts to heritage resources will not materialise. In general, it is preferred that excavations take place into fossiliferous bedrock rather than avoiding impact as this allows palaeontologists access to otherwise inaccessible palaeontological resources. Furthermore, the no-go option will negate the anticipated socio-economic benefits indicated above and as such the no-go option is not preferred.

**e) Avifaunal**

The no-go alternative will result in the current status quo being maintained at the proposed development site as far as the avifauna is concerned. The development site itself consist mostly of natural grassland. The no-go option would maintain the natural grassland which would be beneficial to the avifauna currently occurring there.

### *8.10.1. Costs and Benefits associated with the Vrede Solar PV Facility*

Overall, the implementation of the Vrede Solar PV Facility at the proposed site is expected to result in a number of social and environmental costs and benefits.

Environmental costs identified for the project include:

- Direct loss of biodiversity, flora, fauna, and avifauna due to the clearing of land for the construction and utilisation of land for the project (which is limited to the development footprint). This impact is minimised through the placement of the Vrede Solar PV facility having considered the sensitivities determined by the specialists during the assessment process.
- Impact to major drainage features as a result of the development of the facility. Direct and indirect impact to drainage features can be avoided by implementation of specialist mitigation measures (demarcation of no-go and buffer areas etc.)
- Impacts associated with the presence of construction workers on local communities.
- Impacts related to the potential influx of jobseekers.
- Increased risks to livestock and farming infrastructure associated with the construction related activities and presence of construction workers on the site.
- Increased risk of grass fires associated with construction related activities.
- Noise, dust and safety impacts associated with construction related activities and vehicles.
- Impact on productive farmland.
- The visual impacts and associated impact on sense of place.
- Potential impact on tourism.

The positive implications of establishing the project on the demarcated site include:

- The project will result in important socio-economic benefits at the local and regional scale through job creation, procurement of materials and provision of services and other associated downstream economic development. These will persist during the pre-construction, construction and operation phases of development.
- The project contributes towards the Provincial and Local goals for the development of renewable energy as outlined in the respective IDPs.
- The project serves to diversify the economy and electricity generation mix of South Africa through the addition of solar energy development.
- Creation of employment and business opportunities, and opportunity for skills development and on-site training.
- The establishment of renewable energy infrastructure.
- Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training.
- Generation of additional income for the landowner.
- Benefits associated with the establishment of a Community Trust.

The costs associated with the project are anticipated to occur at a site specific level, the significance of which can be largely reduced through the application of appropriate mitigation measures, and through the appropriate placement of infrastructure within areas of lower sensitivity identified on site. Due to the fact that the benefits of the project are expected to occur at a larger scale (i.e. national, regional and local level), the expected benefits of the project are expected to partially offset the localised environmental costs of the project.

### *8.10.2. Impacts of the Do Nothing Alternative*

The following impacts are anticipated with the implementation of the "Do Nothing" option:

- Failure to provide power generation capacity from clean, renewable energy in accordance with the Department of Mineral Resources and Energy's (DMRE's) National Integrated Resource Plan (IRP).
- Failure to contribute to 100MW to energy generation mix to the national electricity grid (should the project be selected as Preferred Bidder), which in turn has the opportunity to stimulate economic growth and development
- Failure to realise the potential local economic development and social upliftment benefits associated with the implementation of project.

### *8.10.3. Conclusion*

The 'do-nothing' alternative will do little to influence the renewable energy targets set by government due to competition in the sector, and the number of renewable energy projects being bid to the Department of Energy. Not developing the Vrede Solar PV Facility would see such an opportunity being lost. As current land use activities can continue on the study area once the project is operational, the loss of the land to this project during the operation phase is not considered significant.

From the specialist studies undertaken, no environmental fatal flaws were identified to be associated with Vrede Solar PV Facility. All impacts associated with the project can be mitigated to acceptable levels. If the solar PV facility is not developed the following positive impacts will not be realised:

- Job creation and skills development from the construction and operation phases.
- Local and regional economic benefits associated with job creation and business opportunities.
- Economic benefit to participating landowners due to the revenue that will be gained from leasing the land to the developer.
- Meeting of the energy generation mix in a most economic and rapid manner.
- Provision of clean, renewable energy in an area where the energy resource is optimally available.

As detailed above, the 'do-nothing' alternative will result in a number of lost opportunities. The 'do nothing' alternative is, therefore, not preferred and not proposed to be implemented for the development of Vrede Solar PV Facility.

# CHAPTER 9: ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS

As identified and assessed in Chapter 8, the Vrede Solar PV Facility may have impacts (positive and negative) on natural resources, the social environment and on the people living in the project area. The preceding impact assessment chapter has reported on the assessment of the impacts associated with the project largely in isolation (from other similar developments).

The REIPPP Programme has been rolled out in bid windows (rounds) since 2011, in which developers submit planned renewable energy projects for evaluation and selection. The bid selection process considers a number of qualification and evaluation criteria. The proposed tariff, as well as socio-economic development contributions by the project and the bidder are the main basis for selection after the qualification criteria have been met. As a result of the REIPPP Programme, there has been a substantial increase in interest in PV facility developments in South Africa with a number of PV facilities selected as Preferred Bidder projects and 82 PV facilities currently operational (Energyblog, 2021). It is, therefore, important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts are considered and avoided where possible.

This chapter assesses the potential for the impacts associated with the project to become more significant when considered in combination with other large-scale solar power generation developments in the area.

## 9.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of a Environmental Impact Assessment Report

This chapter of the EIA report includes the following information required in terms of the EIA Regulations, 2014 - Appendix 3: Content of EIA Report:

| Requirement | Relevant Section |
|---|---|
| 3(j)(i) an assessment of each identified potentially significant impact and risk, including cumulative impacts. | The cumulative impacts associated with the Vrede Solar PV development are included and assessed within this chapter. |

## 9.1 Approach taken to Assess Cumulative Impacts

The cumulative impacts that have the potential to be compounded through the development of the Vrede Solar PV Facility and its associated infrastructure in proximity to other similar developments include impacts such as those listed below. The role of the cumulative assessment is to test if such impacts are relevant to the Vrede Solar PV Facility within the project site being considered for the development:

- Unacceptable loss of habitat or landscape connectivity through clearing, resulting in an impact on the conservation status of such flora, fauna or ecological functioning;
- Unacceptable risk to avifauna through loss of avifaunal habitats;
- Unacceptable risk to aquatic resources through disturbance associated with construction activities and increased runoff and erosion during the operation phase;
- Unacceptable loss of high agricultural potential areas presenting a risk to current land use activities and increased soil erosion;

- Unacceptable loss of heritage resources (including palaeontological and archaeological resources);
- Complete or whole-scale change in sense in visual quality of the landscape representing an unacceptable visual intrusion;
- Unacceptable impact to socio-economic factors and components.

It is important to explore the potential for cumulative impacts as this will lead to a better understanding of these impacts and the potential for mitigation that may be required. The scale at which the cumulative impacts are assessed is important. For example, the significance of the cumulative impact on the regional or national economy will be influenced by PV facility developments throughout South Africa, while the significance of the cumulative impact on visual amenity may only be influenced by PV facility developments that are in closer proximity to each other. For practical purposes, a sub-regional scale of 30km has been selected for this cumulative impact evaluation. The potential for cumulative impacts is summarised in the sections which follow and has been considered within respective specialist studies in varying degrees (refer to **Appendices D – J**).

**Figure 9.1** indicates the location of the Vrede Solar PV Facility in relation to all known and viable solar power generation developments located within a radius of 30km from the project site, including both solar PV and Concentrated Solar Power (CSP) facilities. These developments were identified using information available in the public domain at the time of this assessment.

It should be noted that not all the solar facilities presently under consideration by various developers will be built for operation. Not all proposed developments will be granted the relevant permits by the relevant authorities (DEFF, DOE, NERSA) due to the following reasons:

- There may be limitations to the capacity of the existing or future Eskom grid;
- Not all applications will receive a positive environmental authorisation;
- There are stringent requirements to be met by applicants in terms of the REIPPP Programme and a highly competitive process that only selects the most competitive projects;
- Not all proposed PV facilities will be able to reduce the associated negative impacts to acceptable levels or be able to mitigate the impacts to acceptable levels (fatally flawed);
- Not all proposed facilities will eventually be granted a generation license by NERSA and sign a Power Purchase Agreement with Eskom; and
- Not all developers will be successful in securing financial support to advance their projects further.

The cumulative impacts of other known solar facilities (PV and CSP) in the surrounding area and the proposed Vrede Solar PV Facility are qualitatively assessed in this Chapter. The following potential impacts are considered:

- Cumulative impacts on ecological processes (including fauna and flora)
- Cumulative impacts on avifauna
- Cumulative impacts on freshwater resources
- Cumulative impacts on heritage resources (including archaeology and palaeontology)
- Cumulative visual impacts
- Cumulative social impacts
- Cumulative impacts on soil and agricultural potential

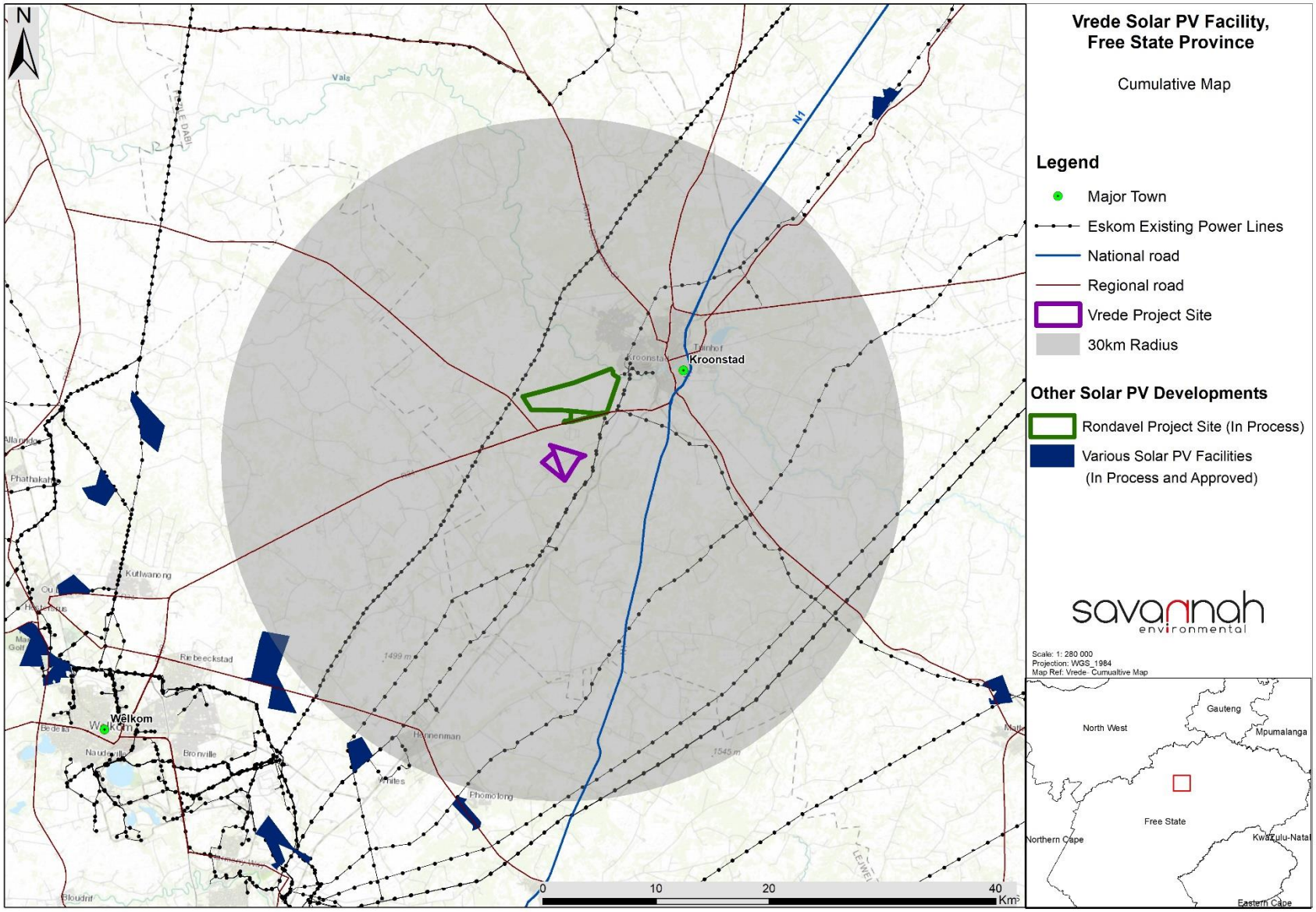


**Figure 9.1:** Cumulative map indicting the location of other solar energy developments within 30km of the Vrede Solar PV Facility site

## 9.2 Cumulative Impact on Ecological processes (including fauna and flora)

Cumulative impacts of developments on population viability of species can be reduced significantly if new developments are kept as close as possible to existing developed and/or transformed areas or, where such is not possible, different sections of a development be kept as close together as possible. Renewable energy facilities, like solar PVs should be constructed as close as possible to existing infrastructure or substations, and if several developments are planned within close proximity, these developments should be situated as close together as possible, not scattered throughout the landscape. In addition, new power lines should follow routes of existing servitudes if these exist.

Cumulative ecological impacts have been identified for the Vrede Solar PV Facility (refer to **Appendix D**). Only two other PV Solar projects are located within the 30 km radius and as such the cumulative impacts in the area was determined to be low. In terms of the cumulative impact on the endangered Vaal-Vet Sandy Grassland, small, fractured portions of this vegetation type are located within the Vrede Solar Energy Facility's project footprint with most of these areas being avoided within the proposed layout, whilst the proposed 75 MW PV Solar farm located to the south west of the proposed Vrede Solar Energy Facility (i.e. Steynsrus PV Facility near Welkom) is entirely located within this vegetation type. The cumulative impact of these developments on the Vaal-Vet Sandy Grassland is subsequently expected to be minimal and will not impact the conservation status and targets of this vegetation type.

The following cumulative ecological impacts were determined for the Vrede Solar PV Facility:

| Impact Nature: Reduced ability to meet conservation obligations and targets (Cumulative Impact).<br><br>The loss of unprotected vegetation types on a cumulative basis from the broader area impacts the country's ability to meet its conservation targets | | |
|---|---|---|
| | Overall impact of the proposed project considered in isolation | Cumulative impact of the project and other projects within the area |
| Extent | Local (1) | Regional (3) |
| Duration | Long Term (4) | Long-Term (4) |
| Magnitude | Small (1) | Low (4) |
| Probability | Improbable (2) | Improbable (2) |
| Significance | Low (12) | Low (22) |
| Status | Slightly Negative | Slightly Negative |
| Reversibility | Low | Low |
| Irreplaceable loss of resources | No | No |
| Can impacts be mitigated? | Yes, to a large extent | |
| Mitigation<br>» The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas.<br>» An open space management plan should be developed for the site, which should include management of biodiversity within the fenced area, as well as that in the adjacent rangeland.<br>» Reduce the footprint of the facility within sensitive habitat types as much as possible. | | |

| Impact Nature: Impacts on Critical Biodiversity Areas and Broad-Scale Ecological Processes (Cumulative Impact) |
|---|

| Transformation of intact habitat could potentially compromise ecological processes of CBAs as well as ecological functioning of important habitats and would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations. | | |
|---|---|---|
| | Overall impact of the proposed project considered in isolation | Cumulative impact of the project and other projects within the area |
| Extent | Local (1) | Regional (2) |
| Duration | Long Term (4) | Long Term (4) |
| Magnitude | Small (1) | Low (4) |
| Probability | Improbable (2) | Improbable (2) |
| Significance | Low (12) | Low (20) |
| Status | Neutral – Slightly Negative | Slightly Negative |
| Reversibility | Low | Low |
| Irreplaceable loss of resources | No | Likely |
| Can impacts be mitigated? | Yes, to a large extent | |

Mitigation

- The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas.
- An open space management plan should be developed for the site, which should include management of biodiversity within the fenced area, as well as that in the adjacent rangeland.
- Reduce the footprint of the facility within sensitive habitat types as much as possible.
- Small to medium sized mammals can be allowed to move between the development area and surrounding areas by creating artificial passageways underneath boundary fences (this is optional and may be implemented by developer if deemed necessary).

Impact Nature: Cumulative impacts due to nearby renewable energy developments (Cumulative Impact)

Cumulative loss of habitats (including sensitive habitats) and further increase in the fractured nature of the landscape may lead to the loss of features responsible for maintaining biodiversity and providing ecosystem goods and services and may potentially lead to:

- A change in the status of the Vaal-Vet Sandy Grassland, subsequently also reducing the ability to meet national conservation obligations and targets;
- A reduction in biodiversity and even the loss of some species from the area;
- Fracturing and isolation of landscapes may cut off important migration routes and prevent genetic variability thus reducing "genetic health" which may in turn lead to weaker species incapable to adapt and react to potential environmental changes and consequently also to a reduction in biodiversity and the extinction of some species from certain areas.
- The loss of CBAs which may lead to the province, being incapable to meet their required biodiversity pattern a process targets.
- The loss of important corridors essential for some species to allow for movement between important habitat types crucial for the survival of these species.

| | Overall impact of the proposed project considered in isolation | Cumulative impact of the project and other projects within the area |
|---|---|---|
| Extent | Local (1) | Regional (2) |
| Duration | Long Term (4) | Long Term (4) |
| Magnitude | Small (1) | Low (4) |
| Probability | Very Improbable (1) | Improbable (2) |
| Significance | Low (6) | Low (20) |

| | | |
|---|---|---|
| Status | Neutral | Slightly Negative |
| Reversibility | Low | Low |
| Irreplaceable loss of resources | No | Likely |
| Can impacts be mitigated? | Yes, to a large extent | |

Mitigation:

- The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas.
- An open space management plan should be developed for the site, which should include management of biodiversity within the fenced area, as well as that in the adjacent rangeland.
- Reduce the footprint of the facility within sensitive habitat types as much as possible.
- Small to medium sized mammals can be allowed to move between the development area and surrounding areas by creating artificial passageways underneath boundary fences (this is optional and may be implemented by developer if deemed necessary).

### 9.3 Cumulative Impact on Avifauna

The cumulative impact of the facility on priority avifauna within a 30km radius around the proposed development is assessed to be low, mainly due to the small size of the proposed development, and the small number of additional renewable energy projects.

**Nature:** Mortality and displacement of priority avifauna due to the construction of the PV facility and associated infrastructure

| | **Overall impact of the proposed project considered in isolation (post mitigation)** | **Cumulative impact of the project and other projects in the area (post mitigation)** |
|---|---|---|
| **Extent** | Local (1) | Local (1) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Moderate (6) | Low (2) |
| **Probability** | Highly probable (4) | Highly probable (4) |
| **Significance** | **Moderate (44)** | **Low (28)** |
| **Status (positive/negative)** | Negative | Negative |
| **Reversibility** | High | High |
| **Loss of resources?** | Yes | Yes |
| **Can impacts be mitigated?** | Yes, but only to some extent | Yes, but only to some extent |

**Mitigation:**

- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary degradation of habitat.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
- The mitigation measures proposed by the vegetation specialist must be strictly enforced.
- A 100m solar panel free buffer zone must be implemented around the pans (-27.736377° 27.134694°, -27.740910° 27.141575°, -27.741723° 27.144815°) to provide avifauna with unhindered access to the water.
- A 100m solar panel free buffer zone must be implemented on both sides of the drainage line on the development area, to maintain a corridor of woodland.
- It is recommended that a single perimeter fence is used.
- A bird-friendly pole design must be implemented. The pole design must be submitted to the avifaunal specialist for approval.

## 9.4 Cumulative Impact on Freshwater resources

Of the three renewable energy facilities, the 75MW PV solar farm located to the east of Riebeeckstad is located within the C4 secondary catchment primarily drained by the Vet River and associated tributaries, whilst the proposed Vrede and Rondavel Solar Energy Facilities is located within the C6 secondary catchment (Vals River and associated tributaries). Subsequently the SEF near Riebeeckstad will not contribute to the cumulative impact on the Vals River's catchment and subsequently the only SEFs likely to contribute to cumulative impacts, are the Vrede and Rondavel SEFs and as such only these two SEFs were taken into account.

Apart from these two SEFs, no other renewable energy project is currently planned within the Vals Rivers' catchment area and as such the expected cumulative impact on this freshwater resource will be very small.

A Freshwater Resource Study and Assessments was also undertaken, as part of the EIA process, for the proposed Rondavel SEF and this study also recommend the avoidance of any freshwater resource features and furthermore has also recommended aquatic buffers. The conclusion drawn from the Rondavel SEF is very similar to that drawn for this study in that the proposed layouts of these facilities indicated limited impacts on their aquatic environments as the proposed structures for the most part, have avoided the delineated wetlands. Based on the findings of the Rondavel study the relevant specialist found no objection to the authorisation of any of SEF inclusive of provided recommended mitigation measures and alternatives.

Probably the most significant potential impact associated with these projects are the modification of roughage (vegetation cover) and the creation of compacted and hard engineered surfaces with the catchment areas, leading to:

- Reduced infiltration; and
- The increase in surface runoff and sediments carried into downstream freshwater resource features.

For these projects concerned, the micro-placing of infrastructure in order to avoid direct impacts on delineated freshwater resources, and to accommodate for recommended buffers, are highly possible and will allow for the avoidance of freshwater resource features, furthermore, reducing the impacts on the aquatic ecosystems.

Both of the projects have indicated that this is their intention with regard to mitigation, i.e. selecting the best possible layout to minimise the local and regional impacts.

Subsequently it can be concluded that the cumulative impact of the proposed project would not be significant provided mitigation measures are implemented.

**Impact Nature**: Compromise of ecological processes as well as ecological functioning of important freshwater resource habitats

Transformation of intact freshwater resource habitat could potentially compromise ecological processes as well as ecological functioning of important habitats and would contribute to habitat fragmentation and potentially disruption of habitat connectivity and furthermore impair their ability to respond to environmental fluctuations. This is especially of relevance for larger watercourses and wetlands serving as important groundwater recharge and

| | | |
|---|---|---|
| floodwater attenuation zones, important microhabitats for various organisms and important corridor zones for faunal movement | | |
| | **Overall impact of the proposed project considered in isolation** | **Cumulative impact of the project and other projects within the area** |
| **Extent** | Local (1) | Local and Downstream areas (3) |
| **Duration** | Long Term (4) | Long Term (4) |
| **Magnitude** | Small (1) | Moderate (6) |
| **Probability** | Improbable (2) | Improbable (2) |
| **Significance** | **Low (12)** | **Low (26)** |
| **Status** | Neutral | Slightly Negative |
| **Reversibility** | Moderate to Low | Moderate to Low |
| **Irreplaceable loss of resources** | No | Limited loss of local resources |
| **Can impacts be mitigated?** | Yes | |
| **Mitigation**<br>» All wetland features and their associated buffer areas should be regarded as No-Go areas for all construction activities.<br>» The recommended buffer areas between the delineated freshwater resource features and proposed project activities should be maintained.<br>» Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.<br>» The potential stormwater impacts of the proposed developments areas should be mitigated on-site to address any erosion or water quality impacts.<br>» Good housekeeping measures as stipulated in the EMPr for the project should be in place where construction activities take place to prevent contamination of any freshwater features.<br>» Where possible, infrastructure should coincide with existing infrastructure or areas of disturbance (such as existing roads).<br>» Disturbed areas should be rehabilitated through reshaping of the surface to resemble that prior to the disturbance and vegetated with suitable local indigenous vegetation. | | |

## 9.5 Cumulative impacts on Heritage Resources (including archaeology and palaeontology)

Cumulative impacts on heritage resources have been identified for the Vrede Solar PV Facility (refer to **Appendix H**). Cumulative impact in terms of heritage was assessed by reviewing the renewable energy facilities and other development infrastructure that are proposed or developed within 20km of the development area. Three renewable Energy Facilities are proposed within 30km of this proposed development area. This includes the Rondawel SEF proposed to be located approximately 5km from the Vrede SEF as well as the approved Steynsrus PV Facilities located approximately 50km from the proposed Vrede SEF.

In addition, impacts to heritage result from all kinds of development and as such, this assessment of cumulative impacts to heritage was not limited to impact from renewable energy facilities. Of the 6 Heritage Assessments conducted within 20km of the proposed development area, four are for residential township developments. One is for a road upgrade and one is for a filling station. At this stage, there is the potential for the cumulative impact of proposed solar energy facilities to negatively impact the cultural landscape due to a change in the landscape character from rural agriculture to semi-industrial, however, due to the limited nature of the development the impact on the experience of the cultural landscape is not foreseen to be significant.

| **Nature:** Cumulative impact to the cultural sense of place. | | |
|---|---|---|
| | **Overall impact of the proposed project considered in isolation** | **Cumulative impact of the project and other projects in the area** |
| **Extent** | Local (1) | Local (1) |
| **Duration** | Medium term (3) | Long term (4) |
| **Magnitude** | Low (4) | Low (4) |
| **Probability** | Improbable (2) | Probable (3) |
| **Significance** | **Low (16)** | **Low (27)** |
| **Status (positive/negative)** | Neutral | Neutral |
| **Reversibility** | High | Low |
| **Loss of resources?** | Unlikely | Unlikely |
| Can impacts be mitigated? | N/A | |
| **Mitigation:**<br>No impacts are anticipated and as such, no mitigation is required | | |

## 9.6. Cumulative Visual impacts

The anticipated cumulative visual impact (refer **Appendix J**) of the two proposed PV facilities within the 30km radius considered is expected to be of moderate significance, which is considered to be acceptable from a visual perspective. This is mainly due to the relatively low viewer incidence within close proximity to the proposed development sites.

| **Nature of Impact:**<br>The potential cumulative visual impact of the solar energy facilities on the visual quality of the landscape. | | |
|---|---|---|
| | **Overall impact of the proposed project considered in isolation (with mitigation)** | **Cumulative impact of the project and other projects within the area (with mitigation)** |
| **Extent** | Local (2) | Regional (3) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Moderate (6) | High (8) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Moderate (36)** | **Moderate (45)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Reversible (1) | Reversible (1) |
| **Irreplaceable loss of resources?** | No | No |
| Can impacts be mitigated? | No, only best practise measures can be implemented | |
| **Generic best practise mitigation/management measures:**<br>Planning:<br>» Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude.<br>Operations:<br>» Maintain the general appearance of the facility as a whole.<br>Decommissioning:<br>» Remove infrastructure not required for the post-decommissioning use.<br>» Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications. | | |

## 9.6 Cumulative Social impacts

Cumulative impacts related to the social environment have been assessed and are detailed here (refer **Appendix J**). The following cumulative impacts were determined by the social specialist:

- Visual impacts associated with the establishment of more than one SEF and the potential impact on the area's rural sense of place and character of the landscape.
- The establishment of a number of solar energy facilities in the MLM will create employment, skills development and training opportunities, creation of downstream business opportunities; and
- The establishment of a number of solar energy facilities in the MLM will create employment, skills development and training opportunities, creation of downstream business opportunities.

Due to the natural topography of the area the Rondavel PV site is not visible from the Vrede site. The potential cumulative impacts on the areas sense of place are therefore low. In addition, the potential cumulative benefits for the local and regional economy are considered significant and are associated with both the construction and operational phase of renewable energy projects and extend over a period of 20-25 years.

| **Nature:** Visual impacts associated with the establishment of more than one SEF and the potential impact on the area's rural sense of place and character of the landscape. | | |
|---|---|---|
| | **Overall impact of the proposed project considered in isolation** | **Cumulative impact of the project and other projects in the area** |
| **Extent** | Local (1) | Local and regional (2) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Low (4) | Low (4) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Low (27)** | **Medium (30)** |
| **Status (positive/negative)** | Negative | Negative |
| **Reversibility** | Yes. Solar energy plant components and other infrastructure can be removed. | |
| **Loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |
| **Confidence in findings:** High. | | |
| **Mitigation:**<br>The recommendations of the VIA should be implemented. | | |

| **Nature:** The establishment of a number of renewable energy facilities in the Moqhaka Local Municipality (MLM) has the potential to place pressure on local services, specifically medical, education and accommodation | | |
|---|---|---|
| | **Without Mitigation** | **With Mitigation[17]** |
| **Extent** | Local and regional (3) | Local and regional (1) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Moderate (6) | Minor (2) |
| **Probability** | Highly Probable (4) | Highly Probable (4) |

[17] The mitigation measures are linked to initiatives undertaken by Provincial and Local Government to address the additional demand for services and accommodation etc. created by the establishment of development renewable energy projects in the Upington Solar REDZ.

| | | |
|---|---|---|
| **Significance** | **Medium (52)** | **Low (28)** |
| **Status** | Negative | Negative |
| **Reversibility** | Yes. Solar energy plant components and other infrastructure can be removed. | |
| **Irreplaceable loss of resources?** | No | No |
| **Can impact be mitigated?** | Yes | |
| **Enhancement:**<br>The Free State Provincial Government, in consultation with the MLM and the proponents involved in the development of renewable energy projects in the MLM, should consider establishing a Development Forum to co-ordinate and manage the development and operation of renewable energy projects in the area with the specific aim of mitigating potential negative impacts and enhancing opportunities. This would include identifying key needs, including capacity of existing services, accommodation and housing and the implementation of an accredited training and skills development programmes aimed at maximising the opportunities for local workers to be employed during the construction and operational phases of the various proposed projects. These issues should be addressed in the Integrated Development Planning process undertaken by the MLM. | | |

| **Nature:** The establishment of a number of solar energy facilities in the MLM will create employment, skills development and training opportunities, creation of downstream business opportunities. | | |
|---|---|---|
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local and regional (3) | Local and regional (4) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Low (4) | Moderate (6) |
| **Probability** | Highly Probable (4) | Definite (5) |
| **Significance** | **Medium (44)** | **High (70)** |
| **Status** | Positive | Positive |
| **Reversibility** | Yes. Solar energy plant components and other infrastructure can be removed. | |
| **Irreplaceable loss of resources?** | No | No |
| **Can impact be mitigated?** | Yes | |
| **Enhancement:**<br>The proposed establishment of suitably sited renewable energy facilities within the MLM and NCP should be supported. | | |

## 9.7 Cumulative Agricultural and Soil impacts

Three cumulative impacts were determined from the Agricultural Agro-Ecosystem Assessment (refer **Appendix G**), all of which were rated either low or medium considering the impact in isolation, and medium within the broader cumulative context. Given there are no highly significant cumulative impacts, the development is considered acceptable from a cumulative agricultural and soil impact perspective.

| Nature: Cumulative impact of decrease in areas available for livestock farming<br><br>Decrease in areas with suitable land capability for cattle farming. | | |
|---|---|---|
| | Overall impact of the proposed project considered in isolation | Cumulative impact of the project and other projects in the area |
| Extent | Local (1) | Regional (2) |
| Duration | Short duration - 2-5 years (2) | Long-term (4) |
| Magnitude | Low (4) | Low (4) |
| Probability | Highly likely (4) | Highly likely (4) |

| | | |
|---|---|---|
| Significance | Low (28) | Medium (40) |
| Status (positive/negative) | Negative | Negative |
| Reversibility | High | Low |
| Loss of resources? | Yes | Yes |
| Can impacts be mitigated? | Yes | No |

Mitigation:

» The only mitigation measure for this impact is to keep the footprints of all renewable energy facilities as small as possible and to manage the soil quality by avoiding far-reaching soil degradation such as erosion.

**Nature:** Cumulative impact of areas susceptible to soil erosion

Increase in areas susceptible to soil erosion.

| | **Overall impact of the proposed project considered in isolation** | **Cumulative impact of the project and other projects in the area** |
|---|---|---|
| **Extent** | Local (1) | Regional (2) |
| **Duration** | Medium-term (3) | Medium-term (3) |
| **Magnitude** | Moderate (6) | Moderate (6) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Medium (30)** | **Medium (33)** |
| **Status (positive/negative)** | Negative | Negative |
| **Reversibility** | Low | Low |
| **Loss of resources?** | Yes | Yes |
| **Can impacts be mitigated?** | Yes | No |

**Mitigation:**

» Each of the projects should adhere to the highest standards for soil pollution prevention and management as defined in the Agricultural Agro-Ecosystem Assessment.

**Nature:** Cumulative impact of increased risk of soil pollution

Increase in areas susceptible to soil pollution

| | **Overall impact of the proposed project considered in isolation** | **Cumulative impact of the project and other projects in the area** |
|---|---|---|
| **Extent** | Local (1) | Regional (2) |
| **Duration** | Short-term (2) | Short-term (2) |
| **Magnitude** | Moderate (6) | Moderate (6) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Low (27)** | **Medium (30)** |
| **Status (positive/negative)** | Negative | Negative |
| **Reversibility** | Low | Low |
| **Loss of resources?** | Yes | Yes |
| **Can impacts be mitigated?** | Yes | No |

**Mitigation:**

» Each of the projects should adhere to the highest standards for soil pollution prevention and management as defined in the Agricultural Agro-Ecosystem Assessment.

## 9.8 Conclusions regarding Cumulative Impacts

Cumulative impacts are expected to occur with the development Vrede Solar PV Facility throughout all phases of the project life cycle and within all areas of study considered as part of this EIA Report. The main aim for the assessment of cumulative impacts is to test and determine whether the development will be acceptable within the landscape proposed for the development, and whether the loss, from an environmental and social perspective, will be acceptable without whole-scale change.

The significance of the cumulative impacts associated with the development of Vrede Solar PV Facility ranges from low to medium, depending on the impacts being considered. A summary of the cumulative impacts is included in **Table 9.1** below.

**Table 9.1:** Summary of the cumulative impact significance the Vrede Solar PV Facility within the project site.

| Specialist assessment | Overall significance of impact of the proposed project considered in isolation | Cumulative significance of impact of the project and other projects in the area |
|---|---|---|
| Ecology | Low | Low |
| Avifauna | Medium | Low |
| Freshwater | Low | Low |
| Heritage | Low | Low |
| Socio-Economic | Low (Negative)<br>Low (Negative)<br>High (Positive) | Medium (Negative)<br>Low (Negative)<br>High (Positive) |
| Visual | Medium | Medium |
| Agriculture potential and soil | Low<br>Medium<br>Low | Medium<br>Medium<br>Medium |

There are only 2 other solar facilities proposed within a 30km radius of the Vrede Solar PV facility. Based on the specialist cumulative assessment and findings, the development Vrede Solar PV Facility and its contribution to the overall impact of all existing and proposed solar energy facilities within a 30km radius, it can be concluded that cumulative impacts will be of a low to medium significance, with only a high positive impact determined in terms of social cumulative impacts. Therefore, the development of Vrede Solar PV Facility will not result in unacceptable, high cumulative impacts and will not result in a whole-scale change of the environment, and is therefore considered acceptable from a cumulative impact perspective.

# CHAPTER 10: CONCLUSIONS AND RECOMMENDATIONS

South Africa Mainstream Renewable Power Developments (Pty) Ltd ('Mainstream') is proposing the construction and operation of the 100MWac Vrede Photovoltaic (PV) Solar Energy Facility (hereafter known as 'the Vrede Solar PV Facility'), Battery Energy Storage System (BESS) and associated infrastructure located near the town of Kroonstad in the Moqhaka Local Municipality (Fezile Dabi District) of the Free State Province of South Africa. The facility will be located within the Remaining extent of the Farm Vrede No. 1152, and Portion 1 of the Farm Uitval No. 1104. The Vrede Solar PV facility will be connected to the grid via a separately authorised grid connection solution, which will consist of a 132kV distribution line from the on-site 33/132kV Eskom substation via a loop in loop out into the Eskom 132kV Kroonstad Municipality – Theseus 1 Switching Station power line.

The Vrede Solar PV Facility comprises the following:

- Solar Arrays:
  - Solar Panel Technology - Mono and Bifacial Photovoltaic (PV) Modules;
  - Mounting System Technology – single axis tracking, dual axis tracking or fixed axis tracking PV;
  - Underground cabling (up to 33kV)
  - Centralised inverter stations or string inverters; Power Transformers;
- Building Infrastructure
  - Offices;
  - Operational control centre;
  - Operation and Maintenance Area / Warehouse / workshop;
  - Ablution facilities;
  - Battery Energy Storage System;
  - Substation building.
- Electrical Infrastructure
  - 33/132kV Independent Power Producer (IPP) onsite substation including associated equipment and infrastructure
  - Underground cabling and overhead power lines (up to 33kV)
- Associated Infrastructure:
  - Access roads and Internal gravel roads;
  - Fencing and lighting;
  - Lightning protection
  - Permanente laydown area;
  - Temporary construction camp and laydown area;
  - Telecommunication infrastructure;
  - Batching plant (if required);
  - Stormwater channels; and
  - Water pipelines

A development area of approximately 263ha has been identified within the project site by the proponent for the development. Site-specific studies and assessments have delineated areas of potential sensitivity within the identified project site. These have been excluded from the layout proposed for the facility (refer to **Figure 10.1**).

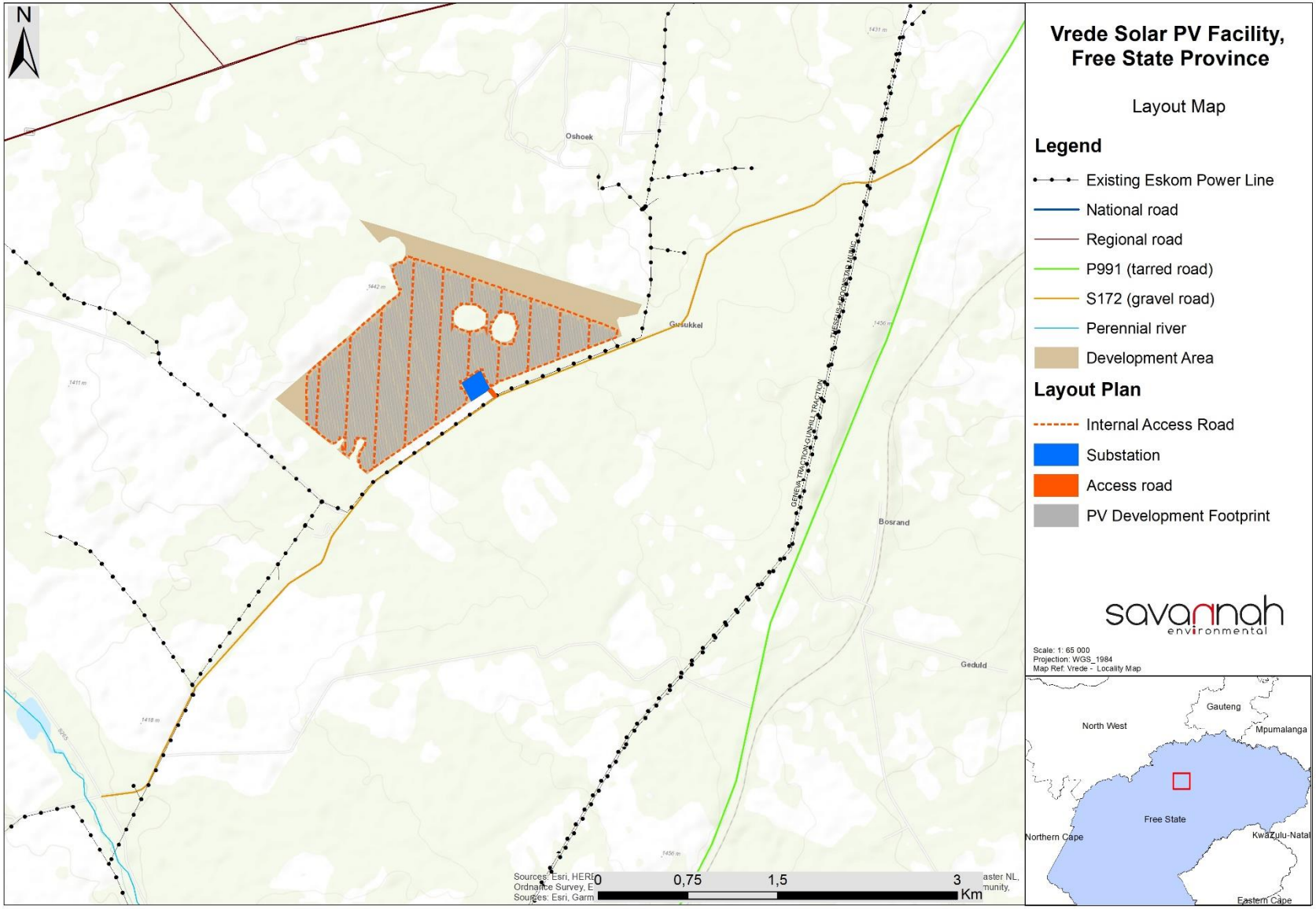


**Figure 10.1:** Layout of the Vrede Solar PV facility assessed within the EIA process

## 10.1 Legal Requirements as per the EIA Regulations, 2014 (as amended). For the undertaking of an EIA Report

This chapter of the EIA report includes the following information required in terms of Appendix 2: Content of EIA Report.

| Requirement | Relevant Section |
|---|---|
| 3(k) where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report | A summary of the findings of the specialist studies undertaken for Vrede Solar PV facility has been included in section 10.2. |
| 3(l) an environmental impact statement which contains (i) a summary of the key findings of the environmental impact assessment, (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives. | An environmental impact statement containing the key findings of the environmental impacts of Vrede Solar PV facility has been included as section 10.5. Sensitive environmental features located within the study area and development area, overlain with the proposed development footprint have been identified and are shown in Figure 10.1. A summary of the positive and negative impacts associated with Vrede Solar PV facility infrastructure has been included in section 10.2. |
| h (xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity. | A concluding statement indicating the preferred alternatives and the preferred location of the activity is included in section 10.5. |
| 3(n) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation. | All conditions required to be included in the Environmental Authorisation of the Vrede Solar PV facility have been included in section 10.5. |
| 3(p) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation. | A reasoned opinion as to whether Vrede Solar PV facility should be authorised has been included in section 10.5. |

## 10.2 Evaluation of the Vrede Solar PV facility

The preceding chapters of this report together with the specialist studies contained within **Appendices D-J** provide a detailed assessment of the potential impacts that may result from the development of proposed Vrede Solar PV facility. This chapter concludes the environmental assessment of Vrede Solar PV facility and associated infrastructure by providing a summary of the results and conclusions of the assessment of the development area. In so doing, it draws on the information gathered as part of the EIA process, the knowledge gained by the environmental specialists and the EAP and presents a combined and informed opinion of the environmental impacts associated with the project.

No environmental fatal flaws were identified in the detailed specialist studies conducted, provided that the recommended mitigation measures are implemented. These measures include, amongst others, the avoidance of features of high sensitivity within the project development area by the development footprint and the undertaking of monitoring, as specified by the specialists. As shown in Figure 10.1, areas of sensitivity have been avoided by the appropriate placement of infrastructure planned for the facility.

The potential environmental impacts associated with Vrede Solar PV Facility identified and assessed through the EIA process include:

» Impacts on ecology, flora and fauna;
» Impacts on freshwater resources;
» Impacts on avifauna;
» Visual impacts on the area imposed by the components of the facility;
» Impacts on heritage resources, including archaeology and palaeontology;
» Socio- economic impacts;
» Impacts to soils and agricultural potential;
» Risks associated with the BESS; and
» Cumulative impacts.

### *10.2.1 Impacts on Ecology (including flora and fauna)*

The Terrestrial Ecology Assessment (**Appendix D**) undertaken determined that there are no impacts associated with the Vrede Solar PV Facility that cannot be mitigated to an acceptable level and as such, the assessed layout was considered acceptable. The most significant potential impacts expected to occur with the development of the proposed Vrede Solar PV Facility are:

» Reduction of a stable vegetation cover and associated below-ground biomass that currently increases soil surface porosity, water infiltration rates and thus improves the soil moisture availability. Without the vegetation, the soil will be prone to extensive surface capping, leading to accelerated erosion and further loss of organic material and soil seed reserves from the local environment.
» Disturbed vegetation in the study area carries a high risk of invasion by alien invasive plants, which may or may not be present in the study area or nearby. The control and continuous monitoring and eradication of alien invasive plants will form and integral part of the environmental management of the facility from construction up to decommissioning.

The majority of impacts associated with the development would occur during the construction phase as a result of the disturbance associated with the operation of heavy machinery at the site and the presence of construction personnel.

The footprint of the development is confined to an area of less than 217 ha, located mostly in an area transformed through historical cultivation practices and overgrazing, and bush encroachment. Approximately 30% of the project site is situated within a CBA1, mainly due to its location within the Vaal-Vet Sandy Grassland which is classified as an Endangered Ecosystem (Mucina & Rutherford, 2006 and National Ecosystem List, GN1002 of 2011). However, during this study it was determined that most of these areas identified as Natural Vaal-Vet Sandy Grassland have been historically subjected to cultivation and vegetation transformation, with small patches of remaining natural vegetation, resembling natural, untransformed Vaal-Vet Sandy Grassland. These patches of natural grassland, collectively, only cover an area of less than 15% of the proposed project site. Furthermore, most of these patches of natural Vaal-Vet Sandy Grassland along the northern boundary will be avoided, according the development layout. Although the development will impact at a small local scale it is highly unlikely that this development will impact on the status of this vegetation type (impact on a regional scale) as the majority of the development will occur, as mentioned, within mostly transformed habitats.

Sensitive habitat types such as riparian fringes, seepages and other wetland habitat types are avoided (including buffer areas around these habitats) within the current layout and subsequently these areas will not be threatened by the development.

Consequently, there are no highly significant impacts present at the site which cannot be mitigated to a low level and which would represent a red flag for the development, and the development is considered acceptable from an ecological perspective. General Development Recommendations from the specialist assessment include:

- To prevent the onset of accelerated erosion, it is recommended that vegetation clearing be limited to clearing high shrubs, all invasive trees and other alien invasives, even if that means that remaining vegetation will be subjected to vehicle damage (from which it can recover over time). Grading should only be done where absolutely necessary and to mitigate existing erosion channels. If extensive grading will become necessary, it will be advisable to create contour buffer strips to slow down runoff and prevent erosion, which could develop into gully erosion damaging the development in the long run as well.
- It is currently not known which species will be able to persist under the shading of PV arrays, but the establishment of the naturally occurring *Cynodon dactylon* (couch grass), a low creeping grass, should be encouraged. Its dense and deep rooting system will spread to stabilise soil, whilst potentially dense mats could greatly reduce rain splash impact. In addition, its stature and biomass would be too low to present a fire risk.
- All indigenous shrubs that will be cleared should be shredded and added to the soil as mulch.
- Alien species must be removed entirely from site and not used as mulch to prevent the spread of regenerative material.

### *10.2.2 Impacts on Freshwater Resources*

Solar energy facilities require an initial high intensity disturbance of a fairly large surface area including the clearance of the vegetation cover and the levelling of earth on different terraces where necessary and the compaction of local soil within the development footprint. Concrete foundations for the framework on which the PV panels will be mounted. Soil disturbance, vegetation clearance and hardened surfaces will also be associated with the construction of access and internal roads within the PV solar facility. The internal substation would also need to be constructed within the site. Temporary laydown and storage areas would need to be placed within the site for the construction works.

The Freshwater Resources Assessment (**Appendix F**) identified a number of wetland areas within the development area and were defined as no-go areas. As indicated in Figure 10.1, these features have been avoided by the proposed layout. Indirect impacts on wetland features are however still possible during the construction and operational phases of the project. With the implementation of mitigation measures, impacts will be localised, short-term and of low intensity and is expected to have a moderate-low to low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Based on the findings of the Freshwater Resources Impact Assessment there is no objection to the authorisation of the proposed activities.

### *10.2.3 Impacts on Avifauna*

The Avifauna Assessment (**Appendix E**) identified a number of avifauna species using the site, i.e. Egyptian Goose, Fiscal Flycatcher, the South African Shelduck and the Fairy Flycatcher. The avifaunal specialist determined that a 100m solar panel free buffer zone must be implemented around the pans on site (-27.736377° 27.134694°, -27.740910° 27.141575°, -27.741723° 27.144815°) to provide avifauna with unhindered access to the water. In addition, a 100m solar panel free buffer zone must be implemented on both sides of the drainage line on the development area, to maintain a corridor of woodland. The layout presented in **Figure 10.1** above considers the above sensitives by exclusion of these areas from the development footprint and facility layout.

Potential impact associated with the project were identified to include:

Construction
» Displacement of priority species due to disturbance associated with construction of the PV plant and associated infrastructure;
» Displacement of priority species due to habitat transformation associated with construction of the PV plant and associated infrastructure.

Operation
» Mortality of priority species due to collisions with solar panels;
» Entrapment of large-bodied birds in the double perimeter fence;
» Mortality of priority species due to electrocution on the 33kV internal reticulation network.

Decommissioning
» Displacement of priority species due to disturbance associated with decommissioning of the PV plant and associated infrastructure

Cumulative
» Cumulative impact of displacement due to construction and habitat transformation, collisions with solar panels and entrapment in fences.

It was concluded that the proposed facility will have a medium to low negative impact on priority avifauna following mitigation, with no high sensitivity impacts determined. The development is supported provided the mitigation measures listed in this report is strictly implemented. No fatal flaws were discovered in the course of the investigations.

### *10.2.4 Visual Impacts*

The findings of the Visual Impact Assessment (**Appendix I**) undertaken for the proposed 100MWac PV facility is that the visual environment surrounding the site, especially within a 1 - 3km radius, may be visually impacted during the anticipated operational lifespan of the facility (i.e. a minimum of 20 years). The following impacts were determined by the visual specialist:

Construction
» Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed solar energy facility.

Operation

» Visual impact on observers travelling along the S172 secondary road and residents at homesteads within a 1km radius of the solar energy facility structures;
» Visual impact on observers travelling along the roads and residents at homesteads within a 1 – 3km radius of the PV facility structures;
» Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed facility;
» The visual impact of solar glint and glare as a visual distraction and possible air travel hazard;
» Visual impact of the ancillary infrastructure during the operation phase on observers in close proximity to the structures;
» The potential impact on the sense of place of the region.

Cumulative

» The potential cumulative visual impact of the solar energy facilities on the visual quality of the landscape.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from moderate to low significance. Anticipated visual impacts on sensitive visual receptors (if and where present) in close proximity to the proposed facility are not considered to be fatal flaws for the proposed PV facility.

Considering all factors, it is recommended that the development of the facility as proposed be supported; subject to the implementation of the recommended mitigation measures (Section 6.10.) and management programme as provided in the specialist report.

### *10.2.5 Impacts on Heritage Resources (archaeological and paleontological)*

The area proposed for the development of the Vrede Solar Energy facility was thoroughly assessed in the field assessment as detailed in the Heritage Impact Assessment (Refer **Appendix H**). It was noted that the area proposed for development has been historically disturbed through agricultural activities. Based on the outcomes of this assessment, it is not anticipated that the proposed development of the SEF at Vrede will negatively impact on any archaeological heritage resources. However, due to the nature of archaeological resources, it is possible that significant archaeological heritage may exist below the ground surface and as such, mitigation measures are recommended in this regard below.

The overall palaeontological sensitivity of the areas proposed for the Vrede and Rondavel SEFs and their associated infrastructure is high to very high. The field survey identified a number of areas of possibly fossiliferous outcrops of the underlying bedrock. In addition, examples of fossilised wood were identified on a neighbouring property. Although ex situ, these findings corroborate the high palaeontological sensitivity of the area. In general, it is preferred that excavations take place into fossiliferous bedrock rather than avoiding impact as this allows palaeontologists access to otherwise inaccessible palaeontological resources. The negative impacts of such excavations to palaeontological resources are managed through careful monitoring of excavations into bedrock by a suitably qualified palaeontologist. It is therefore preferable that excavations do indeed take place on condition that these excavations are properly monitored.

There is no objection to the proposed development on heritage grounds on condition that:

» All excavations into bedrock are monitored by a suitably qualified palaeontologist and a report on the outcomes of the monitoring activities must be submitted to SAHRA on completion of the development of the facility.

- All other excavation activities are subject to the Palaeontological Chance Finds Procedure.
- Should any previously unrecorded archaeological resources or possible burials be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.

### *10.2.6 Social Impacts*

The Social Impact Assessment (**Appendix J**) indicated that the development of the proposed 100MWac Vrede Solar PV Facility will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust will also benefit the local community. The enhancement measures listed in the SIA report should be implemented in order to maximise the potential benefits. The significance of this impact is rated as High Positive. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the negative environmental and socio-economic impacts associated a coal-based energy economy and the challenges created by climate change, represents a significant positive social benefit for society as a whole. The findings of the SIA also indicated that the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has resulted in significant socio-economic benefits, both at a national level and at a local, community level. These benefits are linked to foreign Direct Investment, local employment and procurement and investment in local community initiatives. The establishment of the proposed 100 MWac Vrede Solar PV Facility was therefore supported by the findings of the SIA.

### *10.2.7 Impacts on Soil and Agricultural Potential*

The agricultural specialist determined that even though the development footprint includes areas with High agricultural sensitivity, this application may be considered favourably. The area has not been used for crop production since 2005 (according to the land owner) and aerial imagery has confirmed that the area has not been used for annual crops at least the past ten years. The landowner also indicated that crop farming is not a viable option and that he will not return the fields to crop fields again. The farm is currently used for commercial cattle production of 35 head of cattle and can at most provide employment for two farmworkers.

In contrast to that, the proposed Vrede Solar PV Facility will contribute a significant amount of expenditure to the area and employ 250-300 workers during the construction phase and more than 17 workers during the operational phase. In the light of the high number of employment opportunities that will be created per hectare of land, the proposed Vrede solar PV facility is considered an acceptable land use change.

Considering the results of the specialist assessment, the project is considered acceptable on the condition that the mitigation measures stipulated in the report (refer **Appendix G**) are followed to prevent soil erosion and soil pollution and to minimise impacts on the veld quality of the farm portions that will be affected. The project infrastructure should also remain within the proposed footprint boundaries that will be fenced off and the construction corridor around the access road must be as narrow as possible.

### *10.2.8. Risks Associated with the Battery Energy Storage System*

A Battery Energy Storage Systems (BESS) will allow for energy storage for an extended period (of up to 4 hours). The general purpose and utilisation of the BESS will be to save and store excess electrical output from the facility as it is generated, allowing for a timed release to the national grid when the capacity is required.

The BESS will be contained within insulated containers on site and will connect to the on-site facility substation via underground cabling which will follow the internal access roads of the facility.

The risks associated with battery technologies are generally well understood and researched. The primary risks relate to fire hazards and the potential for a condition known as 'thermal runaway'. Thermal runaway occurs in situations where an increase in temperature changes the conditions in a way that causes a further increase in temperature, often leading to a destructive result. The risks detailed in the table below considers only the risks associated with on-site use of battery energy storage systems for PV facilities.

Possible risks associated with the construction and operation of the BESS from a technical perspective within the development footprint of Vrede Solar PV Facility are limited to health and safety aspects during the project life cycle of the BESS as well as the solar energy facility. The risks identified for the construction and operation of the BESS are detailed in the table overleaf. Mitigation measures have been included within the project EMPr (refer to **Appendix K** and **R**).

### *10.2.9 Assessment of Cumulative Impacts*

Cumulative impacts are expected to occur with the development Vrede Solar PV Facility throughout all phases of the project life cycle and within all areas of study considered as part of this EIA Report. The main aim for the assessment of cumulative impacts is to test and determine whether the development will be acceptable within the landscape proposed for the development, and whether the loss, from an environmental and social perspective, will be acceptable without whole-scale change.

There are only 2 other solar facilities proposed within a 30km radius of the Vrede Solar PV facility. Based on the specialist cumulative assessment and findings, the development Vrede Solar PV Facility and its contribution to the overall impact of all existing and proposed solar energy facilities within a 30km radius, it was concluded that cumulative impacts will be of a low to medium significance, with only a high positive impact determined in terms of social cumulative impacts. Therefore, the development of Vrede Solar PV Facility will not result in unacceptable, high cumulative impacts and will not result in a whole-scale change of the environment, and is therefore considered acceptable from a cumulative impact perspective.

## 10.3 Environmental Sensitivity Mapping

As part of the specialist investigations undertaken within the project development area, specific environmental features and areas were identified. The environmental features identified within and directly adjacent to the development area and development footprint are illustrated in **Figure 10.2**. The features identified specifically relate to ecological and avifauna habitats and freshwater resources. The following points provide a description of those features of very high and high sensitivity identified within the development area:

- **Ecological features:**
  - All wetland features are deemed very high ecological sensitivity and a 30m no-go buffer around them is recommended. These are considered no-go regions.
  - High sensitivity areas (within which development is considered acceptable) includes primary grassland.
- **Freshwater features:**

- All wetland features are deemed high sensitivity and a 30m no-go buffer around them is recommended. These are considered no-go regions.

» **Avifaunal features:**

- Very High sensitivity (No solar panels – other infrastructure allowed): Surface water features. Included in this category are areas within 100m of the pans on the development area. It is important to leave open space for birds to access and leave the surface water area unhindered. Surface water is also important area for raptors to hunt birds which congregate around water troughs, and they should have enough space for fast aerial pursuit. It is important to note that this only excludes solar panels and not other associated infrastructure related to the development.
- Very High sensitivity (No solar panels – other infrastructure allowed): Drainage line woodland. Drainage lines are corridors of woodland which provide nesting and foraging opportunities for woodland species which are dependent on this habitat for their survival. The highest density of woodland and trees at the development area is concentrated around the drainage line. A 100m buffer zone should be implemented on both side of the drainage channel. It is important to note that this only excludes solar panels and not other associated infrastructure related to the development.

» **Soils and Agricultural Potential**

- The largest portion of the development area has land with Moderate (Class 08) land capability that is suitable for dryland crop production. A section along the northern boundary of the site has land with Moderate-High (Class 09) land capability. The remaining areas consist of land with Low-Moderate (Class 06) and Low (Class 05) land capability. The sensitivity rating of the site was also based on land capability classification of the site. Approximately 155.3ha has High agricultural sensitivity, 47.8ha has Medium sensitivity and 9.1ha has Low sensitivity. The development footprint includes areas of all three sensitivity categories. Development in all areas is considered to be acceptable.

## 10.4 Overall Conclusion (Impact Statement)

A technically viable development area and development footprint for the Vrede Solar PV facility was proposed by the developer and assessed as part of the EIA process. The environmental assessment of the development footprint (facility layout) within the development area was undertaken by independent specialists and their findings have informed the results of this EIA Report.

The specialist findings have indicated that there are no identified environmental fatal flaws associated with the implementation of Vrede Solar PV facility. The developer had proposed a technically viable layout for the project and associated infrastructure which has been assessed as part of the independent specialist studies. High sensitivity freshwater features, which are regarded as no-go areas, were identified within the development area. The design of the PV array and associated infrastructure to remain outside of this demarcated area minimises environmental impacts as far as possible. The proposed layout is therefore considered as the most appropriate from an environmental perspective and is considered to be acceptable within all fields of specialist study undertaken for the project. All impacts associated with the proposed layout can be mitigated to acceptable levels or enhanced through the implementation of the recommended mitigation or enhancement measures. The layout map included as **Figure 10.1** is considered to be the preferred facility layout for Vrede Solar PV Facility.

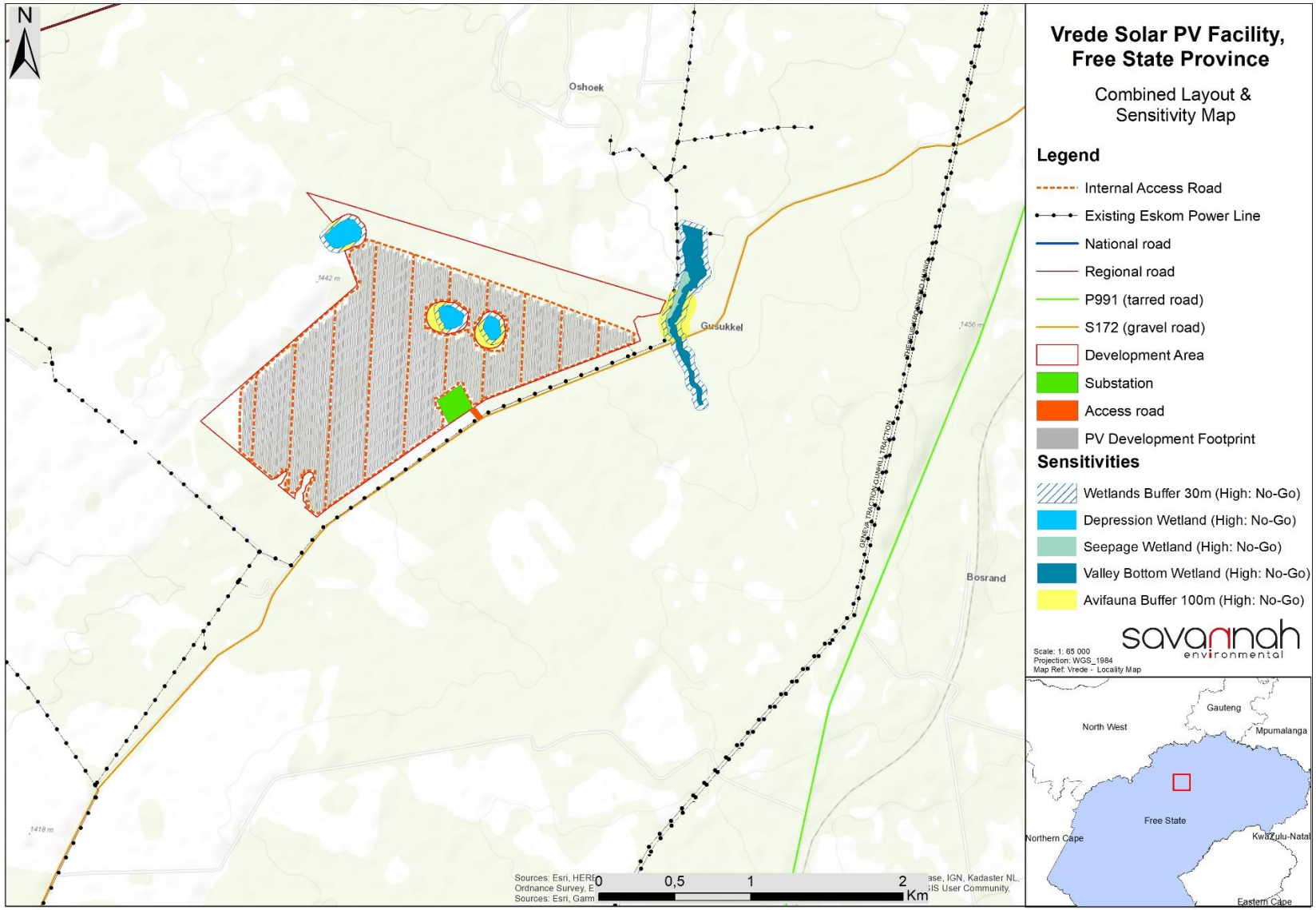


**Figure 10.2:** Sensitive environmental features identified within the development footprint assessed for Vrede Solar PV Facility (A3 map is included in **Appendix L**).

In addition, through the assessment undertaken in this EIA report the following can be concluded regarding the key environmental considerations in terms of the IFC Project Developers Guide for the Vrede Solar PV Facility:

- Construction phase impacts (i.e. OHS, temporary air emissions from dust and vehicle emissions, noise related to excavation, construction and vehicle transit, solid waste generation and wastewater generation from temporary building sites and worker accommodation) will be local in extent and of a low magnitude. The significance of impacts associated with the construction phase will be of a low to medium rating due to the remote location of the site. Those impacts associated with a temporary workforce will be of moderate significance for the local community for the duration of the construction period, as additional people will be residing in the area.
- Water usage (i.e. the cumulative water use requirements) will be kept to a minimum during construction and operation of the project. Appropriate water demand and conservation measures will be implemented.
- Matters relating to the land will be of low significance. The placement of the facility has been undertaken in consultation with the affected landowner, who will enter into a long-term lease agreement with the developer for the facility. There will be no involuntary land acquisition / resettlement associated with this project.
- Landscape and visual impacts (i.e. the visibility of the solar panels within the wider landscape and associated impacts on landscape designations, character types and surrounding communities) will be of low to medium significance and restricted to within 1-3km from the facility.
- Ecology and natural resources (i.e. habitat loss/fragmentation, impacts on designated areas and disturbance or displacement of protected or vulnerable species) will be impacted on by the project. The layout of the facility has been designed to avoid areas of high sensitivity thereby reducing impacts on these resources.
- Cultural heritage (i.e. impacts on the setting of designated sites or direct impacts on below-ground archaeological deposits as a result of ground disturbance during construction) is of low impact significance, and no heritage resources of significance are associated with the development area.
- Transport and access (i.e. impacts of transportation of materials and personnel) related to the project will be appropriately managed, and will make use of existing access roads during construction and operation.
- Consultation and disclosure (i.e. consulting with key authorities, statutory bodies, affected communities and other relevant stakeholders) has been undertaken for the project throughout the entire assessment phase, and documented for inclusion in the assessment of the project. All stakeholders and interested and affected parties have been offered the opportunity to participate in a meaningful way to the EIA for the project.
- An Environmental Management Programme (EMPr) has been compiled to ensure that mitigation measures are identified and taken forward as the project develops (refer to **Appendix K** and **Appendix R** of EIA Report).

Therefore, through the assessment of the development of the Vrede Solar PV Facility within the development footprint it can be concluded that the development of the facility is environmentally acceptable (subject to the implementation of the recommended mitigation measures).

## 10.5 Overall Recommendation

Considering the findings of the independent specialist studies, the impacts identified, the proposed development footprint which avoids all identified no-go/highly sensitive environmental features within the project site, as well as the potential to further minimise the impacts to acceptable levels through mitigation, it is the reasoned opinion of the EAP that the development of the Vrede Solar PV Facility is acceptable within the landscape and can reasonably be authorised. The facility layout is illustrated in **Figure 10.1**. The period for which the Environmental Authorisation is required to remain valid is 10 years from the date of authorisation, with a period of 5 years for the design, planning, construction and commissioning of the activity to be concluded.

The authorisation for Vrede Solar PV Facility would include the following key infrastructure and components:

- Solar Arrays:
  - Solar Panel Technology - Mono and Bifacial Photovoltaic (PV) Modules;
  - Mounting System Technology – single axis tracking, dual axis tracking or fixed axis tracking PV;
  - Underground cabling (up to 33kV)
  - Centralised inverter stations or string inverters; Power Transformers;
- Building Infrastructure
  - Offices;
  - Operational control centre;
  - Operation and Maintenance Area / Warehouse / workshop;
  - Ablution facilities;
  - Battery Energy Storage System;
  - Substation building.
- Electrical Infrastructure
  - 33/132kV Independent Power Producer (IPP) onsite substation including associated equipment and infrastructure
  - Underground cabling and overhead power lines (up to 33kV)
- Associated Infrastructure:
  - Access roads and Internal gravel roads;
  - Fencing and lighting;
  - Lightning protection
  - Permanente laydown area;
  - Temporary construction camp and laydown area;
  - Telecommunication infrastructure;
  - Batching plant (if required);
  - Stormwater channels; and
  - Water pipelines.

The following key conditions would be required to be included within an authorisation issued for Vrede Solar PV Facility:

- All mitigation measures detailed within this EIA Report, as well as the specialist reports contained within **Appendices D to J** are to be implemented.
- The EMPRs as contained within **Appendix K** and **Appendix R** of this EIA Report should form part of the contract with the Contractors appointed to construct and maintain the Vrede Solar PV Facility in order

to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of project is considered key in achieving the appropriate environmental management standards as detailed for this project.

- The high sensitivity wetlands and their associated buffer areas should be regarded as no-go areas for all construction activities.
- The proposed layout must be located within the identified development area. The final layout must be submitted to DFFE for review and approval following detailed design.
- A pre-construction walk-through of the final development footprint for species of conservation concern that would be affected and that can be translocated must be undertaken prior to the commencement of the construction phase.
- Before construction commences individuals of listed species within the development footprint that would be affected, must be counted and marked and translocated, where deemed necessary by the ecologist conducting the pre-construction walk-through survey. Permits from the relevant national and provincial authorities and/or the Department of Forestry, Fisheries, and the Environment (DFFE), must be obtained before the individuals are disturbed.
- The necessary water use authorisation must be obtained from the Department Human Settlements, Water and Sanitation (DHSWS) for impacts to a watercourse and for abstraction of water from natural resources (should this be required) prior to construction.
- The final project footprint must be kept as small as possible and must consider all sensitive environmental features not considered to be suitable for development (as identified by the respective specialists).
- A Chance Find Protocol must be developed and implemented in the event that archaeological or palaeontological resources are found. In the case where the proposed development activities bring these materials to the surface, work must cease and SAHRA must be contacted immediately.The period for which the Environmental Authorisation is required to remain valid is 10 years from the date of authorisation, with a period of 5 years for the design, planning, construction and commissioning of the activity to be concluded
- Alien invasive species management at the site should take place according to the Alien Invasive Management Plan.

# CHAPTER 11: REFERENCES

**Avifaunal**

ANIMAL DEMOGRAPHY UNIT. 2020. The southern African Bird Atlas Project 2. University of Cape Town. http://sabap2.adu.org.za.

COUNTY OF MERCED. 2014. Draft Environmental Impact Report for the Wright Solar Park Conditional Use Permit Application CUP12-017. Public Draft. July. (ICF 00552.13.) Merced, CA. Prepared by ICF International, Sacramento, CA.

FLURI, T.P. 2009. The potential of concentrating solar power in South Africa. Energy Policy 37: 5075-5080.

H. T. HARVEY & ASSOCIATES. 2014a. California Valley Solar Ranch Project Avian and Bat Protection Plan Sixth Quarterly Post construction Fatality Report 16 November 2013 - 15 February 2014.

H. T. HARVEY & ASSOCIATES. 2014b. California Valley Solar Ranch Project Avian and Bat Protection Plan Sixth Quarterly Post construction Fatality Report 16 February 2014 - 15 May 2014.

HARRISON, J.A., ALLAN, D.G., UNDERHILL, L.G., HERREMANS, M., TREE, A.J., PARKER, V & BROWN, C.J. (eds). 1997. The atlas of southern African birds. Vol 1 & 2. BirdLife South Africa, Johannesburg.

HERNANDEZ, R.R., et al., 2014, "Environmental Impacts of Utility-Scale Solar Energy," Renewable and Sustainable Energy Reviews 29: 766–779.

HOCKEY P.A.R., DEAN W.R.J., AND RYAN P.G. 2005. Robert's Birds of Southern Africa, seventh edition. Trustees of the John Voelcker Bird Book Fund, Cape Town.

JENKINS, A.R., RALSTON-PATTON, SMIT- ROBINSON, A.H. 2017. Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa. BirdLife South Africa.

JEAL. C. 2017. The impact of a 'trough' Concentrated Solar Power facility on birds and other animals in the Northern Cape, South Africa. Minor Dissertation presented in partial fulfilment of the requirements for the degree of Master of Science in Conservation Biology. University of Cape Town.

KAGAN, R. A., T. C. VINER, P. W. TRAIL, AND E. O. ESPINOZA. 2014. Avian Mortality at Solar Energy Facilities in Southern California: A Preliminary Analysis. National Fish and Wildlife Forensics Laboratory.

LOSS, S.R., WILL, T., LOSS, S.S., & MARRA, P.P. 2014. Bird–building collisions in the United States: Estimates of annual mortality and species vulnerability. The Condor 116(1):8-23. 2014.

LOVICH, J.E. and ENNEN, J.R. 2011, Wildlife Conservation and Solar Energy Development in the Desert Southwest, United States, BioScience 61:982–992.

MARNEWICK, M.D., RETIEF E.F., THERON N.T., WRIGHT D.R., ANDERSON T.A. 2015. Important Bird and Biodiversity Areas of South Africa. Johannesburg: Birdlife South Africa.

MCCRARY, M. D., R. L. MCKERNAN, R. W. SCHREIBER, W. D. WAGNER, AND T. C. SCIARROTTA. 1986. Avian mortality at a solar energy plant. J. Field Ornithology 57:135-141.

MUCINA. L. & RUTHERFORD, M.C. (Eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

MUNZHEDI, R. & SEBITOSI, A.B. 2009. Re-drawing the solar map of South Africa for photovoltaic applications. Renewable Energy 34: 165-169.

NATIONAL AUDUBON SOCIETY. 2015. Audubon's Birds and Climate Change Report: A Primer for Practitioners. National Audubon Society, New York. Contributors: Gary Langham, Justin Schuetz, Candan Soykan, Chad Wilsey, Tom Auer, Geoff LeBaron, Connie Sanchez, Trish Distler. Version 1.3.

SEYMORE, R., INGLESI-LOTZ, R. & BLIGNAUT, J. 2014. A greenhouse gas emissions inventory for South Africa: a comparative analysis. Renewable & Sustainable Energy Reviews 34: 371-379.

VISSER, E., PEROLD, V., RALSTON-PATON, S., CARDENAL, A.C., RYAN, P.G. 2018. Assessing the impacts of a utility-scale photovoltaic solar energy facility on birds in the Northern Cape, South Africa. https://doi.org/10.1016/j.renene.2018.08.106 Renewable Energy 133 (2019) 1285 – 1294.

WALSTON, L.J. ROLLINS, K.E. SMITH, K.P. LAGORY, K.E. SINCLAIR, K. TURCHI, C. WENDELIN, T. & SOUDER, H. A Review of Avian Monitoring and Mitigation Information at Existing Utility-Scale Solar Facilities. U.S. Department of Energy, SunShot Initiative and Office of Energy Efficiency & Renewable Energy. April 2015.

WALWYN, D.R., BRENT A.C. 2015. Renewable energy gathers steam in South Africa. Renewable and Sustainable Energy 41: 390-401.

WEST (Western EcoSystems Technology, Inc.), 2014, Sources of Avian Mortality and Risk Factors Based on Empirical Data from Three Photovoltaic Solar Facilities, prepared by Western EcoSystems Technology, Inc., June 17.

WORMWORTH, J. & MALLON, K. 2006. Bird Species and Climate Change. WWF – Australia. Sydney, NSW, Australia.

**Ecological**

Apps, P. (ed.). 2012. Smither's Mammals of Southern Africa. A field guide. Random House Struik, Cape Town, RSA

Alexander, G. & Marais, J. 2007. A Guide to the Reptiles of Southern Africa. Struik Nature, Cape Town.

Anhaeusser, C.R., Johnson, M.R., Thomas, R.J. (2008). The Geology of South Africa. Council for Geosciences.

Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J. & de Villiers, M. S. 2014. Atlas and Red List of the Reptiles of South Africa, Lesotho, and Swaziland. Strelitzia 32. SANBI, Pretoria.

Branch W.R. 1998. Field guide to snakes and other reptiles of southern Africa. Struik, Cape Town.

CBD (convention on Biological Diversity). (1993). https://www.cbd.int/doc/legal/cbd-en.pdf. (Accessed: June 2018).

CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) (1973). www.cites.org. (Accessed: June 2018).

CRITICAL BIODIVERSITY AREAS MAPS (PER MUNICIPALITY) AND GIS DATA AVAILABLE FROM: Biodiversity GIS (BGIS), South African National Biodiversity Institute, Tel. +27 21 799 8739 or CapeNature, Tel. +27 21 866 8000. Or on the web at: http://bgis.sanbi.org/fsp/project.asp

CSIR (Council for Scientific and Industrial Research). 2010. National Freshwater Ecosystem Priority Areas (NFEPA). Council for Scientific and Industrial Research, Pretoria, South Africa.

Darwall, W.R.T., Smith, K.G., Tweddle, D. and Skelton, P. (eds) 2009. The Status and Distribution of Freshwater Biodiversity in Southern Africa. International Union for Conservation of Nature (IUCN): Gland, Switzerland and South African Institute for Aquatic Biodiversity (SAIAB), Grahamstown, South Africa. 120 pages.

Department of Environmental Affairs and Tourism, 2007. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Publication of lists of Critically Endangered, Endangered, Vulnerable and Protected Species. Government Gazette, Republic of South Africa

Department of Water and Sanitation. 2014. A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Secondary: [W5 (for example)]. Compiled by RQIS DM:
https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx accessed on 7/10/2018.

DWAF (Department of Water affairs and Forestry). 2005. A practical field procedure for identification and delineation of wetland and riparian areas. Edition 1, September 2005. DWAF, Pretoria.

Driver, A., Nel, J.L., Snaddon, K., Murray, K., Roux, D.J., Hill, L., Swartz, E.R., Manuel, J., Funke, N. (2011). Implementation Manual for Freshwater Ecosystem Priority Areas. Report to the Water Research Commission, Pretoria.

Du Preez, L. & Carruthers, V. 2009. A Complete Guide to the Frogs of Southern Africa. Struik Nature., Cape Town.

Fish, L., Mashau, A.C., Moeaha, M.J., Nembudani, M.T. (2015). Identification Guide to Southern African Grasses: An Identification Manual with Keys, Descriptions, and Distributions. SANBI, Pretoria.

Friedmann, Y. & Daly, B. 2004. Red data book of the mammals of South Africa, a conservation assessment. Johannesburg, Endangered Wildlife Trust.

IUCN (2017). The IUCN Red List of Threatened Species. www.iucnredlist.org (Accessed: October 2020).

Marais, J. 2004. Complete Guide to the Snakes of Southern Africa. Struik Nature, Cape Town.

Measey, G.J. (2011). Ensuring a Future for South Africa's Frogs: A Strategy for Conservation Research. South African National Biodiversity Institute, Pretoria.

Mucina L. & Rutherford M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria

Mucina, L., Rutherford, M.C. & Powrie, L.W. (Eds.). (2018). Vegetation map of South Africa, Lesotho and Swaziland. 1:1 000 000 scale sheet maps. 2nd ed. South African National Biodiversity Institute, Pretoria.

Minter LR, Burger M, Harrison JA, Braack HH, Bishop PJ & Kloepfer D (eds). 2004. Atlas and Red Data book of the frogs of South Africa, Lesotho and Swaziland. SI/MAB Series no. 9. Smithsonian Institution, Washington, D.C.

Nel, J. L., Driver, A., Strydom, W. F., Maherry, A. M., Petersen, C. P., Hill, L., Roux, D. J., Nienaber, S., van Deventer, H., Swartz, E. R. and Smith-Adao, L. B. (2011). Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources, WRC Report No. TT 500/11. Water Research Commission, Pretoria.

Ollis DJ, Snaddon CD, Job NM, and Mbona N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria.

Raimondo, D., Von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C. Kamundi, D.A. & Manyama, P.A. (Eds.). 2009. Red list of South African plants 2009. Strelitzia 25:1-668

Rouget, M., Reyers, B., Jonas, Z., Desmet, P., Driver, A., Maze, K., Egoh, B. & Cowling, R.M. 2004. South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 1: Terrestrial Component APPENDIX A. Pretoria: South African National Biodiversity Institute

SANBI (South African Biodiversity Institute), 2010. Threatened Species: A guide to Red Lists and their use in conservation. Threatened Species Programme, Pretoria, South Africa. 28 pp.

Shulze, R. 1997. South African altas of agrohydrology and climatology. Report TT82/96. Pretoria: Water Research Commission.

Skinner, J.D. & Chimimba, C.T. 2005. The mammals of the Southern African Subregion. Cambridge University Press, Cambridge.

Strohbach, M. 2013. Mitigation of ecological impacts of renewable energy facilities in South Africa. The Sustainable Energy Resource Handbook (Renewable Energy) South Africa 4: 41 – 47.

Stuart, C. & Stuart, T. (1994). A field guide to the tracks and signs of Southern, Central East African Wildlife. Struik Nature, Cape Town.

Stuart, C. and Stuart, T., (2007). Field guide to mammals of Southern Africa. Fourth Edition. Struik Publishers.

Land Type Survey Staff. (1972 - 2006). Land Types of South Africa: Digital Map (1:250 000 Scale) and Soil Inventory Databases. Pretoria: ARC-Institute for Soil, Climate, and Water.

Websites:

AGIS, 2007. Agricultural Geo-Referenced Information System, accessed from www.agis.agric.za

ADU, 2012. Animal Demography Unit, Department of Zoology, University of Cape Town. http://www.adu.org.za

BGIS: http://bgis.sanbi.org/website.asp

EWT. (2016). Mammal Red List 2016. www.ewt.org.za (Accessed: October 2020).

FrogMap (2017). The Southern African Frog Atlas Project (SAFAP, now FrogMAP). http://vmus.adu.org.za (Accessed: October 2020).

MammalMap (2017). http://mammalmap.adu.org.za/ (Accessed: October 2020).

SANBI databases:

South African National Biodiversity Institute. 2016. Botanical Database of Southern Africa (BODATSA). http://SIBIS.sanbi.org

SARCA (2018). South African Reptile Conservation Assessment. http://sarca.adu.org.za/ (Accessed: October 2020).

**Heritage**

Dreyer C, 2005. Archaeological and Historical Investigation of the Proposed New Filling Station at Kroonstad, Free State, AIA Phase 1, NID ID 5968

Dreyer C, 2005. Historical Investigation of the Existing Outbuildings at the Farm Smaldeel 202, Kroonstad, Free State, AIA Phase 1, NID ID 5969

Dreyer C, 2006. First Phase Archaeological and Cultural Heritage Assessment of the Proposed Residential Developments at the Farm Middenspruit 151, Kroonstad, Free State, AIA Phase 1, NID ID 5970

Dreyer C, 2006. Archaeological and Historical Investigation of the Proposed Township Developments at Maokeng, Kroonstad, Free State, AIA Phase 1, NID ID 5971

Dreyer C, 2006. First Phase Archaeological and Cultural Heritage Assessment of the Proposed Residential Developments at the Farm Boschpunt 2218 Kroonstad, Free State, AIA Phase 1, NID ID 5972

Van der Walt J, 2006. Archaeological Impact Assessment Report for the Proposed Steynsrus (19.5MW) Photovoltaic Plant, Free State Province, AIA Phase 1, NID ID 129819.

Matenga E, 2019. PHASE I HERITAGE IMPACT ASSESSMENT (INCLUDING PALAEONTOLOGICAL DESKTOP ASSESSMENT) IN TERMS OF SECTION 38 OF THE NATIONAL HERITAGE RESOURCES ACT NO 25/1999 FOR THE PROPOSED PHASE II MAOKENG HOUSING DEVELOPMENT(5390 ERVEN MOAKENG) (KROONSTAD), FREE STATE PROVINCE, HIA Phase 1, NID ID 533640.

Van Schalkwyk J, 2014. Cultural heritage impact assessment for the UPGRADE OF A SECTION OF NATIONAL ROUTE 1, BETWEEN KROONSTAD AND VENTERSBURG, FREE STATE PROVINCE, HIA Phase 1, NID ID 165622.

**Social**

National Energy Act (2008).

White Paper on the Energy Policy of the Republic of South Africa (December 1998).

White Paper on Renewable Energy (November 2003).

Integrated Energy Plan for South Africa (2016).

Integrated Resource Plan (2019).

The National Development Plan (2011).

New Growth Path Framework (2010).

National Infrastructure Plan (2012).

Free State Provincial Spatial Development Framework (PSDF).

Free State Green Economy Strategy (2014).

Free State Investment Prospectus (2019).

Fezile Dabi District Municipality Integrated Development Plan (2022-21).

Fezile Dabi District Municipality Climate Change Vulnerability Assessment and Response Plan (2016).
Moqhaka Local Municipality Integrated Development Plan (2017-2022).
Moqhaka Local Municipality Spatial Development Framework (2019-2020).
Independent Power Producers Procurement Programme (IPPPP): An Overview (2017), Department of Energy, National Treasury and DBSA;
Powering the Future: Renewable Energy Roll-out in South Africa (2013), Greenpeace South Africa.

**Visual**

Blue Oak Energy, 2016. https://www.blueoakenergy.com/blog/glint-and-glare-studies-for-commercial-and-industrial-solar-
Chief Directorate National Geo-Spatial Information, varying dates. 1:50 000 Topo-cadastral Maps and Data.
CSIR, 2017. Delineation of the first draft focus areas for Phase 2 of the Wind and Solar PV Strategic Environmental Assessment.
CSIR, 2015. The Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa.
DEA, 2014. National Land-cover Database 2018 (NLC2018).
DEA, 2019. South African Protected Areas Database (SAPAD_OR_2019_Q4).
DEA, 2020. South African Renewable Energy EIA Application Database (REEA_OR_2020_Q3).
DEA&DP, 2011. Provincial Government of the Western Cape. Guideline on Generic Terms of Reference for EAPS and Project Schedules.
Department of Environmental Affairs and Tourism (DEA&T), 2001. Environmental Potential Atlas (ENPAT) for the Free State Province.
FAA, 2015. Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach.
Meister Consultants Group, 2014.
http://solaroutreach.org/wp-content/uploads/2014/06/Solar-PV-and-Glare-_Final.pdf
NASA, 2018. Earth Observing System Data and Information System (EOSDIS).
National Botanical Institute (NBI), 2004. Vegetation Map of South Africa, Lesotho and Swaziland (Unpublished Beta Version 3.0)
Oberholzer, B. (2005). Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1.
The Environmental Impact Assessment Amendment Regulations. In Government Gazette Nr. 33306, 18 June 2010.

**Wetland**

Apps, P. (ed.). 2012. Smither's Mammals of Southern Africa. A field guide. Random House Struik, Cape Town, RSA
Alexander, G. & Marais, J. 2007. A Guide to the Reptiles of Southern Africa. Struik Nature, Cape Town.
Anhaeusser, C.R., Johnson, M.R., Thomas, R.J. (2008). The Geology of South Africa. Council for Geosciences.
Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J. & de Villiers, M. S. 2014. Atlas and Red List of the Reptiles of South Africa, Lesotho, and Swaziland. Strelitzia 32. SANBI, Pretoria.
Branch W.R. 1998. Field guide to snakes and other reptiles of southern Africa. Struik, Cape Town.
CBD (convention on Biological Diversity). (1993). https://www.cbd.int/doc/legal/cbd-en.pdf. (Accessed: June 2018).
CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) (1973). www.cites.org. (Accessed: June 2018).
CRITICAL BIODIVERSITY AREAS MAPS (PER MUNICIPALITY) AND GIS DATA AVAILABLE FROM: Biodiversity GIS (BGIS), South African National Biodiversity Institute, Tel. +27 21 799 8739 or CapeNature, Tel. +27 21 866 8000. Or on the web at: http://bgis.sanbi.org/fsp/project.asp

CSIR (Council for Scientific and Industrial Research). 2010. National Freshwater Ecosystem Priority Areas (NFEPA). Council for Scientific and Industrial Research, Pretoria, South Africa.

Darwall, W.R.T., Smith, K.G., Tweddle, D. and Skelton, P. (eds) 2009. The Status and Distribution of Freshwater Biodiversity in Southern Africa. International Union for Conservation of Nature (IUCN): Gland, Switzerland and South African Institute for Aquatic Biodiversity (SAIAB), Grahamstown, South Africa. 120 pages.

Department of Environmental Affairs and Tourism, 2007. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Publication of lists of Critically Endangered, Endangered, Vulnerable and Protected Species. Government Gazette, Republic of South Africa

Department of Water and Sanitation. 2014. A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Secondary: [W5 (for example)]. Compiled by RQIS DM:
https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx accessed on 7/10/2018.

DWAF (Department of Water affairs and Forestry). 2005. A practical field procedure for identification and delineation of wetland and riparian areas. Edition 1, September 2005. DWAF, Pretoria.

Driver, A., Nel, J.L., Snaddon, K., Murray, K., Roux, D.J., Hill, L., Swartz, E.R., Manuel, J., Funke, N. (2011). Implementation Manual for Freshwater Ecosystem Priority Areas. Report to the Water Research Commission, Pretoria.

Du Preez, L. & Carruthers, V. 2009. A Complete Guide to the Frogs of Southern Africa. Struik Nature., Cape Town.

Fish, L., Mashau, A.C., Moeaha, M.J., Nembudani, M.T. (2015). Identification Guide to Southern African Grasses: An Identification Manual with Keys, Descriptions, and Distributions. SANBI, Pretoria.

Friedmann, Y. & Daly, B. 2004. Red data book of the mammals of South Africa, a conservation assessment. Johannesburg, Endangered Wildlife Trust.

IUCN (2017). The IUCN Red List of Threatened Species. www.iucnredlist.org (Accessed: October 2020).

Marais, J. 2004. Complete Guide to the Snakes of Southern Africa. Struik Nature, Cape Town.

Measey, G.J. (2011). Ensuring a Future for South Africa's Frogs: A Strategy for Conservation Research. South African National Biodiversity Institute, Pretoria.

Mucina L. & Rutherford M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria

Mucina, L., Rutherford, M.C. & Powrie, L.W. (Eds.). (2018). Vegetation map of South Africa, Lesotho and Swaziland. 1:1 000 000 scale sheet maps. 2nd ed. South African National Biodiversity Institute, Pretoria.

Minter LR, Burger M, Harrison JA, Braack HH, Bishop PJ & Kloepfer D (eds). 2004. Atlas and Red Data book of the frogs of South Africa, Lesotho and Swaziland. SI/MAB Series no. 9. Smithsonian Institution, Washington, D.C.

Nel, J. L., Driver, A., Strydom, W. F., Maherry, A. M., Petersen, C. P., Hill, L., Roux, D. J., Nienaber, S., van Deventer, H., Swartz, E. R. and Smith-Adao, L. B. (2011). Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources, WRC Report No. TT 500/11. Water Research Commission, Pretoria.

Ollis DJ, Snaddon CD, Job NM, and Mbona N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria.

Raimondo, D., Von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C. Kamundi, D.A. & Manyama, P.A. (Eds.). 2009. Red list of South African plants 2009. Strelitzia 25:1-668

Rouget, M., Reyers, B., Jonas, Z., Desmet, P., Driver, A., Maze, K., Egoh, B. & Cowling, R.M. 2004. South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 1: Terrestrial Component APPENDIX A. Pretoria: South African National Biodiversity Institute

SANBI (South African Biodiversity Institute), 2010. Threatened Species: A guide to Red Lists and their use in conservation. Threatened Species Programme, Pretoria, South Africa. 28 pp.

Shulze, R. 1997. South African altas of agrohydrology and climatology. Report TT82/96. Pretoria: Water Research Commission.

Skinner, J.D. & Chimimba, C.T. 2005. The mammals of the Southern African Subregion. Cambridge University Press, Cambridge.

Strohbach, M. 2013. Mitigation of ecological impacts of renewable energy facilities in South Africa. The Sustainable Energy Resource Handbook (Renewable Energy) South Africa 4: 41 – 47.

Stuart, C. & Stuart, T. (1994). A field guide to the tracks and signs of Southern, Central East African Wildlife. Struik Nature, Cape Town.

Stuart, C. and Stuart, T., (2007). Field guide to mammals of Southern Africa. Fourth Edition. Struik Publishers.

Land Type Survey Staff. (1972 - 2006). Land Types of South Africa: Digital Map (1:250 000 Scale) and Soil Inventory Databases. Pretoria: ARC-Institute for Soil, Climate, and Water.

Websites:

AGIS, 2007. Agricultural Geo-Referenced Information System, accessed from www.agis.agric.za

ADU, 2012. Animal Demography Unit, Department of Zoology, University of Cape Town. http://www.adu.org.za

BGIS: http://bgis.sanbi.org/website.asp

EWT. (2016). Mammal Red List 2016. www.ewt.org.za (Accessed: October 2020).

FrogMap (2017). The Southern African Frog Atlas Project (SAFAP, now FrogMAP). http://vmus.adu.org.za (Accessed: October 2020).

MammalMap (2017). http://mammalmap.adu.org.za/ (Accessed: October 2020).

SANBI databases:

South African National Biodiversity Institute. 2016. Botanical Database of Southern Africa (BODATSA). http://SIBIS.sanbi.org

SARCA (2018). South African Reptile Conservation Assessment. http://sarca.adu.org.za/ (Accessed: October 2020)