MOEDING SOLAR PV FACILITY

North West Province

Basic Assessment Report

January 2019

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PROJECT DETAILS

Title	:	Environmental Impact Assessment Process: Basic Assessment Report for the Moeding Solar PV Facility, North West Province
Authors	:	Savannah Environmental (Pty) Ltd Thalita Botha Jo-Anne Thomas Nicolene Venter Sarah Watson
Client	:	Moeding Solar (Pty) Ltd
Report Revision	:	Revision 0
Date	:	January 2019

When used as a reference this report should be cited as: Savannah Environmental (2018) Basic Assessment Report for the Moeding Solar PV Facility, North West Province.

PURPOSE OF THE BASIC ASSESSMENT REPORT AND INVITATION TO COMMENT

Moeding Solar (Pty) Ltd has appointed Savannah Environmental as the independent environmental consultant to undertake the Basic Assessment (BA) for the Moeding Solar PV Facility, North West Province. The BA process is being undertaken in accordance with the requirements of the 2014 EIA Regulations promulgated in terms of the National Environmental Management Act (NEMA; Act No. 107 of 1998). Due to the geographical location of the project site within the Vryburg REDZ, one of the eight designated REDZ areas, the Moeding Solar PV Facility is now subject to a Basic Assessment (BA) and not a full EIA process, as well as a shortened timeframe of 57 days for the processing of an Application for Environmental Authorisation. The procedure to be followed in applying for environmental authorisation for a large-scale renewable energy project within a REDZ was formally gazetted on 16 February 2018 (in Government Notice (GN) 113 and GN114). The undertaking of a basic assessment process for the project is in-line with the requirements stated in GNR 114 of 16 February 2018.

The BA report is available for review from **16 January 2019 – 15 February 2019** at the following locations:

- Vryburg Public Library, 76 Stella Street, Vryburg
- Huhudi Community Library, 2661 Mosiapoa Street, Huhundi, Vryburg
- www.savannahSA.com

Please submit your comments by **15 February 2019** to:
Rozanne Els of **Savannah Environmental** PO Box 148, Sunninghill, 2157 Tel: 011-656-3237 Fax: 086-684-0547 Email: publicprocess@savannahsa.com

Comments can be made as written submission via fax, post or email.

EXECUTIVE SUMMARY

Moeding Solar (Pty) Ltd proposes the construction of a photovoltaic (PV) solar energy facility, known as the Moeding Solar PV Facility or Moeding Solar, situated on a site approximately 8km south of the town of Vryburg. The Moeding Solar PV Facility is intended to form part of the Department of Energy's (DoE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. The REIPPP Programme aims to secure 14 725MW of new generation capacity from Renewable Energy sources, while simultaneously diversifying South Africa's electricity mix, and positively contributing towards socio-economic, and environmentally sustainable growth.

The solar energy facility will be located within Portion 1 of the Farm Champions Kloof 731, Portion 4 and the Remaining Extent of Portion 3 of the Farm Waterloo 730, hereafter referred to as the affected properties. The affected properties have been identified by the applicant as the preferred project site suitable for the development of a commercial PV facility. From a technical perspective, the Vryburg 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 site, 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.

Furthermore, the affected properties are also located within Renewable Energy Development Zones (REDZ) 6, otherwise known as the Vryburg REDZ and which has been earmarked for the large scale deployment of renewable energy facilities in South Africa (as per GNR114 of February 2018).

Within the affected properties, the applicant identified a project site (~642ha) which will be assessed for the placement of the solar energy facility (refer to **Figure 1**). The proposed project site falls under the jurisdiction of the Naledi Local Municipality and within the greater Dr Ruth Segomotsi Mompati District Municipality in the North West Province, and is accessible via the national route N18 which traverses the eastern section of the site.

Photovoltaic (PV) technology is proposed to be utilised for the generation of electricity. The Moeding Solar PV Facility will have a contracted capacity of up to 100MW. The facility will include the following infrastructure:

- Arrays of PV solar panels with a contracted capacity of up to 100MW.
- Mounting structures to support the PV panels (utilising either fixed-tilt / static, single-axis tracking, or double-axis tracking systems).
- On-site inverters to convert power from Direct Current (DC) to Alternating Current (AC), and a 132kV on-site substation to facilitate the connection between the solar facility and the Eskom grid connection point.
- A new 132kV power line between the on-site substation and the Eskom grid connection point. Two alternatives are currently being considered in this regard:
  - Alternative 1 – a direct connection to the existing Mookodi Main Transmission Substation located north of the project site on the Remaining Extent of the Farm Rosendal 673. A new 132kV power line will be constructed over a distance of ~4km. A 300m power line

corridor has been assessed for Alternative 1.
  - Alternative 2 - a turn-in turn-out connection into the proposed Mookodi - Magopela 132kV power line (to be constructed along the eastern boundary of the project site). A new turn-in and out 132kV power line will be constructed over a distance of ~335m.
- Cabling between the project's components, to be laid underground where practical.
- Battery storage with up to 6 hours of storage capacity.
- Offices and workshop areas for maintenance and storage.
- Laydown areas.
- Internal access roads and fencing around the development area.

The development (i.e. construction and operation) of the proposed Moeding Solar PV Facility is subject to the requirements of the Environmental Impact Assessment (EIA) Regulations of 2014 published in terms of Section 24(5) of NEMA. In terms of the EIA Regulations of 2014 (as amended on 07 April 2017) promulgated under Sections 24 and 24D of the NEMA, various aspects of the project are listed as activities that may have a detrimental impact on the environment. Savannah Environmental (Pty) Ltd has been appointed as the independent environmental consultants responsible for managing the application for EA and supporting the BA process, inclusive of comprehensive, independent specialist studies.

The procedure to be followed in applying for environmental authorisation for a large-scale project in a REDZ was formally gazetted on 16 February 2018 (in Government Notice (GN) 113 and GN114). As the project is located within one of the eight designated REDZ areas, the Moeding Solar PV Facility is now subject to a Basic Assessment and not a full EIA process, as well as a shortened timeframe of 57 days for the processing of an Application for Environmental Authorisation.

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 sensitive features within the project site and the undertaking of monitoring, as specified by the specialists.

Potential impacts associated with the development of the Moeding Solar PV Facility are expected to occur during both the construction and operation phases. Impacts associated with the construction of the Moeding Solar PV Facility can also be expected to be associated with the decommissioning phase (however, to a lesser extent as the project site would have previously undergone transformation and disturbance during construction).

Ecology Impacts

The Ecological and Hydrological Impact Assessment assessed the impact of the Moeding Solar PV Facility on the sensitive ecological and hydrological[1] features present within the project site and 300m power line corridor for the life-cycle of the project. The assessment identified impacts within the construction and operation phases of the project.

During the construction phase, the impacts expected to occur include impacts on vegetation and listed protected plant species, faunal impacts, an increased erosion risk and increased alien plant invasion. The significance of the construction phase impacts ranges from medium to low, following the implementation of the recommended mitigation measures by the specialist. No impacts of a high significance

[1] It must be noted that no sensitive hydrological features have been identified and confirmed within the development footprint of the Moeding Solar PV Facility by the specialist.

were identified prior to the implementation of mitigation.

During the operation phase, the anticipated impacts include altered runoff patterns due to rainfall interception by the PV panel infrastructure and compacted areas resulting in high levels of erosion, increased alien plant invasion, an increased erosion risk and faunal impacts. The significance of the impacts for the operation phase ranges from medium to low, following the implementation of the recommended mitigation measures by the specialist. No impacts of a high significance were identified for the project.

The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures.

Impacts on Avifauna

The Avifauna Impact Assessment identified that although the proposed Moeding Solar PV Facility will have an impact on avifauna due to the extensive spatial requirements of the development, the project site is not considered unique (also classified as low sensitive REDZ within the Strategic Environmental Assessment) and is furthermore not considered critical for the conservation of Red Data species.

The avifauna impacts identified to be associated with the Moeding Solar PV Facility is unlikely to be long-term significant impacts. During the construction phase of the facility a loss of habitat and disturbance due to clearance of vegetation is expected to occur. The significance of this impact can be reduced to low with the implementation of the recommended mitigation measures provided by the specialist.

During the operation phase, the anticipated impacts include disturbance, collisions with solar panels and power line infrastructure and electrocution. The significance of the impacts for the operation phase can be reduced to low, following the implementation of the recommended mitigation measures by the specialist. No impacts of a high significance were identified for the project.

The project site is also located within a Low Risk Site (Regime 1) and it can be concluded that the implementation of Stage 3 and 4 assessments and monitoring, according to the Best Practice Guidelines: Birds & Solar Energy, will not be necessary. The specialist has indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures.

Impacts on Land Use, Soil and Agricultural Potential

The proposed Moeding Solar PV Facility infrastructure is located on shallow, rocky soils with low to moderate-low land capability.

Impacts have been identified for both the construction and operation phases for the Moeding Solar PV Facility. The impacts associated with land use, soil and agricultural potential include an increased risk of soil erosion, potential chemical pollution and loss of land capability. The significance of the impacts ranges from low to medium with the implementation of the mitigation measures recommended by the specialist. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures.

Impacts on Heritage Resources (Archaeological and Palaeontological)

Through a field survey, archival research and evaluation of aerial photography of the sites, several heritage resources have been identified within the project site and the 300m power line corridor (Alternative 1). These sites have a site significance of GP.B.

The Heritage Impact Assessment identified impacts associated with the construction and

operation of the Moeding Solar PV Facility and associated infrastructure. These include impacts on burial grounds, impacts on historical structures and impacts on archaeological sites. With the implementation of mitigation measures, the potential impacts on heritage resources will be low. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures.

Considering the palaeontology of the project site, it was identified that the area in question is underlain by a small portion of the Vryburg Formation of the Transvaal Supergroup (geologically older than 2.6 billion year-old) and the Schmidtsdrift Subgroup, Ghaap Group of the Transvaal Supergroup. Stromatolite assemblages are recorded within both the Schmidtsdrift Subgroup and Vryburg Formation. Poorly- to fairly well-preserved, stromatolite assemblages were recorded within the project site. The impacts relate to the excavations required for the construction of the facility and will occur only in the event that a palaeontological resource is present. The significance of the impact will be low with the implementation of mitigation measures proposed by the specialist. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures.

Visual Impacts

The area that is likely to be affected by the visual impact associated with the solar energy facility will be limited to the area immediately to the south of the urban area of Vryburg. This area is largely impacted by urban and urban fringe development. Due to the ridgeline located to the south of the solar energy facility, the development will not impact on areas to the south that have a more cohesive rural in character and where the landscape character is not influenced by development. The Moeding Solar PV Facility will mainly impact visually on an area where there currently is a strong visual influence from urban and urban fringe development, changes to the landscape quality are unlikely to be problematic.

The construction and operation phase of the Moeding Solar PV Facility will impact on the general landscape character of the area, on small holdings north east (Huhudi), travellers on the N18 and R34, homesteads, the Tiger Kloof Educational Institution and the Vryburg airstrip. The significance of the visual impacts will be low with the implementation of the recommended mitigation measures. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures.

Social Impacts

The Social Impact Assessment identified positive and negative impacts which are expected to occur during the construction and operation phases of the Moeding Solar PV Facility. The assessment identified that the expected benefits associated with the project, which include generation of electricity from renewable sources and local economic and social development, outweigh the perceived impacts associated with the project.

During the construction phase the positive impacts expected to occur includes direct and indirect employment opportunities and skills development and economic multiplier effects. The significance of these impacts are medium with the implementation of the recommended enhancement measures. The negative social impacts expected to occur during the construction phase includes an influx of jobseekers and change in population, safety and security impacts, impacts on daily living and moving patterns, nuisance impacts (i.e. noise and dust) and visual impacts. The significance of the negative construction phase impacts will be low to medium with the implementation of the recommended mitigation measures.

During the operation phase the positive impacts expected to occur includes direct and indirect employment opportunities and skills development, development of non-polluting, renewable energy infrastructure and a contribution to Local Economic Development (LED) and social upliftment. The significance of the positive operation impacts will be medium to high with the implementation of the recommended enhancement measures. The negative impacts expected during the operation phase includes a visual and sense of place impact and impacts associated with the loss of agricultural land. The significance of the negative operation impacts will be low to medium with the implementation of the recommended mitigation measures. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures.

Cumulative Impacts

The Moeding Solar PV Facility falls within the Vryburg REDZ which has been identified by the DEA as an area highly suitable for solar PV energy facilities given a range of factors considered. Within a 30km radius of the Moeding Solar PV Facility project site, there are twenty three (23) PV facilities which were considered as part of the cumulative impact assessment. Of these, only the Waterloo Solar Park is certain to become operational as it is a preferred bidder project in terms of the REIPPP Programme. The cumulative impacts associated with the Moeding Solar PV Facility have been assessed to be acceptable, with no unacceptable loss or risk expected.

Based on the specialist cumulative assessment and findings regarding the development of the Moeding Solar PV Facility and its contribution to the overall impact of all solar energy facilities to be developed within a 30km radius, it can be concluded that the cumulative impacts associated with the Moeding Solar PV Facility will be of a low to medium significance. There are however no impacts or risks identified to be considered as unacceptable with the development of the Moeding Solar PV Facility and other solar energy facilities within the surrounding area. In addition, no impacts which will result in whole-scale change are expected.

From the specialist investigations undertaken for the Moeding Solar PV Facility, sensitive areas/environmental features have been identified and demarcated within the project site and power line corridor and avoided by the development footprint (where necessary) (refer to **Figure 2** and **Figure 3**).

A technically viable project site and development footprint was proposed by the developer and assessed as part of the BA process. The assessment of the development footprint (through the consideration of layout alternatives) within the project site was undertaken by independent specialists and their findings have informed the results of this BA Report.

The specialist findings have indicated that there are no identified environmental fatal flaws associated with the implementation of the Moeding Solar PV Facility within the affected properties. Through the assessment of the development of the Moeding Solar PV Facility within the project site it can be concluded that the development of the solar energy facility is environmentally acceptable (subject to the implementation of the recommended mitigation measures).

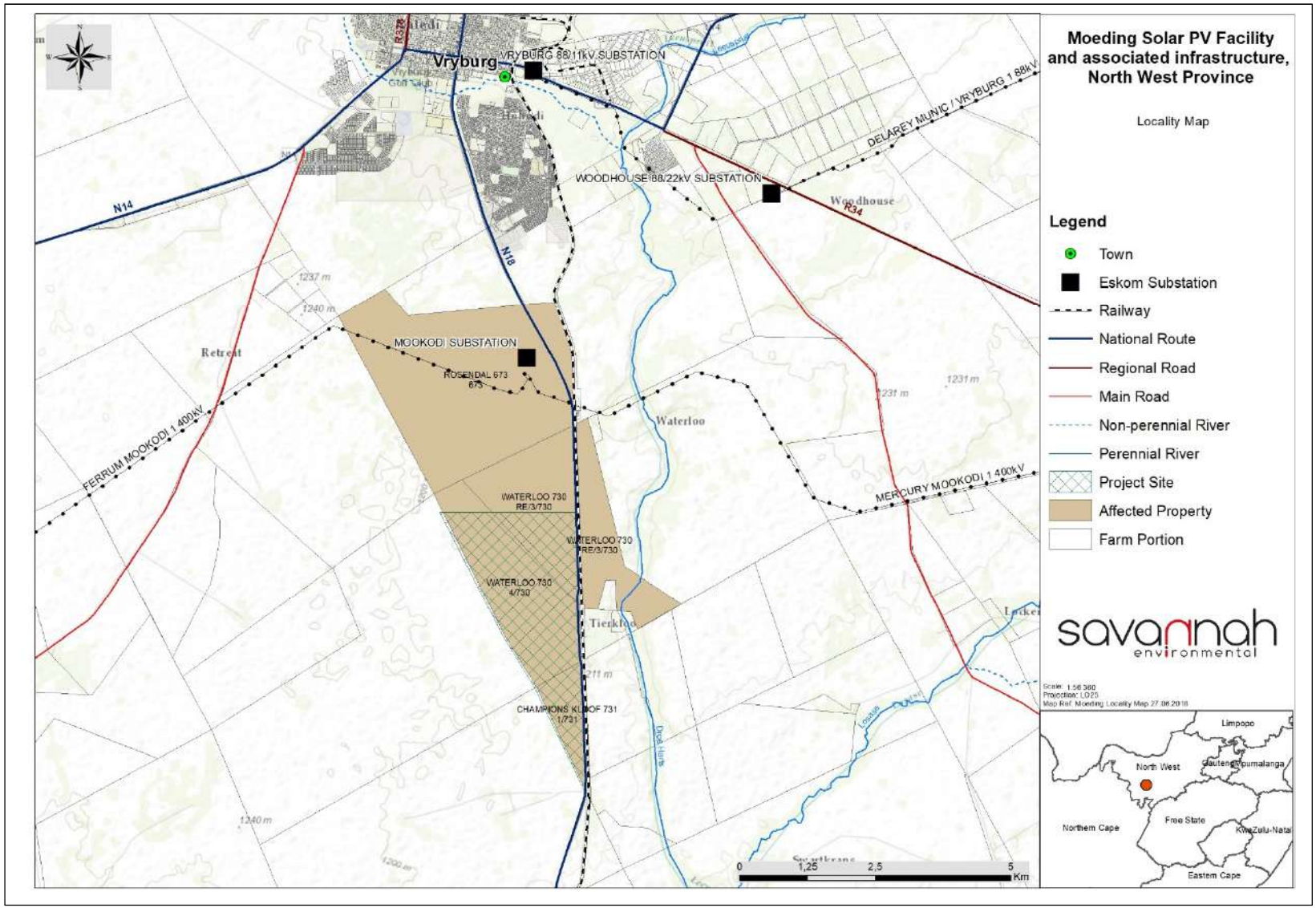

Figure 1: Locality map showing the location of the project site proposed for the development of the Moeding Solar PV Facility.

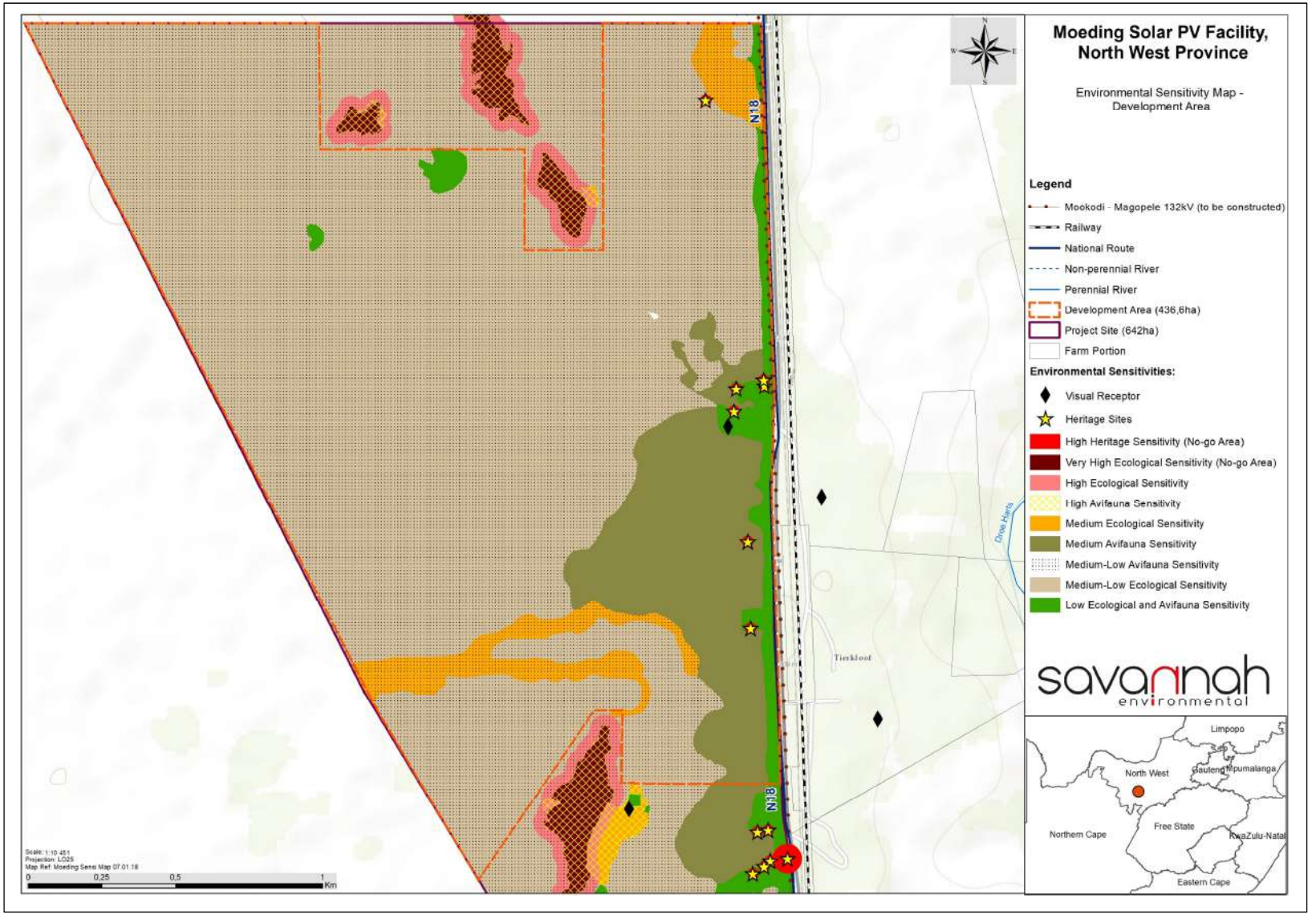

Figure 2: Environmental sensitivity map of the development area for the Moeding Solar PV Facility.

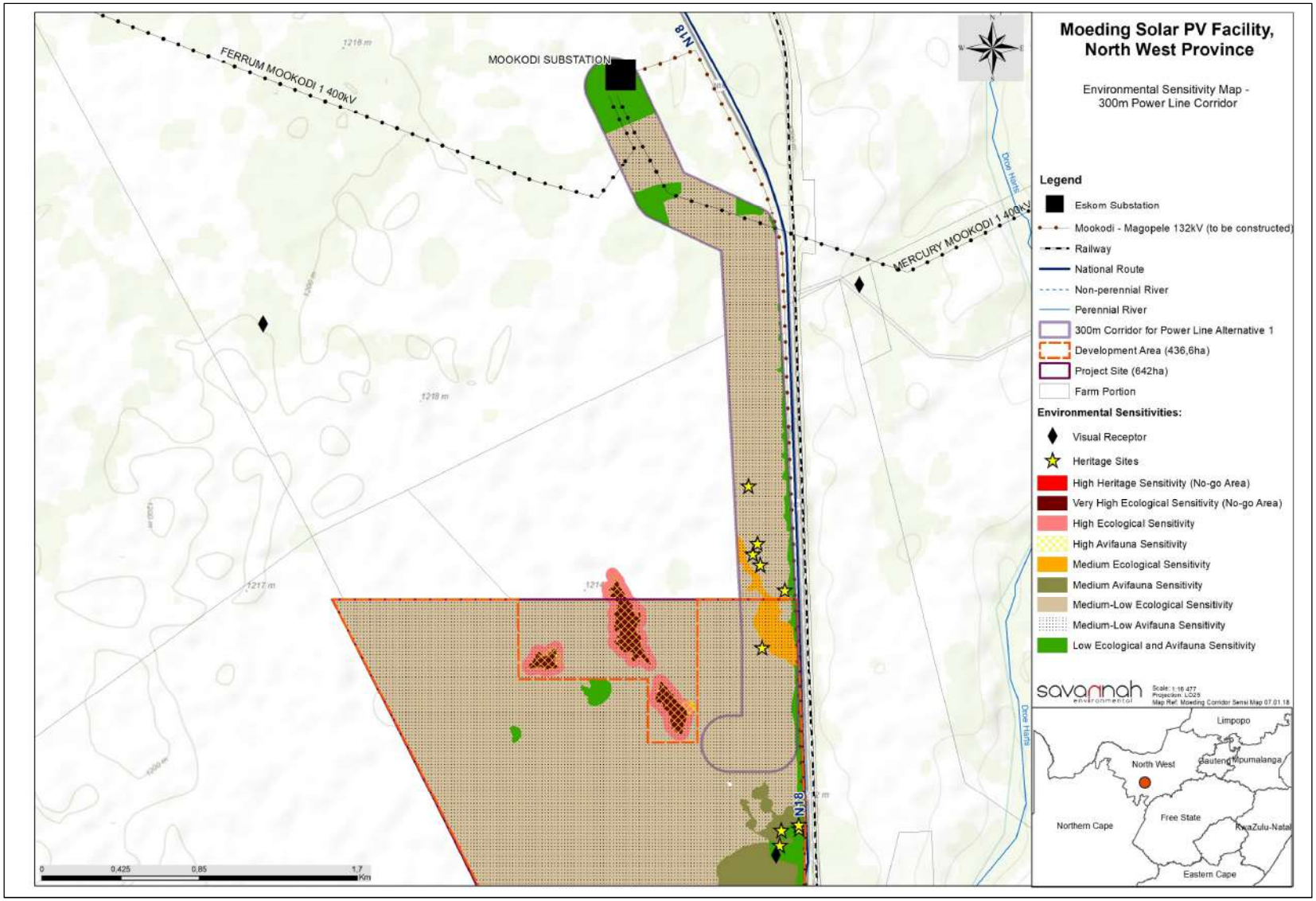

Figure 3: Environmental sensitivity map of the power line alternatives considered for the Moeding Solar

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.

Archaeological material: Remains resulting from human activities which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.

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.

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.

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.

Disturbing noise: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

'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 impact assessment: Environmental Impact Assessment, as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

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.

Perennial and non-perennial: Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.

Photovoltaic effect: Electricity can be generated using photovoltaic solar panels which are comprised of individual photovoltaic cells that absorb solar energy to directly produce electricity. The absorbed solar radiation excites the electrons inside the cells and produces what is referred to as the Photovoltaic Effect.

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).

Riparian: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).

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.

Waste: means—

a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material

or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act; or

b) any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister

Watercourse: as per the National Water Act means -

(a) a river or spring;

(b) a natural channel in which water flows regularly or intermittently;

(c) a wetland, lake or dam into which, or from which, water flows; and

(d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

Wetlands: land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin et al., 1979).

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APPENDICES LIST

CHAPTER 1 INTRODUCTION

Moeding Solar (Pty) Ltd proposes the construction of a photovoltaic (PV) solar energy facility, known as the Moeding Solar PV Facility, situated on a site approximately 8km south of the town of Vryburg. The solar energy facility will comprise several arrays of tracking or static PV panels and associated infrastructure, and will have a contracted capacity of up to 100MW. The solar energy facility will be located within Portion 1 of the Farm Champions Kloof 731, Portion 4 and the Remaining Extent of Portion 3 of the Farm Waterloo 730, hereafter referred to as the affected properties. Within the affected properties, the applicant identified a project site (~642ha) which will be assessed for the placement of the solar energy facility. The proposed project site falls under the jurisdiction of the Naledi Local Municipality and within the greater Dr Ruth Segomotsi Mompati District Municipality in the North West Province (refer to **Figure 1.1**), and is accessible via the national route N18 which traverses the eastern section of the site.

From a regional perspective, the greater Vryburg area is considered favourable for the development of a commercial solar electricity generating facility 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 site, the availability of a direct grid connection (i.e. point of connection to the Eskom National grid) and the availability of land on which the development can take place. The project site is also located within Renewable Energy Development Zones (REDZ) 6, otherwise known as the Vryburg REDZ and which has been earmarked for the large scale deployment of renewable energy facilities in South Africa (as per GNR114 of February 2018).

The proposed solar energy facility is planned to be bid into the Department of Energy's Renewable Energy Independent Power Producers Procurement (REIPPP) Programme with the aim of evacuating the generated power into the Eskom national electricity grid and aiding in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP).

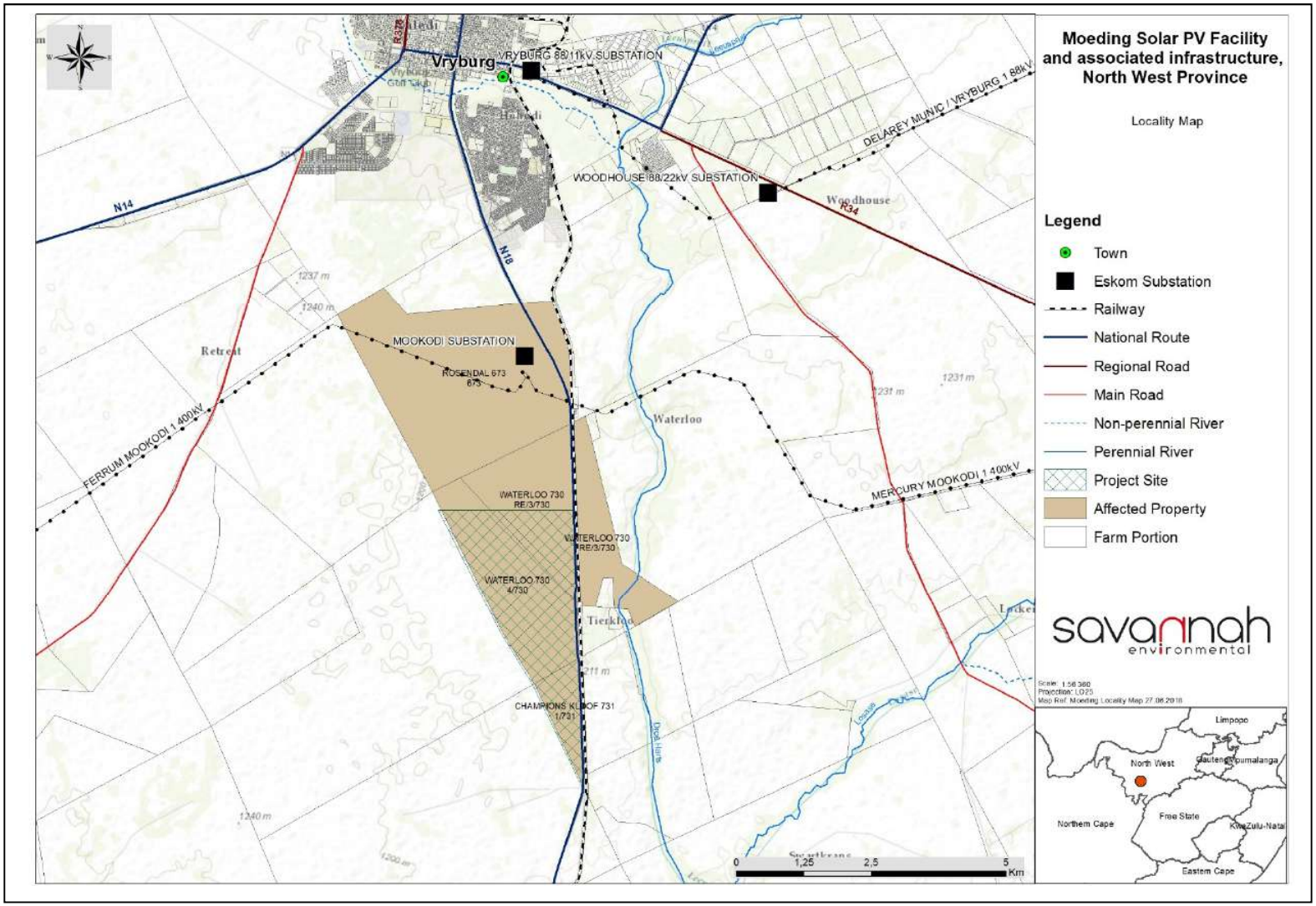


Figure 1.1: Locality map illustrating the location of the Moeding Solar PV Facility project site (hatched area) within Portion 1 of the Farm Champions Kloof 731, the Farm Rosendal 673, Portion 4 and the Remaining Extent of Portion 3 of the Farm Waterloo 730 (refer to **Appendix O** for A3 Maps).

1.1 Project Overview

Photovoltaic (PV) technology is proposed to be utilised for the generation of electricity. The Moeding Solar PV Facility will have a contracted capacity of up to 100MW. The facility will include the following infrastructure:

- Arrays of PV panels (either a static or tracking PV system).
- Mounting structures to support the PV panels.
- Cabling between the project components, to be laid underground where practical.
- On-site inverters to convert the power from a direct current to an alternating current.
- An on-site substation to facilitate the connection between the solar energy facility and the Eskom electricity grid.
- A new 132kV power line between the on-site substation and the Eskom grid connection point.
- Battery storage with up to 6 hours of storage capacity.
- Offices and workshop areas for maintenance and storage.
- Temporary laydown areas.
- Internal access roads and fencing around the development area.

The PV development will occupy an area of up to 300ha within the development area which is approximately 436,6ha in extent, therefore allowing sufficient space to avoid any major environmental sensitivities which may be identified within the site.

In addition to the solar energy facility, the Moeding Solar PV Facility also proposes the development of grid connection infrastructure required to evacuate power generated by the project into Eskom's national electricity grid. The power line corridor will be situated within the Remaining Extent of the Farm Rosendal 673, Portion 4 and the Remaining Extent of Portion 3 of the Farm Waterloo 730. Two possible grid connection options have been identified and are being considered:

- Direct connection to the existing Mookodi Main Transmission Substation located on the northern portion of the affected properties (i.e. within the Remaining Extent of the Farm Rosendal 673).
- A turn-in turn-out connection into the Mookodi - Magopela 132kV power line (to be constructed along the eastern boundary of the project site).

Table 1.1: Detailed description of the project

Province	**North West Province**
District Municipality	Dr Ruth Segomotsi Mompati District Municipality
Local Municipality	Naledi Local Municipality
Ward Number (s)	5 and 9
Nearest town(s)	Vryburg (~8km north of the project site), Amalia (~38km south east of the project site); Pudimoe (~40km south of the project site); Stella (~56km north of the project site); and Schweizer-Reneke (~58km east of the project site)
Farm name(s) and number(s) of properties affected by the solar energy facility	Farm Champions Kloof 731 Farm Waterloo 730
Portion number(s) of properties affected by the solar energy facility	Portion 1 of the Farm Champions Kloof 731 Portion 4 of the Farm Waterloo 730 Remaining Extent of Portion 3 of the Farm Waterloo 730

Province	**North West Province**	
Farm name(s) and number(s) of properties affected by the power line	Farm Rosendal 673 Farm Waterloo 730	
Portion number(s) of properties affected by the power line	Remaining Extent of the Farm Rosendal 673 Remaining Extent of Portion 3 of the Farm Waterloo 730	
SG 21 Digit Code (s)	Portion 1 of the Farm Champions Kloof 731	T0HN00000000073100001
	Farm Rosendal 673	T0IN00000000067300000
	Portion 4 of the Farm Waterloo 730	T0IN00000000073000004
	Remaining Extent of Portion 3 of the Farm Waterloo 730	T0IN00000000073000003
Current zoning	Agricultural	
Site Coordinates (centre of affected properties) – Corner points of the affected properties and project site are included in **Appendix O**.	27° 02'16.56"S 24°44'41.63"E	

The key infrastructure components proposed as part of the Moeding Solar PV Facility are described in greater detail in Chapter 2 of this BA Report.

1.2 Requirement for an Environmental Impact Assessment Process

The National Environmental Management Act (NEMA, Act No 107 of 1998) is the national 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 these 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.

The development (i.e. construction and operation) of the proposed Moeding Solar PV Facility is subject to the requirements of the Environmental Impact Assessment (EIA) Regulations of 2014 published in terms of Section 24(5) of NEMA. In terms of the EIA Regulations of 2014 (as amended on 07 April 2017) promulgated under Sections 24 and 24D of the NEMA, various aspects of the project are listed as activities that may have a detrimental impact on the environment. The main listed activity triggered by the proposed solar energy facility is Activity 1 of Listing Notice 2 (GN R 325) which relates to the development of facilities or infrastructure for the generation of electricity from a renewable resources where the generating capacity is 20 megawatts or more, as the facility will have a contracted capacity of up to 100MW.

The procedure to be followed in applying for environmental authorisation for a large-scale project in a REDZ was formally gazetted on 16 February 2018 (in Government Notice (GN) 113 and GN114). As the project is located within one of the eight designated REDZ areas, the Moeding Solar PV Facility is now subject to a Basic Assessment and not a full EIA process, as well as a shortened timeframe of 57 days for the processing of an Application for Environmental Authorisation. The nature and extent of this solar energy facility, as well as potential environmental impacts and mitigations associated with the construction, operation and decommissioning phases of a development of this nature are explored in more detail in this Basic Assessment Report (hereafter referred to as the BA Report).

The need to comply with the requirements of the EIA Regulations ensures that decision-makers are provided the opportunity to consider the potential environmental impacts of a project early in the project development process, and assess if environmental impacts can be avoided, minimised or mitigated to acceptable levels. Environmental issues are considered through specialist assessments in order to: test the environmental suitability of the project development area[2] for the proposed development; delineate areas of sensitivity within the project site; and, ultimately inform the placement of the Moeding Solar PV Facility and associated infrastructure within the project site. Site specific specialist assessments of the development area, and specifically the proposed development footprint have been undertaken during the BA process.

In terms of GNR 779 of 01 July 2016, the National DEA 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 DEA will be supported by the North West Department of Rural, Environmental and Agricultural Development (READ) as the commenting authority.

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

This BA Report has been prepared in accordance with the requirements of the EIA Regulations published on 08 December 2014 (as amended) promulgated in terms of Chapter 5 of the National Environmental Management Act (Act No 107 of 1998). This chapter of the BA Report includes the following information required in terms of Appendix 1: Content of Basic Assessment Reports:

Requirement	Relevant Section
1(a) the details of the EAP who prepared the report and (ii) the expertise of the EAP, including a curriculum vitae.	The details and expertise of the EAP who prepared the report has been included in section 1.4 and **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 co-ordinates of the boundary of the property or properties.	The location of the Moeding Solar PV Facility is included in section 1.3, **Table 1.1** and **Figure 1.1**. The information provided includes the 21-digit Surveyor General code of the affected properties and the farm name. Additional information is also provided regarding the location of the development which includes the relevant province, local and district municipalities, ward and current land zoning.

The BA Report describes and assesses the Moeding Solar PV Facility. The BA Report is structured according to the following chapters:

[2] The development area is the identified location within the project site within which the Moeding Solar PV Facility will be sited. The development area will include the development footprint, which will house the PV panels and other associated infrastructure to be constructed for the solar energy facility. The development area is approximately 423ha in extent.

- **Chapter 1** provides background to the Moeding Solar PV Facility and the environmental impact assessment, and introduces the rationale behind the selected project site, development area and technology proposed.
- **Chapter 2** describes the project, the project site and development area/footprint selection process, and the identified project alternatives.
- **Chapter 3** outlines the strategic regulatory and legal context for energy planning in South Africa and specifically for the project.
- **Chapter 4** provides the need and desirability of the solar energy facility.
- **Chapter 5** outlines the approach to undertaking the environmental impact assessment process.
- **Chapter 6** describes the existing biophysical and socio-economic environment within and surrounding the project site and specifically the project development area and footprint.
- **Chapter 7** provides an assessment of the potential issues and impacts associated with the project and outlines recommendations for mitigation of significant impacts.
- **Chapter 8** provides an assessment of the potential for cumulative impacts.
- **Chapter 9** presents the conclusions and recommendations based on the findings of the BA.
- **Chapter 10** provides a list of reference material used to compile the BA Report.

1.4 Details and Expertise of the Environmental Assessment Practitioner (EAP)

In accordance with Regulation 12 of the 2014 EIA Regulations (GNR 326) Moeding Solar has appointed Savannah Environmental (Pty) Ltd (Savannah Environmental) as the independent Environmental consultant to undertake the Basic Assessment and prepare the BA Report for the Moeding Solar PV Facility. Neither Savannah Environmental nor any of its specialists are subsidiaries of, or are affiliated to Moeding Solar. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed solar facility. 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 as the company is an Exempted Micro Enterprise (EME). The company was established in 2006 with a clear objective to provide services to the infrastructure development sector. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team that has been actively involved in undertaking environmental studies for a wide variety of projects throughout South Africa and neighbouring countries. Strong competencies have been developed in project management of environmental processes, as well as strategic environmental assessment and compliance advice, and the assessment of environmental impacts, the identification of environmental management solutions and mitigation/risk minimising measures.

The Savannah Environmental team has considerable experience in environmental impact assessments and environmental management, and has been actively involved in undertaking environmental studies for a wide variety of projects throughout South Africa, including those associated with electricity generation and transmission.

The Savannah Environmental team in this project includes:

- **Thalita Botha** - the principle author of this report. She holds a Bachelor degree with Honours in Environmental Management and has three years of experience in the environmental field. Her key

focus is on environmental impact assessments, public participation, environmental management plans and programmes, as well as mapping using ArcGIS for a variety of environmental projects.

» **Jo-Anne Thomas** is a Director at Savannah Environmental (Pty) Ltd. Jo-Anne has a Master of Science Degree in Botany (M.Sc. 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). She has gained extensive knowledge and experience on potential environmental impacts associated with electricity generation and transmission projects through her involvement in related EIA processes over the past 20 years. She has successfully managed and undertaken EIA processes for infrastructure development projects throughout South Africa.

» **Nicolene Venter** – Board Member of IAPSA (International Association for Public Participation South Africa. She holds a Higher Secretarial Diploma and has over 21 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**.

1.5 Details of the Independent Specialist Team

In order to adequately identify and assess potential impacts associated with the project, a number of specialists have been appointed as part of the project team, and have provided specialist input into this BA Report (refer to **Table 1.2**).

Table 1.2: Specialists which form part of the EIA project team

Company	Specialist Area of Expertise	Specialist Name
Nkurenkuru Ecology and Biodiversity	Ecology and Wetland Impact Assessment	Gerhard Botha
Nkurenkuru Ecology and Biodiversity	Avifauna Impact Assessment	Gerhard Botha
TerraAfrica	Soils and Agricultural Potential Impact Assessment	Mariné Pienaar
Environmental Planning and Design	Visual Impact Assessment	Jon Marshall
PGS Heritage	Heritage Impact Assessment	Wouter Fourie
Banzai Environmental	Palaeontological Impact Assessment	Elize Butler
Savannah Environmental	Social Impact Assessment	Sarah Watson with external review by Neville Bews

CVs detailing the independent specialist's expertise and relevant experience are provided in **Appendix A**.

CHAPTER 2 PROJECT DESCRIPTION

The Moeding Solar PV Facility is planned to be developed (i.e. constructed and operated) on Portion 1 of the Farm Champions Kloof 731, Portion 4 and the Remaining Extent of Portion 3 of the Farm Waterloo 730 located approximately 8km south of the town of Vryburg in the North West Province. This chapter provides an overview of the project and details the project scope which includes the planning/design, construction, operation and decommissioning activities. This chapter describes site and technology alternatives, as well as the 'do nothing' option. Lastly, it explores the use of solar energy as a means of power generation.

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

This chapter of the BA Report includes the following information required in terms of Appendix 1: Content of Basic Assessment reports:

Requirement	Relevant Section
(c) a plan which locates the proposed activity or activities applied for as well as associated structures and infrastructure at an appropriate scale;	A plan which locates the proposed activity being applied for as well as associated structure are included in **Figure 2.3**.
(g) a motivation for the preferred site, activity and technology alternative;	A motivation for the location of the identified development area and the development footprint within the project site is included in section 2.3.
(h)(i) details of all the alternatives considered;	The details of all alternatives considered for the development of the Moeding Solar PV Facility are included in section 2.5.
(h)(ix) the outcome of the site selection matrix;	The outcome of the site selection process undertaken for the identification of the preferred project site is included in section 2.3.
(h)(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such.	A motivation for not considering any alternative development locations is included in section 2.5.2.
(h) (xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity.	No alternative development locations within the preferred project site have been identified for the Moeding Solar PV Facility. The motivation for not considering alternative development locations within the project site is included in section 2.5.2.1.

2.2 Project and Site Description

The project site proposed for the solar energy facility is located on Portion 1 of the Farm Champions Kloof 731, Portion 4 and the Remaining Extent of Portion 3 of the Farm Waterloo 730. The site is located

approximately 8km south of Vryburg, situated within the Naledi Local Municipality and the greater Dr Ruth Segomotsi Mompati District Municipality. The full extent of the project site (i.e. 642ha) has been considered for this BA process, within which the development area[3] for the solar energy facility (approximately 436,6ha in extent) has been appropriately located. The development area is located in the northern portion of the project site, west of the N18 national route (refer to **Figure 2.1**).

Based on the specialist studies undertaken as part of this BA process (refer to **Appendix D – J**), sensitivities and areas which were to be excluded from the development footprint were identified within the project site. In order to avoid these areas of potential sensitivity and ensure that detrimental environmental impacts are minimised as far as possible, the developer identified the preferred and most suitable development footprint[4] within which the infrastructure of the solar energy facility is proposed to be located. The development area will accommodate the development footprint of the solar energy facility which will include the PV panels, on-site substation, inverters, buildings and access roads. The 132kV power line proposed for the project will be situated within a 31m wide servitude. A 300m wide power line corridor which is partly situated within the development area and within the Remaining Extent of the Farm Rosendal 673 is being considered for the location of the servitude for Power Line Alternative 1. The entire servitude for Power Line Alternative 2 will be located within the development area.

The Moeding Solar PV Facility and its associated infrastructure is proposed to include:

» Arrays of PV panels (either a static or tracking PV system) with a contracted capacity of up to 100MW.
» Mounting structures to support the PV panels.
» Cabling between the project components, to be laid underground where practical.
» On-site inverters to convert the power from a direct current to an alternating current.
» An on-site substation to facilitate the connection between the solar energy facility and the Eskom electricity grid.
» A new 132kV power line between the on-site substation and the Eskom grid connection point.
» Battery storage with up to 6 hours of storage capacity.
» Offices and workshop areas for maintenance and storage.
» Laydown areas.
» Internal access roads and fencing around the development area.

Table 2.1 provides the details of the project site and technology proposed for the Moeding Solar PV Facility, including the main infrastructure and services.

[3] The development area (~436,6ha in extent) is a smaller focus area within the project site which has been selected as the best practicable option for the facility, considering technical preference and environmental constraints. The development area has been subject to detailed specialist assessments in this BA Report, and provides the boundary within which the development footprint (~300ha) of the solar energy facility will be located.
[4] The total development footprint located within the development area for the solar energy facility, including associated infrastructure is ~300ha in extent.

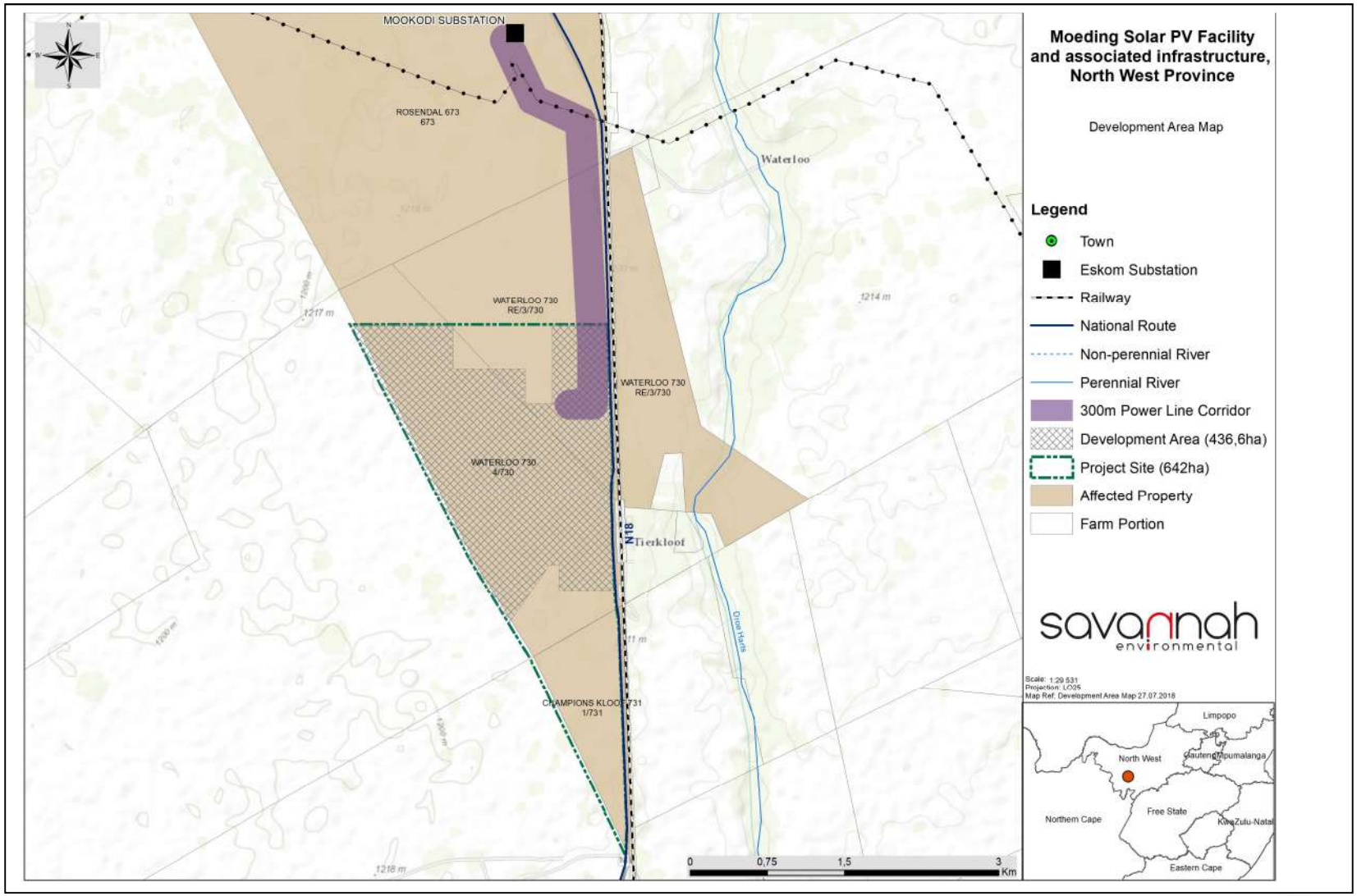


Figure 2.1: Map illustrating the development area (~436,6ha) within the project site proposed for the Moeding Solar PV Facility and the 300m wide assessment corridor for the proposed Power Line Alternative 1.

Table 2.1: Details of the proposed solar energy facility and associated infrastructure

Component	Description / Dimensions	
Location of the project site	» Portion 1 of the Farm Champions Kloof 731. » Portion 4 of the Farm Waterloo 730. » Remaining Extent of Portion 3 of the Farm Waterloo 730.	
Location of the 132kV power line alternatives	» Remaining Extent of the Farm Rosendal 673. » Remaining Extent of Portion 3 of the Farm Waterloo 730.	
Municipal Jurisdiction	» Naledi Local Municipality » Dr Ruth Segomotsi Mompati District Municipality	
SG 21 Digit Code (s)	Portion 1 of the Farm Champions Kloof 731	T0HN00000000073100001
	Farm Rosendal 673	T0IN00000000067300000
	Portion 4 of the Farm Waterloo 730	T0IN00000000073000004
	Remaining Extent of Portion 3 of the Farm Waterloo 730	T0IN00000000073000003
Extent of the project site	~642ha (placed within the affected properties).	
Extent of the facility development area	~436,6ha	
Extent of the facility development footprint	~300ha	
Contracted capacity of facility	Up to 100MW	
Technology	Static or tracking photovoltaic system.	
Internal access	Internal access road of a gravel nature with a width of 6m will be constructed within the development footprint. The total length of the internal roads will be ~11km.	
Site access	Direct access via the N18 national route which is situated along the eastern boundary of the project site.	
Details of the PV panels	» Height: ~5m from ground level (installed). » Up to 370 960 panels required (1956mm x 992mm x 40mm for each panel). » Fixed-tilt, single-axis tracking, and/or double-axis tracking systems.	
On-site substation	» Located within the development area and in close proximity to the site access point. » 132kV in capacity » 120m x 80m = 9 600m^2	
Distribution transformers	» 2,8m in height	
Capacity of main transformer	» 22kV (120MVA)	
Grid connection alternatives	» A new 132kV power line will be required to be established within a 31m wide servitude. Two grid connection alternatives are being considered: ∗ *Alternative 1* – Direct connection to the existing Mookodi Main Transmission Substation located on the Remaining Extent of the Farm Rosendal 473. ∗ *Alternative 2* – A turn-in turn-out connection to the Mookodi - Magopela 132kV power line proposed to be constructed along the eastern boundary of the project site).	
Number of inverters required	Up to 100 inverters (2,8m in height)	

Component	Description / Dimensions
Battery storage	The footprint of the battery will be less that 1 ha
Laydown areas	~10 ha (temporary laydown area) ~2 ha (permanent laydown area)
Temporary infrastructure required during the construction phase (which is estimated to be ~12 months)	» Construction equipment camps; » Construction yard; and » Storage areas. » Total area to be occupied: up to ~400m² within the development area.
Other infrastructure	» Gate house and security building. » Office building. » Batching plant. » Maintenance building (2.5m in height) and Warehousing (4m in height) will be up to ~952m². » Perimeter fence (2.5min height).
Services required	» Refuse material disposal - all refuse material generated from the proposed development will be collected by a contractor and will be disposed of at a licensed waste disposal site off site. This service will be arranged with the municipality when required. » Sanitation – all sewage waste will be stored on site within a septic tank which will be emptied by the municipality for disposal. » Water supply – water will be sourced from the existing borehole located on the property. The project will require 600m³ during the 18 month construction period and 2800 m³ per annum for the 20 year operational phase. » Electricity supply – agreements with the Naledi Local Municipality will be established for the supply of electricity to the solar energy facility.

2.3 Summary of Site Selection Process and Pre-Feasibility Analysis

As a precursor to initiating the BA process, Moeding Solar (Pty) Ltd embarked on a solar resource monitoring programme, as well as a site identification and selection process to determine areas suitable for the development of a solar energy facility (PV facility) from an environmental and technical perspective in the North West Province[5].

Through this process, the broader study area (i.e. the greater Vryburg area) was identified by the applicant as having the potential for the installation of a PV facility on the basis of key technical criteria (i.e. favourable climatic conditions (solar renewable energy facilities are directly reliant on average solar radiation values for a particular area), access and capacity of the electricity grid and connection cost, accessibility of the affected properties, compatibility of current land use and local site topography) being

[5] The North West Province receives a high average daily direct normal and global horizontal irradiation (GHI) (2120-2240 kWh/m²/annum) which indicates that the regional location is appropriate for the development of the solar energy facility in terms of the available solar resource.

met. In addition, the area is located within the Vryburg Renewable Energy Development Zone (REDZ 6), an area designated for the development of large-scale PV solar facilities.

From the initial pre-feasibility analysis, the applicant excluded properties from the feasible land parcels where:

a) the current land use was not considered compatible with the proposed land use,
b) properties were considered to present greater environmental constraints which would have a higher environmental impact if selected for the development and reduce the chances of success for the project (i.e. environmentally constrained), and
c) properties which presented greater technical constraints (i.e. solar energy availability) which would influence the cost effectiveness of the facility and therefore influence the economic feasibility thereof.

After the consideration of the various land parcels for the development of a solar energy facility, the preferred project site identified by the developer (~642ha) is situated within Portion 1 of the Farm Champions Kloof 731, Portion 4 and the Remaining Extent of Portion 3 of the Farm Waterloo 730. It is within this project site that a preferred development area has been identified, where the development of the solar energy facility is proposed to take place. No alternative project sites were identified for assessment within the BA process. The detail regarding site-specific characteristics, and how these provide further motivation for the selection of the specific site selected for this project is provided below:

Project site extent, conditions and land availability: Availability of level land of sufficient extent can be a restraining factor for the development of a solar energy facility. The Moeding Solar PV Facility will have a contracted capacity of up to 100MW which requires an area of ~300ha (i.e. the development footprint) for the construction of the facility. The project site is ~642ha in extent, which provides for sufficient space for the solar energy facility and allows for the avoidance of any environmental sensitivities located within the project site. The landowner of the properties on which the solar energy facility infrastructure is proposed (i.e. Tiger Kloof Educational Institute) is willing to allow the development of the facility to take place on the properties and will allow the developer to lease the portion proposed for the development.

The following are key considerations:

- The project site conditions are optimal for a development of this nature, with the site being of a suitable gradient for the development of a solar energy facility (i.e. PV facility).
- The region within which the project site is located can be described as a flat plateau. The area is consistent with the land type and classifies the landscape with an average slope of between 0% and 2% which is suitable for a development of this nature.
- The development area (inclusive of the development footprint) of the solar energy facility would comprise ~68% of the total extent of the project site.

This project site is therefore considered suitable and favourable from a technical perspective for the construction and operation of the Moeding Solar PV Facility, allowing for avoidance of sensitivities within the greater project site.

Site access: Access to the project site is considered as an important characteristic as easy access is required for the transportation of project related infrastructure and heavy machinery during construction. The proximity of the project site to viable access routes decreases the impact on secondary roads in terms of traffic during the construction and operation phases. The project site can be readily accessed via the national route (N18) which is aligned with the eastern boundary of the project site. Access routes within

the surrounding areas are also an important characteristic to consider. The N14 national route provides access to the area from Upington and Johannesburg.

Agricultural considerations: The majority of the project site is classified as Class VI in terms of the Department of Agriculture, Forestry and Fisheries (DAFF) Land Capability Classification Systems, which is associated with severe limitations that make it generally unsuited for cultivation and limits the use largely to livestock grazing. Two small areas in close proximity to the eastern boundary of the project site are classified as Class IV which indicates that these areas have a low to very low agricultural potential. A small area (~1.8ha of the 642ha) close to the western boundary of Portion 4 of the Farm Waterloo 730 has a moderate land capability. Limitations for agriculture that cannot be avoided include erosion hazards, effects of past erosion, stoniness, shallow rooting zone, low water-holding capacity, salinity or sodicity and severe climate. It can be concluded that very little, if any, of the project site contains high potential soils. Therefore, it can be considered that the development of the Moeding Solar PV Facility within the project site will not result in a loss of viable agricultural land as the chance of successful agricultural activities, including crop production, is minor.

Land use considerations: The current land use of the site is an important consideration in site selection in terms of limiting disruption to existing land use practices. There is no cultivated agricultural land within the affected properties (as a result of low agricultural potential) which could be impacted upon by the proposed solar energy facility. The affected properties are currently used for livestock grazing. The landowner is currently considering options for the alternative use for their land other than for grazing. It is considered that the development of the solar energy facility is compatible with the project site and will not present a conflicting land-use.

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. Solar energy facilities which are in close proximity to a grid connection point and/or demand centre are favourable and reduce the losses associated with power transmission. The grid connection alternatives to connect the facility to the national grid from the proposed site include i) a direct connection to the Mookodi Main Transmission Substation situated directly north of the project site (i.e. on the Farm Rosendal 673), and ii) a turn-in turn out connection to the Mookodi – Magopela 132kV power line (to be constructed along the eastern boundary of the project site). The grid connection alternatives are located in close proximity (i.e. all within 4km) to the development footprint of the solar energy facility, minimising the connection length required. The connection between the facility, the facility on-site substation and grid connection point will be via a new 132kV power line.

Local labour and poverty alleviation: The project site is located ~8km from the town of Vryburg, which will act as the source of local labour during the construction and operation of the solar energy facility.

2.4 PV Technology considered for Moeding Solar PV and the Generation of Electricity

Solar PV energy facilities 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 placing them into a higher state of energy to create electricity.

A PV cell is made of silicon acting as a semi-conductor and used to produce the photovoltaic effect. Individual PV cells are linked and placed behind a protective glass sheet to form a PV panel. The PV cell is

positively charged on one side and negatively charged on the other side and electrical conductors are attached to either side to form a circuit. This circuit then captures the released electrons in the form of an electric current (direct current). An inverter must be used to convert direct current (DC[6]) to alternating current (AC[7]). The electricity is then stepped up from 11kV to 132kV voltage via a transformer before being injected into the national grid via a power line.

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

Photovoltaic Cells

A PV cell is made of silicon that acts as a semiconductor used to produce the photovoltaic effect. A single cell is sufficient to power a small device such as an emergency telephone. However, to produce up to 100MW of power, the proposed facility will require numerous cells arranged in multiples/arrays which will be placed behind a protective glass sheet and fixed to a support structure. Each PV cell is positively charged on one side and negatively charged on the other side, with electrical conductors attached to either side to form a circuit. This circuit captures the released electrons in the form of an electrical current (DC).

The Inverter

An inverter is used to convert the electricity which is produced as direct current into alternating current for the purpose of grid connection. In order to connect a large solar energy facility to the national grid, numerous inverters will be arranged in several arrays to collect, and convert the produced power.

The Support Structure

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 2.2**). 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.

[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. As an adjective, the term DC is used in reference to voltage whose polarity never reverses. In a DC circuit, electrons emerge from the negative, or minus, pole and move towards the positive, or plus, pole. Nevertheless, physicists define DC as traveling from plus to minus. (sourced from https://whatis.techtarget.com/definition/DC-direct-current).

[7] An alternating current (AC) occurs when charge carriers in a conductor or semiconductor and periodically reverse their direction of movement. The voltage of an AC power source can be easily changed by means of a power transformer. This allows the voltage to be stepped up (increased) for transmission and distribution (sourced from https://whatis.techtarget.com/definition/alternating-current-AC).

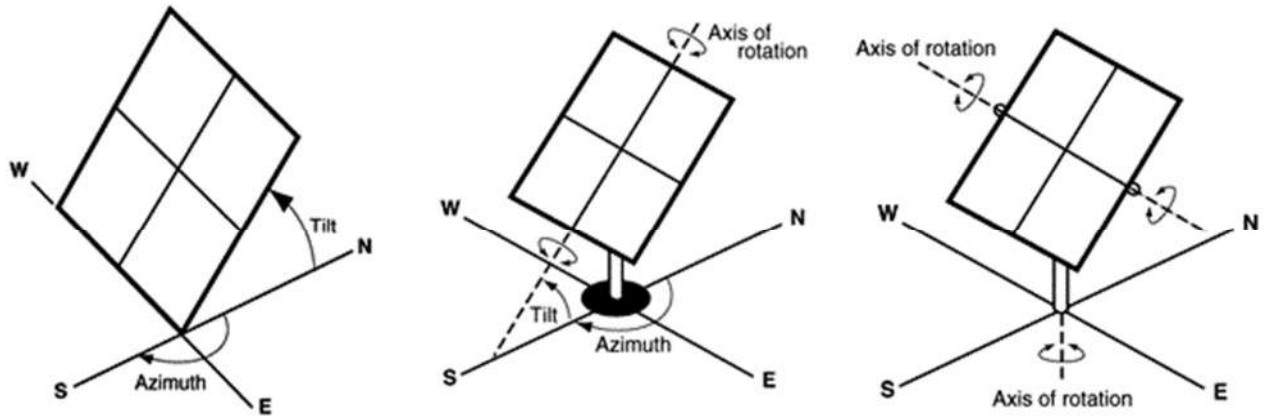


Figure 2.2: Overview of different PV tracking systems (from left to right: fixed-tilt, single-axis tracking, and double-axis tracking (Source: pveducation.com)).

PV panels are designed to operate continuously for more than 25 years, mostly unattended and with low maintenance.

2.5 Project Alternatives under consideration for the Solar Energy Facility

In accordance with the requirements outlined in Appendix 1 of the EIA Regulations 2014 (as amended), the reasonable and feasible alternatives, including site, activity, technology, as well as the "do-nothing" alternative should be considered. The following sections address this requirement.

Most guidelines use terms such as "reasonable", "practicable", "feasible" or "viable" to define the range of alternatives that should be considered. Essentially there are two types of alternatives:

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

2.5.1 Consideration of Fundamentally Different Alternatives

Fundamentally different alternatives are usually assessed at a strategic level, and project-specific EIA processes are therefore limited in scope and ability to address fundamentally different alternatives. Electricity generating alternatives have been addressed as part of the Department of Energy's (DoE's) IRP 2010 – 2030. In this regard, the need for renewable energy power generation from solar has been identified as part of the technology mix for power generation in the country in the next 20 years.

2.5.2 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 to:

» 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.

In determining suitable alternatives for the project, the developer has considered the typical mitigation hierarchy:

1. First mitigation: the avoidance of adverse impacts as far as possible by the use of preventative measures.
2. Second mitigation: minimisation or avoidance of sensitive areas.
3. Third mitigation: remedy or compensation for adverse residual impacts, which are unavoidable and cannot be reduced further.

These project alternatives are discussed under the respective subheadings below.

2.5.2.1 Property or Location Alternatives

In order for the facility to operate successfully and reach the electricity generation goal of up to 100MW, sufficient space is required. Various parcels of land were considered by the developer for the development of a solar energy facility with a contracted capacity of up to 100MW, specifically in the Vryburg area as it is located within an area of suitable solar irradiation and within a REDZ (Zone 6). Land parcels located within and around Vryburg were considered from a land availability and environmental perspective, but as a result of environmental and technical constraints within the land parcels, they were deemed unsuitable for the development of this solar energy facility and were discarded by the developer.

Through this process, the preferred properties for the solar energy facility was identified as the Portion 1 of the Farm Champions Kloof 731, Portion 4 and the Remaining Extent of Portion 3 of the Farm Waterloo 730. As detailed in Section 2.3, the preferred project site was selected on the basis of:

i) the available grid connection infrastructure within close proximity to the project site,
ii) consent of the landowner to undertake the development of the Moeding Solar PV Facility within the affected properties,
iii) technical suitability of the broader project site for the development of a solar energy facility,
iv) the location of the project site within the Vryburg REDZ and therefore compatible with planned future land uses in the area,
v) knowledge obtained from the EIA process undertaken for the Tiger Kloof Solar Energy Facility, and
vi) sufficient space available within the project site in order to successfully develop and operate the solar energy facility.

As the project site complies with the above characteristics, this is considered to be the most reasonable and feasible alternative site for the development. The site has been subject to historic disturbance (extensive grazing activities), and presents an opportunity for the development of a solar energy facility, as a compatible and sustainable land use option. As such, no alternative project sites are further considered for the development of the Moeding Solar PV Facility.

2.5.2.2 Site specific and layout design alternatives

The full extent of the 642ha identified project site was considered in the BA process for the Moeding Solar PV Facility. Specialist field surveys and assessments were undertaken in order to provide the developer with site specific information regarding the larger project site considered for the development (refer to **Appendices D-J**). Areas to be avoided by the development were identified, specifically relating to ecological features and sensitivities present within the project site. The identified sensitivities were utilised as a tool by the developer to identify and locate the development area of the solar energy facility (~436,6ha) within the project site, as well as to locate the development footprint/facility layout within the identified development area. This was undertaken with the aim of avoiding possible sensitive areas within the development footprint so as to limit impacts associated with the development.

This preferred location of the development area within the project site is considered as the most feasible and appropriate location for the Moeding Solar PV Facility, based on the following considerations:

i) sufficient space is available within the development area for the development footprint to avoid the sensitivities identified,
ii) the identified development area is located in close proximity to the proposed grid connection alternatives considered for the facility, which shortens the length of the power line required to be constructed for the connection into the national grid,
iii) the landowner provided consent for the development area of the solar energy facility within that particular portion of the project site to be constructed and operated, and
iv) the development area is considered suitable for the development of a solar energy facility (i.e. the use of photovoltaic (PV) panels) from a technical perspective to ensure the success of the development.

The proposed layout is therefore considered as *least intrusive* on the environment and most suitable (refer to **Figure 2.3**). Therefore, no development area alternatives within the identified project site are being considered for the construction and operation of the solar energy facility.

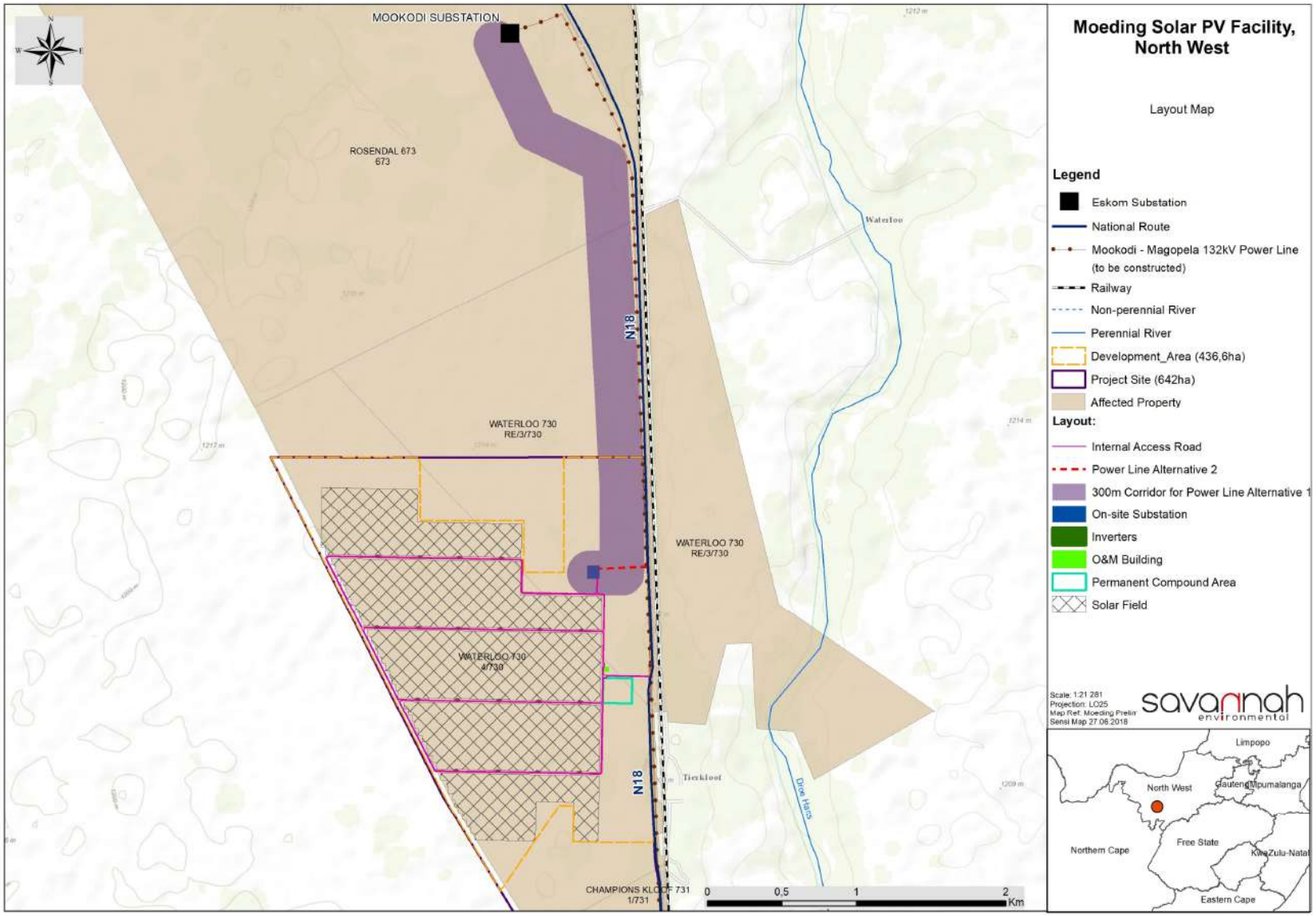


Figure 2.3: Map illustrating the proposed layout located within the development area (~436,6ha).

2.5.2.3 Activity Alternatives

Moeding Solar (Pty) Ltd is an independent power producer (IPP) and a renewable energy project developer and as such will only consider renewable energy technologies for the generation of electricity. Wind power is, however, not considered as a viable alternative to the power generation activity, due to the limited wind resource in the area. The greater Vryburg area and the preferred project site has a strong solar resource for the development of PV solar energy facilities. This is supported by the fact that the area is demarcated as a REDZ for PV solar development and that there are 20 other solar energy facilities (approved) located within a 30km radius from the project site. In this regard, no further activity alternatives were considered as the activity presented the best technical, environmental and social option.

2.5.2.4 Technology Alternatives

Solar energy is considered to be the most suitable renewable energy technology for this site, based on the site location, ambient conditions and energy resource availability. Solar PV was determined as the most suitable option for the proposed project site as large volumes of water are not required for power generation purposes compared to concentrated solar power technology (CSP). PV is also preferred when compared to CSP or CPV technology because of the lower visual profile.

Few technology options are available for PV facilities (i.e. tracking (solar panels that track the sun) or static PV systems), and the use of those that are considered are usually differentiated by weather and temperature conditions that prevail on the site, so that optimality is obtained by the final site selection. The primary differences between the technologies available, which affect the potential for environmental impacts, relate to the extent of the facility, or land-take (disturbance or loss of habitat), as well as the height of the facility (visual impacts). Two solar energy technology alternatives are being considered for the proposed project and include:

- 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).

2.5.3 Grid Connection Alternatives

The grid connection for the project will be finalised based on input from Eskom and the outcome of the environmental assessment. The following is being considered:

- **On-Site Substation**

The on-site substation proposed for the development of the Moeding Solar PV Facility is proposed to be located within the north western corner of the project site and within close proximity to the proposed grid connection alternatives. As detailed above, the layout for the solar energy facility within the identified development area considers the placement of all the project related infrastructure.

Due to the following reasons no alternative on-site substations are considered:

- The on-site substation location is situated close to the solar energy facility and within the development area.

» The length of the new 132kV power line required to complete the connection between the facility on-site substation and the national grid will be less than 5km.

Therefore, considering the above characteristics of the location of the on-site substation no alternative exists, and as such no alternatives are being considered.

» **Grid Connection Power Line Route Alternatives**

In order to establish a connection between the Moeding Solar PV Facility's on-site substation and the grid connection point where the generated electricity will be evacuated into the Eskom national electricity grid, a connection needs to be established. The connection between the facility on-site substation and the grid connection point will be established through a new 132kV power line.

Two grid connection alternatives are being considered and include:

» Alternative 1 – a direct connection to the existing Mookodi Main Transmission Substation located north of the project site on the Remaining Extent of the Farm Rosendal 673. A new 132kV power line will be constructed over a distance of ~4km. A 300m power line corridor has been assessed for Alternative 1.
» Alternative 2 - a turn-in turn-out connection into the proposed Mookodi - Magopela 132kV power line (to be constructed along the eastern boundary of the project site). A new turn-in and out 132kV power line will be constructed over a distance of ~335m.

The following characteristics are associated with both alternatives, which make them suitable for the connection to the national grid:
» The length of the proposed routes from the facility on-site substation to the national grid is not extensive.
» The two power line grid connection alternatives are located within the development area and the 300m power line corridor.
» There is confirmed capacity to evacuate the generated electricity into the national grid via any of the grid connection alternatives.

Both alternatives are considered within this Basic Assessment Report.

2.5.4 Site Access Alternatives

Direct access to the project site is possible via the national route (N18) which is aligned with the eastern boundary of the project site. This route will provide direct access to the main entrance of the Moeding Solar PV Facility. Internal access roads will be constructed between the PV arrays for construction and maintenance purposes. These internal roads will be gravel and will be 4-6m in width.

As the access point is considered as technically viable and the shortest possible route to access the solar energy facility, no site access alternatives are being considered.

2.5.5 The 'Do-Nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the Moeding Solar PV Facility on Portion 1 of the Farm Champions Kloof 731, Portion 4 and the Remaining Extent of Portion 3 of the Farm Waterloo 730.

The "no-go" option would entail no change to the status quo. This alternative is assessed in detail within Chapter 7 of this BA Report as required in terms of the EIA Regulations.

The main reasons why the do-nothing alternative is not preferred or supported in relation to this solar energy facility are discussed below, namely:

- The current land use regime of the site;
- The need for additional clean energy generation capacity in South Africa;
- The need to diversify the energy mix in South Africa;
- Ongoing strategic investment priority by the Government as per the SIP 8;
- The opportunity presented by the Moeding Solar PV Facility for employment generation and local economic regeneration as part of the IDP.

2.6 Energy Storage

The battery storage mechanism will have a storage capacity of up to 6 hours. There are different battery technology which could be utilised for energy storage. Energy generated by the project can be stored in the Li-ion batteries, Lead Acid batteries, Salt Batteries, Vanadium Redox Flow batteries or other technologies for use after hours, when the facility is no longer generating electricity (i.e. at night or on cloudy days). The battery mechanism can also be used to stabilise power generation variability, and assist with power system frequency regulation. **Figure 2.4** provides an illustration of installed battery storage units.

Figure 2.4: Illustration of battery storage units installed by Tesla (Source: fastcompany.com)).

2.7 Activities during the Project Development Stages

In order to construct the Moeding Solar PV Facility and its associated infrastructure, a series of activities will need to be undertaken during the design, pre-construction, construction, operation, and decommissioning phases which are discussed in more detail below.

2.7.1 Design and Pre-Construction Phase

Pre-planning: Several post-authorisation factors are expected to influence the final design of the facility and could result in small-scale modifications of the PV array and/or associated infrastructure. While an objective of the Engineering, Procurement and Construction (EPC) Contractor, who will be responsible for the overall construction phase of the project, will be to comply with the approved facility design as far as possible, it should be understood that the construction process is dynamic and that unforeseen changes to the project specifications will take place. This BA 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 DEA. Importantly, should there be any substantive changes or deviations from the original scope or layout of the project, the DEA will need to be notified and where relevant, 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, substation and the plant's associated infrastructure) and a geotechnical survey. Geotechnical surveys are executed by geotechnical engineers and geologists to acquire information regarding the physical characteristics of soil and rocks underlying a proposed project site. The purpose is to design earthworks and foundations for structures and to execute earthwork repairs necessitated due to changes in the subsurface environment.

2.7.2 Construction Phase

The construction phase will entail a series of activities including:

Procurement and employment

The proposed solar energy facility is likely to create approximately ~800 employment opportunities (temporary) for a period of ~12 to 18 months, depending on the final design, during the construction phase. Of this approximately 60% of the opportunities will be available to unskilled workers (construction labourers, security staff, drivers, equipment operators etc.), 25% will be available to skilled personnel (electricians, site managers etc.) and 15% of employment opportunities will be for highly skilled individuals (engineers, project managers, site managers etc.). Solar PV projects make use of high levels of unskilled and semi-skilled labour so there will be good opportunity to use local labour. Employment opportunities for the proposed solar energy facility 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 greater Vryburg area.

Establishment of an Access Road to the Site

The project site proposed for the development is accessible via the N18 which traverses the eastern section of the project site. Within the site itself, access will be required from new/existing roads for construction purposes (and limited access for maintenance during operation). Internal access roads of up to 6m in width, and of a gravel nature will be required.

Undertake Site Preparation

Site preparation activities will include the 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 components for the proposed development will be transported to site by road. For the proposed solar energy facility, transport of components would be via the N18. Some of the components (i.e. substation transformer) may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)[8] by virtue of the dimensional limitations. Typical civil engineering construction equipment will need to be brought to the 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 substation and site preparation.

Establishment of Laydown Areas on Site

Laydown and storage areas will be required for the typical construction equipment. Once the required equipment has been transported to site, a dedicated equipment construction camp and laydown area (of approximately 10 ha in extent) will be established. 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 project. The laydown area will be used for the storage of the PV panels and the general placement/storage of construction equipment.

Erect PV Cells and Construct Substation and Invertors

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

Figure 2.5: Frame, structural details (*Photo courtesy of Igeteam, 2011*).

The construction of a substation would 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.

Establishment of Ancillary Infrastructure

Ancillary infrastructure will include cabling for the connection to the Eskom national grid, workshop and maintenance building, storage and laydown areas, gatehouse and security complex, as well as a temporary contractor's equipment camp.

The establishment of these facilities/buildings will require the localised clearing of vegetation and levelling of the development footprint and the excavation of foundations prior to construction. A laydown area for building materials and equipment associated with these buildings will also be required.

Construction of the power line

A new 132kV power line will be constructed by surveying the power line route, construction of foundations for the towers, installation of the towers, stringing of conductors and finally the rehabilitation of disturbed area and protection of erosion sensitive areas.

Undertake Site Remediation

Once construction is completed and all construction equipment is removed, the site must be rehabilitated where practical and reasonable. On full commissioning of the solar energy facility, any access points to the site which are not required during the operation phase must be closed and rehabilitated.

2.7.3 Operation Phase

The proposed Moeding Solar PV Facility is expected to be operational for a minimum of 20 years. The project will operate continuously, 7 days a week and will include the capacity of battery storage of up to 6 hours. The battery allows for the storing of generation from the solar arrays, and then dispatching stored energy as and when required.

Key elements of the Operation and Maintenance plan include monitoring and reporting the performance of the project, conducting preventative and corrective maintenance, receiving visitors, and maintaining security of the project. The operation phase of the solar energy facility will create approximately 8 to 10 skilled employment opportunities, with potentially double that number for short periods of time throughout the lifespan of the facility. The number of skilled and semi-skilled personnel will comprise 70% and unskilled will comprise 30% of the workforce during the operation phase. Employees that can be sourced from the local municipal pool include the less skilled and semi-skilled such as safety and security staff and certain maintenance crew. Highly skilled personnel may need to be recruited from outside the local area.

2.7.4 Decommissioning Phase

Depending on the continued economic viability of the facility following the initial 20-year operation period, 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 disassembled and replaced with new, more efficient technology/infrastructure available

at that time. However, if the decision is made to decommission the facility, the following activities will form part of the project scope.

Site Preparation

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

Disassemble and Remove Existing Components

When the Moeding Solar PV Facility is ultimately decommissioned, the equipment to be removed will depend on the proposed land use for the site at that time. At this time, all above ground facilities that are not intended for future use at the site will be removed. Underground equipment (e.g. foundation, wiring) will be removed, and the surface restored. 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 plant would be deconstructed and recycled or disposed of in accordance with regulatory requirements. The site will be rehabilitated returned to a beneficial land use.

Future plans for the site and infrastructure after decommissioning

The plant capacity would have degraded by ±15% over 20 years. The expectation is that the project site will be used for future procurement rounds as the operation phase approaches the termination date of the Power Purchase Agreement (PPA). If decommissioning were to occur it would be 20 years after the commencement of the PPA, unless PPA durations in future rounds are extended to more than 20 years. Alternatively, the plant will also have the opportunity to generate power for a Merchant Market operation (i.e. the client would sell power on bid basis to the market). Another option for the site after decommissioning is for grazing to resume.

CHAPTER 3 POLICY AND LEGISLATIVE CONTEXT

This chapter provides an overview of the policy and legislative context within which the Moeding Solar PV Facility is being planned, and documents the manner in which the development of the solar energy facility complies with and responds to the objectives of relevant policies and legislation.

3.1. Legal Requirements as per the EIA Regulations for the undertaking of a Basic Assessment Report, 2014 (as amended)

This chapter of the BA Report includes the following information required in terms of Appendix 1: Content of the BA Report:

Requirement	Relevant Section
(e) a description of the policy and legislative context within which the development is proposed including (i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are considered in the preparation of the report; (ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;	The policy and legislative context for the development of the Moeding Solar PV Facility has been considered throughout this chapter on a national, provincial and local level. The specific legislation associated with the development is considered in Table 3.4.

3.2. Strategic Electricity Planning in South Africa

The need to expand electricity generation capacity in South Africa is based on national policy and is informed by ongoing strategic planning undertaken by the Department of Energy (DoE). The hierarchy of policy and planning documentation that supports the development of renewable energy projects such as solar energy facilities is illustrated in **Figure 3.1**:. 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 proposed project.

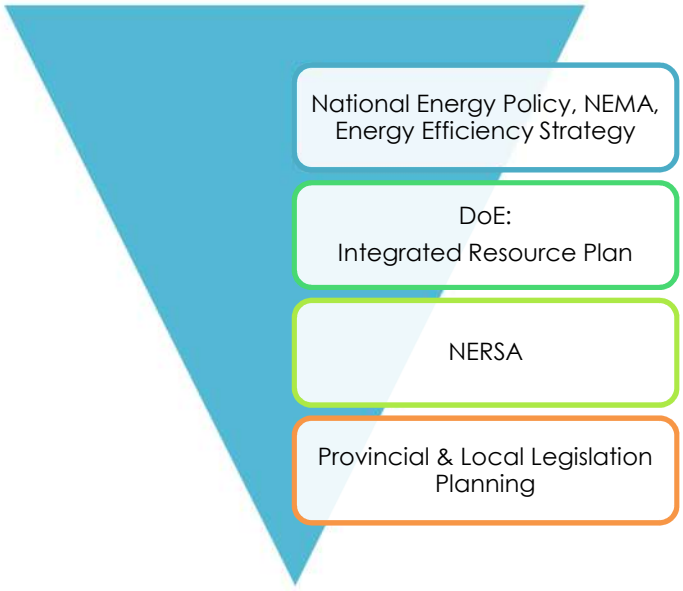


Figure 3.1: Hierarchy of electricity policy and planning documents.

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 for a solar energy facility and the related statutory environmental assessment process.

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

- ***Department of Energy (DoE):*** This Department is responsible for policy relating to all energy forms, and is responsible for forming and approving the IRP (Integrated Resource Plan for Electricity).
- ***National Energy Regulator of South Africa (NERSA):*** This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for IPP projects to generate electricity.
- ***Department of Environmental Affairs (DEA):*** This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the 2014 EIA Regulations as amended on 07 April 2017 (GN R326). The DEA is the competent authority for this project (as per GNR 779 of 01 July 2016), and is charged with granting the relevant Environmental Authorisation (EA) for the project under consideration.
- ***The 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 Water and Sanitation (DWS):*** 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 Agriculture, Forestry and Fisheries (DAFF):*** This Department is responsible for activities pertaining to the subdivision and rezoning of agricultural land. The forestry section is responsible for the protection of tree species under the National Forests Act (Act No 84 of 1998). This Department is also responsible for the issuing of permits for the disturbance or destruction of protected tree species.
- ***Department of Mineral Resources (DMR):*** Approval from the Department of Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of Section 53 of the Mineral and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA). In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise mineral resources that might occur on site.

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

- ***Provincial Government of the North West – North West Department of Rural, Environmental and Agricultural Development (READ):*** This Department is the commenting authority for the project as well as being responsible for issuing of other biodiversity and conservation-related permits.
- ***North West Department of Community Safety and Transport Management:*** This department provides effective co-ordination of crime prevention initiatives, provincial police oversight, traffic management and road safety towards a more secure environment.
- ***North West Provincial Heritage Resources Agency (NWPHRA):*** This Department identifies, conserves and manage heritage resources throughout the North West 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 North West Province, both the local and district municipalities play a role. The local municipality is the Naledi Local Municipality which forms part of the Dr Ruth Segomotsi Mompati 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.

3.3. National Policy

Further to the South African government's commitment in August 2011 to support the development of renewable energy capacity, DoE initiated the Renewable Energy Independent Power Producer Procurement (REIPPP) Programme to procure renewable energy from the private sector in a series of rounds. To date, the DoE has procured more than 6 000MW of renewable energy capacity from 102 independent power producers (IPPs). On 4 April 2018, the Minister of Energy signed the contracts with the Round 4 bidders which will add 2 600MW to the national grid and aid in the diversification and stabilisation of the electricity supply of the country[9]. National policies have to be considered for the construction and operation of the solar energy facility to ensure that the development is in line with the national planning of the country.

[9] https://www.ipp-projects.co.za/ (Date accessed: 25 July 2018)

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

3.3.1. The 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 into account environmental management requirements and interactions amongst economic sectors, as well as matters relating to renewable energy. The National Energy Act also provides for energy planning, increased generation and consumption of renewable energies, contingency energy supply, holding of strategic energy feedstocks and carriers, adequate investment in, appropriate upkeep and access to energy infrastructure. The Act provides measures for the furnishing of certain data and information regarding energy demand, supply and generation, and for establishing an institution to be responsible for promotion of efficient generation and consumption of energy and energy research.

The Act provides the legal framework which supports the development of power generation facilities, such as the Moeding Solar PV Facility.

3.3.2. White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)

The White Paper on Renewable Energy Policy supplements the Government's overarching policy on energy as set out in its White Paper on the Energy Policy of the Republic of South Africa (DME, 1998). The White Paper on Renewable Energy Policy recognises the significance of the medium and long-term potential of renewable energy. The main aim of the policy is to create the conditions for the development and commercial implementation of renewable technologies. The position of the White Paper on Renewable Energy is based on the integrated resource planning criterion of:

"Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options."

The White Paper on Renewable Energy sets out the Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. South Africa relies heavily on coal to meet its energy needs because it is well-endowed with coal resources in particular. However, South Africa is endowed with renewable energy resources that can be sustainable alternatives to fossil fuels, but which have so far remained largely untapped.

This White Paper fosters the uptake of renewable energy in the economy and has a number of objectives that include:

» Ensuring that equitable resources are invested in renewable technologies;
» Directing public resources for implementation of renewable energy technologies;
» Introducing suitable fiscal incentives for renewable energy and;
» Creating an investment climate for the development of renewable energy sector.

The objectives of the White Paper on Renewable Energy are considered in six focal areas, namely:

i) Financial instruments.
ii) Legal instruments.
iii) Technology development.
iv) Awareness raising.
v) Capacity building and education.
vi) Market based instruments and regulatory instruments.

The policy supports the investment in renewable energy facilities, like the Moeding Solar PV Facility, as they contribute towards ensuring energy security through the diversification of energy supply, reducing GHG emissions and the promotion of renewable energy sources.

The White Paper on Renewable Energy of 2003 set a target of 10 000GWh to be generated from renewable energy by 2013. The target was reviewed during the renewable energy summit of 2009 held in Pretoria. The summit raised the issue over the slow implementation of renewable energy projects and the risks to the South African economy of committing national investments in the energy infrastructure to coal technologies. Other matters that were raised include potential large scale roll out of solar water heaters and enlistment of Independent Power Producers (IPPs) to contribute to the diversification of the energy mix.

3.3.3. White Paper on the Energy Policy of the Republic of South Africa, 1998

The White Paper on Energy Policy states the need to improve the energy security in the country by means of expanding the energy supply options. This implies the increase in the use of renewable energy and encouraging new entries into the generation market. The support for the renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account.

Government policy on renewable energy is thus concerned with meeting the following challenges:
» Ensuring that economically feasible technologies and applications are implemented;
» Ensuring that an equitable level of national resources are invested in renewable technologies, given their potential and compared to investments in other energy supply options; and
» Addressing constraints on the development of the renewable industry.

The policy states that the advantages of renewable energy include minimal environmental impacts during operation in comparison with traditional supply technologies, generally lower 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. Therefore, the policy supports the advancement of renewable energy sources at ensuring energy security through the diversification of supply, which is in line with the proposed solar energy facility.

3.3.4. The Electricity Regulation Act (No. 4 of 2006), as amended

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.

3.3.5. Integrated Energy Plan (IEP) (2016)

The purpose and objectives of the Integrated Energy Plan (IEP) are derived from the National Energy Act (No. 34 of 2008). The IEP takes into consideration the crucial role that energy plays in the entire economy of the country and is informed by the output of analyses founded on a solid fact base. It is a multi-faceted, long-term energy framework which has multiple aims, some of which include:

- To guide the development of energy policies and, where relevant, set the framework for regulations in the energy sector;
- To guide the selection of appropriate technologies to meet energy demand (i.e. the types and sizes of new power plants and refineries to be built and the prices that should be charged for fuels);
- To guide investment and the development of energy infrastructure in South Africa; and
- To propose alternative energy strategies, which are informed by testing the potential impacts of various factors such as proposed policies, introduction of new technologies, and effects of exogenous macro-economic factors.

A draft version of the Integrated Energy Plan (IEP) was released for comment on 25 November 2016. The purpose of the IEP is to provide a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development. The development of the IEP is an ongoing continuous process. It is reviewed periodically to take into account changes in the macroeconomic environment, developments in new technologies and changes in national priorities and imperatives, amongst others.

The 8 key objectives of the integrated energy planning process are as follows:

- Objective 1: Ensure security of supply.
- Objective 2: Minimise the cost of energy.
- Objective 3: Promote the creation of jobs and localisation.
- Objective 4: Minimise negative environmental impacts from the energy sector.
- Objective 5: Promote the conservation of water.
- Objective 6: Diversify supply sources and primary sources of energy.
- Objective 7: Promote energy efficiency in the economy.
- Objective 8: Increase access to modern energy.

The IEP recognises the potential of renewable energy for power generation in South Africa and therefore supports the development of the proposed solar energy facility.

3.3.6. The National Development Plan (NDP) 2030

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. The NDP aims to achieve this by drawing on the energies of its people, growing and inclusive economy, building capabilities, enhancing the capacity of the state and promoting leaderships and partnerships throughout society. While the achievement of the objectives of the NDP requires progress on a broad front, three priorities stand out, namely:

- Raising employment through faster economic growth
- Improving the quality of education, skills development and innovation
- Building the capability of the state to play a developmental, transformative role

Enabling milestones include:

- Increased employment from 13 million in 2010 to 24 million in 2030.
- Establish a competitive base of infrastructure, human resources and regulatory frameworks.
- Ensure that skilled, technical, professional and managerial posts better reflect the country's racial gender and disability makeup.
- Increase the quality of education.
- Provide affordable access to quality health care.
- Establish effective, safe and affordable public transport.
- Produce sufficient energy to support the industry at competitive prices, ensuring access for poor households, while reducing carbon emissions per unit of power by about one-third.
- Ensure that all South Africans have access to clean running water in their homes.
- Make high-speed broadband internet universally available at competitive prices.
- Realise a food trade surplus, with one-third produced by small-scale farmers or households.

The NDP aims to provide a supportive environment for growth and development, while promoting a more labour-absorbing economy. The proposed solar energy facility will assist in reducing carbon emissions targets and creating jobs in the local area, as well as assist in creating a competitive infrastructure base in terms of energy contribution to the national grid.

3.3.7. Integrated Resource Plan (IRP) for Electricity 2010 - 2030

The Integrated Resource Plan (IRP) for Electricity 2010 – 2030[10] constitutes a subset of the IEP and is South Africa's national electricity plan. It provides a path to meet electricity needs over a 20-year planning horizon to 2030 and is being used to roll out electricity infrastructure development in line with Ministerial Determinations issued in terms of Section 34 of the Electricity Regulation Act No. 4 of 2006. The current iteration of the IRP for South Africa, initiated by the DoE after a first round of public participation in June

[10] It should be noted that the requirement for renewable energy generation (and specifically that from solar PV) has also been included in the latest IRP, published in August 2018 for comment. The updated IRP is yet to be finalised and promulgated.

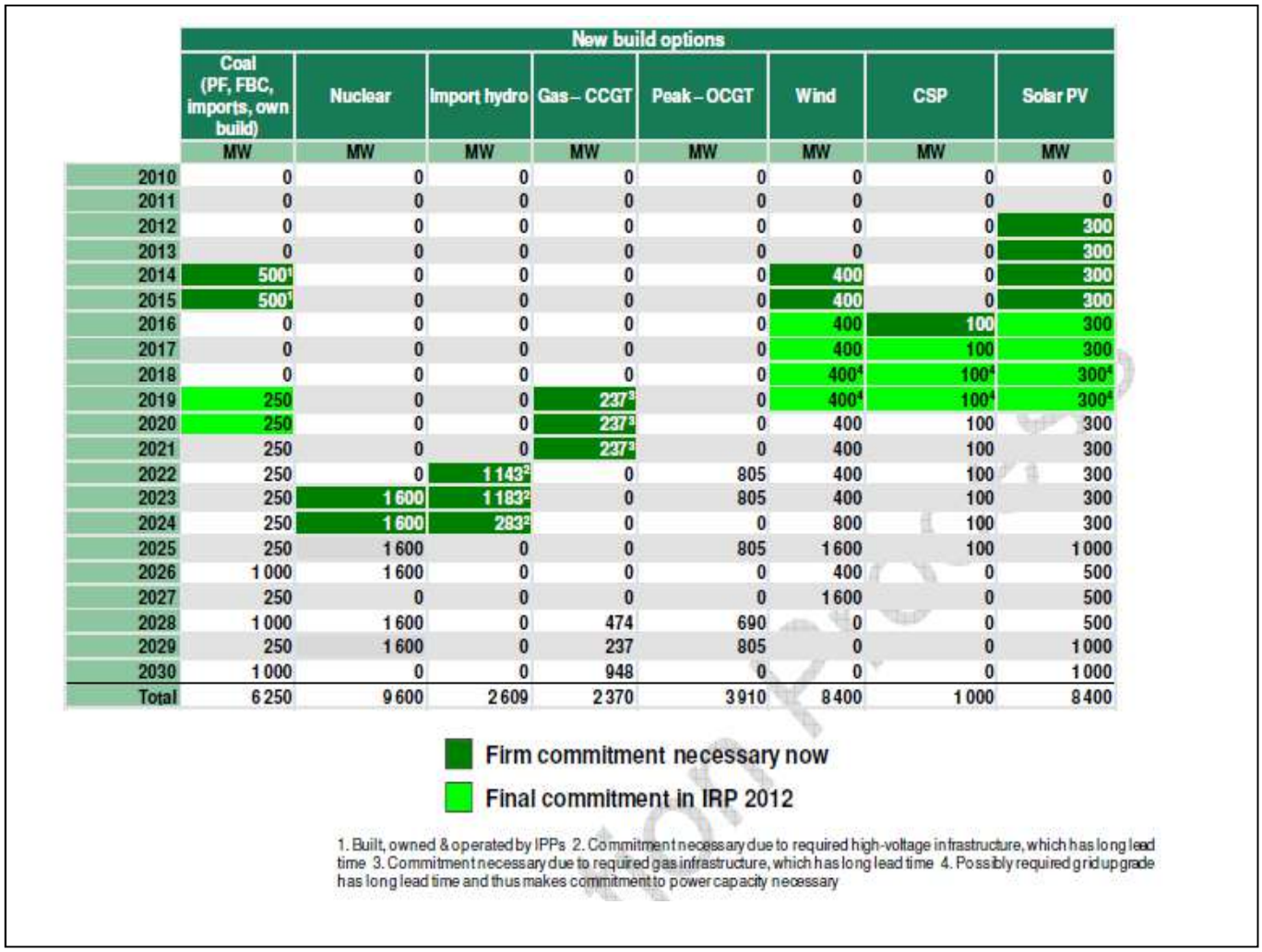
2010, led to the Revised Balanced Scenario (RBS) that was published in October 2010. A second round of public participation was conducted in November / December 2010, which led to several changes to the IRP model assumptions.

The document outlines the proposed generation new-build fleet for South Africa for the period 2010 – 2030. This scenario was derived based on a cost-optimal solution for new-build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures such as local job creation.

The Policy-Adjusted IRP includes the same amount of coal and nuclear new builds as the RBS, while reflecting recent developments with respect to prices for renewables. In addition to all existing and committed power plants, the plan includes 9.6GW of nuclear; 6.25GW of coal; **17.8GW of renewables**; and approximately 8.9GW of other generation sources such as hydro, and gas.

Figure 3.2 indicates the new capacities of the IRP 2010 commitment. The dates shown indicate the latest date that the capacity is required in order to avoid security of supply concerns. The IRP notes that projects could be concluded earlier than indicated, if feasible.

When promulgated in March 2011, it was indicated that the IRP should be a "living plan" which would be revised by the DoE every two years. Since the promulgation of the IRP 2010 there have been a number of developments in the energy sector in South and Southern Africa. In addition the electricity demand outlook has changed markedly from that expected in 2010. An IRP 2010 – 2030 Update Report was prepared and released in November 2013. The IRP 2010 – 2030 Update Report of 2013 estimated the energy demand in 2030 to be in the range of 345TWh – 416TWh as opposed to 454TWh as was originally expected in the policy-adjusted IRP. This equates to a reduction from 67 800MW to 61 200MW of reliable generating capacity. In addition, to uncertainty regarding the future demand, additional variables in the energy sector including the global agenda to combat climate change and the resulting mitigation requirements on South Africa, were taken into consideration. This IRP Update report of 2013 was not adopted by Parliament and was therefore never implemented.



	New build options							
	Coal (PF, FBC, imports, own build)	Nuclear	Import hydro	Gas – CCGT	Peak – OCGT	Wind	CSP	Solar PV
	MW	MW	MW	MW	MW	MW	MW	MW
2010	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	300
2013	0	0	0	0	0	0	0	300
2014	500[1]	0	0	0	0	400	0	300
2015	500[1]	0	0	0	0	400	0	300
2016	0	0	0	0	0	400	100	300
2017	0	0	0	0	0	400	100	300
2018	0	0	0	0	0	400[4]	100[4]	300[4]
2019	250	0	0	237[3]	0	400[4]	100[4]	300[4]
2020	250	0	0	237[3]	0	400	100	300
2021	250	0	0	237[3]	0	400	100	300
2022	250	0	1 143[2]	0	805	400	100	300
2023	250	1 600	1 183[2]	0	805	400	100	300
2024	250	1 600	283[2]	0	0	800	100	300
2025	250	1 600	0	0	805	1 600	100	1 000
2026	1 000	1 600	0	0	0	400	0	500
2027	250	0	0	0	0	1 600	0	500
2028	1 000	1 600	0	474	690	0	0	500
2029	250	1 600	0	237	805	0	0	1 000
2030	1 000	0	0	948	0	0	0	1 000
Total	6 250	9 600	2 609	2 370	3 910	8 400	1 000	8 400

Figure 3.2: National Energy Development Commitments detailed in the IRP 2010.

In November 2016 a draft IRP Update – Assumption, Base Case Results and Observations (Revision 1) document was released for comment. This current update in progress is being undertaken to take into account the changed electricity landscape, in particular with regards to electricity demand and the underlying relationship with economic growth; new developments in technology and fuel options (both locally and globally); scenarios for carbon mitigation strategies, the impact on electricity supply up to 2050; and the affordability of electricity and its impact on demand and supply.

Unlike the IRP 2010 – 2030, which considered the CSIR as well as Eskom demand forecasts, the IRP Update Base Case only uses the forecast developed by the CSIR. The energy demand forecast developed by the CSIR is presented in **Figure 3.3**. Based on the fact that the IRP update uses the High (less energy intense) forecast, energy demand is still anticipated to increase and is expected to be in the region of approximately 52GWH by 2050.

Whereas the IRP 2010 – 2030 assumed Eskom's existing fleet to have an average plant performance of 86%, actual performance has declined to less than 70% in the recent past. Eskom has since adopted a new operation and maintenance strategy which has seen a significant improvement in this performance. The update process currently underway estimates that **18GW of PV** generation capacity would be

required by the end of 2050; in addition to 15GW of coal-fired generation capacity, 37GW of wind, 20GW of nuclear, 34GW of gas, and 2.5GW of import hydro. The 2030 figures in the Base Case exclude the capacity already procured or under procurement (i.e. 6.2GW of renewable energy and 900MW of coal from IPP projects), and therefore differ from those in the IRP 2010 – 2030. The proposed solar energy facility contributes to the targets in this policy. The updated IRP is in the process of being finalised and is expected to be promulgated in mid-August 2018.

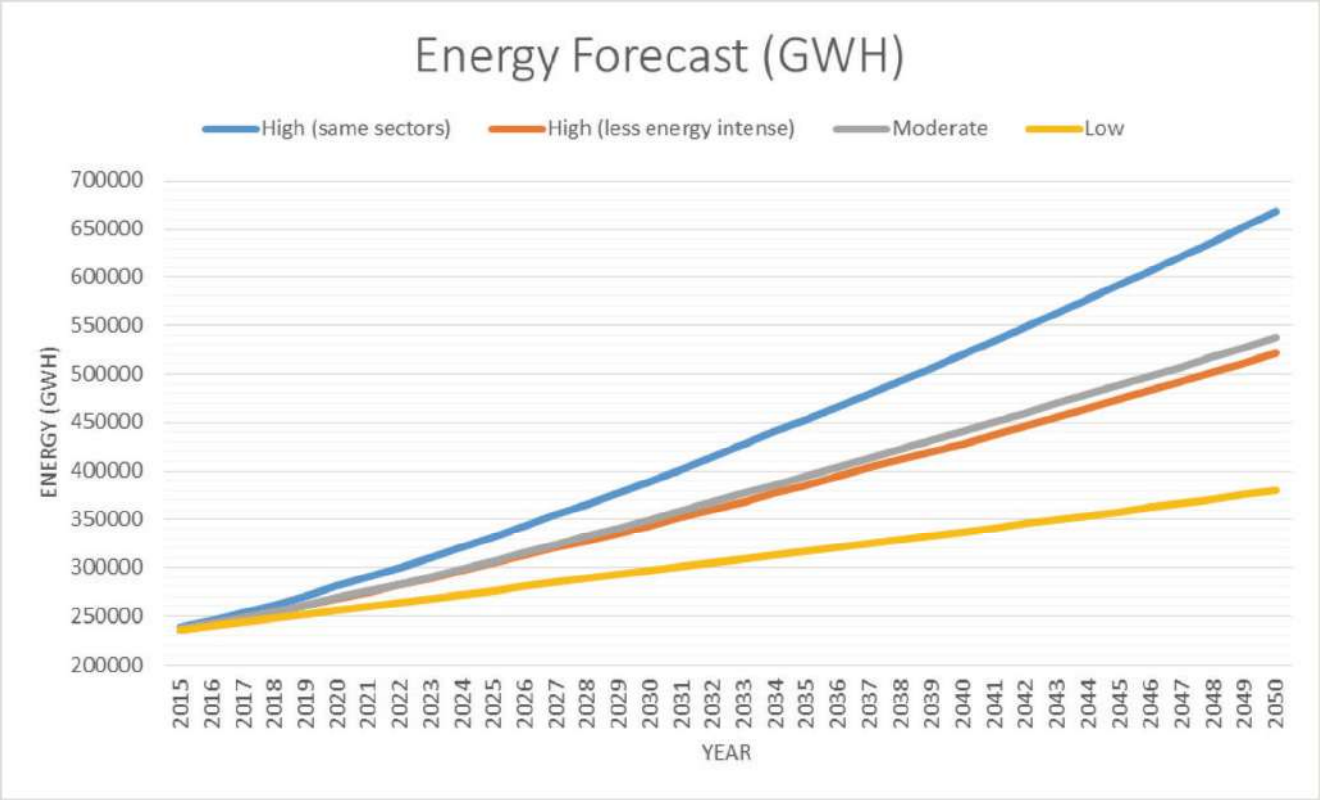


Figure 3.3: Energy Demand Forecast.

3.3.8. Strategic Integrated Projects (SIPs)

The National Infrastructure Plan (NIP), which is fully aligned with the NDP, initiated a process of accelerated infrastructure development to enable economic growth and job creation in South Africa. The Presidential Infrastructure Coordination Commission (PICC), as the coordinator and facilitator of the NIP, subsequently identified 18 Strategic Integrated Projects (SIPs) which are large-scale infrastructure projects of national importance aimed at unlocking development potential in the country, transform the economic landscape, create new jobs, strengthen the delivery of basic services, and support the integration of African economies. A balanced approach is being fostered through greening of the economy, boosting energy security, promoting integrated municipal infrastructure investment, facilitating integrated urban development, accelerating skills development, investing in rural development, and enabling regional integration.

SIP 8 and SIP 9 of the energy SIPs supports the development of the solar energy facility which is as follows:

» *SIP 8: 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. The proposed Moeding Solar PV Facility is a potential SIP 8 Project.

» *SIP 9: Electricity generation to support socio-economic development:*
The proposed Moeding Solar PV Facility is a potential SIP 9 Project as electricity will be generated and social and economic upliftment, development and growth will take place within the surrounding communities. SIP 9 supports the acceleration of the construction of new electricity generation capacity in accordance with the IRP 2010 to meet the needs of the economy and address historical imbalances.

In support of SIP 8, the Department of Environmental Affairs undertook a Strategic Environmental Assessment (SEA) to facilitate the implementation of sustainable green energy initiatives. This SEA identified areas where large scale wind and solar PV energy facilities can be developed in terms of SIP 8 and in a manner that limits significant negative impacts on the natural environment, while yielding the highest possible socio-economic benefits to the country (DEA, 2015). These areas are referred to as Renewable Energy Development Zones (REDZs). 8 REDZ areas have been designated and were gazetted within GNR114 of February 2018. The Moeding Solar PV Facility falls within REDZ 6 (Vryburg).

In support of SIP 10, the Department of Environmental Affairs undertook a Strategic Environmental Assessment (SEA) which aims to provide guidance for the efficient and sustainable expansion of strategic electricity grid infrastructure in South Africa. This SEA identified the optimal location for strategic corridors where transmission infrastructure expansion is needed to enable the balancing of future demand and supply requirements, while minimising negative impacts to the environment. These areas are referred to as Power Corridors, and were gazetted within GNR113 of February 2018. The Moeding Solar PV Facility falls within the Northern Transmission Corridor.

3.3.9. 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. The following objectives are set within the Bill:

a) Provide for the coordinated and integrated response to climate change and its impacts by all spheres of government in accordance with the principles of cooperative governance;
b) Provide for the effective management of inevitable climate change impacts through enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change, with a view to building social, economic, and environmental resilience and an adequate national adaptation response in the context of the global climate change response;
c) Make a fair contribution to the global effort to stabilise greenhouse gas concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system, within a timeframe and in a manner that enables economic, employment, social and environmental development to proceed in a sustainable manner.

The Moeding Solar PV Facility comprises a renewable energy generation facility, and thus would not result in the generation or release of emissions during its operation.

3.3.10. National Climate Change Response Policy 2011

Climate change is one of the major global challenges of the 21st century that requires global response. The adverse impacts of climate change include persistent drought and extreme weather events, rising sea levels, coastal erosion and ocean acidification, further threatening food security, water, energy and health, and, more broadly, efforts to eradicate poverty and achieve sustainable development. Combating climate change would require substantial and sustained reductions in greenhouse gas (GHG) emissions, which, together with adaptation, can limit climate change risks. The convention responsible for dealing with climate change is the United Nations Framework Convention on Climate Change (UNFCCC).

The United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1992 and entered into force in 1994. It provides the overall global policy framework for addressing the climate change issue and marks the first international political response to climate change. The UNFCCC sets out a framework for action aimed at stabilising atmospheric concentrations of GHGs to avoid dangerous anthropogenic interference with the climate system.

The UNFCCC has established a variety of arrangements to govern, coordinate and provide for oversight of the arrangements described in the documentation. The oversight bodies take decisions, provide regular guidance, and keep the arrangements under regular review in order to enhance and ensure their effectiveness and efficiency. The Conference of Parties (COP), established by Article 7 of the Convention, is the supreme body and highest decision-making organ of the Convention. It reviews the implementation of the Convention and any related legal instruments, and takes decisions to promote the effective implementation of the Convention.

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 organizations 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 enter into force once it has been ratified by 55 countries, representing at least 55% of emissions.

This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

(a) Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;
(b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low GHG emissions development, in a manner that does not threaten food production; and
(c) Making finance flows consistent with a pathway towards low GHG emissions and climate-resilient development.

In order to achieve the long-term temperature goal set out in Article 2 of the Agreement, Parties aim to reach global peaking of GHG emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter, in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of this century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty.

The Paris Agreement requires all Parties to put forward their best efforts through "nationally determined contributions" (NDCs) and to strengthen these efforts in the years ahead. This includes requirements that all Parties report regularly on their emissions and on their implementation efforts. In 2018, Parties will take stock of the collective efforts in relation to progress towards the goal set in the Paris Agreement and to inform the preparation of NDCs. There will also be a global stocktake every 5 years to assess the collective progress towards achieving the purpose of the Agreement and to inform further individual actions by Parties.

In working towards this goal, advanced economies have already included renewables in their energy mix and have planned to increase their use in order to meet their mitigation goals: Japan aims to derive 22 – 24% of its electricity production from renewable sources by 2030 and the European Union plans to reach 27% of its final energy consumption. Developing countries are also playing their part, including South Africa, which has included a goal of 17.8GW of renewables by 2030 within the IRP.

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 came into force on 04 November 2016, thirty days after the date on which at least 55 Parties to the Convention accounting in total for at least an estimated 55% of the total global greenhouse gas emissions have deposited their instruments of ratification, acceptance, approval or accession with the Depositary.

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 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. The White Paper provides support for the proposed solar energy 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.

3.4. Provincial Policy and Planning Context

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

3.4.1. North West Provincial Development Plan (PDP), 2030 (2013)

The North West Provincial Development Plan (PDP), 2030, is largely based on, and intended to apply the objectives of, the National Development Plan (NDP) 2030. The overall targets of the PDP have been identified as follows:

By 2030:

- Eliminate income poverty: reduce the percentage of the population living in poverty from 46% to 0% in 2030.
- Reduce inequality: the GINI coefficient should fall from 0.61 to 0.53.
- The targets for poverty reduction and the GINI coefficient compliments the national targets set out for the elimination of poverty and reduction of inequality.
- The unemployment rate should fall from 24% in 2010 to 14% by 2020 and to 6% by 2030. This requires an additional 815 000 jobs. Total employment should rise from 748 000 to 1 563 000.
- The NDP projects that total employment should rise from 13 million to 24 million in South-Africa. 7% of additional jobs that has to be created will be located in the North West Province. By 2030 the North West will be responsible for 6.5% of employment in South-Africa.
- The provincial Gross Value Added (GVA) should increase by 2.9 times in real terms. Such growth will require an average annual Gross Value Added (GVA) growth of 5.4%.

The development of the Moeding Solar PV Facility has the potential to contribute towards a number of the targets set by the PDP, including:

- Job creation and increased income, which woud have a positivie impact on the current unemployment rate, standard of living, levels of inequality, and poverty levels within the Province.
- Contribute towards the capita income, and improve on labour force participation rates.
- Production of clean energy.

3.4.2. North West Provincial Growth and Development Strategy (PGDS) (2004-2014)

The North West Provincial Growth and Development Strategy (PGDS) provides a framework for integrated and sustainable growth and economic development for the province and its people. Challenges facing the Province can be summarised as follows:

- the Province is mostly rural in nature;
- the Province has a low population density, and relative inadequate infrastructure, especially in the remote rural areas;
- the Province has inherited an enormous backlog in basic service delivery and maintenance that will take time to eradicate;
- the population is predominantly poor with high levels of illiteracy and dependency that seriously affect their productivity and ability to compete for jobs;
- the Province is characterised by great inequalities between the rich and poor as well as disparities between urban and rural; is faced with HIV / AIDS as a social and economic challenge; available resources are unevenly distributed, and there is limited potential for improved delivery of services and growth.

From the above, job creation and poverty eradication together with the low level of expertise and skills; stand out as the greatest challenges to be resolved within the Province. The development of the Moeding Solar PV Facility can assist with addressing these issues to come extent.

Goals and objectives of the PGDS are to fight poverty and unemployment, improve the low level of expertise and skills which are classified as both immediate and long term goals and require primary goals for sustained growth and economic development. The proposed solar energy facility will contribute to employment creation and skills development which is in line with the goals and objectives of the North West PGDS.

The North West PGDS aims at building a sustainable economy to eradicate poverty and improve social development. The proposed solar energy facility will contribute to growth and development of the local area by expanding the economic base and creating employment opportunities.

3.4.3. North West Province Spatial Development Framework (PSDF) (2017)

As per the North West Provincial Spatial Development Framework (PSDF) (2017) electricity within the province is primarily provided by Eskom to re-distributors – mainly municipalities (10%), commercial (5%), agriculture (5%), mining (30%), industrial (30%) and Residential (20%). Electricity for supply to the North West Province is mostly generated by Eskom's Matimba coal-fired Power Station in Limpopo which will in future be augmented by Eskom's Medupi coal-fired Power Station.

According to the North West PSDF the proposed project site is located within the Vryburg Distribution Area, which is characterised by minor developments, including Residential, Industrial, and Major Electrification; and has a projected growth of 100MW (Eskom, 2015).

Eskom's Transmission Development Plan 2015 – 2024 represents the transmission network infrastructure investment requirements over the 10 year period between 2015 and 2024. Projects proposed for the North West Province for the next 10 years include the introduction of 400kV powerlines and transformation to support or relieve the existing networks. Five transmission power corridors have been identified as critical to providing a flexible and robust network that could respond to meet the needs of future IPPs and IRP requirements.

According to the North West Province PSDF, and Statistics South Africa, the proposed project site is characterised by fairly low levels of access to electricity (i.e. 60% - 70%), when compared to other areas within the Province (refer to **Figure 3.4**).

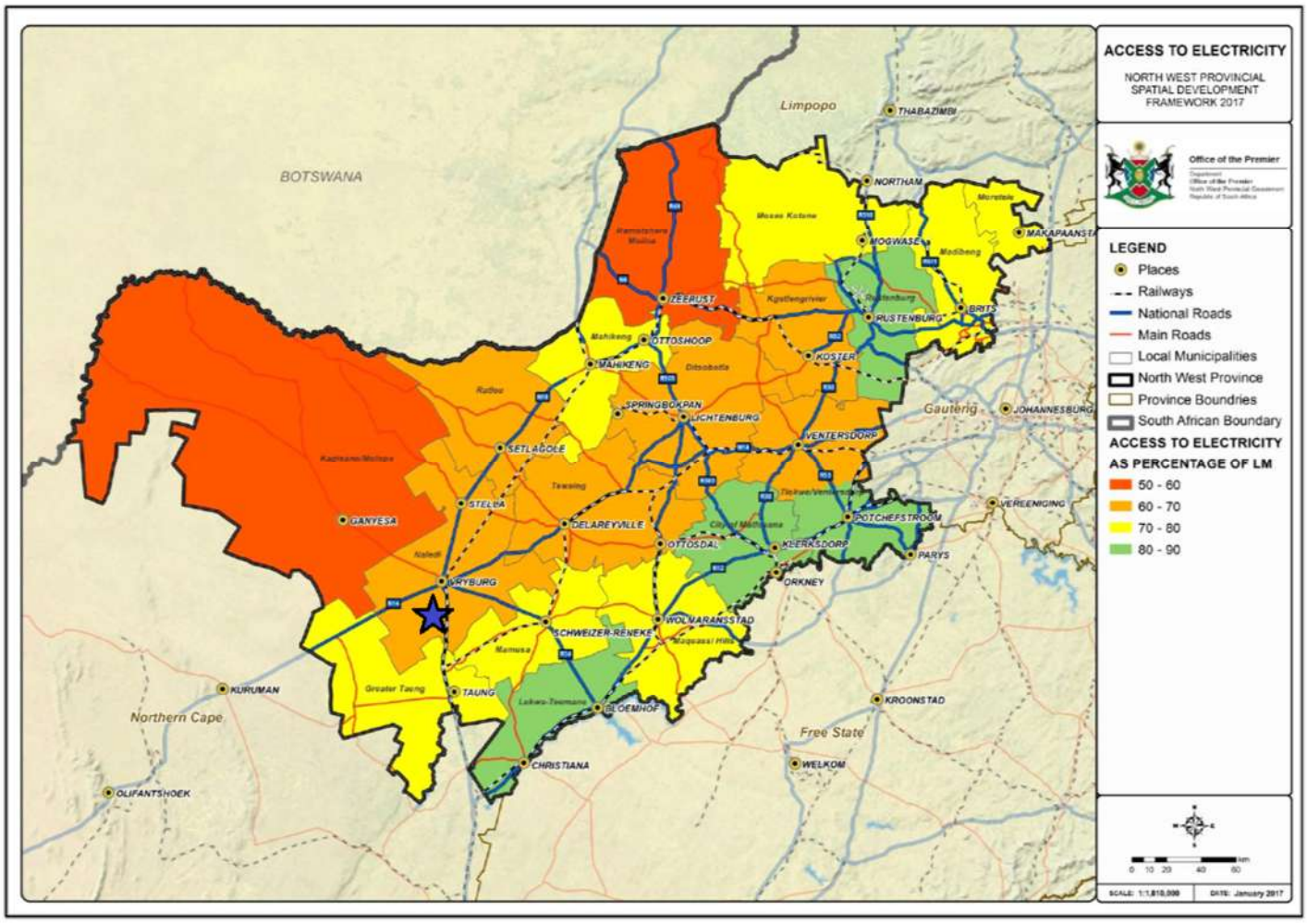


Figure 3.4: Access to Electricity (Source: Statistics South Africa). The proposed project site is indicated by the blue star.

The implementation of the Moeding Solar PV Facility at the proposed project site would therefore result in the generation of additional electricity within an area which is characterised by a fairly low level of access (i.e. between 60% - 70%). The proposed solar energy facility could therefore contribute positively towards improving access levels within the area. In addition, the project has the potential to somewhat alleviate the Province's reliance on electricity generated by coal-fired power stations such as Eskom's Matimba and Medupi coal-fired Power Stations as is currently the case.

3.4.4. Renewable Energy Strategy for the North West Province (2012)

In 2012 the North West Province's then Department of Economic Development, Environment, Conservation and Tourism (DEDECT) developed the Renewable Energy Strategy for the North West Province. The strategy was developed in response to the need of the North West Province to participate meaningfully within South Africa's renewable energy sector. The strategy aims to improve the North West Province's environment, reduce its contribution to climate change, and alleviate energy poverty, whilst promoting economic development and job creation whilst developing its green economy.

According to the strategy, the North West Province consumes approximately 12% of South Africa's available electricity, and is rated as the country's fourth largest electricity consuming province. This is mainly due to the high demand of the electrical energy-intensive mining and related industrial sector, with approximately 63% of the electricity supplied to the province being consumed in its mining sector.

While the strategy recognises that South Africa has an abundance of renewable energy resources available, it is cognisant of the fact that the applicability of these renewable energy resources depend on a number of factors and as a result are not equally viable for the North West Province. The renewable energy sources that were identified to hold the most potential and a competitive strength for the North West Province are solar energy (photovoltaic as well as solar water heaters), Municipal Solid Waste, hydrogen and fuel cell technologies, bio-mass, and energy efficiency.

The advantages and benefits for the North West Province associated with the implementation and use of renewable energy technologies include:

- Provision of energy for rural communities, schools and clinics that are far from the national electricity grid.
- Creation of an environment where access to electricity provides rural communities with the opportunity to create an economic base via agricultural and home-based industries and Small, Medium and Micro Enterprises (SMMEs) in order to grow their income-generating potential.
- The supply of water within rural communities.
- It would result in less time taken for the collection of wood and water, thus improving the quality of life within communities and specifically for women.
- Improved health through the reduced use of fuelwood as energy source for cooking and heating that causes respiratory and other hazards.
- Solar water heating for households in urban and rural settings, reducing the need for either electricity (in urban settings) and fuelwood (in rural settings) to heat water, thus lowering our National peak demand and conservation of woodlands in a sustainable manner.
- Large-scale utilisation of renewable energy will also reduce the emissions of carbon dioxide, thus contributing to an improved environment.
- The fact that renewble energy go hand-in-hand with energy efficiency, it will result in additional financial benefit and the need for smaller renewable energy systems.
- The development of a strong localised renewable energy industry within the North West Province holds substantial potential for Black Economic Empowerment (BEE) and job creation within the Province.
- The establishment of a strong renewable energy base in the North West Province, especially in the manufacturing of fuel cells could stimulate the market for Platinum Group Metals (PGM), which would in turn help the local mining sector.

This is due to renewable energy sources having considerable potential for increasing security of supply by diversifying the energy supply portfolio and increasingly contributes towards a long-term sustainable energy future. In terms of environmental impacts, renewable energy results in the emission of less GHGs than fossil fuels, as well as fewer airborne particulates, and other pollutants.
With an average daily solar radiation of approximately 7 500 MJ/m² South Africa experiences some of the highest levels of solar radiation in the World. Most areas in South Africa average more than 2 500 hours of sunshine per year, which makes solar energy the most readily accessible resource in South Africa and

specifically the North West Province which has a very good solar potential with an average daily solar radiation greater than 8 000 MJ/m². The relative values for the annual solar radiation were determined for each of the four district municipalities in the North West Province compared to the maximum and minimum values for South Africa (refer to **Table 3.3**.

Table 3.3: Global annual solar radiation of the North West Province relative to South African Maximum and Minimum location values.

Description	Annual Solar Radiation Range (MJ/m²)		Relative to South African Maximum	Relative to South African Minimum
Maximum in South Africa	9 001	9 500	-	-
Dr Ruth Segomotsi Mompati District Municipality	8 501	9 000	-5%	40%
Ngaka Modiri-Molema District Municipality	8 501	9 000	-5%	40%
Bojanala Platinum District Municipality	8 001	8 500	-11%	32%
Dr Kenneth Kaunda District Municipality	8 001	8 500	-11%	32%
Minimum in South Africa	6 000	6 500	-	-

While Upington in the Northern Cape Province is located within the area of maximum solar radiation, and is considered a prime location for solar energy projects, the Ruth Segomotsi Mompati District Municipality of the North West Province receives on average only 5% less solar radiation than Upington. In addition, all four district municipalities on average receive 40% to 32% more solar radiation than the locations with the least solar radiation in South Africa (such as Durban). The North West Province therefore shows considerable potential for solar projects as a whole, with higher potential in the Dr. Ruth Segomotsi Mompati and Ngaka Modiri-Molema Districts. The development of PV solar energy facility within the DRRSMDM of North West Province specifically is therefore strongly supported in terms of the Renewable Energy Strategy for the North West Province (2012).

3.5. Local Policy and Planning Context

The entities associated on a local level with the solar energy facility is the Naledi Local Municipality (NLM) and the Dr Ruth Segomotsi Mompati District Municipality (DRRSMDM). The development policies at the district and local level have similar objectives for the respective area, namely economic growth, job creation, community upliftment and poverty alleviation. The development of the proposed Moeding Solar PV Facility is considered to align with the aims of these policies, even if contributions to achieving the goals therein are considered minor.

3.5.1. Dr Ruth Segomotsi Mompati District Municipality Integrated Development Plan (IDP) (2017/2022)

The vision of the district is, "a developmental district where sustainable service delivery is optimised, prioritised and realised."

The existing level of development and challenges in Dr Ruth Segomotsi Mompati District Municipality (DRRSMDM) can be summarised as follows:

- DRRSMDM is endowed with minerals but this sector remains a small contributor to GDP of the Province;
- Population is largely African with low education, low incomes, high unemployment and with minimal access to water and sanitation;
- The large African population is largely young with a small percentage of adults who are economically active;
- Functional literacy does not favour Africans. There is a great challenge in the provision of education to empower Africans;
- Heavy dependency on public administration as employer. There is a critical need to develop the private sector in agriculture and mining involvement. The development of the Small Medium Micro Enterprise (SMME) sector both in the formal and informal sectors is critical.
- Current access to water and sanitation services is a concern.

The above calls for associated action to improve delivery of the needed services for socio and economic development in the Dr Ruth Segomotsi Mompati District Municipality.

The Key Performance Areas (KPA) of the district are as follows:

- *Service delivery and infrastructure development:* The objective is to eradicate backlogs in order to improve access to services and ensure proper operations and maintenance.
- *Public participation and good governance (governance structures):* The objective is to promote a culture of participatory and good governance.
- *Institutional development and transformation:* The objective is to improve organizational cohesion and effectiveness.
- *Financial viability:* The strategic objective is to improve overall financial management in the municipalities by developing and implementing appropriate financial management policies, procedures and systems.
- *Local economic development:* The strategic objective is to create an environment that promotes the development of the local economy and facilitate job creation.
- *Community services & development:* All citizens have a right to an environment that is not detrimental to human health, and it imposes a duty on the State to promulgate legislation and to implement policies aimed at ensuring that this right is upheld.

The strategic objective of the North West Department of Rural, Environment and Agricultural Development (READ) is to facilitate and promote local economic development in the district through existing and shared partnerships. The district is an agricultural hub within the Province and as a result, special attention is given to promoting agricultural initiatives and ensuring value chain benefits from the sector. While it is acknowledged that agriculture is one of the main sectors contributing effectively to the Province's GDP, the district needs to ensure equitable focus on other sectors of the economy.

Attraction of major investments to the district remains a challenge because of the poor infrastructure conditions, more specifically roads, water networks or reticulation, communication, electricity and transport networks. The critical importance of commitment to transforming the economy of the district therefore remains emphasised. This will ensure that job opportunities are increased for the unemployed masses (mainly the youth) of the DRRSMDM.

The IDP aims at promoting local economic growth and social development in order to provide a better life for the communities. The Moeding Solar PV Facility will provide employment opportunities and contribute

in assisting the district municipality in achieving local economic development and building a sustainable economy through introducing a relatively new sector into the local economy.

3.5.2. Naledi Local Municipality Integrated Development Plan (IDP) (2017/2022)

The vision of the municipality is, "to provide basic, quality, sustainable and equitable services through effective an efficient governance and financial management."

The primary objectives of the IDP process are to:

» determine priorities for future budgetary allocations;
» identify critical economic development projects which will expand the municipality's tax base and create new sources of revenue; and
» indicate services that are currently rendered to other spheres of government (e.g. district)and on an agency basis and investigate their cost- effectiveness.

The NLM recognises that the development of affordable, inexhaustible and clean solar energy technologies have major longer-term benefits and that the rapid deployment of renewable energy and energy efficiency result in significant energy security, climate change mitigation, and economic benefits. The NLM therefore aims to attract a large scale renewable energy project to the area.

The development of the Moeding Solar PV Facility falls in line with the Municipality's aim to attract major renewable energy projects into the area. The development will contribute to employment creation and economic growth, which in turn will have a positive multiplier effect on the local area. The IDP 2017/2022 supports the investment of renewable energy developments in the Naledi Local Municipality.

3.6. International Policy and Planning Context

3.6.1. United Nations Framework Convention on Climate Change (UNFCCC) and Conference of the Party (COP)

Climate change is one of the major global challenges of the 21st century that require global response. The adverse impacts of climate change include persistent drought and extreme weather events, rising sea levels, coastal erosion and ocean acidification, further threatening food security, water, energy and health, and more broadly efforts to eradicate poverty and achieving sustainable development. Combating climate change would require substantial and sustained reductions in GHG emissions, which together with adaptation, can limit climate change risks. The convention responsible for dealing with climate change is the United Nations Framework Convention on Climate Change (UNFCCC).

The UNFCCC was adopted in 1992 and entered into force in 1994. It provides the overall global policy framework for addressing the climate change issue and marks the first international political response to climate change. The UNFCCC sets out a framework for action aimed at stabilizing atmospheric concentrations of GHGs to avoid dangerous anthropogenic interference with the climate system.

The UNFCCC has established a variety of arrangements to govern, coordinate and provide for oversight of the arrangements described in the documentation. The oversight bodies take decisions, provide regular

guidance, and keep the arrangements under regular review in order to enhance and ensure their effectiveness and efficiency. The Conference of Parties (COP), established by Article 7 of the Convention, is the supreme body and highest decision-making organ of the Convention. It reviews the implementation of the Convention and any related legal instruments, and takes decisions to promote the effective implementation of the Convention.

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 was open for signature and subject to ratification, acceptance or approval by States and regional economic integration organizations that are Parties to the Convention from 22 April 2016 to 21 April 2017, and thereafter open for accession.

The Paris Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

(a) Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change.
(b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low GHG emissions development, in a manner that does not threaten food production.
(c) Making finance flows consistent with a pathway towards low GHG emissions and climate-resilient development.

In order to achieve the long-term temperature goal set out in Article 2 of the Agreement, Parties aim to reach global peaking of GHG emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of this century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty.

The Paris Agreement requires all Parties to put forward their best efforts through "Nationally Determined Contributions" (NDCs) and to strengthen these efforts in the years ahead. This includes requirements that all Parties report regularly on their emissions and on their implementation efforts. In 2018, Parties will take stock of the collective efforts in relation to progress towards the goal set in the Paris Agreement, and to inform the preparation of NDCs. There will also be a global stocktake every 5 years to assess the collective progress towards achieving the purpose of the Agreement and to inform further individual actions by Parties.

In working towards this goal, advanced economies have already included renewables in their energy mix and have planned to increase their use in order to meet their mitigation goals: Japan aims to derive 22 – 24% of its electricity production from renewable sources by 2030, and the European Union plans for them to reach 27% of its final energy consumption. Developing countries are also playing their part, including South Africa which has included a goal of 17.8GW of renewables by 2030 within the IRP.

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 came into force on 04 November 2016, thirty days after

the date (on which at least 55 Parties to the Convention accounting in total for at least an estimated 55% of the total global greenhouse gas emissions) have deposited their instruments of ratification, acceptance, approval or accession with the Depositary.

COP 23 was held in Bonn, Germany from 06 to 17 November 2017, and is the second COP to be held since COP 21. One of the key outcomes of COP 23 was the launch of the "Powering Past Coal Alliance", led by the UK and Canada. More than 20 countries joined the alliance, including Denmark, Finland, Italy, New Zealand, Ethiopia, Mexico, and the Marshall Islands; as well as the United States (US) states of Washington and Oregon. The alliance notes that analysis shows that coal phase-out is needed by no later than 2030 in the Organisation for Economic Co-operation and Development (OECD) and EU28, and by no later than 2050 in the rest of the world to meet the Paris Agreement, however it does not commit signatories to any particular phase-out date. It also does not commit the signatories to ending the financing of unabated coal power stations, but rather just restricting it.

3.6.2. The Equator Principles III (June, 2013)

The Equator Principles (EPs) III 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 and apply globally to all industry sectors.

The EPs comprise the following principles:

Principle 1: Review and Categorisation
Principle 2: Environmental and Social Assessment
Principle 3: Applicable Environmental and Social Standards
Principle 4: Environmental and Social Management System and Equator Principles Action Plan
Principle 5: Stakeholder Engagement
Principle 6: Grievance Mechanism
Principle 7: Independent Review
Principle 8: Covenants
Principle 9: Independent Monitoring and Reporting
Principle 10: Reporting and Transparency

When a project is proposed for financing, the Equator Principle Financial Institution (EPFI) will categorise it based on the magnitude of its potential environmental and social risks and impacts.

Projects can be categorized as follows:

Category A: Projects with potential significant adverse environmental and social risks and / or impacts that are diverse, irreversible or unprecedented.
Category B: Projects with potential limited adverse environmental and social risks and / or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures.
Category C: Projects with minimal or no adverse environmental and social risks and / or impacts.

Based on the abovementioned criteria, the Moeding Solar PV Facility can be anticipated to be categorised as a Category B project.

Category A and Category B projects require that an assessment process be conducted to address the relevant environmental and social impacts and risks associated with the project. Such an assessment may include the following where applicable:

- An assessment of the baseline environmental and social conditions.
- Consideration of feasible environmentally and socially preferable alternatives.
- Requirements under host country laws and regulations, applicable international treaties and agreements.
- Protection and conservation of biodiversity (including endangered species and sensitive ecosystems in modified, natural and Critical Habitats) and identification of legally protected areas.
- Sustainable management and use of renewable natural resources (including sustainable resource management through appropriate independent certification systems).
- Use and management of dangerous substances.
- Major hazards assessment and management.
- Efficient production, delivery and use of energy.
- Pollution prevention and waste minimisation, pollution controls (liquid effluents and air emissions), and solid and chemical waste management.
- Viability of Project operations in view of reasonably foreseeable changing weather patterns / climatic conditions, together with adaptation opportunities.
- Cumulative impacts of existing Projects, the proposed Project, and anticipated future Projects.
- Respect of human rights by acting with due diligence to prevent, mitigate and manage adverse human rights impacts.
- Labour issues (including the four core labour standards), and occupational health and safety.
- Consultation and participation of affected parties in the design, review and implementation of the Project.
- Socio-economic impacts.
- Impacts on Affected Communities, and disadvantaged or vulnerable groups.
- Gender and disproportionate gender impacts.
- Land acquisition and involuntary resettlement.
- Impacts on indigenous peoples, and their unique cultural systems and values.
- Protection of cultural property and heritage.
- Protection of community health, safety and security (including risks, impacts and management of Project's use of security personnel).
- Fire prevention and life safety.

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 the proposed SEF. 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 (refer to **Section 0**).

The Moeding Solar PV Facility is currently being assessed in accordance with the requirements of the 2014 EIA Regulations, as amended (GNR 326), 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.

3.6.3. International Finance Corporation (IFC) Performance Standards on 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. The overall objectives of the IFC PSs are:

- To fight poverty;
- To do no harm to people or the environment;
- To fight climate change by promoting low carbon development;
- To respect human rights;
- To Promote gender equity;
- To provide information prior to project development, free of charge and free of external manipulation;
- To collaborate with the project developer to achieve the PS;
- To provide advisory services; and
- To notify countries of any Trans boundary impacts as a result of a project.

The PSs comprise the following:

Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts.
Performance Standard 2: Labour and Working Conditions.
Performance Standard 3: Resource Efficiency and Pollution Prevention.
Performance Standard 4: Community Health, Safety and Security.
Performance Standard 5: Land Acquisition and Involuntary Resettlement.
Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.
Performance Standard 7: Indigenous Peoples.
Performance Standard 8: Cultural Heritage.

Performance Standard 1 establishes the importance of:

i) Integrated assessment to identify the social and environmental impacts, risks, and opportunities of projects.
ii) Effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them.
iii) The management of social and environmental performance throughout the life of a project through an effective Environmental and Social Management System (ESMS).

PS 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. PS 1 is the overarching standard to which all the other standards relate. PS 2 through 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, PS 2 through 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 PS 1.

Given the nature of the Moeding Solar PV Facility, it is anticipated (at this stage of the process) that PSs 1, 2, 3, 4, 6, and 8 may be applicable to the project.

CHAPTER 4 NEED AND DESIRABILITY

Appendix 2 of the 2014 EIA Regulations (GNR 326) requires that a Scoping Report include a motivation for the need and desirability of a proposed development including the need and desirability of the activity in the context of the preferred location. The need and desirability of a development needs to consider whether it is the right time, and right place for locating the type of land-use / activity being proposed. Need and desirability is therefore equated to the wise use of land, and should be able to answer the question of what the most sustainable use of land is.

This Chapter provides an overview of the anticipated suitability of the Moeding 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.

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

This chapter of the BA Report includes the following information required in terms of Appendix 1: Content of Basic Assessment reports:

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 of the Moeding Solar PV Facility in the proposed location is included in Chapter 4.

4.2 Need and Desirability from an International Perspective

The need and desirability of the Moeding 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 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 social and economic development issues such as poverty, hunger, health, education, climate change, gender equality, water, sanitation, energy, urbanization, environment and social justice. The SDGs comprise 17 global goals set by the United Nations. The 17 SDGs are characterised by 169 targets, and 304 indicators.

Goal 7 of the SGDs 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. 7.1.2 Proportion of population with primary reliance on clean fuels and technology.
7.2 By 2030, increase substantially the share of	7.2.1 Renewable energy share in the total final energy

Targets		Indicators	
	renewable energy in the global energy mix.		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	Mobilized 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 Moeding Solar PV Facility would contribute positively towards Goal 7 of the SGDs through the following means:

- By generating up to 100MW 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 Energy's (DoE'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 is not a consumptive technology and 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.

4.3 Need and Desirability from a National Perspective

The Moeding Solar PV Facility is proposed in specific response to a national government initiative, namely the DoE's Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. This programme was initiated in order to give effect to the requirements of the IRP with regards to renewable energy targets. As a result the need and desirability of the project from a national perspective can largely be assimilated 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 3**). The following key policies have been developed by government to take into account 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 abovementioned policies have been extensively researched and are updated on an ongoing 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 which guides future energy infrastructure investments and policy development. 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 megajoules 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 IRP 2010 - 2030 includes 9.6GW of nuclear, 6.25GW of coal, **17.8GW of renewables**, and approximately 8.9GW of other generation sources such as hydro, and gas in addition to all existing and committed power plants.

On 22 August 2018 the Draft IRP 2018 was released for comment. The latest update of the IRP includes estimates that **7.82GW of PV**, 9GW of wind, 10.94GW of gas (CCGT / CCGE / OCGT), and 0.025GW of landfill gas would be required by the end of 2030[11].

In line with government policy to reduce greenhouse gas (GHG) emissions, the IRP update uses the moderate decline constraint for GHG emissions. Although this is subject to change following recent correspondence received from Department of Environmental Affairs (DEA) indicating that carbon budget methodology must be used instead of emissions decline constraints, the consideration of GHG emissions in the determination of the energy generation mix indicates government's commitment to international obligations under the Paris Agreement.

In response to the IRP, the DoE initiated a number of IPP Procurement Programmes to secure electricity generated by a range of resources from the private sector (i.e. from 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 DoE and a Power Purchase Agreement (PPA) with Eskom as the buyer. IPPPPs include the Renewable Energy IPP Procurement Programme (REIPPPP), the Co-generation IPP Procurement Programme, the Liquefied Natural Gas (LNG) to Power IPP Procurement Programme, and the Coal Baseload IPP Procurement Programme (CBIPPPP) (refer to **Table 4.1**).

Table 4.1: Overview of IPP Procurement Programmes and their current allocation (MW).

IPP Procurement Programme	Technology	MW	Total
Renewables	Onshore Wind	6 360 MW	14 725MW
	Concentrated solar thermal	1 200 MW	
	Solar Photovoltaic	4 725 MW	
	Biomass	210 MW	
	Biogas	110 MW	
	Landfill Gas	25 MW	
	Small hydro	195 MW	
	Small Projects	400 MW	
	Solar Parks	1 500MW	
Coal Baseload	Coal	2 500MW	2 500MW
Cogeneration	Cogeneration	800MW	800MW
Gas	Gas	3 000MW	3 000MW

Renewable resources are valuable in contributing towards electricity generation and diversifying South Africa's electricity mix. Under the REIPPPP the DoE 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 2 291.83MW of PV generated electricity has been awarded to preferred bidders across four (4) rounds of bidding to date, with 2 433.17 MW still remaining to be allocated in subsequent bidding rounds. Preferred bidders identified

[11] These figures reflect capacities for the Least Cost Plan (IRP1) by year 2030 without Annual Build Limits on RE (IRP3).

under any IPPPP, including the REIPPPP, 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, IPPPPs therefore also contribute positively towards socio-economic development of a region, over and above job creation.

The need for new power generation from PV has therefore been identified and assessed by government at a national scale considering the national energy requirements as well as international commitments under the Paris Agreement, and provision has been made for the inclusion of new PV power generation capacity in South Africa's' energy mix. The implementation of the proposed project therefore 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 NDP.

The proposed project 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 project would have reduced water requirements when compared with some other generation technologies in alignment with one of the vision 2030 themes of the DWS's National Water Resource Strategy 2 (2013) (i.e. transitioning to a low carbon economy through stimulating renewable energy and retrofitting buildings).

4.3.1 Renewable Energy Development Zones (REDZ)

The Department of Environmental Affairs (DEA) has committed to contribute to the implementation of the National Development Plan (NDP), the National Infrastructure Plan and the undertaking of Strategic Environmental Assessments (SEAs) to identify adaptive processes that streamline the regulatory environmental requirements for Strategic Integrated Projects (SIPs) while safeguarding the environment.

The solar photovoltaic (PV) and wind SEA was accordingly commissioned by DEA in support of SIP 8 (Strategic Infrastructure Projects), which aims to facilitate the implementation of sustainable green energy initiatives. This SEA identifies areas where large scale solar PV and wind energy facilities can be developed in terms of SIP 8 and in a manner that limits significant negative impacts on the environment, while yielding the highest possible socio-economic benefits to the country. These areas are referred to as Renewable Energy Development Zones (REDZ).

In the Statement on Cabinet Meeting of 17 February 2016 the cabinet approved the gazetting of Renewable Energy Development Zones (REDZ). The procedure to be followed in applying for environmental authorisation for a large-scale project in a REDZ was formally gazetted on 16 February 2018 (in GN113 and GN114). The aim of the zones are to streamline the regulatory process, identifying geographical areas where wind and solar Photovoltaic technologies can be incentivised and where intense grid expansion can be directed. These REDZ will ensure a transition to a low carbon economy, accelerating infrastructure development and contributing to a more coherent and predictable regulatory framework.

As shown in **Figure 4.1**, the Moeding Solar PV Facility falls within the Vryburg REDZ which was selected by the Department of Environmental Affairs as an area highly suitable for solar energy facilities given a range of factors considered. This provides further motivation for the selection of the specific site chosen for this project.

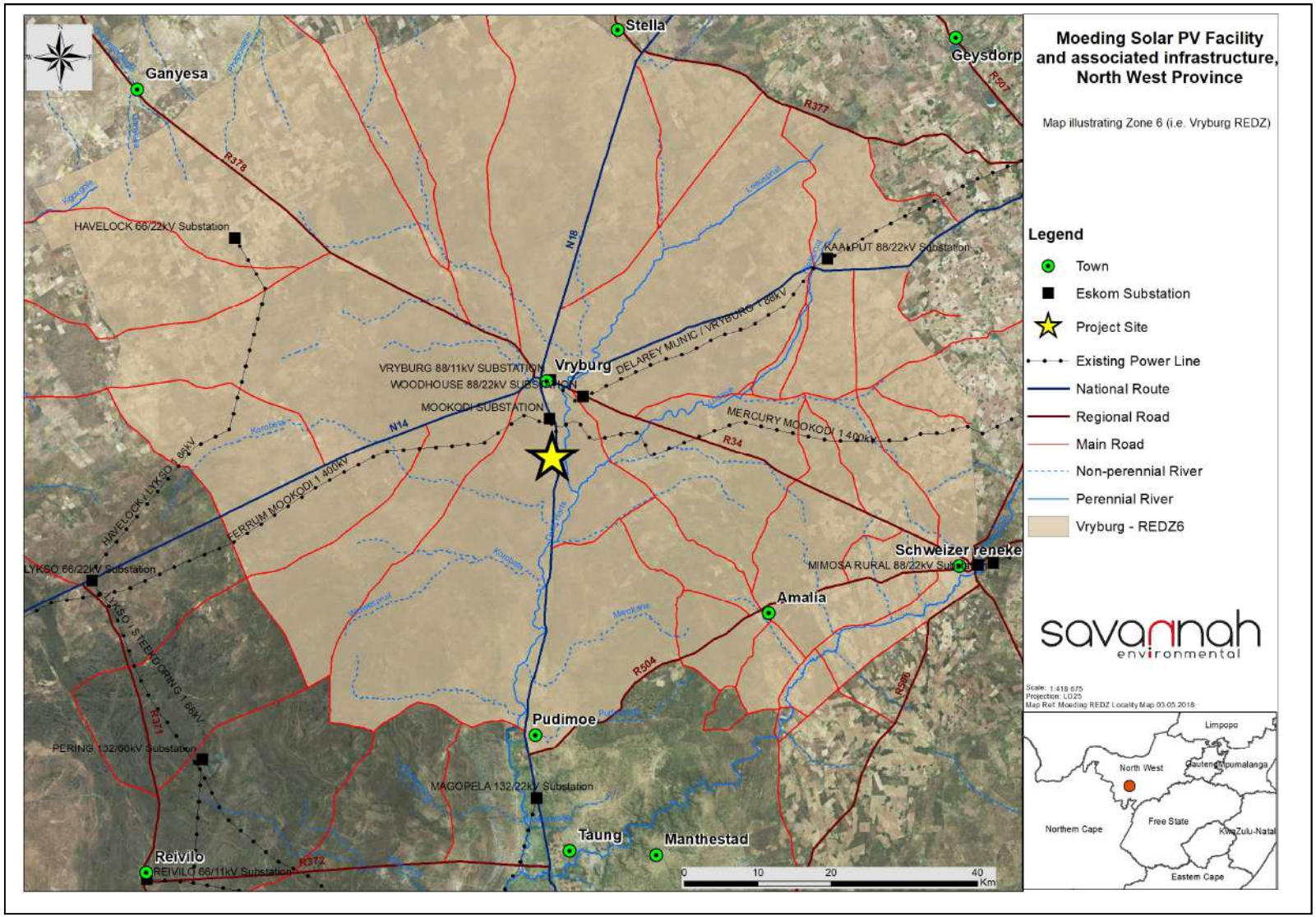


Figure 4.1: The Moeding Solar PV Facility project site is centrally located within the Zone 6, known as the Vryburg REDZ

4.4 Need and Desirability of the project from a Regional Perspective

South Africa's electricity generation mix has historically been dominated by coal. This can be attributed to the fact that South Africa has abundant coal deposits, which are relatively shallow with thick seams, and are therefore easy and comparatively cost effective to mine. In 2016 South Africa had a total generation capacity of 237 006GWh. Approximately 85.7% (equivalent to 203 054GWh) of this figure was generated by coal, and only 0.9% (equivalent to 2 151GWh) was generated by solar (refer to **Figure 4.2**).

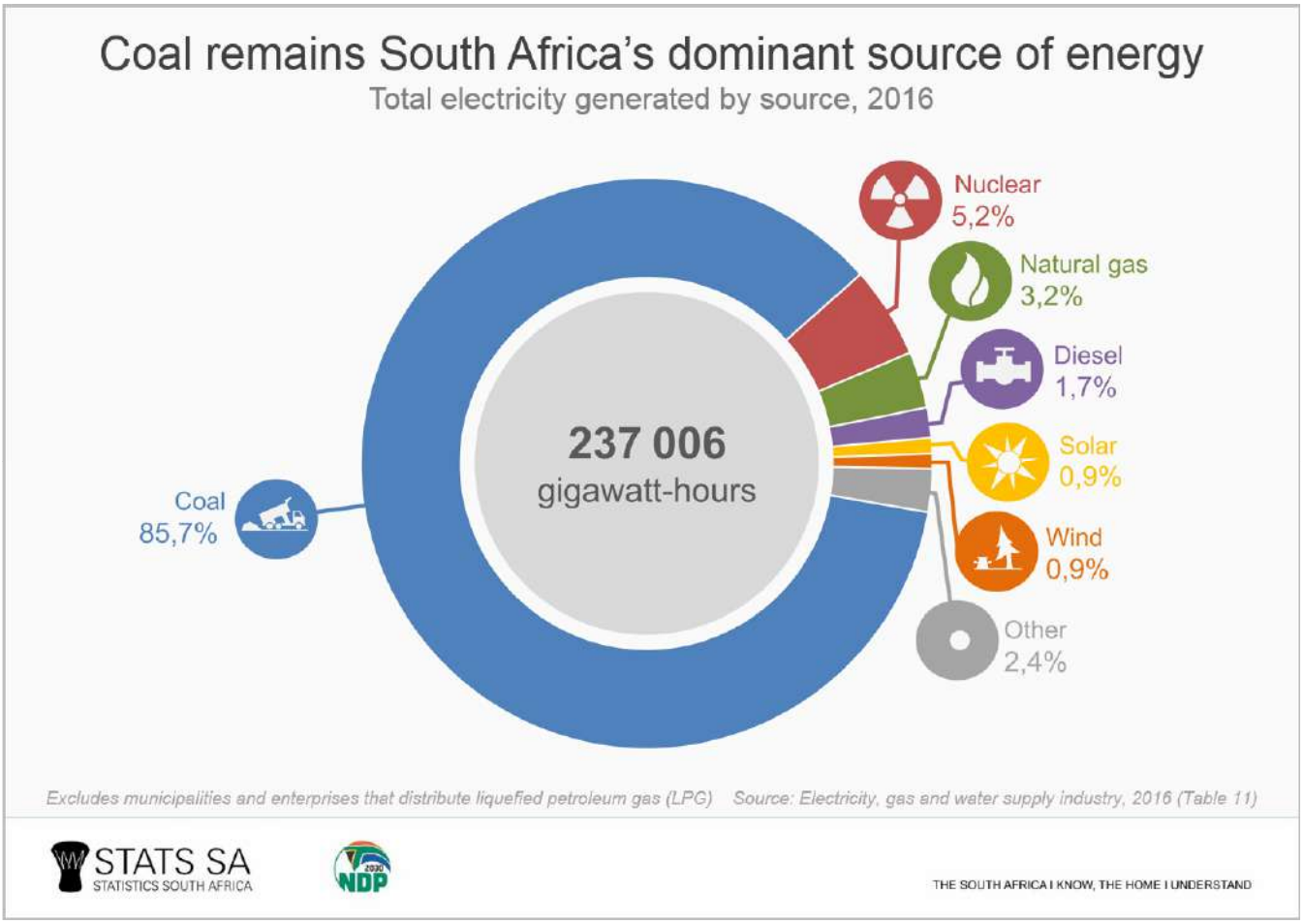


Figure 4.2: Overview of South Africa's electricity generation by source (Source: StatsSA 2016 Electricity, gas and water supply industry).

Whereas the majority of South Africa's electricity generation infrastructure is currently located within Mpumalanga Province due to the location of coal resources within this province, the North West Province has been identified as an area where the development of solar energy facilities is a feasible and suitable option for electricity generation. The project site is therefore suitably located for the proposed development.

4.4.1 Renewable Energy Strategy for the North West Province (2012)

In 2012 the North West Province's then Department of Economic Development, Environment, Conservation and Tourism (DEDECT) developed the Renewable Energy Strategy for the North West Province (2012). The strategy was developed in response to the need of the North West Province to participate meaningfully

within South Africa's renewable energy sector. The renewable energy strategy aims to improve the North West Province's environment, reduce its contribution to climate change, and alleviate energy poverty, whilst promoting economic development and job creation whilst developing its green economy.

According to the strategy the North West Province consumes approximately 12% of South Africa's available electricity, and is rated as the country's fourth largest electricity consuming province. This is mainly due to the high demand of the energy-intensive mining and related industrial sector, with approximately 63% of the electricity supplied to the province being consumed in its mining sector.

While the strategy recognises that South Africa has an abundance of renewable energy resources available, it is cognisant of the fact that the applicability of these renewable energy resources depend on a number of factors and as a result are not equally viable for the North West Province. The renewable energy sources that were identified to hold the most potential and a competitive strength for the North West Province are Solar Energy (PV as well as solar water heaters), Municipal Solid Waste, hydrogen and fuel cell technologies, bio-mass, and energy efficiency.

The advantages and benefits for the North West Province associated with the implementation and use of renewable energy technologies include:

» Provision of energy for rural communities, schools and clinics that are far from the national electricity grid.
» Creation of an environment where access to electricity provides rural communities with the opportunity to create an economic base via agricultural and home-based industries and Small, Medium and Micro Enterprises (SMMEs) in order to grow their income-generating potential.
» The supply of water within rural communities.
» It would result in less time taken for the collection of wood and water, thus improving the quality of life within communities and specifically for women.
» Improved health through the reduced use of fuelwood as energy source for cooking and heating that causes respiratory and other hazards.
» Solar water heating for households in urban and rural settings, reducing the need for either electricity (in urban settings) and fuelwood (in rural settings) to heat water, thus lowering our National peak demand and conservation of woodlands in a sustainable manner.
» Large-scale utilisation of renewable energy will also reduce the emissions of carbon dioxide, thus contributing to an improved environment.
» The fact that renewable energy goes hand-in-hand with energy efficiency, it will result in additional financial benefit and the need for smaller renewable energy systems.
» The development of a strong localised renewable energy industry within the NWP holds substantial potential for BEE and job creation within the province.
» The establishment of a strong renewable energy base in the North West Province, especially in the manufacturing of fuel cells could stimulate the market for Platinum Group Metals (PGM), which would in turn help the local mining sector.

This is due to renewable energy sources having considerable potential for increasing security of supply by diversifying the energy supply portfolio and increasingly contributes towards a long-term sustainable energy future. In terms of environmental impacts, renewable energy results in the emission of less GHGs than fossil fuels, as well as fewer airborne particulates, and other pollutants. Furthermore, renewable energy generation technologies save on water consumption in comparison with coal-fired power plants.

4.4.1.1. Solar Energy

With an average daily solar radiation of approximately 7 500MJ/m² South Africa experiences some of the highest levels of solar radiation in the World. Most areas in South Africa average more than 2 500 hours of sunshine per year, which makes solar energy the most readily accessible resource in South Africa and specifically the North West Province which has a very good solar potential with an average daily solar radiation greater than 8 000MJ/m².

The relative values for the annual solar radiation were determined for each of the four district municipalities in the North West Province compared to the maximum and minimum values for South Africa (refer to **Table 4.2**).

Table 4.2: Global annual solar radiation of the North West Province relative to South African Maximum and Minimum location values.

Description	Annual Solar Radiation Range (MJ/m²)		Relative to South African Maximum	Relative to South African Minimum
Maximum in South Africa	9 001	9 500	-	-
Dr Ruth Segomotsi Mompati District Municipality	8 501	9 000	-5%	40%
Ngaka Modiri-Molema District Municipality	8 501	9 000	-5%	40%
Bojanala Platinum District Municipality	8 001	8 500	-11%	32%
Dr Kenneth Kaunda District Municipality	8 001	8 500	-11%	32%
Minimum in South Africa	6 000	6 500	-	-

While Upington in the Northern Cape Province is located within the area of maximum solar radiation, and is considered a prime location for solar energy projects, the Dr Ruth Segomotsi Mompati District Municipality of the North West Province receives on average only 5% less solar radiation than Upington. In addition, all four municipalities which comprise the North West Province on average receive 40% to 32% more solar radiation than the locations with the least solar radiation in South Africa (such as Durban). The North West Province therefore shows considerable potential for solar applications in renewable energy as a whole, with higher potential in the Ngaka Modiri-Molema and Dr Ruth Mompati District Municipalities. The development of commercial PV solar energy facility within the Dr Ruth Mompati District Municipality of North West Province specifically is therefore strongly supported in terms of the Renewable Energy Strategy for the North West Province (2012).

4.4.2 North West Provincial Spatial Development Framework (2017)

As per the North West Provincial Spatial Development Framework (PSDF) (2017) electricity within the province is primarily provided by Eskom to re-distributors – mainly municipalities (10%), commercial (5%),

agriculture (5%), mining (30%), industrial (30%) and residential (20%). Electricity for supply to the North West Province is mostly generated by Eskom's Matimba coal-fired Power Station in Limpopo.

According to the North West PSDF the proposed project site is located within the Vryburg Distribution Area, which is characterised by minor developments, including Residential, Industrial, and Major Electrification, and has a projected growth of 100MW (Eskom, 2015).

Eskom's Transmission Development Plan 2015 – 2024 represents the transmission network infrastructure investment requirements over the 10 year period between 2015 and 2024. Projects proposed for the North West Province for the next 10 years include the introduction of 400kV power lines and transformation to support or relieve the existing networks. Five transmission power corridors have been identified as critical to providing a flexible and robust network that could respond to meet the needs of future IPPs and IRP requirements. The location of the potential MTS substation projects for additional grid access and the transmission power corridor routes are shown in **Figure** 4. **4.3**.

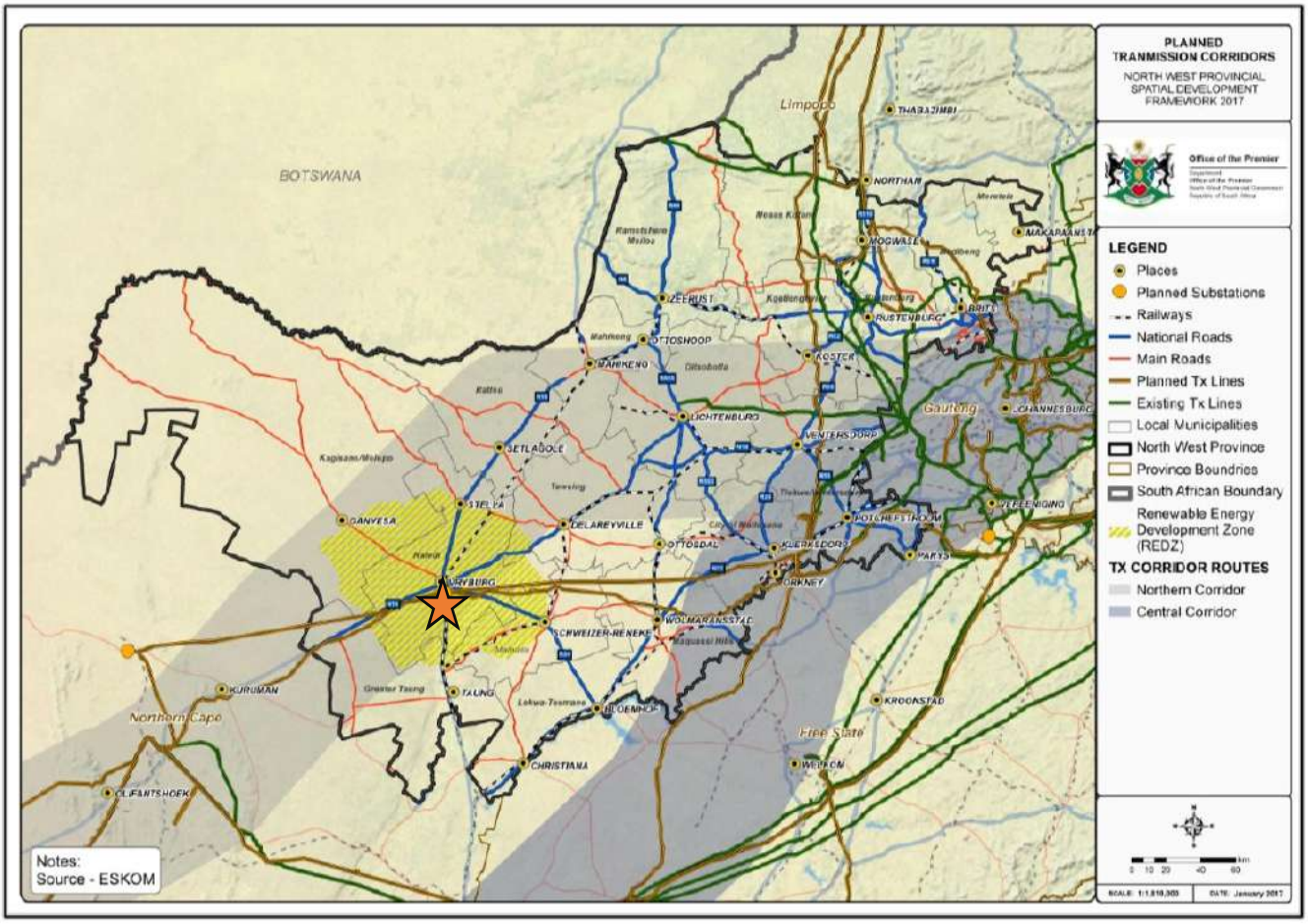


Figure 4.3: Planned Transmission Power Corridors (Source: North West PSDF, 2017). The proposed project location is indicated by the orange star.

The Moeding Solar PV Facility's project site is located within the Northern Power Corridor (refer to **Figure 4.3**), which provides assurance of the viability of a grid connection solution in the long-term.

According to the North West Province PSDF, and Statistics South Africa, the proposed project area is characterised by fairly low levels of access to electricity (i.e. 60% - 70%), when compared to other areas within the Province (refer to **Figure 4.4**). The implementation of the Moeding Solar PV Facility at the proposed project site would result in the generation of additional electricity within an area which is characterised by a fairly low level of access (i.e. between 60% - 70%). In addition, the project has the potential to somewhat alleviate the Province's reliance on electricity generated by coal-fired power stations such as Eskom's Matimba and Medupi coal-fired Power Stations as is currently the case.

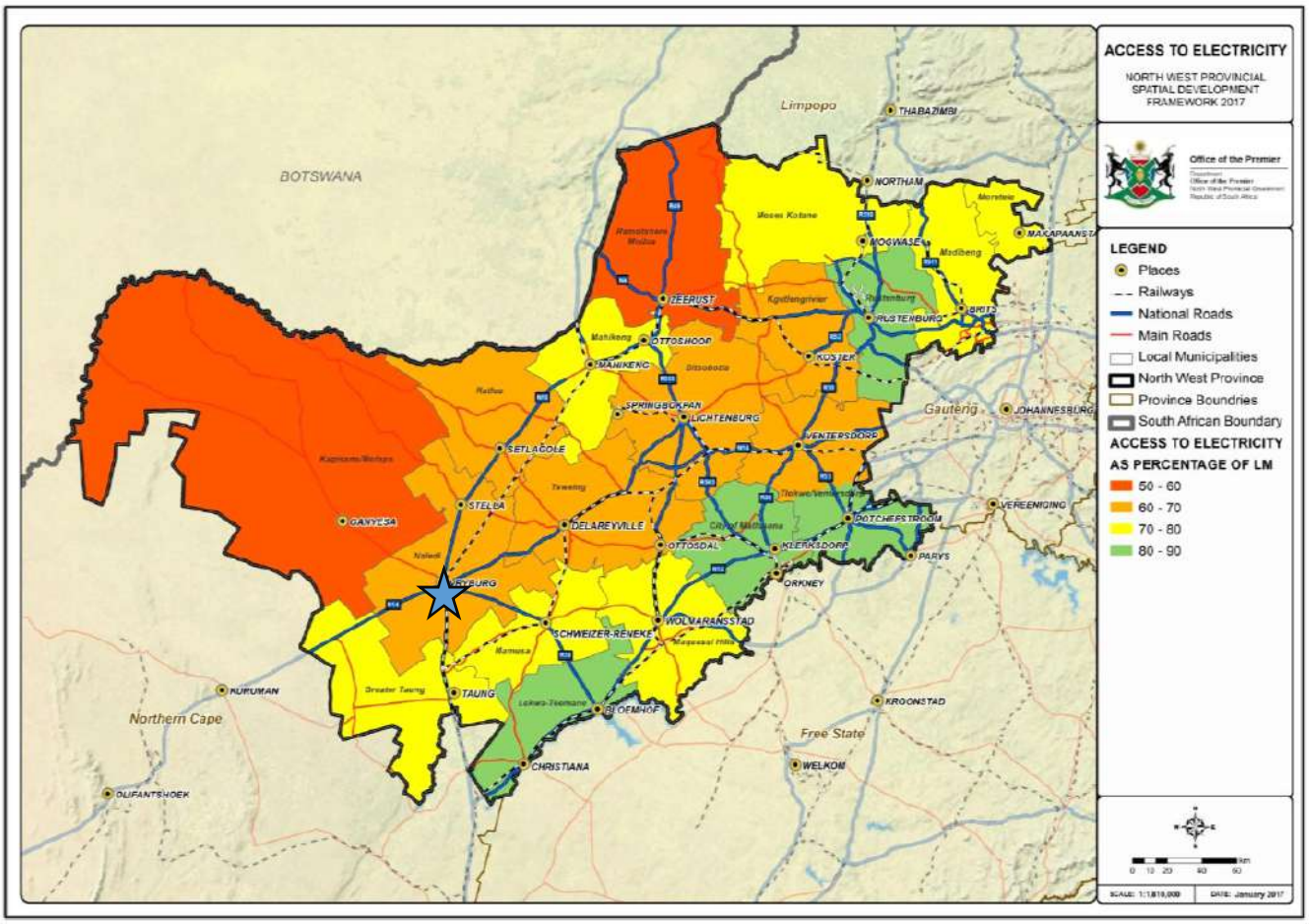


Figure 4.4: Access to Electricity (Source: North West PSDF, 2017). The proposed project location is indicated by the blue star.

4.5 Need and Desirability of the project from a Local Perspective

The Dr Ruth Segomotsi Mompati District Municipality and the Naledi Local Municipality are the municipalities who hold jurisdiction over the area within which the project site is located. These entities both have similar aims and objectives regarding development and growth in their governing areas. This includes accelerated economic growth, job creation, and the upliftment of communities and poverty alleviation. The development of the proposed solar energy facility is considered to align with the aims of the Municipalities.

The Dr Ruth Segomotsi Mompati District Municipality Integrated Development Plan (IDP) (2017-2022) makes provision for the development of the solar energy facility, which further strengthens the need and desirability of the project within the identified project site. The IDP includes the districts Spatial Development Framework (SDF). According to the IDP and sections on the SDF particular types of land-use should be encouraged and/or discouraged, and areas at which the intensity of land development could be either increased or reduced. It is indicated within the SDF 2013 that the proposed solar energy facility is located within the districts Intervention Zone 1 and as such the development is considered as desirable and appropriate.

From a local perspective in terms of the Naledi Local Municipality Integrated Development Plan (2017-2022) (IDP), the development falls in line with the key performance area 5 which refers to local economic development. The development of the Moeding Solar PV Facility will contribute to this key performance area through job creation, economic growth and development in the region adding to the need for the development.

When considering the need and desirability of the Moeding Solar PV Facility within the project site, the development is associated with positive development and growth within the broader study area (i.e. the greater Vryburg area) where there has in recent times only been a decline in the economic sector, which in-turn affects the larger communities and the associated decline in the standard of living of the residents as well as a decline in the quality of the area. The development also falls in line with the policies of the area in terms of development and growth, therefore formally strengthening the need and desirability for the development. The development of the solar energy facility will also provide the proposed project site with an alternative and sustainable purpose and land use other than grazing, which has been the dominant land-use within the site. The construction and operation of a solar energy facility on the affected properties is considered to be a preferred land use option due to the suitability of the land for the development and the availability of the sufficient solar resource.

The suitability of the project site for the development of the Moeding Solar PV Facility is also measured in terms of other solar energy facilities in the surrounding areas. Within a 30km radius from the project site there are at least 20 other proposed solar energy facilities located (authorised), one project has been selected as a preferred bidder, and none of which have been constructed. These facilities are included in **Table 4.3**.

Table 4.3: Other solar energy facilities located within 30km from the affected properties

Project Name	Approximate distance from the affected properties	Project Status
Tiger Kloof Solar Energy Facility	Located within the affected properties (Remaining Extent of Portion 3 of the Farm Waterloo 730)	Authorised
Protea Solar Power Plant	Located adjacent to the affected properties (west)	Authorised
Waterloo Solar Park	Located adjacent to the affected properties (east)	Authorisation granted (Preferred Bidder Round 4.5)
Khubu Solar Power Plant	Located adjacent to the affected properties (south east)	Authorised
Sedawo PV 1 Facility	Located adjacent to the affected properties (west)	Authorised

Project Name	Approximate distance from the affected properties	Project Status
Sedawo PV 2 Facility	Located adjacent to the affected properties (west)	Authorised
Sedawo PV 3 Facility	Located adjacent to the affected properties (west)	Authorised
Sediba Solar Energy Facility (Rosendal)	Located adjacent to the affected properties (north)	Authorised
Gamma Solar Power Plant	5.9km east of the affected properties	Authorised
Sonbesie Solar Power Plant	6.2km north west of the affected properties	Authorised
Woodhouse Solar 1 PV Facility	8km east of the affected properties	Authorised
Woodhouse Solar 2 PV Facility	8km east of the affected properties	Authorised
Klondike PV1 Facility	8.5km north west of the affected properties	Authorised
Klondike PV2 Facility	8.5km north west of the affected properties	Authorised
Klondike PV3 Facility	8.5km north west of the affected properties	Authorised
Carocraft Solar Park	19km north east of the affected properties	Authorised
60MW Carocraft PV Solar Park	19km north east of the affected properties	Authorised
Renewable Energy Generation Project	22.5km north of the affected properties	Authorised
Meerkat Solar Power Plant	28.5km west of the affected properties	Authorised
Alpha Solar Power Plant	30km west of the affected properties	Authorised

Given the competitive nature of the Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, a high annual solar irradiation value and grid connectivity suitability are some of the most important factors of success for the development of a solar energy facility. The location of the project site within a REDZ, the number of other proposed solar energy facilities within a 30km radius from the project site and the selection of the abovementioned Waterloo Solar Park as a Preferred Bidder project, is a confirmed indicator that the Moeding Solar PV Facility project site is located where the required solar resources and grid connectivity characteristics are competitive and suitable for the selection process by the Department of Energy for future bidding rounds of the REIPPP Programme.

4.6 Receptiveness of the proposed project site to develop the Moeding Solar PV Facility

The overarching objective for the development of the Moeding Solar PV Facility is to maximise electricity production through exposure to the South African renewable solar resource and to diversify and stabilise the electricity mix of the country. It also aims to reduce infrastructure, operational and maintenance costs, while minimising detrimental social and environmental impacts. From a regional site selection perspective, this region is considered to be a preferred area for solar energy developments by virtue of its annual solar irradiation values. The GHI for the project site derived from the World Bank Group's Global Solar Atlas is

approximately 2 141kWh/m²/annum, which tends towards the higher side of the spectrum (refer to **Figure 4.5**.

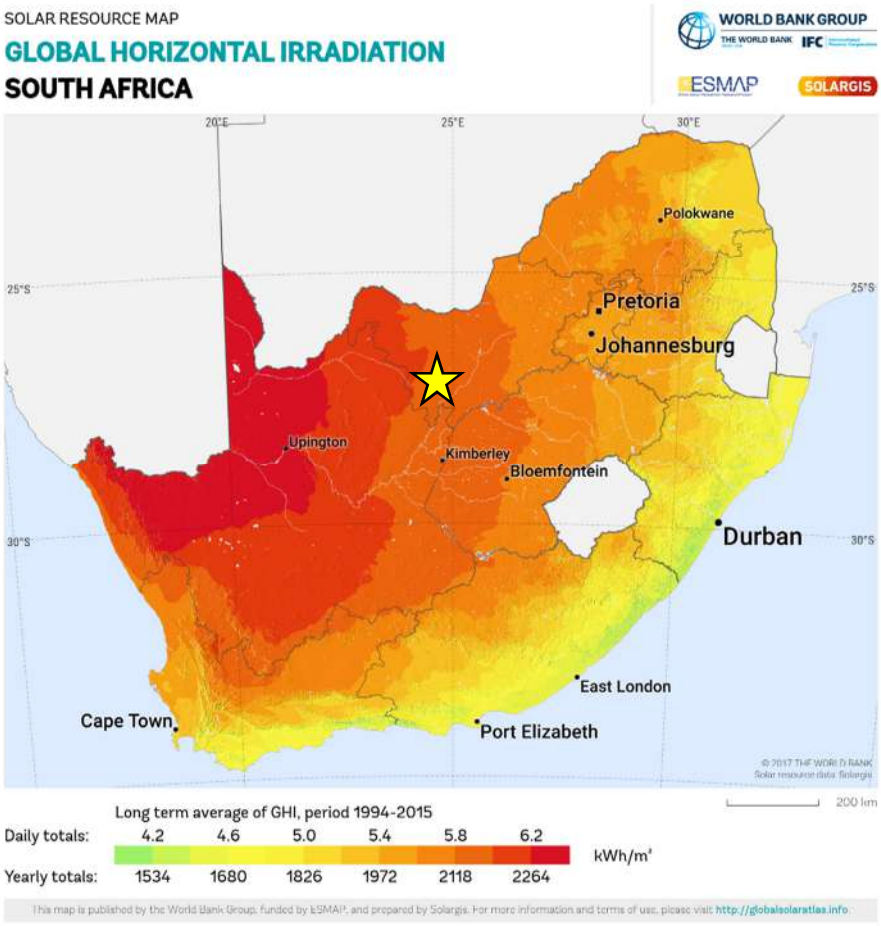


Figure 4.5: Solar irradiation map for South Africa; the proposed position of the Moeding Solar PV Facility is shown by the yellow star on the map. (Source: World Bank Groups Global Solar Atlas).

The location of a solar energy facility is strongly dependent on several factors including climatic conditions (solar radiation levels), topography, the location of the site, and in particular the location in a planned 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 has specifically been identified by the applicant as being highly desirable from a technical perspective for the development of a solar facility due to the following site characteristics:

- **Solar resource**: The economic viability of a solar facility is directly dependent on the annual direct solar irradiation values. The GHI for the proposed project site is in the region of approximately 2 141kWh/m²/annum, which is well suited to the development of a solar energy facility.
- **Topography**: A surface area with favourable topography facilitates the work involved in construction and maintenance of the solar energy facility. The proposed project site is characterised as having flat topography with slopes of 0 – 2% across the full extent of the site.
- **Site extent:** The project site is approximately 642ha in extent, which is sufficient for the installation of the facility allowing for avoidance of site sensitivities. The development area of the facility would occupy an area equivalent to approximately 68% of the full project site.

- **Site access**: Access to the project site is obtained via the N18 which is aligned with the eastern boundary of the project site.
- **Grid access:** A key factor in the siting of any project is that the project must have a viable grid connection. Grid connection options are available via the existing Mookodi Main Transmission Substation situated directly north of the project site.
- **Land suitability:** There is no cultivated agricultural land within the affected properties (as a result of low agricultural potential) which could be impacted upon by the proposed solar energy facility. The affected property is currently used for livestock grazing.
- **Geographic location**: The proposed project site is located within an area which has become a node for renewable energy projects. The proposed project site is in close proximity to several authorised solar PV developments and therefore compliments existing and future land use.
- **Landowner support:** The selection of a project 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 or future land use practices.

4.7 Benefits of Renewable Energy Developments

The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits are detailed below and provides further motivation for the selection of the specific project site chosen for the Moeding Solar PV Facility:

Increased energy security: Renewable energy can play a significant role in terms of power supplementation, diversification and stabilisation in South Africa. In addition, given that renewable energy projects 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. These real benefits have already been enjoyed by citizens, with renewable energy generation since early 2012 making an increasingly important contribution to supply security.

Resource saving: It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings (i.e. water not required for energy generation related to PV solar energy facilities) of approximately 16.5 million kilolitres per annum, which also translates into revenue savings of R26.6 million 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. Other non-renewable resources which will experience reduced usage pressure is the use of fossil fuels (i.e. coal) as a resource for the generation of electricity.

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

Economics: As a result of the excellent resource and competitive procurement processes, both solar PV power and wind power are now proven in South Africa as cheaper forms of energy generation than coal power. These projects have also attracted R197 billions worth of inward investment to South Africa as part of the Government focus on developing strategic infrastructure via the Strategic Infrastructure Programme. They offer value for money to the economy and citizens of South Africa. In addition, such technologies can be deployed faster and more expediently than other conventional power generation plants. The

economics of the country and communities surrounding the solar PV and wind power developments also experience upliftment as a result of the Department of Energy's REIPPP Programme, which requires the establishment of a Community Trust for the economic enhancement, development and growth of communities.

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 radiation 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 greenhouse gas (GHG) emissions. South Africa is estimated to be currently responsible for approximately 1% of the 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.

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 the Kyoto Protocol, and for cementing its status as a leading player within the international community.

Employment creation: The development, procurement, installation, maintenance and management of renewable energy facilities have significant potential for job creation and skills development in South Africa and specifically the town of Vryburg and the informal settlement, Huhudi.

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

Industrialisation: The development of renewable energy offers the opportunity to establish a new industry within the South African and Naledi Local Municipality's economies, which will create jobs and skill local communities which have the potential for further renewable energy projects. The new industry will also attract interest and investment from abroad which further enhances the economic advancement.

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 general objectives of Integrated Environmental Management have been taken into account for this BA report by means of identifying, predicting and evaluating the actual and potential impacts on the environment, socio-economic conditions and cultural heritage component. The risks, consequences, alternatives as well as options for mitigation of activities have also been considered with a view to minimise negative environmental and social impacts, maximise benefits, and promote compliance with the principles of environmental management and sustainable development.

Socio-economic and enterprise development: The establishment of the Moeding Solar PV Facility with a contracted capacity of up to 100MW (and other renewable energy facilities in the area) has the potential to result in significant socio-economic opportunities for the region, which, in turn, will result in a positive social benefit. This was also one of the primary considerations in the determination of the REDZ (the site is located in Zone 6 known as the Vryburg REDZ as depicted in **Figure 4.1**). The positive impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. The Community Trust associated with the project will also create significant socio-economic benefits for the surrounding communities. These benefits should also be viewed within the context of the limited socio-economic opportunities in the area. All areas within a 50km radius of the proposed solar energy facility will benefit from the socio-economic and enterprise development initiatives committed to by the Moeding Solar PV Facility as prescribed by the Department of Energy in their Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. These commitments will allow the local community to own a share in the Moeding Solar PV Facility, therefore benefitting from dividends, and will also see a percentage of turnover being deployed back into the local community.

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CHAPTER 5 APPROACH TO UNDERTAKING THE BA PROCESS

In terms of the EIA Regulations of December 2014 published in terms of the NEMA (Act No. 107 of 1998) as amended, the construction and operation of the proposed solar energy facility is a listed activity requiring environmental authorisation. In terms of GNR114 of February 2018, the application for authorisation is required to be supported by a Basic Assessment (BA) process.

The BA process aims at identifying and describing potential environmental issues associated with the proposed solar energy facility and associated infrastructure. In order to ensure that a comprehensive assessment is provided to the competent authority and Interested and Affected Parties (I&APs) regarding the impacts of the solar energy facility, detailed specialist studies were undertaken as part of the BA process. In addition, a comprehensive consultation process was carried out, and included interested and affected parties (I&APs), the competent authority, directly impacted landowners/occupiers, adjacent landowners/occupiers, relevant organs of state departments, ward councillors and other key stakeholders. This chapter serves to outline the process which was followed during the BA process.

5.1 Legal Requirements as per the EIA Regulations for the undertaking of a Basic Assessment Report, 2014 (as amended)

This chapter of the Basic Assessment Report includes the following information required in terms of Appendix 1: Content of the BA Report.

Requirement	Relevant Section
1(d)(i) a description of the scope of the proposed activity, including all listed and specified activities triggered and being applied for.	All listed activities triggered and applied for are included in section 5.3.1 and Table 5.1.
(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.	The public participation process followed throughout the BA process of the Moeding Solar PV Facility is included in section 5.4 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.	The main issues raised through the undertaking of the public participation process including consultation with I&APs are included in Table 5.4 and the Comments and Responses Report included in Appendix C8.
(h)(vi) 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;	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 5.5.
(o) a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	A description of any assumptions, uncertainties, and gaps in knowledge are included in section 5.6.

5.2. Objectives of the Basic Assessment Report

The Basic Assessment aims to:

- Identify, describe and evaluate potential environmental (biophysical and social) impacts (direct, indirect, and cumulative) and benefits of all phases of the solar energy facility (including design, construction, operation and decommissioning) within the site and provide a comprehensive assessment of the social and biophysical environments affected by the project.
- Comparatively assess any alternatives put forward as part of the project.
- Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
- Undertake a fully inclusive public participation process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

The BA Report includes an assessment of potential direct, indirect, and cumulative[12] impacts (both positive and negative) associated with all phases of the project including design, construction, operation and decommissioning. In this regard the BA Report aims to provide the relevant authorities with sufficient information to make an informed decision regarding the proposed Moeding Solar PV Facility.

5.3. Relevant listed activities

5.3.1. 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 - CA) charged by NEMA with granting of the relevant EA. Due to the fact that the Moeding Solar PV Facility is a power generation project and therefore relates to the IRP for Electricity 2010 – 2030, the National DEA has been determined as the CA in terms of GNR 779 of 01 July 2016. The North West Province, the North West Department of Rural, Environmental and Agricultural Development (READ) 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 project.

[12] "Cumulative environmental change or cumulative effects may result from the additive effect of individual actions of the same nature or the interactive effect of multiple actions of a different nature" (Spaling and Smit, 1993).

The BA process being conducted for the Moeding Solar PV Facility is being undertaken in accordance with Section 24 (5) of the National Environmental Management Act (No. 107 of 1998) (NEMA). Section 24 (5) of NEMA pertains to EAs, 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 NEMA which are likely to have a detrimental effect on the environment, and which may not commence without EA from the competent authority subject to the completion of an environmental assessment process (either a BA of full S&EIA).

Table 5.1 details the listed activities in terms of the EIA Regulations of December 2014 (as amended) which apply to the Moeding Solar PV Facility, and for which an Application for Environmental Authorisation has been submitted. The table also includes a description of the specific project activities which relate to the applicable listed activities.

Table 5.1: Listed activities triggered by the Moeding Solar PV Facility

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant notice) :	Describe each listed activity as per project description
GN 327, 08 December 2014 (as amended on 07 April 2017)	11(i)	The development of facilities or infrastructure for the transmission and distribution of electricity - (i). outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts. ***An on-site substation with a capacity of 132kV and a 132kV overhead distribution power line outside an urban area will be required to connect the solar energy facility to the national electricity grid.***
GN 327, 08 December 2014 (as amended on 07 April 2017)	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 (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare. ***The total area of land to be developed for the solar energy facility is larger than 1 hectare and is currently used for agricultural purposes. The total extent of the development footprint is 300ha.***
GN 325, 08 December 2014 (as amended on 07 April 2017)	1	The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more. ***The total electricity output for the solar energy facility will be more than 20MW, with a maximum contracted capacity of 100MW.***
GN 325, 08 December 2014 (as amended on 07 April 2017)	15	The clearance of an area of 20 hectares or more of indigenous vegetation. ***The clearance of more than 20 hectares of indigenous vegetation will be required during construction of the solar energy facility. The total extent of the development footprint is 300ha.***
GN 324, 08 December	10(h)(vi)	The development and related operation of facilities or

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant notice) :	Describe each listed activity as per project description
2014 (as amended on 07 April 2017)		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 meters (h) in North West (vi) in areas within 100 metres from the edge of a watercourse or wetland. ***The construction and operation of the solar energy facility will require the storage and handling of a dangerous good such as hydraulic oil, fuel and cement which will be stored in containers with a combined capacity of 30 cubic meters, however not exceeding 80 cubic meters. The site is located within 100m from depression wetlands.***
GN 324, 08 December 2014 (as amended on 07 April 2017)	12(h)(vi)	The clearance of an area of 300 square meters or more of indigenous vegetation (h) in North West (vi) in areas within 100 metres from the edge of a watercourse or wetland. ***The clearance of 300m² will be required for the development of the solar energy facility. The development footprint is located within 100 metres from depression wetlands.***

5.4. Overview of the Process for the Moeding Solar PV Facility

Key tasks undertaken for the Basic Assessment included:

- Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
- Undertaking of independent specialist studies in accordance with Appendix 6 of GNR326.
- Undertaking a public participation process in accordance with Chapter 6 of GNR326 in order to identify issues and concerns associated with the proposed project.
- Compilation of a Comments and Responses Report detailing the comments raised by Interested and Affected Parties (I&APs) and responses provided by the project team as part of the public participation process.
- Submission of the completed application for authorisation to the competent authority (i.e. the National DEA) in terms of Regulations 5 and 16 of the EIA Regulations 2014, as amended in April 2017 (GNR326).
- Preparation of a BA Report in accordance with the requirements of Appendix 1 of GNR326.

The tasks are discussed in detail in the sub-sections below.

5.4.1. Authority Consultation and Application for Authorisation

In terms of Government Notice 779 of 01 July 2016, the National Department of Environmental Affairs (DEA) is the competent authority for all projects related to the IRP. As the project is located within the North West READ is the commenting authority. A record of all authority consultation undertaken is included within this BA Report. Consultation with the regulating authorities (i.e. DEA and North West READ) as well as with all other relevant Organs of State will continue throughout the BA process. To date, this consultation has included the following:

- Notification and consultation with Organs of State (refer to **Table 4.1**) that may have jurisdiction over the project, including:
  - National and Provincial departments (competent and commenting authorities)
  - Parastatals and Non-Governmental Organisations
  - Local Municipality and District Municipality
- Submission of the application for authorisation to DEA;
- Submission of the Basic Assessment Report for review to relevant Organs of State departments and the competent and commenting authorities from 16 January 2019 to 15 February 2019.

The following will also be undertaken as part of this BA process:

- Submission of a final BA Report to DEA following the 30-day public review period of the BA Report.
- If required, an opportunity for DEA and READ representatives to visit and inspect the proposed development area.

A record of all authority correspondence undertaken during the BA process is included in **Appendix C**.

5.4.2. Public Involvement and Consultation

Public Participation is an essential and regulatory requirement for an environmental authorisation process and is guided by Chapter 6 of the EIA Regulations 2014, as amended in April 2017, under NEMA. The sharing of information forms the basis of the public participation process and provides I&APs the opportunity to become actively involved in the BA process from the outset. The public participation process is designed to provide sufficient and accessible information to I&APs in an objective manner to assist them to:

During the BA process:
- provide opportunities to submit comment and provide suggestions for enhanced benefits regarding the project;
- assist in identifying reasonable alternatives;
- contribute relevant local information and knowledge to the environmental assessment;
- verify that their comments have been recorded, considered in the environmental investigations; and
- comment on the findings of the environmental assessments.

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 review.
» Public participation is facilitated in such a manner that I&APs are provided with a reasonable opportunity to comment on the Moeding Solar PV Facility.
» An adequate review period is provided for I&APs to comment on the findings of the BA Report.

In terms of the requirement of Chapter 6 of the EIA Regulations of December 2014, the following key public participation tasks will be undertaken:

» Fixing a notice board at a place conspicuous to the public at the boundary or on the fence of—
    (i) the site where the activity to which the application relates is or is to be undertaken; and
    (ii) any alternative site mentioned in the application;
» Giving written notice to:
    (i) the owner or person in control of that land if the applicant is not the owner or person in control of the land;
    (ii) the occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
    (iii) owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
    (iv) the municipal councillor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;
    (v) the municipality which has jurisdiction in the area;
    (vi) any organ of state having jurisdiction in respect of any aspect of the activity; and
    (vii) any other party as required by the competent authority.
» Placing an advertisement in one local newspaper.
» Open and maintain a register of interested and affected parties and organs of state.
» Release of a BA Report for a 30-day review period.
» Preparation of a Comments and Responses Report which documents the comments received on the BA Report and the responses provided by the project team.

In compliance with the requirements of Chapter 6: Public Participation of the EIA Regulations, 2014 (as amended), the following summarises the key public participation activities conducted to date.

i. Stakeholder identification

The first step in the public participation process is to initiate the identification of potential I&APs. I&APs have been identified through a process of networking and referral, obtaining information from Savannah Environmental's existing stakeholder database, liaison with potentially affected parties in the greater study area and a registration process involving the completion of a reply form. Key stakeholders and affected and surrounding landowners have been identified and registered on the project database. Other stakeholders are required to formally register their interest in the project. An initial list of key stakeholders identified and registered is listed in **Table 5.2**.

Table 5.2: List of Stakeholders identified for the inclusion in the project database during the public participation process for the Moeding Solar PV Facility

Organs of State
National Government Departments
Department of Agriculture, Forestry and Fisheries (DAFF)
Department of Energy (DoE)
Department of Mineral Resources (DMR)
Department of Public Works (DPW)
Department of Rural Development and Land Reform (DRDLR)
Department of Water and Sanitation (DWS)
Department of Communications
Department of Science and Technology (DST)
Government Bodies and State Owned Companies
National Energy Regulator of South Africa (NERSA)
Sentech
South African Civil Aviation Authority (CAA)
South African National Roads Agency Limited (SANRAL)
Square Kilometre Array: Southern Africa (SKA)
Telkom SA Ltd
Eskom SOC Ltd
Provincial Government Departments
North West Provincial Department of Rural, Environment and Agricultural Development
North West Provincial Heritage Resources Agency
North West Provincial Department of Community Safety & Transport Management
Local Government Departments
Naledi Local Municipality
Dr Ruth Segomotsi Mompati District Municipality
Non-Governmental Organisations
BirdLife South Africa
Wildlife and Environment Society of South Africa (WESSA)
Endangered Wildlife Trust (EWT)
Key Stakeholders
Vodacom
Landowners
Affected landowners
Neighbouring landowners

ii. Register of Interested and Affected Parties

In accordance with Regulation 42 of the EIA Regulations, 2014 (as amended in April 2017), all relevant stakeholder and I&AP information has been recorded within a register of I&APs (refer to **Appendix C1** for a listing of the recorded parties). The register of I&APs contains the names, contact details and addresses of:

- all persons who requested to be registered on the database in writing and disclosed their interest in the project;
- all organs of state which hold jurisdiction in respect of the activity to which the application relates; and
- all persons who submitted written comments or attended meetings during the public participation process.

I&APs have been encouraged to register their interest in the BA process from the onset of the project, and the identification and registration of I&APs will be on-going for the duration of the BA process. The database of I&APs will be updated throughout the BA process, and will act as a record of the I&APs involved in the public participation process.

iii. Advertisements and Notifications

The BA process was announced with an invitation 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 via the following:

- Compilation of a background information document (BID) (refer to **Appendix C3**) providing details on the project and how to become involved in the BA process. The BID has been distributed to identified stakeholders and I&APs, and additional copies have been made available at public venues within the surrounding areas of the study area. The BID is also available electronically on the Savannah Environmental website.
- Placement of site notices announcing the BA process at visible points along the boundary of the project site, in accordance with the requirements of the EIA Regulations. Photographs and the GPS coordinates of the site notices are contained in **Appendix C2**.
- Placement of an advertisement announcing the BA process for the project and inviting members of the public to register themselves as I&APs on the project database in the Stellalander on 01 August 2018. The tear sheet of the newspaper advert is contained in **Appendix C2**.
- Placement of advertisement announcing the availability of, and inviting comment on the Basic Assessment Report in the Stellalander on 16 January 2019 at the commencement of the 30-day review period. The tear sheet of the newspaper advert will be contained in **Appendix C2** of the final BA Report.
- BA process notification letters announcing the BA process, notifying organs of state, potentially affected and neighbouring landowners, as well as stakeholders/I&APs of the Moeding Solar PV Facility, providing background information of the project and inviting I&APs to register on the project's database, were distributed via email and registered post on 30 July 2018. The evidence of the distribution of the process notification letters are contained in **Appendix C** of the BA Report.
- The availability of the BA Report for review has been made available for review by I&APs for a 30-day review period from 16 January 2019 to 15 February 2019. CD and hard copy versions of the BA Report have been circulated to Organs of State via courier at the commencement of the review period. The evidence of distribution of the Basic Assessment Report will be included in the final BA Report, which will be submitted to the DEA.

iv. Public Involvement and Consultation

In order to accommodate the varying needs of stakeholders and I&APs within the greater study area, as well as capture their views, issues and concerns regarding the project, various opportunities have been

and will continue to be provided to I&APs to note their issues. I&APs are being consulted through the following means:

Table 5.3: Consultation undertaken with I&APs for the Moeding Solar PV Facility

Activity	Date
Distribution of process notification and stakeholder reply form announcing the BA process and inviting I&APs to register on the project database.	30 July 2018
Advertising of the BA process in the Stellalander newspaper.	1 August 2018
Placement of site notices on-site and in public places.	6 August 2018
Focus Group Meetings: » Affected Landowners; » Adjacent Landowners; » Tiger Kloof Educational Institution.	6 – 7 August 2018
Distribution of notification letters announcing the availability of the BA Report for review for a 30-day public review and comment period. These letters were distributed to organs of state departments, ward councillors, landowners within the greater study area, neighbouring landowners and key stakeholder groups.	16 January 2019
Advertising of the availability of the BA Report for public review in the Stellalander newspaper.	16 January 2019
Public review period for the Basic Assessment Report for comment.	16 January 2019 – 15 February 2019

Records of all consultation undertaken are included in **Appendix C**.

v. Review of the Basic Assessment Report

The Basic Assessment Report has been made available for review from **16 January 2019 – 15 February 2019** at the following locations:

» Vryburg Public Library, 76 Stella Street, Vryburg
» Huhudi Community Library, 2661 Mosiapoa Street, Huhundi, Vryburg
» www.savannahSA.com

vi. Identification and Recording of Comments

Focus group meetings where held with the affected and adjacent landowners and key stakeholders in August 2018 in order to identify issues and obtain comment on the Moeding Solar PV Facility project. In addition, stakeholders were consulted through telephonic discussions and email correspondence (refer to **Appendix C5**). The key issues emanating from this consultation are summarised below in **Table 5.4**.

Table 5.4: Summary of key issues raised during the public participation process

Summary of main issues raised by I&APs	Summary of response from EAP
Vodacom (Pty) Ltd has no objection to the proposed solar PV facility, situated on Portion 1 on the farm Champions Kloof 731, Portion 4 and the remaining extent	The content of Vodacom's letter was acknowledged.

of Portion 3 of the farm Waterloo 730, situated approximately 8km south of Vryburg in the North West Cape Province.	
Water is scares in the study area.	The applicant will consider the possibility of trucking in water in terms of availability and the costs involved. It was also advised that the applicant is aware of an existing Sedibeng Water pipeline running parallel to the N18 and in close proximity to the proposed site, and would therefore be in contact with Sedibeng Water once the project is selected as a preferred bidder.
Concern were raised as to what mitigation measures will be in place to ensure the safety and security of adjacent landowners.	The applicant advised that the site will be fenced and that there will be an access control point through which all construction workers will be entering and leaving. It was also confirmed that the only persons allowed on the site after hours will be the Security Officers. Security will be 24/7 consisting of 3 x 8 hours shifts.

Issues and comments raised by I&APs over the duration of the BA process have been synthesised into a Comments and Responses Report which is included in **Appendix C8**. The Comments and Responses Report includes detailed responses from members of the EIA project team and/or the project proponent to the issues and comments raised during the public participation process. Comments raised during the 30-day review of the Basic Assessment Report will be recorded, included and responded to in the final Basic Assessment Report that will be submitted to the DEA.

5.5. Assessment of Issues Identified through the BA Process

Issues identified as requiring investigation, as well as the specialists involved in the assessment of these impacts are indicated in **Table 5.5** below.

Table 5.5: Specialist consultants appointed to evaluate the potential impacts associated with the Moeding Solar PV Facility

Specialist Name	Specialist Company	Specialist Area of Expertise	Appendices
Gerhard Botha	Nkurenkuru Ecology and Biodiversity	Ecology and Wetland Impact Assessment	Appendix D
Gerhard Botha	Nkurenkuru Ecology and Biodiversity	Avifauna Impact Assessment	Appendix E
Mariné Pienaar	TerraAfrica	Soils and Agricultural Potential Impact Assessment	Appendix F
Jon Marshall	Environmental Planning and Design	Visual Impact Assessment	Appendix G
Wouter Fourie	PGS Heritage	Heritage Impact Assessment	Appendix H
Elize Butler	Banzai Environmental	Palaeontological Impact Assessment	Appendix I
Sarah Watson (peer reviewed by Neville Bews)	Savannah Environmental	Social Impact Assessment	Appendix J

Specialist studies considered direct and indirect environmental impacts associated with the development of all components of the Moeding Solar PV Facility. Issues were 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).

As the Applicant has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), 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) is included as **Appendix K**.

5.6. Assumptions and Limitations of the BA Process

The following assumptions and limitations are applicable to the studies undertaken within this BA process:

- All information provided by the developer and I&APs to the environmental team was correct and valid at the time it was provided.
- It is assumed that the development footprint for the solar energy facility identified by the developer represents a technically suitable site for the establishment of the proposed Moeding Solar PV Facility which is based on the design undertaken by technical consultants for the project.
- The proposed connection to the National Grid is correct in terms of viability and need.
- This report and its investigations are project-specific, and consequently the environmental team did not evaluate any other power generation alternatives.

Refer to the specialist studies in **Appendices D – J** for specialist study specific limitations.

5.7. Legislation and Guidelines that have informed the preparation of this Basic Assessment Report

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

- National Environmental Management Act (Act No. 107 of 1998);
- EIA Regulations of December 2014, published under Chapter 5 of NEMA (as amended in GNR R326 in Government Gazette No 40772 of April 2017); and
- International guidelines – the Equator Principles and the International Finance Corporation and World Bank Guidelines.

Table 5.6 provides an outline of the legislative permitting requirements applicable to the Moeding Solar PV Facility as identified at this stage in the project process.

Table 5.2: Applicable Legislation, Policies and/or Guidelines associated with the development of the Moeding Solar PV Facility

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	National Legislation		
National Environmental Management Act (Act No. 107 of 1998)	The EIA Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation. A BA process is required to be undertaken for the Moeding Solar PV Facility in accordance with GN114, as formally gazetted on 16 February 2018, due to the location of the project site within the REDZ.	» National Department of Environmental Affairs (DEA). » North West Department of Rural, Environment and Agricultural Development (READ) - commenting authority.	The listed activities triggered by the proposed project have been identified and assessed in the BA process being undertaken. This BA Report will be submitted to the competent and commenting authority in support of the application for authorisation.
National Environmental Management Act (Act No. 107 of 1998)	In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with a project is avoided, stopped or minimised.	» National Department of Environmental Affairs (DEA).	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section is applicable during the BA process) and will continue to apply throughout the life cycle of the project.
National Environmental Management: Biodiversity Act (Act No. 10 of 2004)	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.	» National Department of Environmental Affairs (DEA). » North West Department of Rural, Environment and	Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	Three government notices have been published in terms of Section 56(1) of NEM:BA as follows: » Commencement of TOPS Regulations, 2007 (GNR 150). » Lists of critically endangered, vulnerable and protected species (GNR 151). » TOPS Regulations (GNR 152). 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).	Agricultural Development (READ).	An ecological impact assessment has been undertaken as part of the BA Report (refer to **Appendix D**). As such the potential occurrence of critically endangered, endangered, vulnerable, and protected species and the potential for them to be affected has been considered. A permit may be required should any listed plant species be disturbed or destroyed as a result of the proposed solar energy facility. No species of conservation concert under this Act have been identified on site.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	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. The Minister may amend the list by –	» National Department of Environmental Affairs (DEA). » North West Department of Rural, Environment and Agricultural Development	As no waste disposal site is to be associated with the proposed project, no permit is required in this regard. Waste handling, storage and disposal during construction and operation is required to be

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	» Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of this Act (GN 921), A Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities (Category A and B) while Category C Activities (such as storage of waste) must be undertaken in accordance with the necessary norms and standards. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in any other way rendered unlit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking. » The waste cannot be blown away. » Nuisances such as odour, visual impacts and breeding of vectors do not arise; and » Pollution of the environment and harm to health are prevented.	(READ).	undertaken in accordance with the requirements of the Act, as detailed in the EMPr (refer to **Appendix K**).

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
National Environmental Management: Air Quality Act (Act No. 39 of 2004)	Measures in respect of dust control (section 32) and National Dust Control Regulations of November 2013. GN R 827 – National Dust Control Regulations prescribes general measures for the control of dust in all areas	» National Department of Environmental Affairs (DEA). » Naledi Local Municipality.	No permitting or licensing requirements arise from this legislation. The EMPr however makes provision for managing and mitigating potential dust impacts (refer to **Appendix K**).
National Water Act (Act No. 36 of 1998)	Water uses under S21 of the Act must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation. In terms of S19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing, or recurring.	» Department of Water and Sanitation (DWS).	A water use license (WUL) is required in terms of sections 21(c) and 21 (i) of the National Water Act, if wetlands or drainage lines are impacted on, or the regulated area of a watercourse (being the riparian zone or the 1:100yr floodline whichever is greatest). Should water be extracted from groundwater/a borehole on site for use within the solar energy facility, a water use license will be required in terms of sections 21(a) and 21 (b) of the National Water Act.
Environment Conservation Act (Act No. 73 of 1989)	In terms of section 25 of the ECA, the national noise-control regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) were promulgated. The NCRs were revised under Government Notice Number R55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations. Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996, legislative responsibility for administering the noise control regulations was devolved to	» National Department of Environmental Affairs (DEA). » North West Department of Rural, Environment and Agricultural Development (READ). » Naledi Local Municipality.	Noise impacts are expected to be associated with the construction phase of the solar energy facility and are not likely to present a significant intrusion to the local community. There is no requirement for a noise permit in terms of the legislation.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	provincial and local authorities. Provincial Noise Control Regulations exist in the Free State, Western Cape and Gauteng provinces, but the Northern Cape province have not yet adopted provincial regulations in this regard. Allows the Minister of Environmental Affairs to make regulations regarding noise, among other concerns.		
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	An Environmental Authorisation and mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. 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.	» Department of Mineral Resources (DMR).	As no borrow pits are expected to be required for project, no mining permit or Environmental Authorisation is required to be obtained for borrow pits. In terms of Section 53 of the MPRDA approval is required from the Minister of Mineral Resources to ensure that the proposed development does not sterilise a mineral resource that might occur on site.
National Heritage Resources Act (Act No. 25 of 1999)	» S38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including » The construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » Any development or other activity which will change the character of	» SAHRA – National heritage sites (grade 1 sites) as well as all historic graves and human remains. » North West Provincial Heritage Resources Agency (NWPHRA).	An Archaeological Impact Assessment was undertaken as part of the BA process to identify heritage sites (refer to **Appendix H**) as per the requirements of the National Heritage Resources Act.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	a site exceeding 5 000 m^2 in extent » The relevant Heritage Authority must be notified of developments such as linear developments (i.e. roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided. » Standalone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of S38. In such cases only those components not addressed by the EIA should be covered by the heritage component.		
National Forests Act (Act No. 84 of 1998)	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 536. 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	» Department of Agriculture, Forestry and Fisheries (DAFF). » North West Department of Rural, Environment and Agricultural Development (READ).	A permit or license is required for the destruction of protected tree species and/or indigenous tree species within a natural forest. *Acacia erioloba* (Declining and protected within the National Forest Act) were identified within the development footprint.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	manner acquire or dispose of any protected tree, except under a licence granted by the Minister".		
National Veld and Forest Fire Act (Act 101 of 1998)	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. 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.	» Department of Agriculture, Forestry and Fisheries (DAFF).	While no permitting or licensing requirements arise from this legislation, this Act will find application during the construction and operation phase of the solar energy facility. The relevant management and mitigation measures have been included in the EMPr (refer to **Appendix K**).

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
Conservation of Agricultural Resources Act (CARA) (Act No 43 of 1983)	Regulation 15 of GN R1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GN R1048. Declared Weeds and Invaders in South Africa are categorised ac-cording to one of the following categories: » Category 1 plants: are prohibited and must be controlled. » Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread. » Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may re-main, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands. These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.	» Department of Agriculture, Forestry and Fisheries (DAFF).	While no permitting or licensing requirements arise from this legislation, this Act is applicable during the BA process and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. The EMPr provides mitigation for soil erosion and weed control and management (refer to **Appendix K**). The permission of agricultural authorities will be required if the development of the solar energy facility requires the draining of vleis, marshes or water sponges on land outside urban areas.
Hazardous Substances Act (Act No. 15 of 1973)	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	» Department of Health.	It is necessary to identify and list all the Group I, II, III, and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license could be required to

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	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. » 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 to be Group I or Group II hazardous substance; » Group IV: any electronic product; » Group V: any radioactive material. The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		be obtained from the Department of Health.
National Road Traffic Act (Act No 93 of 1996)	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 vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed.	» Provincial Department of Transport (provincial roads). » South African National Roads Agency Limited (national roads).	An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include: » Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. » Transport vehicles exceeding the dimensional limitations (length) of 22m. » Depending on the trailer configuration

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts. The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.		and height when loaded, some of the project components may not meet specified dimensional limitations (height and width).
Astronomy Geographic Advantage Act (Act No. 21 of 2007)	The Astronomy Geographic Advantage 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. Chapter 2 of the Act allows for the declaration of astronomy advantage areas whilst Chapter 3 pertains to the management and control of astronomy	» Department of Science and Technology.	The site falls outside of the Northern Cape and the area governed by the AGA.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	advantage areas. Management and control of astronomy advantage areas include, amongst others, the following: * Restrictions on use of radio frequency spectrum in astronomy advantage areas * Declared activities in core or central astronomy advantage area * Identified activities in coordinated astronomy advantage area; and * Authorisation to undertake identified activities.		
Provincial Policies / Legislation			
Transvaal Nature Conservation Ordinance (No. 12 of 1983) (TNCO)	The Nature Conservation Ordinance accompanied by all amendments is regarded by the North West Department of Rural, Environment and Agricultural Development as the legal binding, 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 species. In its entirety, with special reference to: » Schedule 2: Protected Game » Schedule 3: Specially Protected Game » Schedule 4: Protected Wild Animals » Schedule 5: Wild Animals » Schedule 7: Invertebrates » Schedule 11: Protected Plants	» North West Department of Rural, Environment and Agricultural Development (READ).	Approval from READ will be required in terms of the protection and conservation of fauna and flora in the North West Province. The following species have been confirmed within the development footprint that are listed within the TNCO: » *Acacia erioloba* » *Babiana hypogea* » *Nerine laticoma* » *Ammocharis coranica* » *Aloe greatheadii*

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	» Schedule 12: Specially Protected Plants		
Bophuthatswana Nature Conservation Act (Act 3 of 1973) (BNCA)	The Nature Conservation Act accompanied by all amendments is regarded by the North West Department of Rural, Environment and Agricultural Development as the legal binding, 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 species. In its entirety, with special reference to: » Schedule 1: Protected Game » Schedule 1A: Specially Protected Game » Schedule 2: Ordinary Game » Schedule 3: Wild Animals In Respect Of Which The Provision Of Section 3 (a) (ii) Apply » Schedule 4: Wild Animals To Which The Provisions Of Section 4 (1) (b) Do Not Apply » Schedule 7: Protected Plants » Schedule 7: Specially Protected Plants	» North West Department of Rural, Environment and Agricultural Development (READ).	Approval from READ will be required in terms of the protection and conservation of fauna and flora in the North West Province. The following species have been confirmed within the development footprint that are listed within the BNCA: » *Acacia erioloba* » *Babiana hypogea* » *Nerine laticoma* » *Ammocharis coranica* » *Aloe greatheadii*
North West Biodiversity Sector Plan	The Biodiversity Sector Plan informs land use planning, environmental assessments, land and water use authorisations, as well as natural resource management, undertaken by a range of sectors whose policies and decisions impact on biodiversity. This is done by providing information of biodiversity priority areas, referred to as Critical	» North West Department of Rural, Environment and Agricultural Development (READ).	Approval from READ will be required for the development of the Moeding Solar PV Facility.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), with accompanying land use planning and decision making guidelines.		

5.7.1. 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 5.1** 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 5.1: 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.

For the purposes of the Moeding Solar PV Facility, the proposed development has been classified as a Regime 1 site. One site visit during peak season (minimum of 1 to 5 days) will be undertaken as part of the independent Avifauna Impact Assessment being conducted as part of the BA process. The results from the monitoring will be used to inform both the development footprint and Avifauna Impact Assessment report, to be attached as an Appendix to the BA Report.

5.7.2. 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

5.7.3. 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. consultating 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).

CHAPTER 6. 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, the proposed development have been described. This information has been sourced from both existing information available for the area as well as collected field data by specialist consultants, and aims to provide the context within which this BA process is being conducted. Copies of the specialist investigations are attached as **Appendices D to J** of this Scoping Report.

6.1. Legal Requirements as per the EIA Regulations, 2014 (as amended)

This chapter of the BA report includes the following information required in terms of the EIA Regulations, 2014 - Appendix 1: Content of basic assessment reports:

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 footprint, as well as the broader environment, are described and considered within this chapter and includes the following: » The regional setting within which the Moeding Solar PV Facility project site is located is described in section 6.3. » The climatic conditions of the area within which the Moeding Solar PV Facility project site is located is discussed in section 6.4. » The biophysical characteristics of the project site and the surrounding areas is described in section 6.5. This includes the topography and terrain, geology, soils and agricultural potential and the ecological profile of the site (i.e. vegetation, fine-scale habitats, critical biodiversity areas and broad-scale processes and terrestrial fauna. » The heritage of the project site and the surrounding areas (including the archaeology, palaeontology and cultural landscape) is discussed in section 6.8. » The visual quality of the affected environment is discussed in section 6.6. » The social context within which the project site is located is described in section 6.7.

6.2. Regional Setting: Description of the Broader Study Area

The North West Province is situated in the central-northern extent of South Africa. The province is bordered by the Northern Cape Province to the west, and south-west, the Free State Province to the south, Gauteng Province to the east, Limpopo Province to the north-east, and Botswana to the north. It occupies an area of land approximately 104 882km² in extent, making it South Africa's 6th largest in terms of land area. The province has a population of 3 509 953 (2011), and a population density of 33/km² (2011), making it South Africa's 7th most densely populated province.

The North West Province is characterised by altitudes ranging from 920 – 1 782m amsl, which makes it one of the provinces with the most uniform terrain. The central and western extents of the province are characterised by gently undulating plains, while the eastern extent is characterised as mountainous, and includes the Magaliesberg mountain range. Ancient igneous rock formations dominate the north-eastern and north-central extent of the Province, and the Gatsrand between Potchefstroom and Carletonville is considered to be one of the most ancient preserved landscapes in the world. The geology of the province is significant given its mineral resources which are rich in platinum, gold, uranium, iron, chrome, manganese and diamonds.

In terms of land use patterns, approximately 69% of the North West Province is in a natural, or near-natural state, while 31% of the province is irreversibly modified as a result of croplands (25.6%), urban (3.5%), and mining (0.7%) activities. The province is predominantly rural with the main economic activities comprising mining and agriculture.

The North West Province comprises 4 District Municipalities (DMs), namely Bojanala Platinum, Ngaka Modiri Molema, Dr Ruth Segomotsi Mompati, and Dr Kenneth Kaunda (refer to **Figure 6.1**).

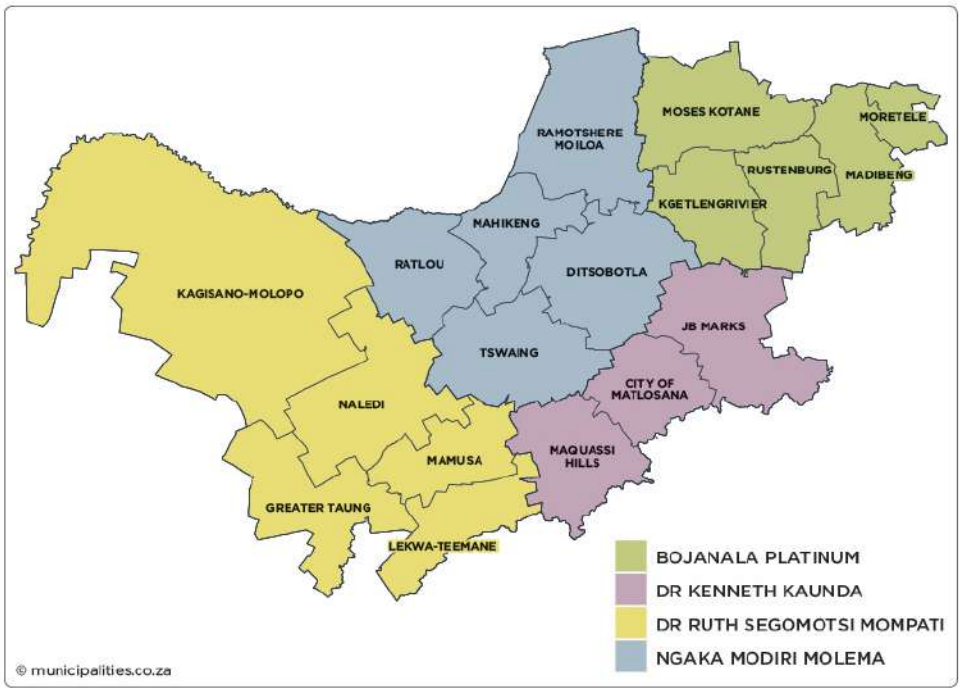

Figure 6.1: Districts of the North West Province (Source: Municipalities of South Africa).

Dr Ruth Segomotsi Mompati DM (formerly Bophirima DM) is located in the western extent of the North West Province. It is bordered by the Ngaka Modiri Molema and Dr Kenneth Kaunda DMs to the east, Lejweleputswa DM of the Free State Province to the south-east, Frances Baard and John Taolo Gaetsewe DMs of the Northern Cape Province to the south-west and west, and Botswana to the north. The DM occupies an area 44 052km² in extent, making it the largest DM in the North West Province. It is also the least populated DM with a population of 463 814 and a population density of 10.5/km² (equivalent to almost one third of the Ngaka Modiri Molema DM which is the second least populated DM in the North West Province).

The Dr Ruth Segomotsi Mompati DM is largely rural in nature, with poor rural areas situated in the former Bophuthatswana homeland. Prominent cities and towns within the DM include Amalia, Bloemhof, Christiana, Piet Plessis, Pomfret, Pudimoe, Reivilo, Schweizer-Reneke, Stella, Taung, and Vryburg. The DM comprises five LMs, namely Naledi, Greater Taung, Kagisano-Molopo, Mamusa and Lekwa-Teemane LM's (refer to **Figure 6.2**).

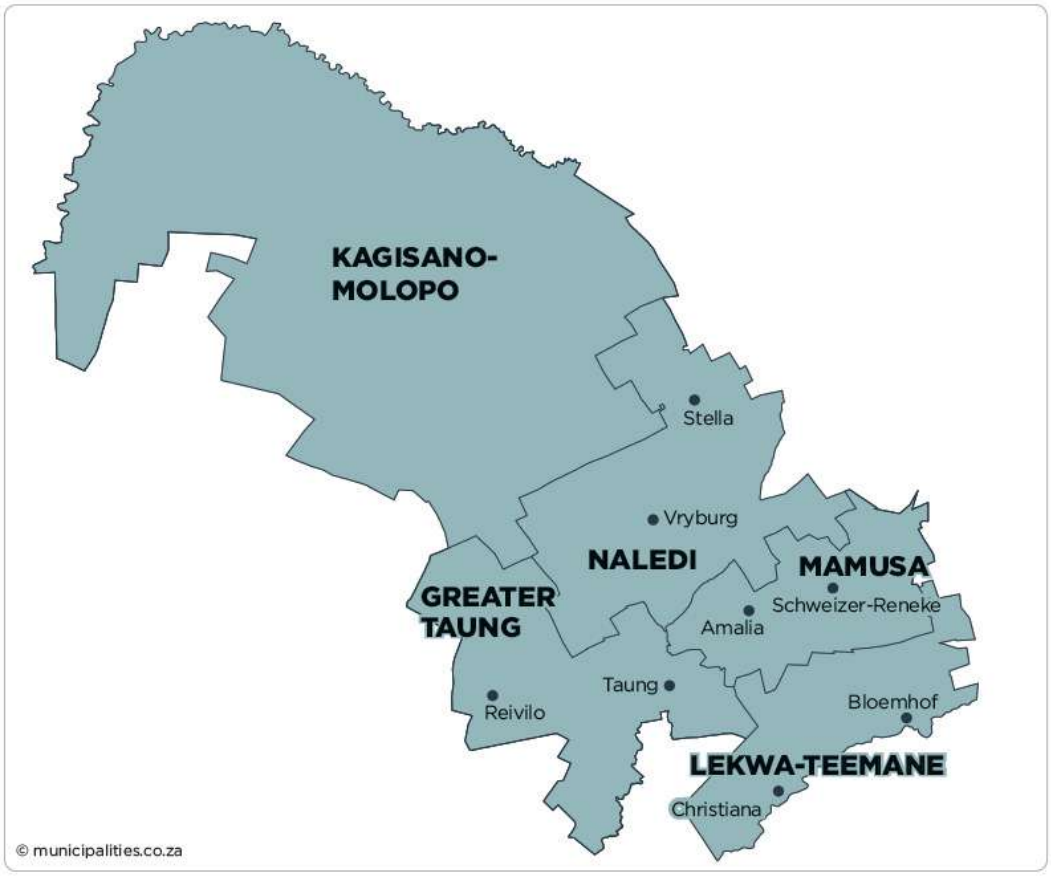

Figure 6.2: Local Municipalities of the Dr Ruth Segomotsi Mompati District (Source: Municipalities of South Africa).

The Naledi LM is located in the central-eastern extent of the Dr Ruth Segomotsi Mompati DM. It occupies an area approximately 7 258km² in extent which is equivalent to 15% of the Dr Ruth Segomotsi Mompati DM, and constitutes the second largest LM in the DM. The Naledi LM is known as the "Texas of South Africa" due to the cattle breeding and other agricultural activities that occur there.

Predominant town, villages, and communities within the LM include Vryburg, Kismet Park, Huhudi, Colridge, Dithakwaneng, Stella, Devondale, Broedersput and the newly developed extension 25/28. The town of Vryburg constitutes the administrative centre of the Naledi LM, and is also considered the agricultural and industrial centre of the Dr Ruth Segomotsi Mompati DM. Vryburg is home to South Africa's 3rd largest agricultural show, namely the Vryburg Show, which attracts farmers from across South Africa, as well as farmers from neighbouring countries such as Namibia and Botswana.

6.3. Regional Setting: Location and description of the Project Site

The closest towns to the proposed development include Vryburg, located approximately 8km north and Huhudi (informal settlement) located approximately 6.3km north (refer to **Figure 6.3**). Other towns in proximity of the project site include Amalia located approximately 38km south east of the project site, and Schweizer-Reneke located approximately 58km east of the project site. Built infrastructure in the form of a school, farm homesteads and workers quarters occur within and around the project site, and may be impacted on (i.e. in terms of nuisance and / or visual impacts) as a result of the proposed project.

The Tiger Kloof Educational Institution (i.e. the Tiger Kloof Combined School) is directly adjacent (east) of the project site. The school was established in 1904 on Tierkloof Farm and accommodates Pre-primary, Primary, and High School learners (both boarders and day scholars).

Prominent/major road systems within the area include the N18 national road located along the eastern boundary of the project site, the N14 national road located approximately 9km north-west of the project site, the R34 regional road located approximately 9.5km east of the project site. Access to the project site is obtained via a new access road that joins the N18. The Kimberley-Mahikeng railway line is located immediately east of the N18 national road, and for the most part follows the N18 road alignment through the project site, diverting in an eastward direction in the northern extent of the project site.

The Mookodi Main Transmission Substation is located within the Remaining Extent of the farm Rosendal 673 (i.e. affected property). The project site is located approximately 8.5km north of the existing Woodhouse 88kV/22kV Substation and approximately 9.6km from the existing Vryburg 88kV/11kV Substation. There are also a significant number of power lines within the general vicinity, including:

- Ferrum/Mookodi 400kV power line which traverses the northern portion corner of the affected properties;
- Mercury/Mookodi 400kV power line which traverses the northern portion corner of the affected properties; and
- Delarey Munic/Vryburg 88kV power line situated approximately 9.6km north east of the project site.

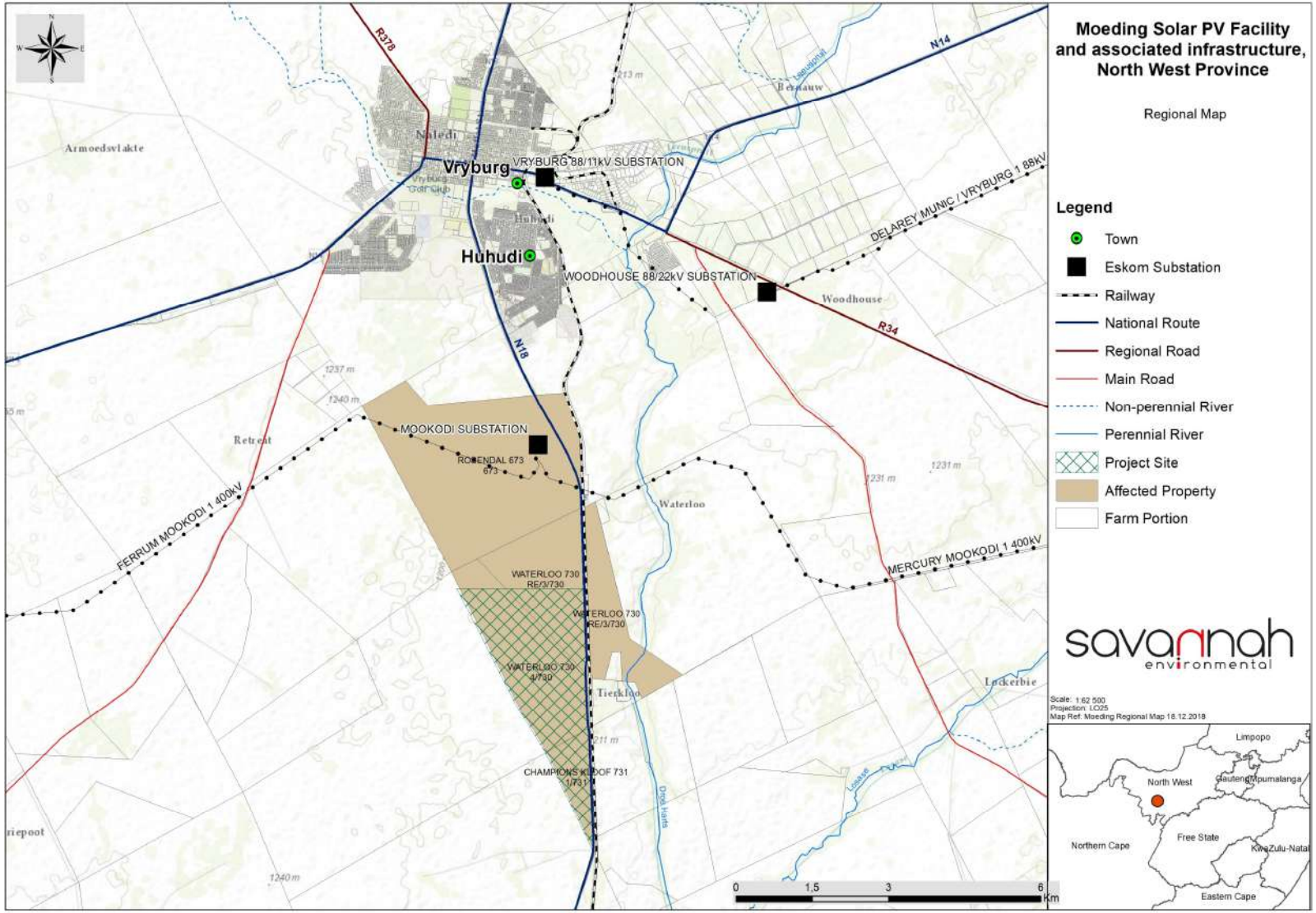

Figure 6.3: Regional context of the Moeding Solar PV Facility project site.

6.4. Climatic Conditions

The Vryburg area is typically characterised as having a local steppe climate (BSk) with little rainfall during the year. The area receives a mean annual average rainfall of approximately 477mm. Precipitation is highest in January with an average of 89mm; and lowest in July with an average of 4mm. Minimal rain occurs between May to September. The average annual temperature in Vryburg is 17.9°C. January is the hottest month of the year with an average temperature of 24.8°C, while July is the coldest month of the year with an average temperature of 9.3°C (refer to **Figure 6.4**).

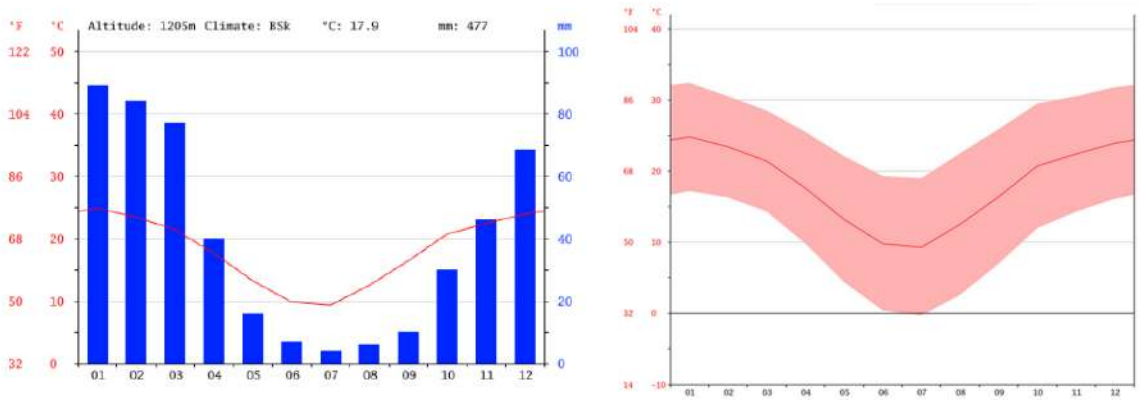

Figure 6.4: Climate and Temperature graphs for Vryburg, North Western Province (Source: en.climate-data.org).

6.5. Biophysical Characteristics of the Study Area

6.5.1. Landscape Features

The landscape within the project site can be described as a flat plateau with a well-developed shrub layer and consists of five terrain units. The project site consists of two land types, Ae 36 and Ag10 (refer to **Figure 6.5**). Wetlands occur most frequently in valley bottoms (Unit 5), but can also occur on crests, mid slopes and foot slopes (Units 1, 3 and 4). The catena within land type Ag10 incorporates Units 1, 3, 4 and 5. The catena within land type Ae36 incorporates only the lower lying terrain Units 4 and 5, with 5 being a slight depression feature such as pans.

The project site is characterised by small micro-topographical variations mostly due to small geological variations such as low scattered bedrock exposures, depression features (pan wetlands) and overlying calcretes. The project site is located at the edge of the valley rim of the Droë Harts River valley which is characterised by steep, narrow inner slopes and a relatively narrow valley floor.

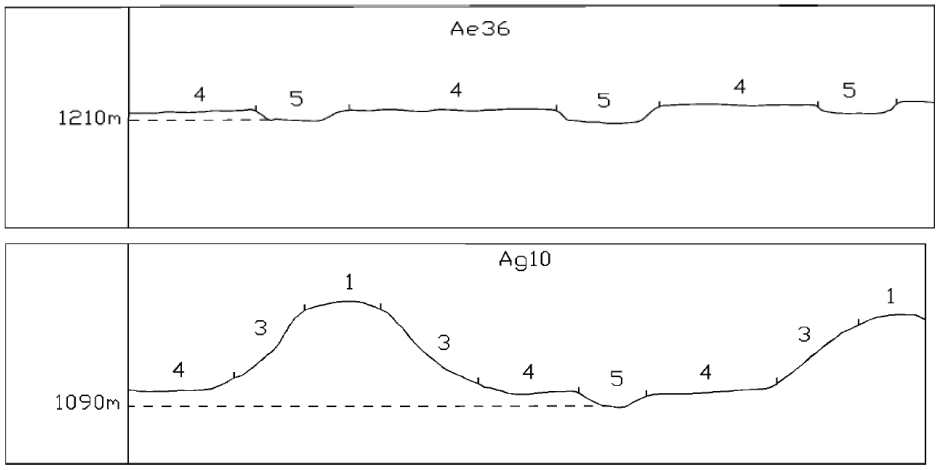

Figure 6.5: Terrain units within Ae36 and Ag10 land types (described in Section 6.5.3 below).

6.5.2. Geology

The north-eastern portion of the project site is underlain by a small section of the Vryburg Formation of the Transvaal Supergroup (geologically older than 2.6 billion year-old). While the remaining portion of the project site is primarily underlain by the Schmidtsdrift Subgroup, Ghaap Group of the Transvaal Supergroup.

The south-western margin of the project site is underlain by ancient sedimentary rocks of the Schmidtsdrif Subgroup and consists of flat terrain. The Schmidtsdrif Subgroup can be separated into the geological older Boomplaas Formation and younger Clearwater Formation. The Ghaap Group represents 200 million years of chemical sedimentation. This chemical sedimentation within the Griqualand West Basin is represented by iron and manganese ores, cherts and carbonates.

The north-eastern portion of the project site is underlain by shallow marine or lagoon sediments as well as volcanic rocks of the Vryburg Formation. The Vryburg formation is approximately 140m thick and overlies lavas of the Ventersdorp Supergroup. The lower portion of the Vryburg series comprises of basal conglomerates followed by the 20m thick Kobaga beds showing prominent weathering of cross-bedded feldspathic quartzites. The power line corridor is primarily underlain by the Vryburg Formation of the Transvaal Supergroup.

6.5.3. Soil, Land types and Agricultural Potential

A land type is defined as an area with a uniform terrain type, macroclimate and broad soil pattern. The area under investigation is covered by the following land types:

» The Ae group of landtypes consist of red-yellow apedal, freely drained soils. These soils are moderately deep (ave. 500mm – 1200mm) red, freely drained and apedal (structureless) and generally occur in areas associated with low to moderate rainfall (300mm – 700mm per annum) in the interior of South Africa and have a high fertility status. A wide range of texture occurs (usually sandy loam to sandy clay loam). Common soil forms are Mispah and Hutton and to a lesser extent, Clovely, Stertkspruit and Rensburg.

» The Ag group of landtypes consist of red-yellow apedal, freely drained soils. These soils are shallow (less than 300mm), red, freely-drained, apedal soils that occur in arid to semi-arid areas associated with low rainfall (less than 500mm per annum), as well as areas underlain by hard to weathered rock.

Red soils typically have a high base status. A wide range of textures may occur (usually loamy sand to sandy loam). Stones or rocks are often present on the soil surface. Common soil forms are Mispah, Hutton and rock whilst soil forms such as Glenrosa and Shortlands are sparsely present.

The majority of the project site has a very low to moderately low land capability and is considered suitable for livestock grazing with management practices in place. A small area consisting of 1.8ha situated within Portion 4 of the Farm Waterloo 730 adjacent to the southern boundary has a moderate agricultural potential and is considered to be suitable for arable agriculture. Although the soil form present within this area (i.e. Hutton) are suitable for arable agriculture in other areas of the country, this small area is not appropriate for crop production due to the absence of irrigation boreholes and supporting irrigation infrastructure. The area of the proposed powerline corridor also falls into the very low to moderately-low land capability classification. The grazing capacity of the veld in the project site and powerline corridor area is 10 to 12 hectares per large animal unit or large stock unit (LSU) (ARC-ISCW). The project site (642 ha) therefore has grazing veld available for 53 to 64 head of cattle and the powerline corridor area (97 ha) for 8 to 10 head of cattle whilst maintaining the quality of the field. Cattle farming is a viable long-term land use for the project site as long as the field quality is maintained by never exceeding the grazing capacity. In addition to this, the area is ideal for a wide variety of small and large game that can be managed as a profitable land use.

6.5.4. Hydrology and Geohydrology

The project site is situated within the Lower Vaal Water Management Area (WMA) 10, Quaternary Catchment C32B (Dry Harts River Catchment) and Southern Kalahari Ecoregion. The Lower Vaal WMA is located downstream of Bloemhof Dam and upstream of Douglas Weir and extends to the headwaters of the Harts, Molopo and Kuruman River in the north and the Vaal River downstream of Bloemhof Dam in the south. The project site is situated approximately 0.8km west of the Dry Harts River and approximately 3.8km north-east of the Korobela River. These two watercourses along with the Losase River form the most important surface hydrological features of the region (refer to **Figure 6.6**).

The Dry Harts River flows mostly in a South-South-West direction, mostly through gradual to flat areas, for approximately 89.1km, before terminating into the Harts River (approximately 100km above the confluence of the Vaal- and Orange Rivers). Major tributaries of the Dry Harts River include the Leeuspruit-, Losase-, Korobela-, Dwarsrivier- Morokane and Pudumong Rivers. The only lake and wetland of note is at Baberspan in the upper Harts River catchment which has been given Ramsar status as a wildlife conservation area.

Major impacts within the C32B Quaternary Catchment include agricultural return flows, flow regulation for irrigation use, and water quality related problems due to urbanisation, and agriculture (DWA, 2012). Water in the Harts River downstream of the Vaalharts irrigation scheme is of exceptional high salinity as a result of saline leachate from the irrigation fields (± 1100 mg/l salinity).

The Desktop Present Ecological State (PES) of the relevant Sub-Quaternary Reach (SQR) (i.e. C32B-01953: section of the Dry Harts River) is Moderately Modified (C Category) and a loss and change of natural habitat and biota have occurred (loss of between 60 - 79%). The basic ecosystem functions are still predominantly unchanged. According to the Department of Water and Sanitation (DWS, 2014), the water quality (WQ), potential flow characteristics as well as instream and riparian habitats are seriously impacted on by agriculture, roads, weirs and a fairly large gravel quarry.

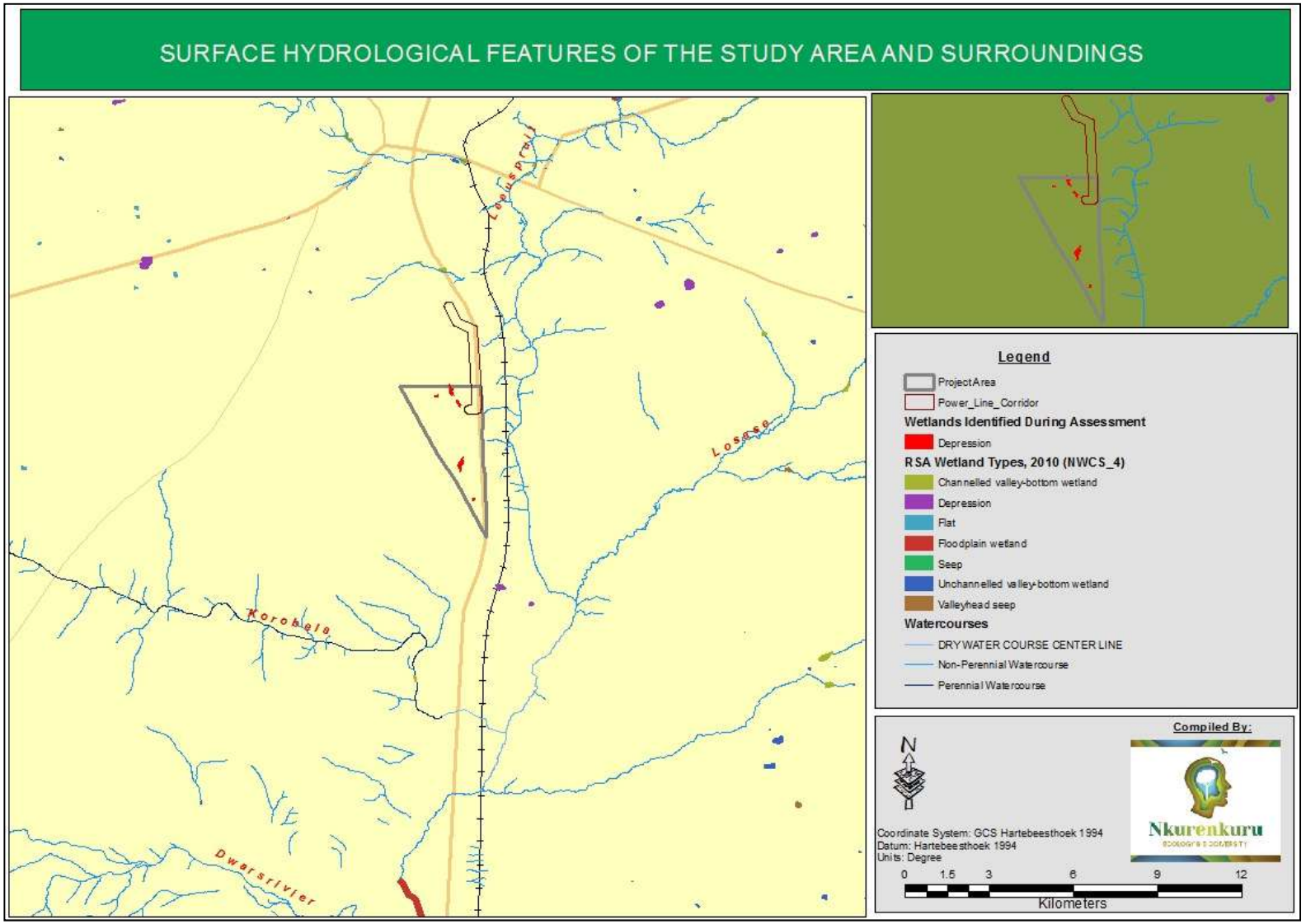

Figure 6.6: Hydrological features within and surrounding the project site for the Moeding Solar PV Facility.

The Ecological Importance (EI) of C32B-01953 is Moderate due to the presence of only 26 species (riparian, wetland and aquatic species) in this sub-quaternary catchment, with no conservation important species. The main habitats for these species include seasonal / ephemeral grassy edges, pools in incised channel, riparian trees and shrubs and floodplains. The watercourse of C32B-01953 has a Moderate Ecological Sensitivity (ES) Mean Class Rating and a High sensitivity to modified flow conditions and water level changes (DWS, 2014).

Wetlands within the greater region are mostly depressions (pans) and wetland flats within the relatively flat plains where a slight change in geomorphology and underlying geology may result in the collection of water and saturated soil conditions. Most of the pans and wetland flats are endorheic, meaning they retain water and do not allow outflow to other external bodies of water. Sections along the Dry Harts River contain some wetland features, mostly in the form of channelled valley-bottom wetlands.

Surface water features identified within the project site includes five depression wetlands (pans) and one small drainage line (~107 m), connecting two (2) wetlands. The drainage line is situated at the base of the almost inconspicuous, low ridge line. Aside from these surface water features, no rivers or other forms of watercourses were identified within the project site and power line corridor.

The depression wetlands are described as follows:

» Wetland 1:
This depression wetland is ~4.14ha in extent and can be classified as a depression wetland with some channelled inflow and outflow, connecting this wetland with a downstream depression as well as a depression wetland located "upstream". The "upstream" wetland as well as the drainage line connecting the two pan structures are located outside of the project site's boundaries. This wetland along with Wetland 2 forms part of a larger wetland and drainage line system and is located at the distal portion of this drainage system. All of the depression wetlands as well as drainage lines associated with this hydrological system are located at the base of a small ridge line. Based on outflow and inflow characteristics, this wetland can be classified as an exoreic depression with channelled inflow.

» Wetland 2:
This depression wetland is ~1.74 ha in extent and can be classified as a depression wetland with some channelled inflow and no clear channelled outflow. Wetland 2 is connected to Wetland 1 with a short drainage line and forms part of a larger hydrological system (various depression wetlands connected via drainage lines). This pan wetland forms the distal portion of the hydrological system. Based on outflow and inflow characteristics this pan wetland can be classified as an endorheic depression with channelled inflow.

» Wetland 3:
This depression wetland is the second smallest of the wetlands identified within the project site and is ~1.11ha in extent. This small pan contains closed elevation contours which slightly increase in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates. This wetland contains no clear inlet or outlet and can be classified as endorheic with no channelled outflow. The hydrodynamics of this wetland are primarily dominated by vertical water level fluctuations. Water inflow is furthermore fed primarily by surface interflow from the immediate catchment.

» Wetland 4:
This depression wetland is the largest wetland identified within the project site and is ~6.1ha in extent. This pan wetland contains no indications of channelled inflow and outflow and is subsequently regarded as an endorheic system. Furthermore, this pan is situated within a basin area infringing slightly on the elevated ridge line, to the south and the east furthermore contributing to the endorheic nature. This pan depression appears to have been linked to the ephemeral drainage system identified within the project site and which largely runs in a west to east direction. For most part of this palaeo channel surface drainage functionality has been lost. This linear feature is ~5.9km in length and then dissipate, for most part, not being linked to the wider drainage network anymore. Shallowed out basins within this palaeo-channel form a suitable physical template for endorheic depression wetlands. This larger depression/pan wetland within the project site form such a feature within the distal portion of the palaeo-channel. Other similar depression wetlands are present within this palaeo-channel outside of the project site's boundaries. Even though, some of the pan wetlands within this palaeo-channel may be linked, there is no indication of surface connection with any features inside of the project site and therefore, ecological and surface-hydrology connectivity between the pan wetland within the project site and other depression wetlands within the palaeo-channel (outside of the project site) are regarded as absent. The hydrodynamics of this wetland are primarily dominated by vertical water level fluctuations. Water inflow is furthermore fed primarily by surface interflow from the immediate catchment.

» Wetland 5:
This depression wetland is the smallest of the wetlands identified within project site and is ~1 ha in extent. This small pan contains closed elevation contours, which slightly increase in depth from the perimeter to a central area of greatest depth and within which water typically accumulates. This wetland contains no clear inlet or outlet and can be classified as endorheic with no channelled outflow. The hydrodynamics of this wetland are primarily dominated by vertical water level fluctuations. Water inflow is furthermore fed primarily by surface interflow from the immediate catchment.

6.5.5. Ecological Profile

6.5.5.1. Broad vegetation types and the vegetation conservation status

The project site is situated in the Savanna Biome, and Eastern Kalahari Bushveld Bioregion. The vegetation within and surrounding the project site comprises Ghaap Plateau Vaalbosveld (SVk 7). The distribution of the vegetation type is spread across the Northern Cape and North West Province, from Campbell in the south east of Danielskuil through Reivilo to around Vryburg in the north. The Ghaap Plateau Vaalbosveld vegetation type can be described as a flat plateau with well-developed shrub layer with *Tarchonanthus camphoratus* and *Acacia karroo*. Much of the south-central portion of this unit has remarkably low cover of Acacia species for an arid savanna and is dominated by the non-thorny *T. camphoratus, R. lanceae* and *O. europaea* subsp. *africana*.

Table 6.1: Key species associated with the Ghaap Plateau Vaalbosveld.

Growth Form	Key Species

DOMINANT SPECIES	
Low Shrubs	*Anthospermum rigidum subsp. pumilum, Indigofera comosa, Pygmaethamnus zeyheri var. rogersii, Searsia magaliesmontana, Tylosema esculentum, Ziziphus zeyheriana.*
Graminoids	*Aristida congesta, Brachiaria serrata, Cynodon dactylon, Digitaria tricholaenoides, Hiheteropogon ampletens, Eragrostis chloromelas, E. racemosa, Heteropogon contortus, Loudetia simplex, Schizachyrium sanguineum, Setaria sphacelata, Themeda triandra, Alloteropsis semilata subsp. eckloniana, Andropogon schirensis, Aristida canescens, A. diffusa, Bewsia bifola, Bulbostylis burchellii, Cymbopogon caesius, Elinonurus muticus, Eragrostis curvula, E. gummiflua, E. plantana, Eustachys paspaloides, Hyparrhenia hirta, Melinis nerviglumis, M. repens subsp. repens, Monocymbium ceresiiforme, Panicum coloratum, Pogonarthria squarrosa, Trichoneura grandiglumis, Triraphis andropogonoides, Tristachya leucothrix, T. rehmannii.*
Herbs	*Acalypha angustata, Chamaecrista mimosoides, Euphorbia inaequilatera, Crabbea angustifolia, Dianthus mooiensis, Dicoma anomala, Helichrysum caespititium, H. miconiifolium, H. nudifolium var. nudifolium, Ipomoea ommaneyi, Justicia anagalloides, Kohautia amatymbica, Kyphocarpa angustifolia, Ophrestia oblongifolia, Pollichia campestris, Senecio coronatus, Hillardia oligocephala.*
Geophytic Herbs	*Boophane disticha (Declining – Red List), Habenaria mossii.*
Geoxylic Suffrutex	*Elephantorrhiza elephantina, Parinari capensis subsp. Capensis.*
ENDEMIC SPECIES	
Succulent Shrub	*Delosperma davyi.*

A total of 369 indigenous species have been recorded in the Vryburg region according to the SANBI database. It is highly unlikely that all of these species will occur within the project site. A total of 33 alien invasive species have also been recorded within the relevant quarter degree grids.

The vegetation types of South Africa are categorised according to their conservation status, which is 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 remains intact, relative to various thresholds. On a national scale these thresholds are determined by the best available scientific approaches (Driver et al. 2005) (refer to **Table 6.2**). The level at which an ecosystem becomes Critically Endangered (CR) differs from one ecosystem to another and varies from 16% to 36% (Driver et al. 2005).

Table 6.2: Determining ecosystem status (from Driver et al. 2005). *BT = biodiversity target (the minimum conservation requirement.

Habitat Remaining (%)	80 – 100	Least Threatened	LT
	60 – 80	Vulnerable	VU
	*BT – 60	Endangered	EN
	0 – *BT	Critically Endangered	CR

The National List of Ecosystems that are Threatened and in need of protection (GNR 1002 of 2011), published under the National Environment Management: Biodiversity Act (No. 10 of 2004) (NEM:BA), lists national vegetation types that are afforded protection on the basis of rates of transformation.

According to Mucina and Rutherford (2006) only 1% of the Ghaap Plateau Vaalbosveld vegetation type has been transformed. The conservation status of this vegetation unit is classified as Least Threatened by Mucina and Rutherford (2012), but is not listed within the National List of Ecosystems that are Threatened

and in need of protection (GNR 1002 of 2011), published under NEM:BA. The vegetation type does not currently fall within any formal conservation areas.

6.5.5.2. Listed and protected plant species of the project site

Of the species that are considered to occur within the geographical area under consideration, 19 species are regarded conservation worthy. According to the South African Red List Categories 1 is listed as Rare (*Gnaphalium nesonii*), 1 as Vulnerable (*Rennera stellata*) and 1 as Near Threatened (*Lithops lesliei*). The remaining 15 species are protected within the Transvaal Nature Conservation Ordinance (TNCO) and Bophuthatswana Nature Conservation Act (BNCA) (refer to **Table 6.3**). *Boscia albitrunca* is the only tree species protected according to the National Forest Act (NFA) that may potentially occur within the project site.

Table 6.3: Species listed as conservation worthy within the South African Red List, National Forests Act (NFA), Transvaal Nature Conservation Ordination (TNCO), and Bophuthatswana Nature Conservation Act (BNCA).

Species	Status
Gnaphalium nesonii	TNCO and BNCA
Rennera stellate	TNCO and BNCA
Lithops lesliei	TNCO and BNCA
Boscia albitrunca	Rare
Ammocharis coranica	Vulnerable
Brunsvigia radulosa	Near Threatened
Crinum crassicaule	NFA
Nerine frithii	TNCO and BNCA
Nerine hesseoides	TNCO and BNCA
Nerine laticoma	TNCO and BNCA
Brachystelma dimorphum subsp. dimorphum	TNCO and BNCA
Brachystelma foetidum	TNCO and BNCA
Ceropegia crassifolia var. crassifolia	TNCO and BNCA
Hoodia pilifera subsp. annulata	TNCO and BNCA
Stapelia grandiflora var. grandiflora	TNCO and BNCA
Aloe grandidentata	TNCO and BNCA
Aloe zebrine	TNCO and BNCA
Chortolirion angolense	TNCO and BNCA
Babiana bainesii	TNCO and BNCA

6.5.5.3. Fine Scale Vegetation Patterns

The project site was found to be relatively species diverse with over 170 plant species identified within the boundaries of the project site. Variations in edaphic, geological factors as well as soil moisture content contribute to this diversity. The forb and graminoid layer was relatively well-developed and represented by 134 species (88 forb species and 46 graminoid species). Even though the tree and shrub layer are represented by a moderate diversity of species (22 species: 9 tree species and 13 shrub species), these species play an important role in the vegetation structure of the development area. Geophytes and succulents only make up 5.8% of the total species composition. Furthermore, the most dominant plant

families within the development area are; Poaceae with 26%, Asteraceae with 12%, Fabaceae with 7% and Malvaceae with 3.5%.

Weeds and invasive alien species are not abundant within the development area and are represented by 24 species of which only 6 species are listed as Invasive Alien Plants (NEM:BA, 2017) namely; *Eucalyptus camaldulensis, E. sederoxylon, Prosopis glandulosa, Opuntia ficus-indica, Datura stamonium* and *Argeomone mexicana.* Most species were confined to areas around homesteads and disturbed areas such as trampled areas around watering and feeding points and kraals. None of these species occur at high densities. The only species that was recorded to occur within the primary grassland/open savannah was *Opuntia ficus-indica*. Highly trampled areas were regularly invaded with *Argeomone mexicana* and *Datura stramonium* but as mentioned the densities of this species are not regarded as problematic.

Five conservation important species were identified within the project site of which two species are Red Listed Species (*Boophone disticha* – Declining and *Acacia erioloba* – Declining) whilst the remaining three species area listed as protected species within the relevant provincial conservation ordinations (*Ammocharis coranica*, *Nerine laticoma*, *Babiana hypogea and Aloe greatheadii*). No other protected plant or tree species were identified within the project site.

The project site was confirmed to be consistent with the description for Ghaap Plateau Vaalbosveld with some variations occurring in terms of the herb (grass) tree / shrub layer relationship (different forms of savannah). Generally, the tree/shrub layer decreases along a soil moisture gradient with trees and shrubs almost entirely absent from the depression wetland areas apart from some woody patches at the peripheral fringe of some of the pan wetlands. As the soil layer becomes deeper and sandier in texture, the tree / shrub layer becomes less dense. The current and historical grazing regimes also play some part in this tree/shrub and grass relationship, although to a lesser extent. The grazing regimes on the other hand play a more important role in terms of species composition within the grass/forb layer. Key species associated with the project site are provided in **Table 6.4.**

Table 6.4: Key species associated with the project site.

Growth Form	Key Species
DOMINANT SPECIES	
Shrubs	*Grewia flava, Trachonanthus camphoratus, Asparagus laricinus, Searsia tridactyla.*
Trees	*Searsia lancea, Ziziphus mucronata.*
Graminoids	*Aristida congesta, Digitaria eriantha, Eragrostis lehmanniana, Eragrostis ridgidior, E. superba, Cymbopogon pospischilli, Schmidtia pappophoroides, Centropodia glauca, Kylinga alba.*
Forbes	*Geigeria burkei, Salvia disermas, Senna italica, Cleome rubella, Heliotropium ciliatum, Barleria macrostegia, Chascanum pinnatifidum, Pupalia lappaceae.*
Geophytic Herbs	*Boophane disticha (Declining – Red List), Moraea polystachya, Babiana hypogea.*
Geoxylic Suffrutex	*Elephantorrhiza elephantine.*

Five vegetation habitats were identified within the project site (**Figure 6.7**). Each of the five habitats identified as present on the Moeding Solar PV Facility project site are illustrated and described in detail in **Table 6.5**.

Table 6.5: Details of the five habitat communities identified within the Moeding Solar PV Facility project site

Habitat	Unit
Savannah Grassland: Comprises of a dominant open grassland with some scattered shrubs and trees (mainly *Trachonanthus camphoratus, Grewia flava* and *Searsia tridactyla*). Tall trees are scarce and usually clumped together. These features of circular clumped and/or "mottles" of woody plants is also consistent of a Parkland Savanna type (two-phase mosaic landscape) but due to the fact that such clumps are quite scarce and the grass layer form such a prominent feature within this area, the former savannah type is preferred. Such clumps typically comprise of *Searsia lanceae, Ziziphus mucronata* and *Trachonanthus camphoratus*.	<u>Open Vaalbos Shrubland:</u> This vegetation type typically occurs on deeper sandy soils and comprise of a moderately tall (1m and taller) grassland with some scattered shrubs (*Trachonanthus camphoratus, Grewia flava* and *Searsia tridactyla*). This vegetation unit comprise of 52 species of which graminoids form 40% of the total species composition with a cover abundance of over 65%. Trees and shrubs form approximately 17% of the project site with a cover abundance of approximately 30%. The remaining 5% comprise of forbs and geophytes. The stability of the habitat is medium to high if the habitat is kept intact. The stability is slightly higher where the vegetation within the habitat is moderate to dense (i.e. woodland patches). If the soil surface is disturbed through severe overgrazing and trampling then the stability will be reduced to low. Should degradation of the habitat occur, the reversibility thereof will be limited and relatively slow but possible only with the retention of the topsoil. The re-establishment of the full original biodiversity will be slow. Disturbance will most likely lead to a rapid invasion by undesirable indigenous and possibly alien invasive species. Key Species within unit include: *Aristida congesta, Digitaria eriantha, Eragrostis rigidior, Eragrostis superba, Eragrostis lehmanniana, Anthephora pubescens, Centropodia glauca, Schmidtia pappophoroides, Brachiaria nigropedata, Cymbopogon pospischilli, Themeda triandra, Grewia flava, Trachonanthus camphoratus, Geigeria burkei, Asparagus suaveolens, Hertia pallens, Sida chrysanta* and *Barleria macrostegia*. Species of conservation importance that were observed within this unit were occasional *Boophone disticha* plants, whilst *Babiana hypogea* was relatively regularly observed. Other conservation important plants less frequently observed include; *Ammocharis coranica, Aloe greatheadii* and very occasionally, individuals of *Acacia erioloba*.
	<u>Short Griekwa Karee Shrubland:</u> Tall trees are mostly absent from this vegetation type and the higher strata is mostly made up with *Searsia tridactyla.* Shrubs such as *T. camphoratus* and *G. flava* are much less prominent than in the other vegetation units. This vegetation unit typically occurs on relatively shallow, stony soils, normally dolomite with chert and some calcretes. Most of the central portion of the project site comprise of a low, almost inconspicuous cherty-dolomite ridge intersected by the fossil-channel and forms the main location for this vegetation unit. Within this portion of the project site, this vegetation unit and its boundaries are relatively well defined. Some outcrops and areas with shallower soils scattered within the other vegetation units comprise of this vegetation unit, but with less defined boundaries. These scattered patches of Short Griekwa Karee Shrubland occur especially within the Open Vaalbos Shrubland.

Habitat	Unit
	The stability of the habitat is medium to high if the habitat is kept intact. The stability will fluctuate during seasons and will be low if the shrub layer remains relatively stable. Should degradation of the habitat occur, the reversibility thereof will be low where specific bedrock configurations are modified excessively. Reversibility will be slow on rocky and gravel plains due to low moisture retention of soils This unit comprises of 51 species of which graminoids form 45% of the total species composition. The forb diversity which make up 33% of the total species diversity are relative prominent within the project site. The forb/graminoid layer are typically relative short (less than 0.8 m) with taller patches (1m and higher) forming a mosaic within this vegetation stratum. Even though the shrub layer is relatively species poor (11% of total species composition) and is primarily dominated by one species (*Searsia tridactyla*), this species form a key feature within this vegetation unit. Approximately 35% of the unit is covered by shrubs, mostly *S. tridactyla*, whilst graminoid/forb covers approximately 63%. Key graminoid and forb species include: *Aristida congesta, Anthephora pubescens, Eragrostis lehmanniana, Eragrostis rigidior, Microchloa caffra, Eragrostis echinochloidea, Eragrostis nindensis, Enneapogon desvauxii, Geigeria burkei, Oxalis obliquifolia, Cleome rubella, Senna italica, Hermannia* spp. and *Kylinga alba*. The remaining 2% comprises mostly geophytic species such as *Moraea polystachya, Ledebouria revoluta* and *Boophone disticha*. Species of conservation importance that were observed within this unit were occasional *Boophone disticha* plants and a single population of *Nerine laticoma*.
	<u>Palaeo drainages:</u> The palaeo-valley is located within the central portion of the project site and is fringed along the southern bank by a very low, cherty-dolomite ridge line. The palaeo-channel is mostly flat or very gradually sloping. Although there is still a very slight incision of the channel, it is mostly filled with a moderately thin layer of sand and/ or silt and clay covering bedrock and stones of dolomite and chert with some isolated calcretes. Pockets of deeper sediment occur within this channel. The stability of the habitat is medium to high if the habitat is kept intact. Loss of functionality (habitat and niche diversity) will result from clearing this vegetation and altering the surface and may potentially lead to erosion. Should degradation of the habitat occur, the reversibility thereof will be limited and relatively slow and may potentially be subjected to erosion. This relict drainage feature is mostly indicated by a linear pattern of greyer (bleached) hydric soils. This linear feature does not appear to being linked to the wider drainage network (although it is possible that this system was potentially linked to the palaeo Dry Harts River drainage system). This characteristic may reflect the macro-geomorphological development of the project site over time, in which diminution of surface fluvial activity over time occurred in the wider Kalahari area. Although dunes are not

Habitat	Unit
	found in the project site, the development of endorheic drainage, as in the Kalahari, has occurred in the project site, with many rivers poorly defined, and 'severed'. The grey colour of the soils as opposed to the surrounding orange soils indicates the presence of hydric soils. The linear distribution of the soils may reflect a relict drainage line that has retained some form of hydromorphic character. Some of these 'severed' drainage systems appear to be linked to pans, with the possibility of pans being the expression of the process of development of this endorheic drainage. Surface drainage functionality of this palaeo-channel within the project site appears to be absent and therefore this feature is no longer considered to be a watercourse. Some moisture within the soil may however be retained for longer periods of time, following rainfall events (higher than the surrounding area), but seldom exhibit saturated soil conditions within the development area. These areas of higher moisture content are characterized by a plant species composition different from the surrounding dryer areas and is almost entirely covered with graminoids with some forbs. Shrubs are almost absent from this channel except for the occasional presence of *Grewia flava*. The grass layer is moderately tall (±1 m) with *Aristida congesta, Digitaria eriantha, Eragrostis lehmanniana, Eragrostis superba* and *Themeda triandra* forming the key species. The palaeo-channel comprises of 46 species with 20 graminoid species and 22 forb species whilst the remaining 4 species are geophytes and shrubs. Shallow soils are typically covered by shorter grasses such as *Eragrostis x pseudo-obtusa, Chloris virgata, Enneapogon desvauxii, Tragus berteronianus* and *Eragrostis nindensis*. Trampled and severely overgrazed areas are typically covered by *Schkuria pinnata, Geigeria burkei* as well as *Aristida congesta*. Only one conservation important species was observed namely *Nerine laticoma* and was only occasionally observed, normally in small clusters of not more than 6 species per population.
Savannah Shrubland: Comprises of a dominant and dense shrub layer, primarily *T. camphoratus* and *G. flava*. The forb/ grass layer is also relatively well developed. Taller tree species are occasionally scattered within this shrub dominated area. This habitat predominantly occupies the slightly elevated calcareous beds or mantles.	<u>Tall Vaalbos Shrubland:</u> This vegetation unit covers the calcareous beds within the project site and is fairly species poor comprising of only 35 species. *T. camphoratus* and *G. flava* are the most dominant species within this unit and cover approximately 60% - 70% of the project site, creating a fairly dense, medium tall shrub layer. The grass layer below these shrubs comprises of 12 species of which *Anthephora pubescens, Eragrostis lehmanniana, Cymbopogon pospischilli, Enneapogon desvauxii* and *Themeda triandra* are the most dominant species. The forbs, *Hertia pallens, Barleria macrostegia, Pentzia incanum, Geigeria burkei,* and *Blepharis integrifolia* as well as the dwarf shrub, *Felicia muricata* are also dominant within this unit and are prominent and diagnostic of this unit. It is likely that this shrub layer may have densified and somewhat encroached over this calcareous layer due to overgrazing over a long period of time. Taller shrubs and small trees such as *Acacia karroo* and *Searsia lancea* occasionally rise above the dominant *T. camphoratus* and *G. flava* cover. The only conservation-worthy species recorded within this unit is *Acacia erioloba* which is very sparsely distributed within this unit and very seldom encountered. The stability of the habitat is medium where the vegetation is moderate to dense (woodland patches). Habitat stability is low if soil

Habitat	Unit
	surface is disturbed due to high levels of disturbance (severe overgrazing and trampling). Should degradation of the habitat occur, rehabilitation of vegetation and ecosystem functionality after disturbance will be slow but possible only with the retention of the topsoil. Disturbance will most likely lead to a rapid invasion by undesirable indigenous and possibly alien invasive species.
Tree Savannah: Comprises of an open tree savanna characterised by medium size trees and a well-developed and moderate to dense grass layer. This vegetation unit has a relative close resemblance to the Open Vaalbos Shrubland in terms of species composition and diversity, with differences occurring in the form of the structure and relationship between the different plant strata. The tree savannah contains a denser (although still open) tree layer whilst the shrub layer is much more open. As within the Open Vaalbos Shrubland, clustering of trees may occur. Dominant tree species include; *Searsia lancea*, *Acacia karoo, Acacia tortilis* and *Ziziphus mucronata*. *T. camphoratus* and *G. flava*, even though still constant throughout the area, are much lower in density. Within the tree savannah, two vegetation units were identified namely; Tall Karee Woodland covering the central-eastern portion of the project site as well as the Secondary Open Woodland occurring on historically cultivated areas.	<u>Tall Karee Woodland:</u> This vegetation unit covers moderately deep sandy soils with some local shallow soils and exposed dolomites. The tree layer comprises between 15% and 20% of the unit with *S. lancea* and *Z. mucronata* being the prominent tree species. The shrub layer comprising predominantly of T. *camphoratus* cover approximately 20% of the project site. The grass layer is well developed and relative dense comprising of *D. erinatha, A. pubescens, E. lehmanniana, E. rigidior, E. superba, S. pappophoroides* and *A. congesta*. Species diversity within this unit is fairly low comprising of 36 species, including 16 graminoid species, 4 shrub species and 4 tree species. Species of conservation importance that were observed within this unit were occasional *Aloe greatheadii* plants. Other conservation important plants less frequently observed include; *Ammocharis coranica,* and very occasionally, individuals of *Acacia erioloba*. The stability of the habitat is medium to high if kept intact. The stability is slightly higher where the vegetation within the habitat is moderate to dense (i.e. woodland patches). If the soil surface is disturbed through severe overgrazing and trampling then the stability will be reduced to low. Should degradation of the habitat occur, rehabilitation of vegetation and ecosystem functionality after disturbance will be slow but possible only with the retention of the topsoil. Disturbance will most likely lead to a rapid invasion by undesirable indigenous and possibly alien invasive species. <u>Secondary Open Woodland:</u> This vegetation unit occupies historically cultivated areas and can be regarded as a plagio-climatic habitat. This unit occupies a fairly deep gravelly soil. Other important ecological factors influencing the vegetation composition of this unit are trampling and overgrazing and is evident from the dominance of increasing II grass species, especially *A. congesta, E. echinochloidea, S. pappophoroides* and *E. lehmanniana*. This unit comprises of an open tree layer with some local clustering of tree species. The tree layer constitutes approximately 15% of the total vegetation cover and comprise of an almost equal mixture of broad leave and compound leave species. The shrub layer constitutes approximately 20% of the unit, predominantly *G. flava*. The project site comprises a moderate diversity of species (49 species) with all strata relatively well represented (15 grass species; 6 shrub species, 5 tree species and 18 forb species). Key species includes: *A. congesta, E. lehmanniana, E. superba, S. pappophoroides, E. echinochloidea, G. flava, T. camphoratus, S. lancea, A karroo, Z. mucronata, A. tortilis, Asparagus laricinus, Lantana rugosa, Pentzia incanum, Chascanum pinnatifidum, Nolletia ciliaris* and *Hertia pallens*. Species of conservation importance that were observed within unit were occasional *Aloe greatheadii* plants. The stability of the habitat is medium to high if kept intact. The stability is slightly higher where the vegetation within the habitat is

Habitat	Unit
	moderate to dense (i.e. woodland patches). If the soil surface is disturbed through severe overgrazing and trampling then the stability will be reduced to low. Should degradation of the habitat occur, rehabilitation of vegetation and ecosystem functionality after disturbance will be slow but possible only with the retention of the topsoil. Disturbance will most likely lead to a rapid invasion by undesirable indigenous and possibly alien invasive species.
Savannah Woodland: Comprises a dense tall shrub / tree cover, forming an almost closed canopy in some areas. Open patches and peripheries of these woodlands contain shade loving grasses whilst the deeper shaded areas contain forbs. The Tall Mixed Woodland Patch is, located near the western portion of the project site, whilst the Tall Woodland Fringe is typically associated with rocky peripheries of some pan wetlands.	<u>Tall Mixed Woodland Patch:</u> This small isolated patch occurs on moderately to deep sandy soils overlying calcrete located near the western portion of the project site. Some calcrete gravel is also present on the surface. This patch is dominated by a tall dense tree cover comprising of a mixture of broad- and compound leaved tree species (Acacia karroo, Searsia lancea and Ziziphus mucronata). The lower shrub stratum is characterised by *Diospyros lycioides, Gymnosporia buxifolia* and *Searsia leptidictya.* The lower stratum comprise predominantly of shade tolerating forbs such as *Pergularia daemia, Sida chrysantha* and *Pavonia burchelii*. The nitrogen enriched areas around *A. karroo* trees are dominated by a dense sward of *Setaria verticilata*. This patch is located near a few informal dwellings and adjacent to a kraal and is subsequently subjected to regular trampling and some wood harvesting. This unit is regarded as moderately disturbed with a highly transformed grass / forb layer. The stability of the habitat is medium to high if kept intact. Clearing and monitoring of weeds and invasive species will be necessary. Loss of functionality (habitat and niche diversity) will result from clearing this vegetation and altering the surface. This habitat unit will be difficult to recreate after significant modification, rehabilitation of vegetation and ecosystem functionality after disturbance will be problematic and slow.
	<u>Tall Woodland Fringe:</u> These woody patches are found as small, dense patches at the peripheries of some of the pan wetlands, where the soils are slightly clayey and relatively shallow with surface rock typically present. These patches comprise a combination of small to moderately sized trees and shrubs with a moderate ground cover, predominantly forbs and shade loving graminoids. The stability of the habitat is medium to high if kept intact. Clearing and monitoring of weeds and invasive species will be necessary. Loss of functionality (habitat and niche diversity) will result from clearing this vegetation and altering the surface. Disturbance and transformation within this unit may expose high sensitive wetlands to impacts associated with the proposed development. This habitat unit will be difficult to recreate after significant modification, rehabilitation of vegetation and ecosystem functionality after disturbance will be problematic and slow. Key species include *Searsia lancea, Ziziphus mucronate, Searsia pyroides, Diospyros lycioides, Grewia flava*, *Asparagus laricinus* and *A. suaveolens.* The only conservation-worthy species recorded within this unit is *Acacia erioloba* which is very sparsely distributed within this unit.

Habitat	Unit

Depression "Pan" Wetlands:

This habitat type does not form part of the Savannah habitat types but rather moisture loving grasslands located in depressions, experiencing various periods of soil saturation with some small areas which may experience short periods of inundation. These areas are also usually characterised by soils with a higher clay content due to the accumulation of such textures in these low-lying areas. The depression wetlands comprise of a low to tall moisture loving grassland which may be replaced by forbs when regularly trampled and grazed. The composition of dominant species typically varies along a moisture gradient.

The stability of the habitat is high to high if kept intact, despite very variable seasonal herb cover. Loss of functionality will result from clearing this vegetation and altering the surface. This habitat unit is easily invaded by weeds and alien invasive species and easily degraded by excessive trampling and overgrazing. The rehabilitation of the herb layer will only be possible if the existing micro topography and topsoil characteristics of this and the immediately surrounding environment is maintained.

The zones within these pans that are saturated seasonally to almost temporary are characterized by low growing graminoids such as *Panicum coloratum*, *Cynodon dactylon*, *Eragrostis cilianensis, Echinochloa holubii* and *Brachiaria marlothii* as well as *Eragrostis curvula*. Trampled areas may be dominated by C. dactylon, Tragus berteronianus, and Schkuria pinnata. Areas experiencing periods of inundation (typically temporarily for a few months after sufficient rainfall events) are characterised by Persicaria serrulata and Echinochloa holubii.

The seasonal to temporary saturated zone are usually characterized by a mixture of short and tall grasses with a stronger forb representation. Key species includes: *Brachiaria marlothii, Panicum coloratum, Cymbogon pospischilii, Cynodon dactylon, Salvia disermas, Gomphrena celosioides, Stachys natalensis* and *Heliotropium ciliatum*. Trampled areas are usually dominated by *Schkuria pinnata, Urochloa panicoides, Cynodon dactylon, Heliotropium ciliatum* and *Gomphrena celosioides*.

The outer edges of the temporary zones are very seldom saturated and comprise of a mixture of the surrounding dry terrestrial species and wetland species, predominantly tall grass species. Key species includes; *Digitaria eriantha, Enneapogon desvauxii, Eragrostis lehmanniana, Eragrostis rigidior, Cymbopogon pospischilii, Panicum coloratum, Sporobolus ioclados, Heliotropium ciliatum* and *Schkuria pinnata*. Very occasionally tall *Acacia erioloba* species may be located within these areas, which is regarded as a conservation important species.

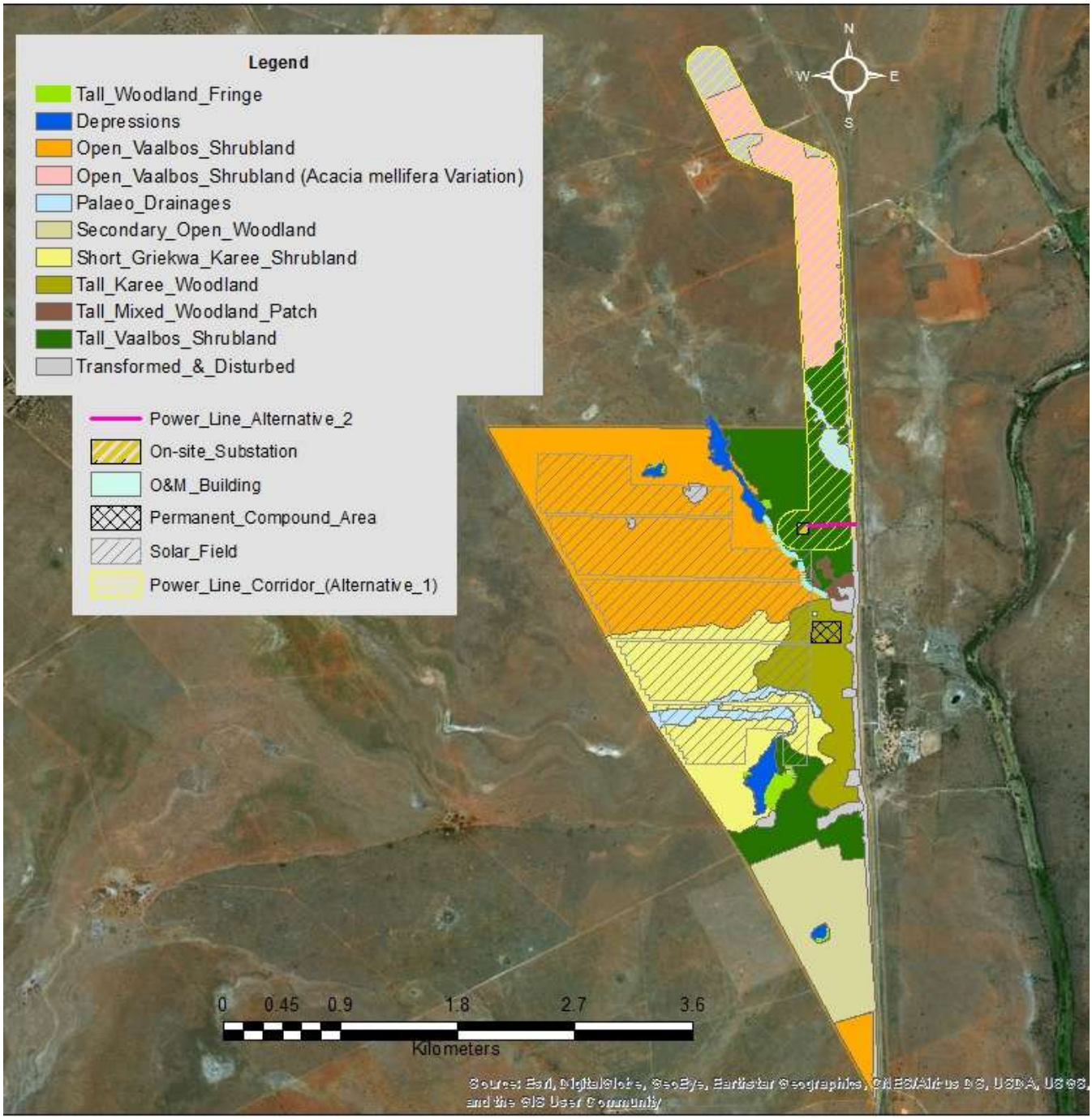

Figure 6.7: Habitats identified within the project site and power line corridor for the Moeding Solar PV Facility.

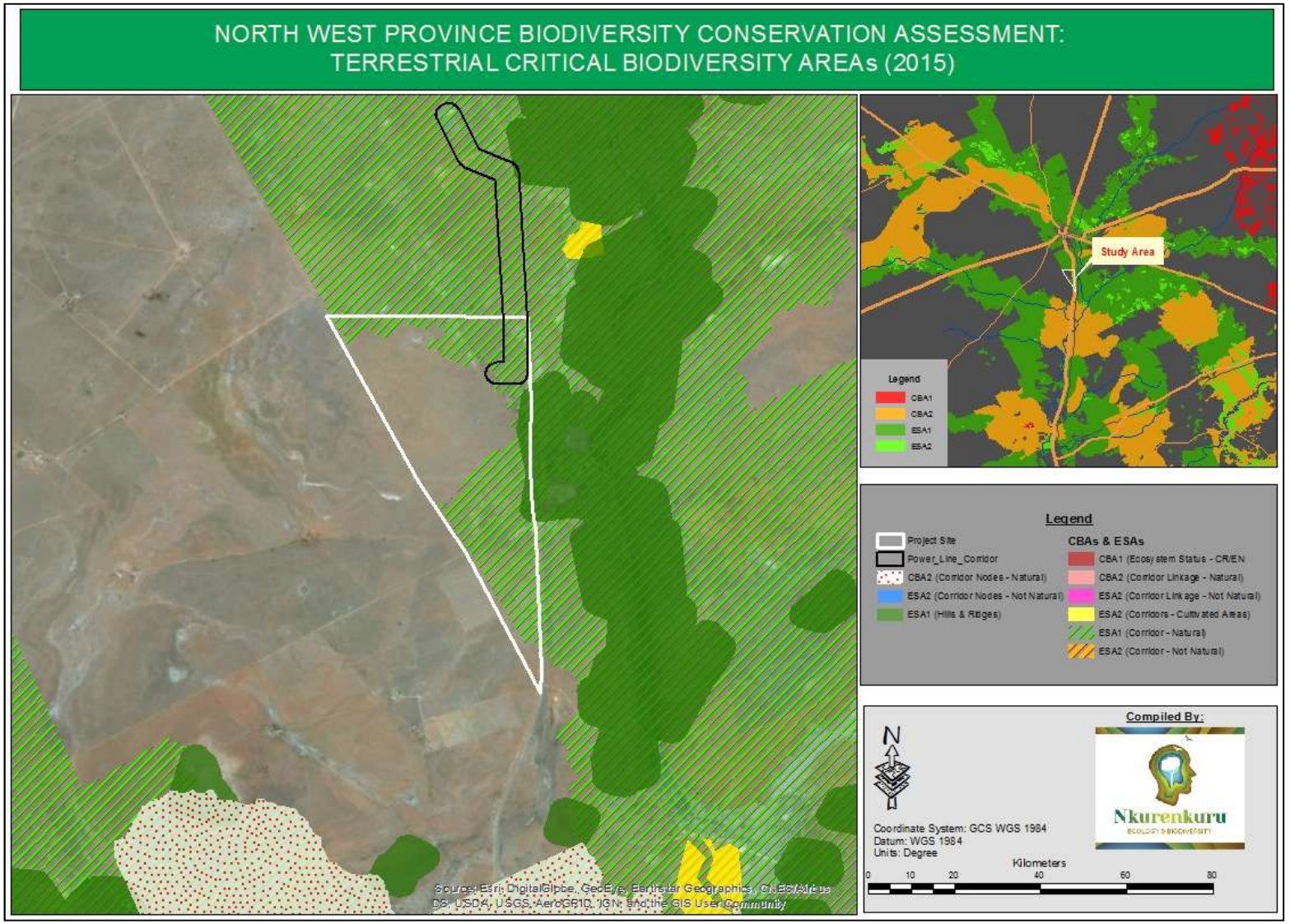

Figure 6.8: Critical Biodiversity Areas map of the North West Province illustrating the project site and the surrounding environment.

6.5.5.4. Critical Biodiversity Areas (CBA) and Broad-Scale Processes

Half of the project site and power line corridor (Power Line Alternative 1) is situated with an Ecological Support Area (ESA). No Critical Biodiversity Area (CBA) is present within the project site (refer to **Figure 6.8**). The largest portion of the ESA has been classified as an ESA as this area forms part of a corridor for faunal movement along the Dry Harts River. A small section along the eastern boundary of the project site has been furthermore classified as an ESA due to the presence of a ridge or hill structure.

Major artificial structures, especially linear features, have severely limited the potential of this area to contribute to the proposed function as a corridor for movement and have fractured this portion of the landscape from the Dry Harts River. Some degree of movement is still possible and the area may provide such a function albeit to a limited extent.

Such disturbances include:
- the N18 Road;
- the railway line and train station;
- the 400kV Overhead Power Line;
- infrastructure associated with the Tierkloof Educational Institution;
- the gravel quarry, and
- numerous farm and boundary fences.

6.5.5.5. Fauna

a) *Terrestrial Mammals*

The potential diversity of mammals within the project site is high with as many as 98 terrestrial mammals potentially occurring. Of the 98 mammals that have a distribution that includes the project site, 74 are known to occur in Degree Grid 2724 and11 species within 2724 (MammalMap, 2018). Of the species that have a distribution that includes the project site, 41 species are regarded as Conservation Important Species with 21 species either listed as Red Data species or as a Protected Species within the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004). Due to the relatively homogenous nature of the project site as well as the high level of disturbances associated with anthropogenic activities (agricultural activities and major roads), it is however expected that the diversity within the project site itself are low to moderate. Even though suitable habitat is provided for approximately 41 species and some 25 marginal species, the actual on-site diversity is, as mentioned, expected to be much lower.

A number of antelope species have been recorded by the Animal Demographic Unit (ADU) within the 2724 Degree Grid. Some of these South African indigenous antelope species do not have a natural distribution within the specific region. Most of these antelope species are confined by fences and occur only where farmers have introduced them or allow them to persist and should be considered as part of the farming system rather than as wildlife per se.

During the site visit undertaken by the specialist, the following faunal species were confirmed on site:

- Small colony of rodent burrows (most likely Pouched Mouse – *Saccostomus campestris* and/or Bushveld Gerbil – *Gerbilliscus leucogaster* and/or Four-striped Grass Mouse – *Rhabdomys pumilio*).
- Single rodent burrows (most likely Pygmy Hairy-footed Gerbil – *Gerbillurus paeba*).

- Common Mole-rat (*Cryptomys hottentotus*).
- Cape Porcupine (*Hystrix afrecaeaustralis*).
- Slender Mongoose (*Galerella sanguinea*).
- Yellow Mongoose (*Cynictis penicillata*).
- Savanna Hare (*Lepus victoriae*).
- Sringhare (*Pedetes capensis*).
- Relative large burrows (likely to have been made and utilized by Aardwolf – *Proteles cristatus* and/or Aardvark – *Orycteropus afer*).
- Greater Kudu (*Tragelaphus strepsiceros*).
- Steenbok (*Raphicerus campestris*).

None of these species are listed and/or protected species.

b) *Reptiles and Amphibians*

The potential diversity of reptilian species within the greater area is moderate with up to 71 reptile species of which only 26 are known to occur in the 2724 Degree Grid with 3 species within the 2724 QDS (ReptileMap, 2018).

Of the species that have a distribution that include the project site, 1 species is regarded as Conservation Important (Southern African Python) whilst 13 species are endemic/ near endemic to South Africa. The diversity within the project site itself is expected to be moderate as a result of the relative homogenous nature of the project site. Up to 29 species are likely to inhabit the project site and 22 have a moderate potential to occur.

The potential diversity of amphibian species is regarded as low with 21 species having distribution that includes the project site, of which only 15 are known to occur in the 2724 Degree Gird with only 2 species recorded within the 2724BA QDS (FrogMap, 2018). Of the species that have a distribution that include the project site, 1 species is regarded as Conservation Important (Giant Bullfrog – Near Threatened). These species prefer and breed in the shallows of temporary rain filled depressions in grassland and dry savannah.

The diversity within the project site itself is regarded as low as result of the absence of suitable habitat due to disturbances and habitat transformation, which include a fractured landscape, surrounding agricultural practices, the presence of large roads and other anthropogenic activities.

During the site visit undertaken by the specialist, the following herpetofaunal species were confirmed on site:

- Cape cobra (*Naja nivea*).
- Western Ground Agama (*Agama aculeata aculeata*).
- Speckled Rock Skink (*Trachylepis punctatissima*)
- Wahlberg's Snake-eyed Skink (*Afroablepharus wahlbergii*).
- Spotted Sandveld Lizard (*Nucras intertexta*).
- Holub's Sandveld Lizard (*Nucras holubi*).
- Savanna Lizard (*Meroles squamulosus*).
- Common Barking Gecko (*Ptenopus garrulus garrulus*).

None of these recorded species are listed as Red Data species.

6.5.5.6. Avifauna

a) *Avifauna Habitat Types*

The project site is mostly consistent with the description of the Ghaap Plateau Vaalbosveld with some variations occurring between the grass and tree layer. This variation in vegetation structure species composition formed the basis for the identification of the different habitat types. Five important avian micro-habitats have been identified within the project site, as discussed below:

» Savannah Grassland: This micro-habitat comprises of a dominant open grassland with some scattered shrubs and trees (mainly *Trachonanthus camphoratus, Grewia flava* and *Searsia tridactyla*). Tall trees are scarce and usually clumped together. Such clumps typically comprise of *Searsia lanceae, Ziziphus mucronata* and *T. camphoratus*. Variations within this habitat type occur and include areas where *T. camphoratus* and other taller tree/shrub species are less prominent with *Searsia tridactyla* forming the diagnostic shrub species. This variation mostly covers the low, almost inconspicuous chert ridge. The palaeo-channel on the other hand contains very little trees and shrubs which occasionally occurs along the channel. Key grass species includes; *Aristida congesta*, *Eragrostis lehmanniana, E. superba, Anthephora pubescens, Centropodia glauca, Schmidtia pappophoroides, Brachiaria nigropedata* and *Cymbopogon pospischilli*.

»

» This habitat represents the majority of the vegetation within the project site and 300m power line corridor and has been subjected to historical and long-term overgrazing which has subsequently altered the vegetation structure, especially within the grass/forb layer. The grass – tree interactions, especially where tree clumps are surrounded by open portions of grassland contribute to variation within this habitat, and subsequently niche habitats.

»

» The avian diversity within this habitat is regarded as moderate with 35 species recorded. The larger tree clumps may provide roosting and nesting for many bird species although no important roosting or nesting sites were recorded in the project site and 300m power line corridor. The open grassy areas represent foraging and/or hunting areas for many insectivorous and granivorous bird species, including species such as Helmeted Guineafowl, Common Quail, Kori Bustard, Northern Black Korhaan, Eastern Clapper Lark, Spike-heeled Lark, Desert Cisticola, Ant-eating Chat, Red-billed Quelea and African Pipit. Taller shrubs and tree species provide perching for especially insectivorous species such as; Southern Fiscal, Bokmakierie, Black-chested Prinia and Kalahari Scrub Robin. Avifaunal species typically recorded within and in close proximity to the tree clumps include; Ring-neck Dove, Cape penduline Tit, Black-chested Prinia, Yellow-bellied Eremomela, Kalahari Scrub Robin and Chestnut-vented Warbler.

»

» Artificial features also contribute to the diversity within this habitat and include structures such watering points, cement dams, Mercury / Mookodi 400kV power line, short grasslands and bare areas on severely trampled and grazed patches. The artificial watering points and cement dams regularly attract species such as; Laughing Dove, Namaqua Dove, Lefaillant's Cisticola, Southern Grey-headed Sparrow, Red-billed Quelea, Black-throated Canary and Yellow Canary. Crowned Lapwing, Laughing Dove and Spike-heeled Lark were typically associated with the trampled and

severely overgrazed patches. Few species were recorded, utilising the power line as a perched and included Ring-necked Dove, Laughing Dove, Red-billed Quelea, Pied Crow and Cape Sparrow

»

» The only Conservation Important avifaunal species recorded within this habitat type was a single Kori Bustard (Near Threatened).

»

» Savannah Shrubland: This micro-habitat predominantly occurs on the calcareous beds within the project site and is fairly plant species poor. *T. camphoratus* and *G. flava* are the most dominant species within this unit and cover approximately 60% - 70% of the project site, creating a fairly dense, medium tall shrub layer. The 300m power line corridor contains a fairly large portion of this habitat type. The grass layer below these shrubs comprise predominantly of *Anthephora pubescens, Eragrostis lehmanniana, Cymbopogon pospischilli, Enneapogon desvauxii* and *Themeda triandra*. Forbs such as *Felicia muricata*, *Hertia pallens, Barleria macrostegia, Pentzia incanum, Geigeria burkei,* and *Blepharis integrifolia* are also relative dominant species. It is likely that this shrub layer may have densified and somewhat encroached over this calcareous layer due to overgrazing over a long period of time.

»

» Avian diversity within this habitat is regarded as low with only 13 species recorded. This is likely due to the largely homogenous and dense plant composition and structure. Prominent avifaunal species within this habitat includes; Southern Fiscal, Cape Penduline Tit, Black-chested Prinia, Chestnut-vented Warbler and Kalahari Scrub Robin.

»

» No Conservation Important avifaunal species were recorded within this habitat type.

»

» Tree Savannah (medium size trees and moderate to dense grass layer): This micro-habitat comprises of an open tree Savannah characterised by medium size trees and a well-developed and moderate to dense grass layer. This vegetation unit may show some resemblance to portions of the Open Vaalbos Shrubland in terms of species composition and diversity, with differences occurring in the form of the structure and relationship between the different plant strata. The tree Savannah contains a denser (although still open) tree layer whilst the shrub layer is much more open. As within the Open Vaalbos Shrubland, clustering of trees may occur. Dominant tree species include; *Searsia lancea*, *Acacia karoo, Acacia tortilis* and *Ziziphus mucronata*. *T. camphoratus* and *G. flava*.

»

» Within the tree Savannah two distinctions (forms) could be made based on the degree of transformation and are:

- a near-natural to natural tree Savannah dominated by *S. lancea* and *Z. mucronata* and a dense, well developed grass cover; and
- a transformed form of tree Savannah occurring on historically cultivated areas, dominated by *S. lancea* and *A. karroo*. The grass layer is much sparser and dominated by mostly wiry unpalatable species.

»

» Avian diversity within this habitat varies between the two forms with the natural form being moderate with 26 species recorded whilst the transformed form was relatively poor (16 species recorded).

»

» The natural Tree Savannah habitat has a higher biomass and structural and compositional variation in vegetation which supports a higher diversity and abundance of bird species, with large trees potentially providing roosting and nesting for many bird species. The denser woody areas provided

niche and habitat for species such as Golden-breasted Bunting, Yellow Canary, Violet-eared Waxbill, Red-billed Firefinch, Ring-neck Dove, Cape penduline Tit, Black-chested Prinia, Yellow-bellied Eremomela, Kalahari Scrub Robin and Chestnut-vented Warbler. Within the more open grassy areas the following species were regularly recorded; Helmeted Guineafowl, Northern Black Korhaan, Eastern Clapper Lark, Sabota Lark, Desert Cisticola, Ant-eating Chat and Red-billed Quelea.

»

» No Conservation Important avifaunal species were recorded within this habitat type.

»

» Tree Savannah (dense tall shrub/tree cover): This Savannah type is very small and limited in extent within the project site and comprise a dense tall shrub / tree cover, forming an almost closed canopy in some areas. Open patches and peripheries of these woodlands contain shade loving grasses whilst the deeper shaded areas contain forbs with some possessing the ability to climb. This patch is dominated by a tall dense tree cover comprising of a mixture of broad- and compound leaved tree species (*Acacia karroo, Searsia lancea and Ziziphus mucronata*). The lower shrub stratum is characterised by *Diospyros lycioides, Gymnosporia buxifolia* and *Searsia leptidictya.* The lower stratum comprises predominantly of shade tolerating forbs such as *Pergularia daemia, Sida chrysantha* and *Pavonia burchelii*. The nitrogen enriched areas around *A. karroo* trees are dominated by a dense sward of *Setaria verticilata*.

»

» Avian diversity within this habitat was relatively poor with only 13 species recorded which is most likely due to the location of this habitat in close proximity to infrastructure. This unit is unique in terms of species composition and vegetation structure and subsequently contribute to habitat niche diversity. Species that was recorded within this habitat type included; Golden-breasted Bunting, Violet-eared Waxbill, White-bellied Sunbird, Cape Starling, Chestnut-vented Warbler, Black-chested Prinia, Red-faced Mousebird, Acacia Pied Barbet and Barred Wren-Warbler.

»

» No Conservation Important avifaunal species were recorded within this habitat type.

»

» Grassy pan wetlands with woody/shrubby peripheries: Five ephemeral pans (which will only hold water after heavy rains with larger wetlands being inundated for some time) have been identified within the project site. These areas are also usually characterised by soils with a higher clay content due to the accumulation of such textures in these low-lying areas. These pans comprise of a low to tall moisture loving grassland which may be replaced by forbs when regularly trampled and grazed. Key species include; *Panicum coloratum, Cynodon dactylon, Eragrostis cilianensis, Echinochloa holubii, Brachiaria marlothii, Schkuria pinnata* and *Persicaria serrulata*. The composition of dominant species typically varies along a moisture gradient. Woody patches are found as small, dense patches at the peripheries of some of the pan wetlands, where soils are slightly clayey and relatively shallow with surface rock typically present. These patches comprise a combination of small to moderately sized trees and shrubs with a moderate ground cover, predominantly forbs and shade loving graminoids. Key species include *Searsia lancea, Ziziphus mucronate, Searsia pyroides, Diospyros lycioides, Grewia flava*, *Asparagus laricinus* and *A. suaveolens* with the occasional *Acacia erioloba* species. This habitat unit is considered important for numerous species, as it is a reliable source of surface water in the area and as the vegetation potentially supports numerous wetland bird species especially during periods of inundation.

»

» Avian diversity within this habitat is regarded as moderate with 26 species recorded. The larger tree clumps at the peripheries may provide roosting and nesting for many bird species. The open grassy

areas represent foraging and/or hunting areas for many insectivorous and granivorous bird species, including species such as Common Quail, Crowned Lapwing, Namaqua Sandgrouse, Spike-heeled Lark, Red-capped Lark, Lefaillant's Cisticola, Red-billed Quelea, Red-headed Finch, Grey-backed Sparrow Lark, Black-faced Waxbill, Yellow Canary and African Pipit. Taller shrubs and tree species (especially taller *A. erioloba* trees associated with pan fringes) provide perching for insectivorous species and smaller raptor species such as Greater Kestrel, Lanner Falcon, Black-winged Kite, Sabota Lark, Familiar Chat, Chat Flycatcher, Southern Fiscal, Black-chested Prinia and Kalahari Scrub Robin. Other avifaunal species typically recorded within and in close proximity to the tree clumps furthermore include; Red-eyed Dove, Ring-neck Dove, Cape penduline Tit, Yellow-bellied Eremomela, Violet-eared Waxbill and Chestnut-vented Warbler. The larger specimens of *A. erioloba* are especially regarded as important avifaunal features within this habitat unit and are preferential perching sites for raptor species.

- During periods of inundation waterfowl, herons and waders may frequent these pans and likely include Spur-winged Goose, Egyptian Goose, South African Shelduck, Yellow-billed duck, Hadada Ibis, Black-headed Heron, Pied Avocet, Three-banded Plover, Common Greenshank and sandpiper species, etc.
- The only Conservation Important avifaunal species recorded within this habitat type was a single Lanner Falcon (Vulnerable).

b) *Species Composition*

Based on information derived from the South African Bird Atlas Project (SABAP1 and 2) a total of 221 bird species are expected to occur within the project site and the surrounding area of which 55 species were recorded within the project site. This included sightings of Kori Bustard (Near Threatened) and Lanner Falcon (Vulnerable). White-backed Vulture (Critically Endangered) and Greater Flamingo (Near Threatened) were recorded outside of the project site but due to the transient nature of these species, White-backed Vulture and Greater Flamingo could come into contact with the development. Of the 221 bird species, 17 species are classified as Red Data species (Barnes 2014), 12 as endemic species and 28 as near-endemic species.

The birds of greatest potential relevance and importance in terms of the possible impacts of a Solar PV Facility and its associated infrastructure are likely to be local populations of threatened or endemic passerines (Ant-eating Chat and Cape Longclaw), shy ground-nesting species (Burchell's Courser and Double-banded Courser), resident or visiting large terrestrial birds (Secretarybird, Abdim's Stork, Black Stork and Blue Crane), resident or passing raptors (Martial Eagle, Tawny Eagle, Lanner Falcon and Red-footed Falcon and White-back Vulture) and transient waterbirds (Greater Flamingo, Lesser Flamingo, South African Shelduck and Yellow-billed Stork).

During a site survey undertaken from 14 May 2018 to 15 May 2018 bird species diversity and abundance was recorded to be moderate to low across the entire project site and power line corridor, with a total of 55 species recorded. The most commonly recorded species within the project site were passerine of which Scaly-feathered Weaver, Bokmakierie, Southern Fiscal, Desert Cisticola, Eastern Clapper Lark, Red-billed Quelea, Black-chested Prinia, Cape Penduline Tit, Chestnut-vented Warbler, Kalahari Scrub Robin and Yellow Canary. Non-passerines recorded included Ring-necked Dove, Namaqua Dove, Northern Black Korhaan and Crowned Lapwing.

Raptor species were not common within the project site and were mostly associated with the taller *A. erioloba* species located within the woodland fringes of some of the pan wetlands. Raptor species that were recorded included, Black-winged Kite, Southern Pale Chanting Goshawk, Greater Kestrel and Lanner Falcon. Sixteen Endemic and Near-Endemic species were recorded during the site survey and included; Southern Pale Chanting Goshawk, Northern Black Korhaan, Namaqua Sandgrouse, Acacia Pied Barbet, Bokmakierie, Sabota Lark, Spike-heeled Lark, Grey-backed Sparrow Lark, African Red-eyed Bulbul, Barred Wren-Warbler, Chestnut-vented Warbler, Kalahari Scrub Robin, Ant-eating Chat, Chat Flycatcher, Scaly-feathered Weaver and Yellow Canary. Two Red listed species were recorded within the project site namely; Kori Bustard (Near Threatened) and Lanner Falcon (Vulnerable).

On the basis of the observations recorded during the field visit, and in combination with already documented information on the avifauna of the project site, 17 priority species are considered central in this avifaunal impact study (**Table 6.6**). These are mostly threatened species which are known to occur, or could occur, in relatively high numbers in the project site and the broader impact zone of the development and which are likely to be, or could be, negatively affected by the Solar PV Facility.

c) *Conservation Areas, Protected Areas and Important Bird Areas (IBA)*

The project site and power line corridor is not located within or in close proximity to any Important Bird Area (IBA).

Table 6.6: Red listed species recorded in the project site and surroundings, ranked according to their red-list status. Species that have been confirmed within the project site have been highlighted in green. (NT = Near Threatened; VU = Vulnerable; EN = Endangered; LC = Least Concern; CR = Critically Endangered)

English Name	Taxonomix Name	Red-list status (Regional)	Endemism	Preferred habitat	Probability of occurrence	Susceptible to
Black Stork	*Ciconia nigra*	Vulnerable	-	Wetland habitats, dried up watercourses and small isolated pools. Roosts on cliff, tree or pylon.	Moderate	Collision / Electrocution
Abdim's Stork	*Ciconia abdimii*	Near Threatened	-	Grassland, Savannah woodland, pan edges, pastures and cultivated areas. Regularly found foraging on irrigated lands, pastures and ploughed fields. Roost in large trees (incl. Eucalyptus), or cliffs.	Moderate	Habitat Loss / Disturbance / Collision / Electrocution
Yellow-billed Stork	*Mycteria ibis*	Endangered	-	Wide variety of wetland and aquatic habitats. Forages in shallow water free of emergent vegetation. Roosts communally on sandbanks, lake margins and large trees.	Moderate	Habitat loss / Disturbance
Greater Flamingo	*Phoenicopterus ruber*	Near Threatened	-	Open water bodies (e.g. dams, sewage treatment works, ephemeral pans, river mouths and coastal mudflats). Breeds at recently flooded, large, eutrophic, shallow salt pans	Moderate	Collision
Lesser Flamingo	*Phoenicopterus minor*	Near Threatened	-	Open, eutrophic, shallow wetlands. Small, ephemeral freshwater wetlands important for smaller flocks. Colonial nester. Breeds on saline lakes and saltpans	Moderate	Collision
Maccoa Duck	*Oxyura maccoa*	Near Threatened	-	Permanent wetlands in open grassland. Breeding habitat comprise of dense stands of emergent vegetation especially reeds, rushes and tall sedges.	Low	Habitat loss / Disturbance / Collision
Secretarybird	*Sagittarius serpentarius*	Vulnerable	-	Open grassland with scattered trees and shrubs. Roosts in crown of trees (mostly Acacia spp.).	High	Habitat loss / Disturbance / Collision
Cape Vulture	*Gyps coprotheres*	Endangered	E	Roosts mostly in mountainous area but may utilise large trees and pylons. Very wide and varying foraging range (up to 121,655 km2).	Low	Collision / Habitat loss / Disturbance / Electrocution

English Name	Taxonomix Name	Red-list status (Regional)	Endemism	Preferred habitat	Probability of occurrence	Susceptible to
White-backed Vulture	*Gyps africanus*	Critical	-	Savannah woodland and bushveld.	Low	Habitat loss / disturbance / collisions / electrocutions
Martial Eagle	*Polemaetus bellicosus*	Endangered	-	Open woodland in fairly flat country, also open shrubland with drainage line woodland or high-tension pylons, and open farmland with clumps of trees.	Moderate	Collision / Electrocution
European Roller	*Coracias garrulus*	Near Threatened	-	Open woodlands.	Moderate	Habitat loss / Disturbance
Tawny Eagle	*Aquila rapax*	Endangered	-	Open Savannah woodland.	Moderate	Habitat loss / disturbance / Electrocution
Lanner Falcon	*Falco biarmicus*	Vulnerable	-	Open grassland, open or cleared woodland, and agricultural areas. Nesting sites includes; cliffs (normally), large trees, electricity pylons and buildings).	Confirmed	Collision/ Disturbance / Habitat loss / Electrocution
Red-footed Falcon	*Falco vespertinus*	Near Threatened	-	Open habitat with some trees, including semi-forested areas, forest fringes, croplands and wetlands. Mostly associated with open, grassy, arid woodland. Often utilises dead trees, telephone poles and wire and fence lines as perches. Roosts in small tree clumps (often Eucalyptus stands).	High	Collision/ Disturbance / Habitat loss / Electrocution
Blue Crane	*Anthropoides paradiseus*	Near Threatened	E	Open grassland but also wetlands, pastures and croplands. Frequently observed in cultivated fields. Roosts in shallow water bodies. Breeds in varies habitats including marshes, wet ground and grassland with a clear all-round visibility as the most important requirement.	Low	Collision
Kori Bustard	*Ardeotis kori*	Near Threatened	-	Dry open Savannah woodland, dwarf shrubland and occasionally grassland	Confirmed	Habitat loss / Disturbance / Collision
Burchell's Courser	*Cursorius rufus*	Vulnerable	NE	Open grassland but also wetlands, pastures and croplands. Frequently observed in	Low	Collision

English Name	Taxonomix Name	Red-list status (Regional)	Endemism	Preferred habitat	Probability of occurrence	Susceptible to
				cultivated fields. Roosts in shallow water bodies. Breeds in varies habitats including marshes, wet ground and grassland with a clear all-round visibility as the most important requirement.		

6.6. Visual Quality

6.6.1. Landscape Character

Landscape character is defined as "a distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another". Landscape Character is a composite of a number of influencing factors including:

» Landform and drainage;
» Nature and density of development; and
» Vegetation patterns.

6.6.1.1. Landform and drainage

The REDZ 6 boundary roughly follows a band of hills and ridgelines that enclose Vryburg on its northern, eastern and western sides. A series of minor watercourses drain from this watershed in a general southerly direction and through the opening in the surrounding higher land.

The project site is located on a relatively flat area close to the western edge of the main drainage line. The area immediately south of the project site falls relatively steeply towards the south. The area immediately to the north of the project site also falls towards the existing Mookodi Main Transmission Substation.

The topography can be described as gently undulating with the head of the valley being approximately 60m above the valley floor. Minor ridgelines extend into the valley in the vicinity of the project site (approximately 20 – 30m above the valley floor).

The relatively low nature of the proposed development and the fact that it is located on a relatively flat plateau with land falling away from the project site boundary on both its northern and southern edges, it is likely that these small changes in landform could play a significant role in helping to screen the Moeding Solar PV Facility.

6.6.1.2. Nature and Density of Development

The general development pattern in the study area includes:

» The urban area of Vryburg:
» The dense Vryburg urban area which, typically of many towns, is set out on a grid pattern with roads running north/south and east/west. The two closest areas of the town to the project site include;
  - A commercial and light industrial area that extends south of the settlement; and
  - The residential township of Huhudi that extends along the N18 to the north of the project site.

  The area of dense development which includes the Huhudi suburb is likely to result in views of the surrounding landscape from the town only being possible from the urban edges and possibly along the straight roads that are likely to channel narrow views of surrounding rural area into the urban area. The commercial and light industrial area to the south of Vryburg is unlikely to be sensitive to the proposed development.

» An area of small holdings directly to the east of Vryburg.
» Development in this area is mixed and includes;
- Social facilities including a local church;
- Semi-industrial uses associated with transportation; and
- Residential uses.

In terms of visual implications, the openness of this development means that views of the surrounding landscape are likely to be possible from within the area. It should be noted however that this area is close to the Approximate Limit of Visibility (8km) of the proposed development and that there are other areas of solar development that are closer to the area of smallholdings.

» The rural area surrounding Vryburg:
» The majority of this area is used for cattle grazing. Within the agricultural area there are numerous farmsteads that are comprised of farm houses, agricultural buildings and farm worker's accommodation.
»
» In terms of visual implications, the farmsteads could be sensitive to landscape change that might be associated with the proposed development particularly if secondary uses include tourism related activities such as guest houses.
»
» In addition to general uses in the area, there are a number of service and urban fringe uses that also have an influence on localised landscape character including:
- Adjacent roads;
- A railway line runs immediately to the east of the proposed project site;
- Agri-industrial areas including areas of stock pens;
- Existing electrical infrastructure including overhead power lines that are located close to the N18 and along the proposed route of Power Line Alternative 1;
- Isolated transportation uses within the rural area;
- The Tiger Kloof Educational Institute which is located on the opposite side of the N18 and adjacent to the project site. This provides a relatively large urban element within an otherwise mainly rural setting.

These elements all have the effect of eroding the natural character of the area. From the site visit undertaken it is obvious that these elements have greatest impact on the area immediately around Vryburg and along the N18 extending towards the project site. To the south of the town of Vryburg. a minor ridgeline breaks views of the project site from the majority of the urban area. It is only from close to the southern section of Huhudi that views towards the project site start to open up.

6.6.1.3. Vegetation Patterns

Vegetation types present within the broader study area include:
» Natural vegetation that is generally associated with the rural landscape:
» The project site is situated in the natural vegetation of the Kalahari Plateau Bushveld which is a fairly dense bushveld composed of shrubs and occasionally small trees in a mixed grassland mosaic. This natural vegetation is recorded as being under pressure from grazing. However, it is evident that the general pattern of small trees and shrubs in grassland cover much of the area surrounding Vryburg.

Whilst the density of taller shrubs and small trees is relatively sparse, in flat topography and over distance, these elements can combine to provide significant screening of low structures such as the proposed solar array.

» Ornamental vegetation and street planting (generally associated with the urban area as well as the homesteads that occur within the rural area:

» Ornamental trees and shrubs are generally located within gardens in the urban area of Vryburg and surrounding farmsteads in the rural area. This has the following visual effects;
  - It makes the location of farmsteads obvious in the landscape.
  - It helps to screen views of the surrounding landscape from both farmsteads and from within the urban area.

6.6.2. Visual Receptors

Visual Receptors are defined as "individuals and/or defined groups of people who have the potential to be affected by the proposal".

It is possible that an area might be sensitive due to an existing use of the area. The nature of an outlook is generally more critical to areas that are associated with recreation, tourism and in areas where outlook is critical to land values.

Possible visual receptors within the landscape, which due to use, could be sensitive to landscape change include:

» *Point Receptors*: include isolated and small groups of farmsteads that are generally associated with and located within the Rural Landscape Character Area (LCA).

» *Area Receptors*: include the Semi Rural LCA and the Urban LCA and particularly the southern edges of Vryburg that overlook the project site. Tiger Kloof Educational Institute is comprised of a small area of development that includes a high school, a pre-primary school, various sports facilities, administration and accommodation blocks. The school is located on the opposite side of the N18 to the project site.

» *Linear Receptors*: include the N14, the N18, the R34 as well as two un-surfaced local roads. Both national roads (N14 and N18) are likely to carry a proportion of recreational and tourism related traffic. This elevates the importance of the landscape and particularly natural landscape areas as they are viewed from the road. The Regional Road (R34) is likely to carry less recreational and tourism related traffic so may not be as significant. The N18 is situated directly adjacent to the eastern boundary of the project site whereas all other roads are situated in excess of 5km from the project site. This is likely to mean that the N18 will be subject to the greatest level of visual impact.

» *Vryburg Airstrip*: located approximately 7km to the north of the proposed array. The southern approach to the Vryburg airstrip could be impacted by glare reflecting from the face of PV panels.

6.7. Social Characteristics of the Broader Study Area and the Project Site

The following is a baseline summary of the socio-economic profile of the Naledi Local Municipality (LM) within which the Moeding Solar PV Facility is proposed:

» The project is proposed within the North West Province, which is South Africa's 6th largest, and 7th most densely populated Province.

- Between 2001 and 2011 the Naledi LM experienced a positive population growth rate of 1.7% per year, which is more than double that of the Dr Ruth Segomotsi Mompati District Municipality (DM) which experienced a population growth rate of 0.8% per year for the same period.
- Black Africans comprise the predominant population group within the Naledi LM, Dr Ruth Segomotsi Mompati DM, North West Province, and South Africa as a whole. Coloureds comprise the second largest population group accounting for approximately 14.7% of the Naledi LM population.
- Both the Naledi LM and North West provincial populations are slightly male dominated, whereas the Dr Ruth Segomotsi Mompati DM and South African national populations are both female dominated.
- The Naledi LM, Dr Ruth Segomotsi Mompati DM, North West provincial and South African national populations are all heavily youth dominated, with the population age structures comprising predominantly of the economically active population between the ages of 15 – 64. This implies that there is sufficient human resource base for development projects to involve the local populations.
- The Naledi LM has a lower dependency ratio (36) than that of the Dr Ruth Segomotsi Mompati DM (41.6), but higher than the North West provincial (35.3) and South African national (34.5) dependency ratios.
- There are relatively low education levels within the area, with the majority of the Naledi LM (29.3%) and Dr Ruth Segomotsi Mompati DM (28.1%) having received some secondary schooling. Approximately 16.7% of the Naledi LM population ages 20 years and older have received no form of schooling, and 68.8% have not completed Grade 12 / Matric. The majority of the population can be expected to have a relatively low-skill level and would either require employment within low-skilled sectors, or skills development opportunities in order to improve the skills level of the area, and therefore income levels.
- The unemployment rate of the economically active population within the Naledi LM (15.0%) is fractionally higher than that of the Dr Ruth Segomotsi Mompati DM (14.8%). The proportion of economically inactive population is considerably higher in the Dr Ruth Segomotsi Mompati DM (49.5%) than in the Naledi LM (38.2%). The proportion of the economically inactive population has an impact with regards to the proportion of local human capital who are available and willing to work.
- Household income levels are low within the area, with the vast majority falling within the poverty level (64% in the Naledi LM and 70% in the Dr Ruth Segomotsi Mompati DM). The area can therefore be expected to have a high poverty level with associated social consequences such as not being able to pay for basic needs and services and poor living conditions.
- The primary economic activities within the Naledi LM comprise agriculture and hunting which contribute 27.8% to the LM's economy. Other important job creating sectors include finance and insurance, public administration, health and social, and transport. Government is the main employer (as well as the most significant contributor to the GDP).
- The Naledi LM is equipped with 2 hospitals, both of which are located within Vryburg, 2 clinics, 6 mobile clinics, and 2 community health centres.
- Approximately 71.7% of households within the Naledi LM comprise houses (i.e. house or brick / concrete block structure on a separate stand or yard or on a farm), followed by 12.5% which comprise informal dwellings (i.e. a shack not in a back yard).
- The majority of households within the Naledi LM are adequately serviced with regards to water, sanitation, electricity, and refuse removal. However there are sufficient backlogs which have been identified within the LM which require addressing.

6.8. Heritage Resources

6.8.1. Heritage and archaeology

The pre-history of the Vryburg area is evident through the presence of numerous farms with rock engravings, including Verdwaal Vlakte, Bernauw, Schatkist, Wonderfontein and Kinderdam (Van Schalkwyk, 2012; Morris, 1998). Numerous dry pans in the northern section of the project site increase the probability of finding Stone Age Sites associated with hunter gatherer subsistence within the project site.

Heritage Resources associated with the South African War can be traced through the presence of blockhouse lines between Taung and Vryburg and onwards towards Madibogo, as well as the Vryburg concentration camp situated on the Vryburg Allotment area that is now part of the Leon Taljaard Nature Reserve to the north west of Vryburg. Other areas of significance identified are the Devondale Mission (*circa* pre-1900), Tiger Kloof Institute (*circa* 1904) as well as the farmstead of the first and only president, Gerrit Jacobus van Niekerk, of the republic of Stellaland on the farm Niekerksrus some 36km northwest of Vryburg.

Table 6.7 provides a summary of the history of Vryburg and the surrounding areas.

Table 6.7: Summary of the history of the town of Vryburg and the surrounding areas.

Date	Description
2.5 million to 250 000 years ago	The Earlier Stone Age (ESA) is the first and oldest phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these technological phases is known as Oldowan which is associated with crude flakes and hammer stones and dates to approximately 2 million years ago. The second technological phase in the ESA of Southern Africa is known as the Acheulean and comprises more refined and better made stone artefacts such as the cleaver and bifacial hand axe. The Acheulean phase dates back to approximately 1.5 million years ago. A total of 11 ESA sites with Acheulean lithics have been recorded in the Harts River valley, immediately east of the town of Taung and roughly 60 km east of the present study area (Kuman, 2001).
250 000 to 30 000 years ago	The Middle Stone Age (MSA) is the second oldest phase identified in South Africa's archaeological history. It is associated with flakes, points and blades manufactured by means of the prepared core technique.
30 000 years ago to the historic past	The Later Stone Age (LSA) is the third phase in South Africa's Stone Age history. It is associated with an abundance of very small stone artefacts (microliths). The Later Stone Age is also associated with rock engravings and rock paintings. Rock engravings are known from the wider vicinity of the project site (Bergh, 1998), with one known site located at Dinkweneng (approximately 43km east of the project site). Furthermore, a low-density surface scatter of LSA material was identified at the Pering Mine (approximately 60km south-west of the project site) (Birkholtz, 2011).
Early 1600s	The Tswana groups known as the Thlaping and Thlaro moved southward into the area presently known as the Northern Cape. A century later they were settled in areas as far south as Majeng (Langeberg), Tsantsabane (Postmasburg) and Tlhaka le Tlou (Daniëlskuil) (Snyman, 1986).

Date	Description
c. 1770	The Kora moved into the area. Due to their superior firearms they applied increasing pressure on the Thlaping and Thlaro groups. In the end the Thlaping moved into a north-eastern direction to settle in the general vicinity of Dithakong, north-east of present-day Kuruman. The Thlaro settled in areas to the west and north-west of the Thlaping (Snyman, 1986).
c. 1795	Legassick (2010) confirms the presence of the Thlaping, Thlaro and Kora in the general vicinity of the project site during this time.
Early 1800s	After the threat of the Kora became less intensive the Thlaping moved to the vicinity of present-day Kuruman. The Thlaro returned to the Langeberg, establishing them on a permanent basis during the 1820s (Snyman, 1986). During this time, German-born deserter Jan Bloem and his followers established themselves at Lekatlong (Legassick, 2010).
1833	Hurutshe refugees established themselves at Taungs (Legassick, 2010). The present-day town of Taung is approximately 40km dsouth of the project site.
1834	Mahura and his Thlaping followers moved from the vicinity of Kuruman to Taungs. Apart from the 1500 individuals that followed Mahura to Taungs, the settlement of Taungs at the time also included some 2,000 Hurutshe, the Kora leader Mosweu Taaibosch and his followers as well as some 1,500 Maidi (Legassick, 2010).
November 1840	Gasibonwe, the son of Mothibi, attacked Mahura's cattle posts at Taungs and further afield. His aim was to degenerate Mahura's rule and to achieve supremacy over all the Thlaping (Legassick, 2010).
22 April 1842	A treaty was signed between Griqua leader Andries Waterboer and Thlaping leader Mahura at Mahura's settlement near Taungs. The agreement included a definition of the boundary between the two groups. The section of the agreed upon boundary closest to the project site ran from Danielskuil to Boetsap, which meant that the project site and surrounding area was defined as part of this treaty as forming part of Thlaping land (Legassick, 2010). This boundary was very similar to an earlier treaty that was thought to have been agreed to during the 1820s as a boundary between the Griqua and the Thlaping (Legassick, 2010).
1867	Diamonds were discovered for the first time in South Africa near Hopetown. Alluvial diamonds were also discovered along both banks of the Orange River in the vicinity of the confluence of the Vaal and Harts Rivers (Van Staden, 1983). This resulted in large numbers of fortune seekers streaming into the area from overseas, which would have had a profound impact on the social-dynamics of the landscape.
27 October 1871	The area located in the triangle formed by the Orange and Vaal Rivers was proclaimed as British Territory and named Griqualand West. This proclamation came as a result of ownership disputes between the Griqua, the Boer Republic of the Orange Free State and the Boer Republic of the Zuid-Afrikaansche Republiek in terms of the newly discovered diamond diggings.
1879	After Barend Barends was defeated by the Khumalo Ndebele of Mzilikazi, Boetsap was occupied by two shopkeepers, Hunter and Tasker.
1882-1885	The Boer Republic of Stellaland existed during this time in the general area of the Vryburg district. Stellaland had its roots in the conflict between Mankurwane's Tlhaping and Mosweu's Kora over land. Both sides used white mercenaries who as part of their remuneration were to receive farms. Almost 300 Boers joined the side of Mosweu in this war and on 26 July 1882 Mankurwane sued for peace. As a result of the peace agreement a portion of land was set aside for the mercenaries. From September 1882 the capital of Stellaland was being laid out and named Vryburg. On 6 August 1883 the Republic of Stellaland was proclaimed. However, the republic

Date	Description
	ceased to exist when Sir Charles Warren proclaimed the Bechuanaland Protectorate on 30 September 1885 (Bergh, 1999). The Taungs area, including the farm Brakfontein, was located just outside the southern boundary of Stellaland.
30 September 1885	Sir Charles Warren proclaims British Bechuanaland. This proclaimed area included the project site and surrounding area.
1895	British Bechuanaland was incorporated into the Cape of Good Hope. The project site subsequently formed part of the Cape of Good Hope. In the same year the Kaukwe Native Reserve was established in accordance with British Bechuanaland Proclamation No. 220 (Breutz, 1986). This reserve is located 60km south west of the present project site.
1904	Reverend William Charles Willoughby and his wife Bessie arrives in the vicinity of the current project site with the aim of assisting the Batswana to establish a school in Bechuanaland. After several attempts the Institution was finally established at Tiger Kloof.

Two archaeological sites are known in the surrounding landscape and include

» Taung: In 1924 Raymond Dart identified the skull of an infant gracile australopithecine from a limestone quarry near Taung. While numerous fossils have been recovered from the same quarry, the skull of the Taung Child is the only hominin remains recovered from this site. Taung is one of only three localities in South Africa where fossil evidence for early hominins were recovered, the other two being the Cradle of Humankind (with sites such as Sterkfontein and Kromdraai) and Makapansgat (Mitchell, 2002). The Taung Skull World Heritage Site is located 70 km south of the project site.

» Harts River Valley Survey Project: In 1989 the University of the Witwatersrand was commissioned to conduct an archaeological survey of a section of the Harts River valley that was scheduled to be flooded by the proposed construction of the Taung Dam. A total of 28 Stone Age and three pastoralist sites were identified during the survey. Of the 38 identified Stone Age sites, a total of 11 could be associated with the ESA.

»

The best-preserved sites identified during the survey were excavated in 1992, including two of the ESA sites namely 2724DB3 and 2724DB4. Incidentally, the research undertaken at these two sites has provided valuable insight into the Acheulian archaeology of South Africa.

Seven rock art sites were also identified in the footprint area of the proposed Taung Dam. These seven sites comprise finger paintings of geometric patterns as well as one site which contains paintings of "...riders on horseback...riders on horseback chasing an elephant...and two geometric patterns" (Dowson et.al., 1992:28).

During the field assessment thirty four 34 significant heritage sites were identified within the project site and power line corridor and included:

- Twenty one find spots;
- One erosion site exposing Stone Age materials;
- Five significant Stone Age sites;
- One pan like site with extensive exposure of Stone Age artefacts;
- Three historical sites;

- One burial ground;
- One area of stacked stones; and
- One possible grave.

Of these sites listed above, four sites fall within the 300m corridor and none within the development footprint of the solar energy facility.

6.8.2. Palaeontology (Fossils)

The north-eastern portion of the project site and the majority of the 300m power line corridor are underlain by shallow marine or lagoon sediments as well as volcanic rocks of the Vryburg Formation of the Transvaal Supergroup (geologically older at 2.6 billion year-old) (refer to **Figure 6.9**). The Vryburg formation is approximately 140m thick and superimposes lavas of the Ventersdorp Supergroup. The lower portion of the Vryburg series comprises of basal conglomerates followed by the 20m thick Kobaga beds displaying prominent weathering of cross-bedded feldspathic quartzites.

The Kobaga beds in turn are overlain by c. 20m andesitic or basaltic lavas of the Rosendal Member and lastly by the Waterloo Member which consists of c. 20-50m of amydaloidal and non-amydaloidal basaltic or andesitic lavas which is overlain by 14m of interbedded pyroclastic sediments and thin lenticular limestones.

Microbial stromatolites in the upper Vryburg Formation were described by Smith (1991). Altermann and Wotherspoon, (1995) concluded that the stromatolitic carbonates are intertidal. To date, no detailed descriptions of the Vryburg stromatolite occurrences are present in literature, although South African Archaean stromatolites have been discussed in detail (Altermann, 2001; Buick, 2001; and Schopf, 2006). Columnar stromatolites from the Schmidtsdrif Subgroup of the Northern Cape have been described by Bertrand-Sarfarti and Eriksson (1977).

The remaining portion of the project site is primarily underlain by ancient sedimentary rocks of the Schmidtsdrift Subgroup and consists of flat terrain. In the Griqualand West Basin, the Schmidtsdrif Subgroup is the basal subdivision of the Late Archaean to Early Proterozoic Ghaap Group (Transvaal Supergroup), Ghaap Plateau Sub-basin. The Schmidtsdrif Subgroup can be separated into the geological older Boomplaas Formation and younger Clearwater Formation. The Ghaap Group represents 200 million years of chemical sedimentation. This chemical sedimentation within the Griqualand West Basin is represented by iron and manganese ores, cherts and carbonates.

During the site survey undertaken in June 2018, stromatolite assemblages were recorded within the Schmidtsdrif Subgroup while no fossils were recorded in the Vryburg Formation although there is a possibility that fossils could be present in this geological formation. Poorly- to fairly well-preserved, stromatolite assemblages (loose as well as *in situ*) were recorded within the project site. Mapping of the stromatolites identified within the project site was very difficult due to the vegetation and gravelly soil.

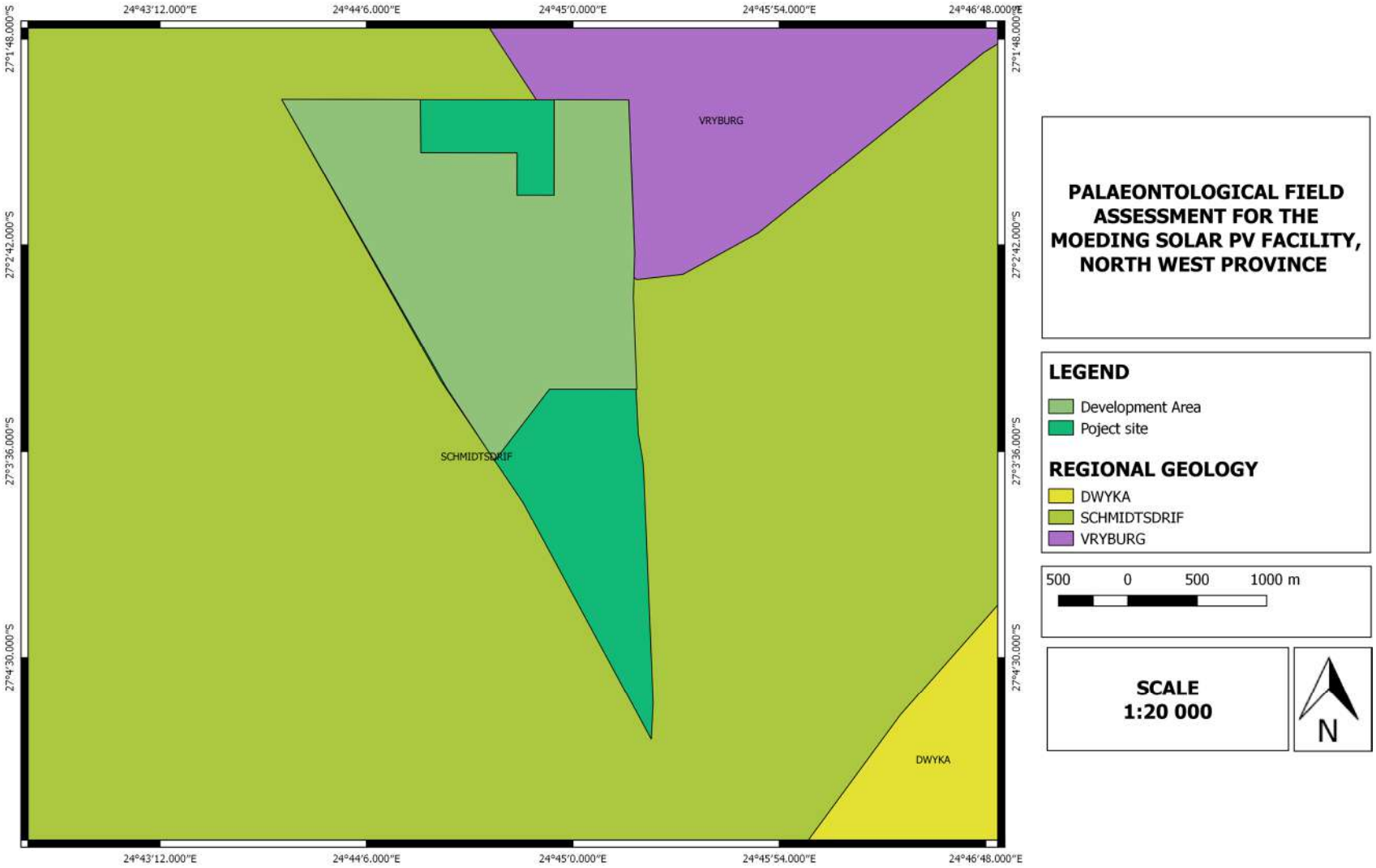

Figure 6.9: The surface geology of the proposed project site. The site is underlain by the Vryburg Formation (Transvaal Supergroup) and the Schmidtsdrift Subgroup, Ghaap Group of the Transvaal Supergroup.

CHAPTER 7 ASSESSMENT OF IMPACTS

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the development of the Moeding Solar PV Facility and its associated infrastructure. This assessment has considered the construction of a solar energy facility with a contracted capacity of up to 100MW, within a development footprint of approximately 300ha for the solar energy facility and Power Line Alternative 2 and a 300m corridor for Power Line Alternative 1. The project will comprise the following key infrastructure and components:

- Arrays of PV panels (either a static or tracking PV system).
- Mounting structures to support the PV panels.
- Cabling between the project components, to be laid underground where practical.
- On-site inverters to convert the power from a direct current to an alternating current.
- An on-site substation to facilitate the connection between the solar energy facility and the Eskom electricity grid.
- A new 132kV power line between the on-site substation and the Eskom grid connection point. Two alternatives are being considered and include:
  - Alternative 1 – a direct connection to the existing Mookodi Main Transmission Substation (MTS) located north of the project site on the Remaining Extent of the Farm Rosendal 673. A new 132kV power line will be constructed over a distance of ~4km. A 300m power line corridor has been assessed for Alternative 1.
  - Alternative 2 - a turn-in turn-out connection into the proposed Mookodi - Magopela 132kV power line (to be constructed along the eastern boundary of the project site). A new turn-in and out 132kV power line will be constructed over a distance of ~335m.
- Battery storage with up to 6 hours of storage capacity.
- Offices and workshop areas for maintenance and storage.
- Temporary laydown areas.
- Internal access roads and fencing around the development area.

The full extent of the project site was considered through the BA process by the independent specialists and the EAP. On-site sensitivities were identified through the review of existing information, desk-top evaluations and field surveys. The identification of a development footprint for the solar energy facility within the project site was proposed by the developer through consideration of the sensitive environmental features and areas as identified through the Scoping Study. A layout for the facility was designed within this development footprint. Two power line corridor alternatives were provided by the developer (refer to **Figure 7.1**) for consideration. A comparative assessment of the alternatives for the project is undertaken as part of the impact assessment in order to identify the preferred alternative from an environmental perspective.

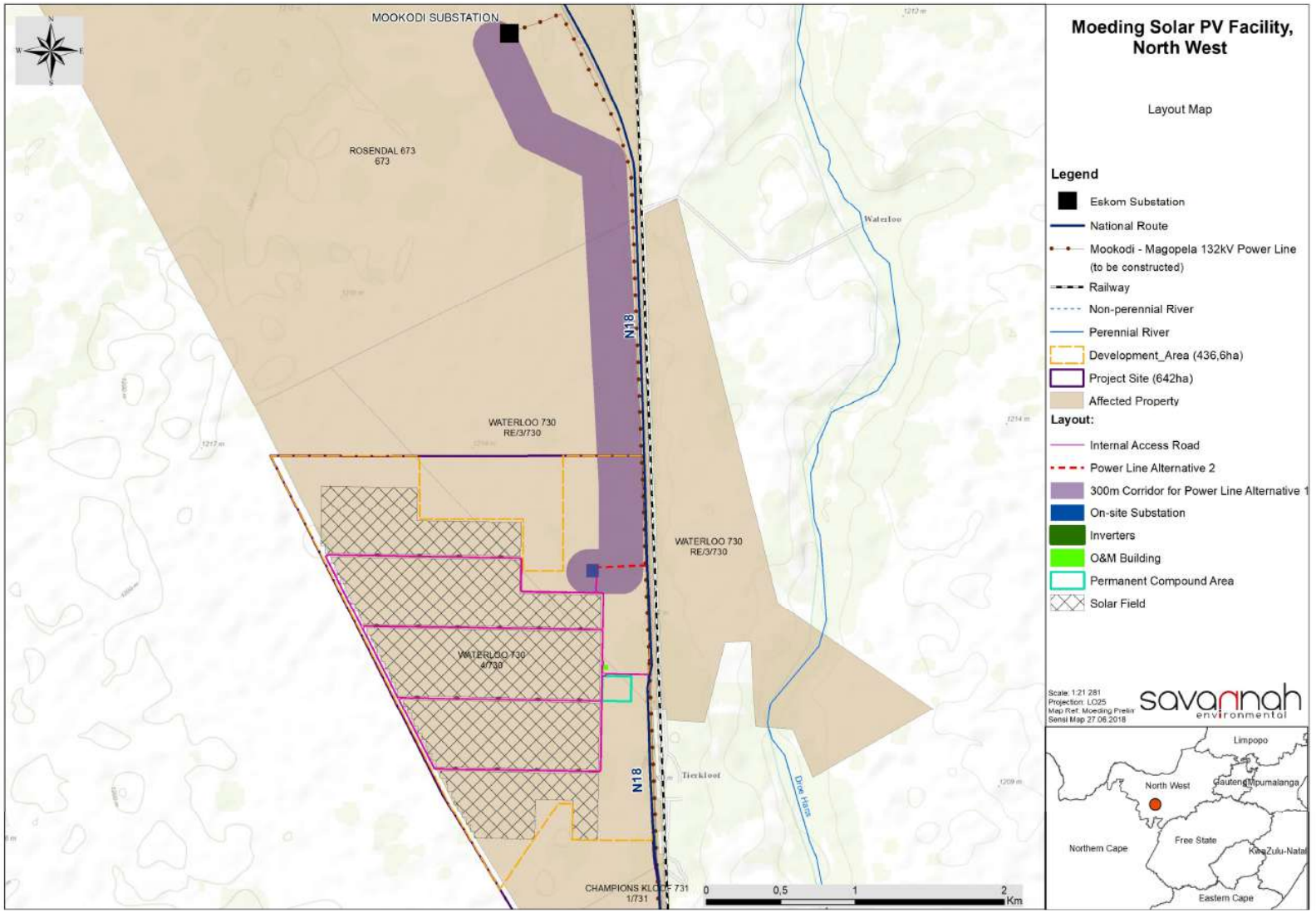

Figure 7.1: Map illustrating the proposed layout located within the development area (~436,6ha) and the two power line alternatives assessed as part of this BA process (refer to **Appendix O** for A3 maps)..

The development of the Moeding 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; 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 for the Moeding Solar PV Facility is estimated 12 to 18 months.
- *Operation* – will include the operation of the solar energy facility and the generation of electricity, which will be fed into the national grid via the facility on-site substation and an overhead power line. The operation phase of the Moeding Solar PV Facility is expected to be approximately 20 years (with maintenance).
- *Decommissioning* – depending on the economic viability of the solar energy 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 PV facility, clearance of the relevant infrastructure at the site and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to those associated with construction activities. Therefore, these impacts are not considered separately within this chapter.

Environmental issues associated with construction and decommissioning activities may include, among others, threats to biodiversity and ecological processes, including habitat alteration and impacts on fauna, impacts to sites of heritage value, soil erosion and loss of agricultural land, and nuisance from the movement of vehicles transporting equipment and materials during decommissioning.

Environmental impacts associated with the operation phase include mismanagement of the facility which may result in an increase in alien invasive species and possibly result in erosion. Other impacts associated with the operation phase includes night time lighting, impacts on visual receptors and sense of place.

7.1. Legal Requirements as per the EIA Regulations, 2014 (as amended)

This chapter of the BA report includes the following information required in terms of the EIA Regulations, 2014 - Appendix 1.

Requirement	Relevant Section
3(h)(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts (aa) can be reversed, (bb) may cause irreplaceable loss of resources, and (cc) can be avoided, managed or mitigated.	The impacts and risk associated with the development of the Moeding Solar PV Facility, including the nature, significance, consequence, extent, duration and probability of the impacts and the degree to which the impacts can be reversed and cause an irreplaceable loss of resources are included in sections 7.3.3, 7.4.3, 7.5.3, 7.6.3, 7.7.3 and 7.8.3.
3(h)(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects	The positive and negative impacts associated with the development of the Moeding Solar PV Facility are included in sections 7.3.3, 7.4.3, 7.5.3, 7.6.3, 7.7.3 and 7.8.3.
3(h)(viii) the possible mitigation measures that could be applied and the level of residual risk.	The mitigation measures that can be applied to the impacts associated with the Moeding Solar PV Facilityare

Requirement	Relevant Section
	included in sections 7.3.3, 7.4.3, 7.5.3, 7.6.3, 7.7.3 and 7.8.3.
3(i) a full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures,.	A description of all environmental impacts identified for the Moeding Solar PV Facility during the BA process, and the extent to which the impact significance can be reduced through the implementation of the recommended mitigation measures provided by the specialists are included in sections 7.3.3, 7.4.3, 7.5.3, 7.6.3, 7.7.3 and 7.8.3.
3(j) an assessment of each identified potentially significant impact and risk, including (i) cumulative impacts, (ii) the nature, significance and consequences of the impact and risk, (iii) the extent and duration of the impact and risk, (iv) the probability of the impact and risk occurring, (v) the degree to which the impact and risk can be reversed, (vi) the degree to which the impact and risk may cause irreplaceable loss of resources and, (vii) the degree to which the impact and risk can be avoided, managed or mitigated.	An assessment of each impact associated with the development of the Moeding Solar PV Facility, including the nature and significance, the extent and duration, the probability, the reversibility, and the potential loss of irreplaceable resources, as well as the degree to which the significance of the impacts can be mitigated are included in sections 7.3.3, 7.4.3, 7.5.3, 7.6.3, 7.7.3 and 7.8.3.
3(m) based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management outcomes for the development for inclusion in the EMPr.	Mitigation measures recommended by the various specialists for the reduction of the impact significance are included in sections 7.3.3, 7.4.3, 7.5.3, 7.6.3, 7.7.3 and 7.8.3.

7.2. Quantification of Areas of Disturbance on the Site

Site-specific impacts associated with the construction and operation of the Moeding Solar PV Facility relate to the direct loss of vegetation and species of special concern, disturbance of animals and loss of habitat, and impacts on soils. In order to assess the impacts associated with the Moeding Solar PV Facility, it is necessary to understand the extent of the affected area.

The project footprint being assessed for the Moeding Solar PV Facility requires an area of approximately 300ha (equivalent to 68% of the project site), of which the PV structures / modules will occupy an area of approximately 266ha, while supporting infrastructure such as internal roads (6.6ha), permanent laydown area (2ha), an on-site substation (1ha) and auxiliary buildings will occupy the remaining extent. During construction, a temporary laydown area of approximately 10ha in extent will be required.

Two alternative power line corridors are being proposed for the development for which a 300m corridor will be assessed for Power Line Alternative 1. Power Line Alternative 2 is situated within the project site assessed for the solar energy facility. It is within this corridor and/or development area that a 132kV power line will be located to connect the Moeding Solar PV Facility to the national grid. The servitude of the power line will be up to 31m in width, with the towers required to support the power line up to 24m in height.

7.3. Potential Impacts on Ecology and Hydrology (Ecology, Flora, Fauna and Wetlands)

The majority of the ecological impacts associated with the development would occur during the construction phase as a result of the disturbance associated with site clearance, excavations, the operation of heavy machinery at the site and the presence of construction personnel. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix D** for more details).

7.3.1. Results of the Ecological Impact Assessment

7.3.1.1 Ecology

Specific habitats (ecosystems) and features have been identified within the project site, and have been investigated by the specialist to determine the sensitivity of the habitats and features in order to determine the potential for and significance of the impacts associated with the proposed Moeding Solar PV Facility. The habitats present include (refer to **Table 7.1** below):

- Savannah Grassland;
- Savannah Shrubland;
- Tree Savannah;
- Savannah Woodland;
- Depression "Pan" Wetlands; and
- Severely transformed and disturbed areas.

Table 7.1: Details of the five habitat communities identified within the Moeding Solar PV Facility project site

Habitat Unit	Description
Open Vaalbos Shrubland (conservation Status - medium to low with a moderate species diversity)	This habitat provides several ecosystem functions including vegetation for grazing and stabilisation of soils, infiltration of runoff, prevention of soil degradation and maintenance of pollinator populations. Denser tree patches provide additional niches and habitats for other plants and faunal species. Two Red Data species have been confirmed within the project site and includes *Boophone disticha* (Declining) and *Acacia eroloba* (Declining). There is also a high potential for occurrence of the White-tailed Mouse (Endangered), African Striped Weasel (Near Threatened), South African Hedgehog (Near Threatened) and Black-footed cat (Vulnerable). Protected species frequently observed include *Babian hypogea* and occasionally observed *Ammocharis coranica* and *Aloe greatheadii.* Considering the functionality and condition of the habitat, as described above, the levels of change proposed to the habitat through the development of the Moeding Solar PV Facility is considered acceptable. This habitat has already been impacted through trampling and overgrazing, and is in a moderately disturbed state which has altered some of the functions provided by this habitat type. A sensitivity rating of medium to low has been applied to this habitat within the Moeding Solar PV Facility project site.
Short Griekwa Karee Shrubland (conservation status - medium to low with a moderate species diversity)	This habitat provides several ecosystem functions including vegetation for grazing and stabilisation of soils, infiltration of runoff, prevention of soil degradation and maintenance of pollinator populations. Moderate species diversity adds to resilience of vegetation to drought and continued availability of resources to fauna. One Red Data species have been confirmed within the project site and includes *Boophone disticha* (Declining). There is also a high potential for occurrence of the White-tailed Mouse

Habitat Unit	Description
	(Endangered) and African Striped Weasel (Near Threatened). A single population of *Nerine laticoma* (protected) was observed within the project site. Considering the functionality and condition of the habitat, as described above, the levels of change proposed to the habitat through the development of the Moeding Solar PV Facility is considered acceptable. This habitat has already been impacted through trampling and overgrazing, and is in a moderately disturbed state which has altered some of the functions provided by this habitat type. A sensitivity rating of medium to low has been applied to this habitat within the Moeding Solar PV Facility project site.
Palaeo drainages (conservation status - medium as a result of the high local moisture content)	This habitat provides several ecosystem functions including vegetation for grazing and stabilisation of soils, absorption and reduction of occasional flash floods, infiltration of runoff, retention of nutrients and filtering of runoff, potential corridor for faunal movement and migration, niche and source of food for animals and is considered to be a unique habitat (variation from typical Vaalbos Savanna found in the area). No Red Data species have been confirmed within the project site but there is a high potential for occurrence of the Giant Bullfrog (Near Threatened), White-tailed Mouse (Endangered) and African Striped Weasel (Near Threatened). Occasional populations of *Nerine laticoma*, typically occurring in small populations of not more than 6 – 8 species per population, were identified within this habitat unit. Considering the functionality and condition of the habitat, as described above, the levels of change proposed to the habitat through the development of the Moeding Solar PV Facility is considered acceptable. This habitat has already been impacted through trampling and overgrazing, and is in a moderately disturbed state which has altered some of the functions provided by this habitat type. A sensitivity rating of medium has been applied to this habitat within the Moeding Solar PV Facility project site and power line corridor.
Tall Vaalbos Shrubland (conservation status - medium to low)	This habitat provides several ecosystem functions including vegetation for grazing and stabilisation of soils, infiltration of runoff, prevention of soil degradation and maintenance of pollinator populations. One Red Data species have been confirmed within the project site and includes *A. erioloba* (Declining). There is also a high potential for occurrence of the African Striped Weasel (Near Threatened) and South African Hedgehog (Near Threatened). Considering the functionality and condition of the habitat, as described above, the levels of change proposed to the habitat through the development of the Moeding Solar PV Facility is considered acceptable. This habitat has already been impacted through trampling and overgrazing, and is in a moderately disturbed state which has altered some of the functions provided by this habitat type. A sensitivity rating of medium to low has been applied to this habitat within the Moeding Solar PV Facility project site and power line corridor.
Tall Karee Woodland (conservation status - medium to low with a moderate species diversity)	This habitat provides several ecosystem functions including vegetation for grazing and stabilisation of soils, infiltration of runoff, prevention of soil degradation and maintenance of pollinator populations. Denser tree patches provide additional niches and habitats for other plants and faunal species. One Red Data species have been confirmed within the project site and includes *Boophone disticha* (Declining). There is also a high potential for occurrence of the White-tailed Mouse (Endangered), African Striped Weasel (Near Threatened), South African Hedgehog (Near Threatened) and Black-footed cat (Vulnerable). Protected species occasionally observed include *Ammocharis coranica* and *Aloe greatheadii.*

Habitat Unit	Description
	Considering the functionality and condition of the habitat, as described above, the levels of change proposed to the habitat through the development of the Moeding Solar PV Facility is considered acceptable. This habitat has already been impacted through trampling and overgrazing, and is in a moderately disturbed state which has altered some of the functions provided by this habitat type. A sensitivity rating of medium to low has been applied to this habitat within the Moeding Solar PV Facility project site.
Secondary Open Woodland (conservation status - low with a moderate species diversity)	This habitat provides several ecosystem functions including limited grazing and stabilisation of soils, infiltration of runoff and maintenance of pollinator populations. Denser tree patches provide additional niches and habitats for other plants and faunal species. This vegetation unit has impaired functionality especially during the dry season. No Red Data species have been confirmed within the project site but there is a high potential for occurrence of the African Striped Weasel (Near Threatened), South African Hedgehog (Near Threatened) and Black-footed cat (Vulnerable). Protected species occasionally observed include *Aloe greatheadii*. This vegetation unit falls outside of the development footprint and subsequently will not be impacted by the proposed development. A sensitivity rating of low has been applied to this habitat within the Moeding Solar PV Facility project site.
Tall Mixed Woodland Patch (conservation status - low with a moderate species diversity)	This habitat provides several ecosystem functions including limited grazing, niche and source of food for animals and maintenance of pollinator populations. This habitat unit is considered to be unique and contribute to habitat, faunal and floral diversity within the affected region. Due to levels of disturbance and location to human presence, no Red Data Species have been confirmed within the project site. Considering the functionality and condition of the habitat, as described above, the levels of change proposed to the habitat through the development of the Moeding Solar PV Facility is considered acceptable. This habitat has already been impacted through trampling and overgrazing, and is in a moderately disturbed state which has altered some of the functions provided by this habitat type. A sensitivity rating of medium has been applied to this habitat within the Moeding Solar PV Facility project site.
Tall Woodland Fringe (conservation status – medium)	This habitat provides several ecosystem functions including grazing and stabilisation of soils, infiltration of runoff, Soil conservation, accumulation and slowing down of runoff and maintenance of pollinator populations. This unit is considered to be a corridor for movement of faunal species between depression wetland and terrestrial habitat. One Red Data species have occasionally been observed and include *Acacia erioloba* (Declining). South African Hedgehog (Near Threatened) has a high potential for occurring within the project site. Most of the habitat unit are located within the recommended wetland buffer zones or outside of buffer zones but also outside the development footprint and subsequently can be maintained intact. Subsequently no change in the morphology and vegetation structure of these depressions and their associated vegetation are likely to occur. A sensitivity rating of medium has been applied to this habitat within the Moeding Solar PV Facility project site.
Depression "Pan" Wetlands (conservation status - high as some species	This habitat provides several ecosystem functions including seasonal preferential grazing, a corridor for faunal movement between habitat types and a niche habitat which ensures persistence of organisms and provides seasonal water and food to migrating fauna. Larger shrubs and small trees on the periphery provide (Tall Woodland Fringe) nesting space for birds

Habitat Unit	Description
are restricted to these areas)	and shelter/breeding areas for fauna. One Red Data species have occasionally been observed within the outer boundary of the pan wetlands and include *Acacia erioloba* (Declining). Giant Bullfrog (Near Threatened) has a high potential for occurring within the project site. These wetlands are situated outside of the development footprint and subsequently can be maintained intact. Subsequently no change in the morphology and vegetation structure of these depressions and their associated vegetation, including the Tall Woodland periphery of these wetlands, should be allowed. A sensitivity rating of very high has been applied to this habitat and is therefore considered to be a no-go area for development.
Severely transformed and disturbed areas	Areas within the project site that have been severely transformed by historical and current anthropogenic activities are considered to be of a low sensitivity due to the disturbance which has resulted in whole-scale change in the associated areas and habitat. The areas classified as being of a low sensitivity include: » Highly trampled and severely overgrazed areas. » All areas containing infrastructure such as buildings, cattle kraals, cement dams, etc. » The existing power line and water pipeline servitude; » Sand and gravel quarries.

7.3.1.2. Hydrology

Surface water features identified within the project site include five depression wetlands (pans) and one small drainage line (~107 m), connecting Wetlands 1 and 2. The drainage line is situated at the base of the almost inconspicuous, low ridge line. The depression wetlands are described as follows:

» Wetland 1:
» This depression wetland is regarded as largely natural to semi-natural with limited transformation. Disturbances within this depression include trampling and grazing (cattle), dirt road (twin track) and farm fences.
»
» Prominent ecosystem functions and services provided by this wetland includes:
  * Collection and retention of runoff and associated resources after large rainfall events.
  * Seasonal preferential grazing.
  * Niche habitat ensures persistence of organisms and provides seasonal water and food to migrating fauna.

» Wetland 2:
» This depression wetland is regarded as largely natural to semi-natural with limited transformation. Disturbances within this depression include trampling and grazing (cattle) and a dirt road (twin track).
»
» Prominent ecosystem functions and services provided by this wetland includes:
  * Collection and retention of runoff and associated resources after large rainfall events.
  * Seasonal preferential grazing.
  * Niche habitat ensures persistence of organisms and provides seasonal water and food to migrating fauna.
  * Larger shrubs and small trees on the periphery provide nesting space for birds and shelter/breeding areas for fauna.

» Wetland 3:
» This depression wetland is regarded as mostly natural with very limited disturbance, mostly in the form of trampling and grazing by livestock (cattle).
»
» Prominent ecosystem functions and services provided by this wetland includes:
  * Collection and retention of runoff and associated resources after large rainfall events.
  * Seasonal preferential grazing.
  * Larger shrubs and small trees on the periphery provide nesting space for birds and shelter/breeding areas for fauna.

» Wetland 4:
» This depression wetland is considered the most disturbed of the wetlands occurring within the project site but can still be classified as semi-natural. Important disturbances within this wetland include; trampling and grazing (cattle), two dirt roads (twin tracks) and some quarrying for rock, sand and also likely lime (small isolated portions along the southern and western boundaries of the wetland).
»
» Prominent ecosystem functions and services provided by this wetland includes:
  * Collection and retention of runoff and associated resources after large rainfall events.
  * Seasonal preferential grazing.
  * Niche habitat ensures persistence of organisms and provides seasonal water and food to migrating fauna.
  * Larger shrubs and small trees on the periphery provide nesting space for birds and shelter/breeding areas for fauna.

» Wetland 5:
» This depression wetland is regarded as disturbed and transformed, especially the catchment area which is a secondary open savannah woodland on historically cultivated areas. Other disturbances include, high levels of trampling and grazing (cattle) and an alteration to the vegetation composition (numerous weeds and alien plants).
»
» Prominent ecosystem functions and services provided by this wetland includes:
  * Collection and retention of runoff and associated resources after large rainfall events.

Figure 7.2 provides an illustration of the surface hydrological features identified within the project site.

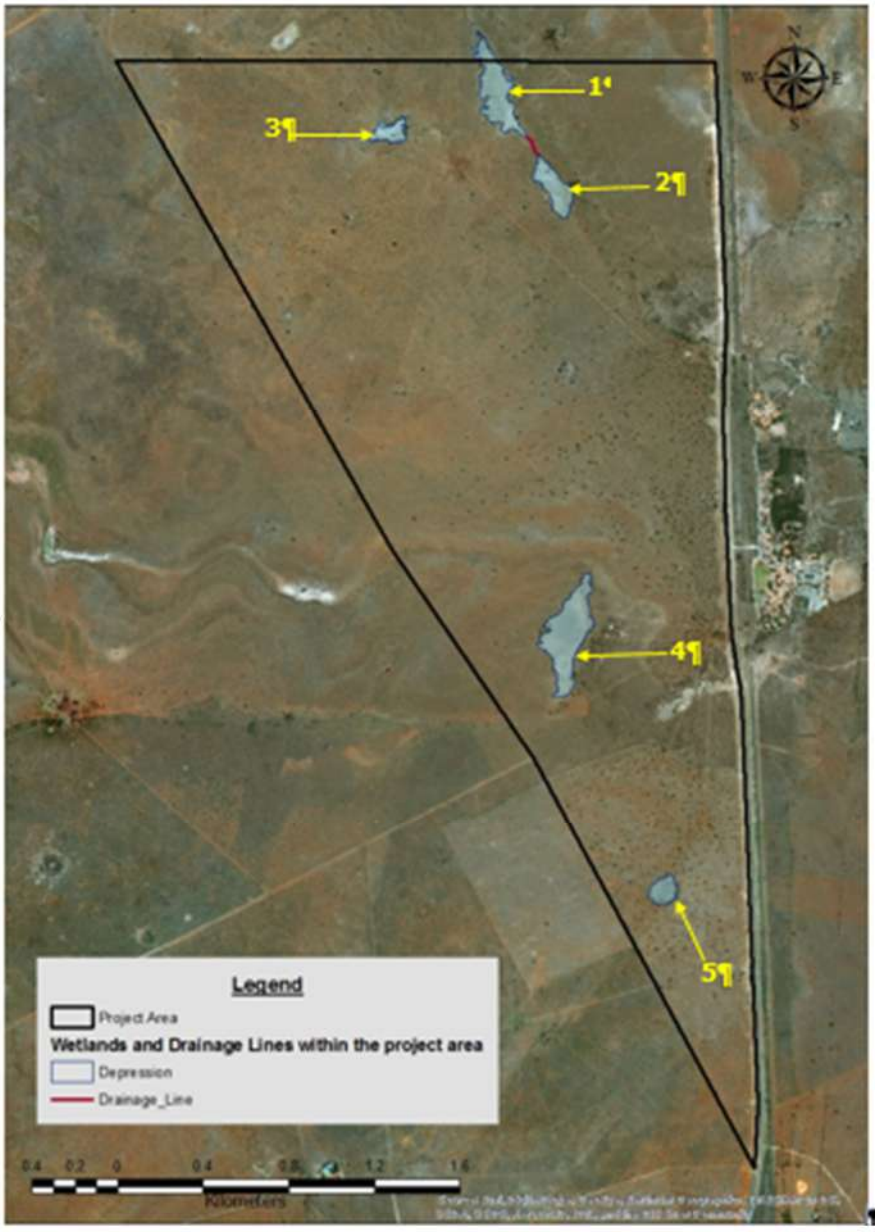

Figure 7.2: Surface hydrological features identified within the Moeding Solar PV Facility project site.

An ecological and hydrological (surface) sensitivity map is included within **Figure 7.3.**

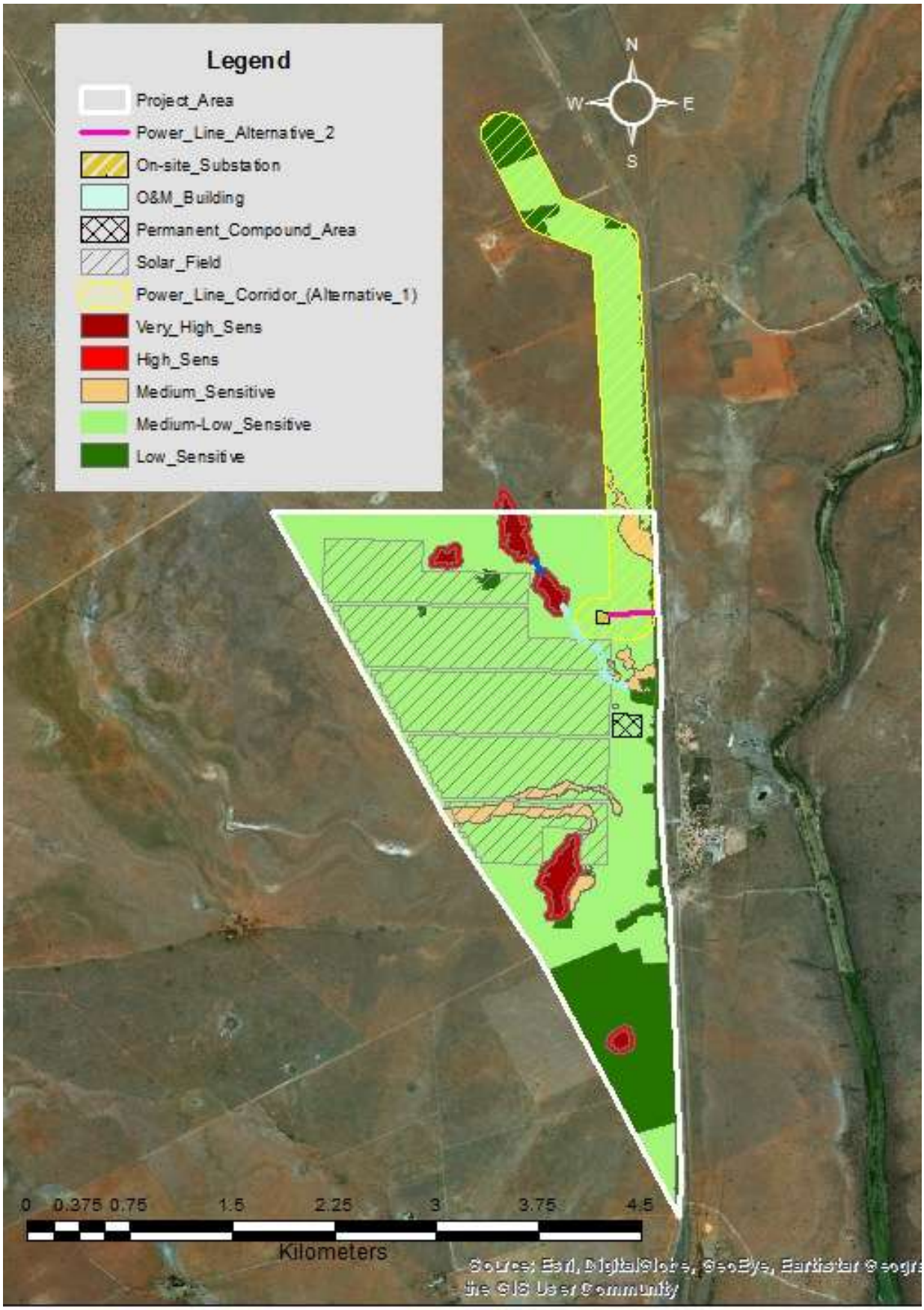

Figure 7.3: Ecology and hydrology sensitivity map of the project site and power line alternatives overlain with the proposed development footprint.

7.3.2. Description of Ecological and Hydrological Impacts

Potential impacts on the ecology of the project site due to the Moeding Solar PV Facility would stem from a variety of activities and risk factors associated with the construction and operation phases of the project.

Construction Phase Impacts

- Site clearing and exploration activities for site establishment.
- Vegetation clearing could impact listed plant species. Vegetation clearing would also lead to the loss of vegetation communities and habitats for fauna and potentially the loss of faunal species, habitats and ecosystems. On a larger and cumulative scale (if numerous and uncontrolled developments are allowed to occur in the future in the surrounding areas) the loss of these vegetation communities and habitats may potentially lead to a change in the conservation status of the affected vegetation type as well as the ability of this vegetation type and associated features to fulfil ecological responsibilities (functions).
- Soil compaction and increased erosion risk would occur due to the loss of plant cover and soil disturbance created during the construction phase. This may potentially impact the downstream watercourses, wetlands and aquatic habitats located outside of the project site, mainly due to an increase of surface water and silt inflow from the surrounding disturbed areas. These potential impacts may result in a reduction in the buffering capacities of the landscape during extreme weather events.
- Movement of construction vehicles and placement of infrastructure within the boundary of the palaeo drainage line may lead to the disturbance of this habitat, removal of vegetation cover and a potential increase in erosion which may eventually spread into downstream areas.
- Invasion by alien plants may be attributed to excessive disturbance to vegetation, creating a window of opportunity for the establishment of alien invasive species. In addition, regenerative material of alien invasive species may be introduced to the project site by machinery traversing through areas with such plants or materials that may contain regenerative materials of such species.
- Presence and operation of construction machinery on the project site. This will create a physical impact as well as generate noise, potential pollution and other forms of disturbance at the site.
- Increased human presence can lead to poaching, illegal plant harvesting and other forms of disturbance such as fire.

Operation Phase impacts

- The facility will require management and if this is not done effectively, it could impact adjacent intact areas through impacts such as erosion and the invasion of alien plant species.

During both the construction and operation phases human presence and uncontrolled access may result in negative impacts on fauna and flora through poaching of fauna and uncontrolled collection of plants for traditional medicine or other purposes.

7.3.3. Impact tables summarising the significance of impacts on ecology and hydrology during construction and operation (with and without mitigation)

The impacts assessed below apply to the project site and all alternatives proposed and assessed for the Moeding Solar PV Facility. Due to the current development footprint, which already avoids highly sensitive features, the significance of the impacts after mitigation is low.

Solar Energy Facility: Construction Phase Impacts

Nature: *Potential impacts on vegetation and listed protected plant species* There are a number of listed and protected species present at the project site and it is highly likely that some of these would be impacted by the development. Vegetation clearing during construction will lead to the loss of currently intact habitat within the development footprint and is an inevitable consequence of the development.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Minor (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (44)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Highly Probable	Moderate Probability
Can impacts be mitigated?	Reasonably but with limited full restoration potential.	

Mitigation:

- Pre-construction walkthrough of the final development footprint for species of conservation concern that would be affected and that can be translocated. Should be undertaken by a suitably qualified botanist.
- Since a large proportion of the identified conservation-worthy species at the site are geophytic and succulent species (e.g. *Aloe greatheadii, Nerine laticoma, Babiana hypogea 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 walkthrough survey, and according to the recommended ratios. Permits from the relevant provincial authorities, i.e. the North West Department of Rural, Environment and Agricultural Development (READ), 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 ECO and/or Contractor's Environmental Officer (EO).
- Pre-construction environmental induction for all construction staff on site must be provided to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, 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.
- ECO and/or Contractor's EO must 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 on demarcated roads 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 ECO and or Contractor's EO, and without the relevant permits.
» No fires must be allowed on-site.

Residual Impacts:
Some loss of vegetation is inevitable and cannot be avoided.

Nature: *Potential faunal impacts*
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.

Disturbance could have a negative impact on the breeding activities of various species, particularly if this occurs during a sensitive period in the breeding cycle. Species of concern are predominantly Kori Bustards. Other small avian species do occur within the development footprint but these species are non-Red Data species.

The proposed site is located within an agricultural habitat close to National and Domestic roads. Therefore, species within this landscape often experience disturbance. As a result, disturbance of birds by the proposed power line construction activities is anticipated to be of low significance as birds will move away from the area temporarily. The relatively small scale of the development (in relation to the large agricultural landscape in the region) is unlikely to have a significant impact on avifauna. However, species are particularly sensitive to disturbance during the breeding season and this must be borne in mind during the construction phase.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (7)	Minor (3)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Moderate Probability	Low Probability
Can impacts be mitigated?	Noise and disturbance during the construction phase 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:
» Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person, e.g. the Contractor's EO.
» All personnel must undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.
» All hazardous materials used during construction 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 is recommended) to avoid collisions with susceptible species such as snakes and tortoises.
» When possible, no activity should be undertaken at the site between sunset and sunrise, except for security personnel guarding the development.
» Any dangerous fauna (snakes, scorpions etc.) that are encountered during construction should not be handled or antagonised by the construction staff and the ECO or other suitably qualified person(s), e.g. the Contractor's EO, should be contacted to remove the animals to safety.

- » No litter, food or other foreign material must be thrown or left around the site and must be placed in demarcated and fenced rubbish and litter areas that are animal proof.
- » The collection, hunting or harvesting of any plants or animals at the site must be strictly forbidden. Personnel must not be allowed to wander off the demarcated construction site.
- » Fires must not be allowed on site.

Residual Impacts:

The altered development area will contain a lower diversity of habitat types and niches for faunal species. Faunal diversity is relatively low and subsequently the residual impact will not be significant.

Nature: *Potential increased erosion risk during construction*

During construction, 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 (2)	Local (1)
Duration	Long-term (4)	Short-term (1)
Magnitude	Moderate (6)	Minor (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (48)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Low – if erosion has reached severe levels the impacts will not be remedied easily.	High
Irreplaceable loss of resources?	Moderate Probability	Low Probability
Can impacts be mitigated?	Yes, to a large extent.	

Mitigation:

- » Any erosion problems observed within the development area as a result of the construction activities should be rectified immediately and monitored thereafter to ensure that they do not re-occur.
- » All bare areas resulting from the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential.
- » Roads and other disturbed areas within the development area should be regularly monitored for erosion problems and problem areas should receive follow-up monitoring to assess the success of the remediation.
- » Silt traps should be used where there is a danger of topsoil or material stockpiles eroding and entering watercourses and other sensitive areas.
- » Topsoil should be removed from construction areas and stored separately from subsoil. Topsoil should 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 should be practiced so that cleared areas are not left un-vegetated and vulnerable to erosion for extended periods of time.
- » Construction of gabions and other stabilisation features must be undertaken to prevent erosion, where deemed necessary.
- » Activity at the site must be reduced after large rainfall events when the soils are wet. No driving off of hardened roads should occur at any time and particularly following large rainfall events.

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.

Nature: *Impact on "pan" wetlands through the possible increase in surface water runoff during construction*

The primary threat associated with wetlands during the construction phase, is increased run-off, sediment inputs and turbidity. This is during vegetation clearing for the PV arrays and excavation of pits for the foundations of the individual PV panels. An increase in volume and velocity of surface water flow from the cleared construction areas into the wetlands, may result in the loss of natural wetland vegetation and formation of erosion gullies.

The likelihood of these impacts occurring is however relatively low due to the geographical location of the proposed development footprint (within a relatively low lying flat to slightly sloping landscape). The potential risk and significance of this impact will furthermore be significantly reduced through the implementation and maintenance of the recommended buffer areas. The potential for these impacts to occur can also furthermore be eluded with diligent and effective mitigation measures in place.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Short-term (1)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (8)**
Status (positive or negative)	Negative	Negative
Reversibility	Low – if erosion has reached severe levels the impacts will not be remedied easily.	High
Irreplaceable loss of resources?	Moderate Probability	Low Probability
Can impacts be mitigated?	Yes, to a large extent.	

Mitigation:

» No activities may be allowed outside of the development area, and especially within the identified wetland areas as these areas are regarded as no-go areas.

As all identified wetlands are located outside of the development footprint, the most likely potential impacts on the wetlands will be of an indirect nature and as such the following mitigations measures, although not directly associated with the wetlands, are recommended:

» Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effectively 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).
» No unnecessary vegetation clearance may be allowed and vegetation should be allowed to persist under and around the PV panels once operational.
» Apart from the specified linear activities that are allowed, no other activities and infrastructure may be allowed or placed within the recommended wetland buffer areas whose natural vegetation cover should be maintained.

Residual Impacts:

By avoiding the identified wetland areas and recommended buffer zones, residual impacts are unlikely to be present.

Nature: *Increase sedimentation and erosion during construction*

The primary threat associated with wetlands during the construction phase is increased run-off, sediment inputs and turbidity. This could occur during vegetation clearing for the PV arrays and excavation of pits for the foundations of the individual PV panels. An increase in volume and velocity of surface water flow from the cleared construction areas into the wetlands may result in erosion and an increase in sediment inputs into the pan wetlands in the vicinity of the development area.

The likelihood of these impacts occurring are however relatively low due to the geographical location of the proposed

development footprint (within a relatively low lying flat to slightly sloping landscape). The potential risk and significance of this impact will furthermore be significantly reduced through the implementation and maintenance of the recommended buffer areas. The potential for these impacts to occur can also furthermore be eluded with diligent and effective mitigation measures in place.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Short-term (1)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (8)**
Status (positive or negative)	Negative	Negative
Reversibility	Low – if erosion has reached severe levels the impacts will not be remedied easily.	High
Irreplaceable loss of resources?	Moderate Probability	Low Probability
Can impacts be mitigated?	Yes, to a large extent.	

Mitigation:

As all identified wetlands are located outside of the development footprint, most potential impacts on the wetlands will be of an indirect nature and as such the following mitigation measures, although not directly associated with the wetlands, are recommended in order to avoid the encroachment of erosion into these habitats or a reduction in water quality due to an increase in sedimentation into these systems:

- Any erosion problems observed as a result of the development 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.
- Roads used for project-related activities 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.
- Silt traps must be used where there is a danger of topsoil or material stockpiles eroding and entering streams and other sensitive areas.
- Topsoil must be removed and stored separately and should be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas.
- Where practical, phased development and vegetation clearing should be applied so that cleared areas are not left un-vegetated and vulnerable to erosion for extended periods of time.
- Construction of gabions and other stabilisation features on steep slopes must be undertaken to prevent erosion, if deemed necessary.
- Activity at the site must be reduced after large rainfall events when the soils are wet. No driving off of hardened roads should occur at any time, and particularly immediately following large rainfall events.
- Apart from the specified linear activities that are allowed, no other activities and infrastructure may be allowed or placed within the recommended wetland buffer areas whose natural vegetation cover should be maintained.

Residual Impacts:

By avoiding the identified wetland areas and recommended buffer zones residual impacts are unlikely to be present.

Nature: *Potential impact on localised surface water quality*

During the construction phase, chemical pollutants (hydrocarbons from equipment and vehicles), cleaning fluids, cement and contaminated water could be washed downslope into the pan wetlands and eventually affect water quality.

The likelihood of this impact occurring is however relatively low due to the geographical location of the proposed development footprint (within a relatively low lying flat to slightly sloping landscape). The potential risk and significance of this impact will furthermore be significantly reduced through the implementation and maintenance of

the recommended buffer areas. The potential for these impacts to occur can also furthermore be eluded with diligent and effective mitigation measures in place.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Short-term (1)
Magnitude	High (8)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (39)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Low – if erosion has reached severe levels the impacts will not be remedied easily.	High
Irreplaceable loss of resources?	Moderate Probability	Low Probability
Can impacts be mitigated?	Yes, to a large extent.	

Mitigation:

» Strict use and management of all hazardous materials used on site must be implemented.
» Strict management must be implemented of potential sources of pollutants (e.g. litter, hydrocarbons from vehicles and machinery, cement during construction etc.).
» Containment of all contaminated water by means of careful run-off management on the development area must be undertaken.
» Infrastructure may not be placed within the recommended buffer areas whose natural vegetation cover should be maintained in a natural condition.
» Due to the low gradient of most of the development footprint, any accidental spill or leakage of hazardous or harmful substances can be effectively contained around the source of the spillage. In the case of such an accidental spillage, prompt and effective action is required in order to prevent the spillage form spreading and to successfully rehabilitate the contaminated area.

Residual Impacts:
By avoiding the identified wetland areas and recommended buffer zones, residual impacts are unlikely to be present.

Solar PV Facility: Operation Phase Impacts

Nature: *Potential increased alien plant invasion during operation*
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 during the operation phase 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	Highly Probable (4)	Highly Probable (4)
Significance	**Moderate (56)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Highly Probability	Moderate Probability
Can impacts be mitigated?	Yes, to a large extent.	

Mitigation:

» Regular monitoring for alien plants at the site should occur and could be conducted simultaneously with erosion monitoring.
» When alien plants are detected, these should 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 should aim to keep disturbance to a minimum and must be undertaken in accordance with relevant guidelines.
» No planting or importing of any alien species to the site for landscaping, rehabilitation or any other purpose should be allowed.

Residual Impacts:

With appropriate mitigation such as regular monitoring and eradication, residual impacts will be very low and will likely comprise of few alien plants establishing for short periods of time between monitoring and eradication phases.

Nature: *Altered runoff patterns due to rainfall interception by PV panel infrastructure and compacted areas resulting in high levels of erosion*

Disturbance created during construction could take several years to fully stabilise and the presence of hardened surface 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 (1)
Magnitude	Moderate (7)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (12)**
Status (positive or negative)	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 (monitoring and inspections done by the Operations and Management Team).
» Shading from PV panels may prevent or slow down the re-establishment of some desirable vegetation species, therefore re-establishment should be monitored and species composition adapted if vegetation fails to establish sufficiently.
» Alternatively, soil surfaces where no re-vegetation 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 large 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 channeled or stormwater adequately controlled to prevent localised rill and gully erosion.
» Any erosion problems observed within the development site should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
» Roads and other disturbed areas within the development site 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 themselves with a good

vegetation cover. With appropriate avoidance and mitigation, residual impacts will be very low.

Nature: *Altered runoff patterns due to rainfall interception by PV panel infrastructure and compacted areas resulting in high levels of erosion, sedimentation and turbidity within the lower lying "pan" wetland areas.*

Disturbance created during construction could take several years to fully stabilise and the presence of hardened surface (roads) will generate a large amount of runoff which will pose a significant erosion risk, if not managed. For wetlands, the primary threat related to PV developments during the operation phase, is such increased run-off, erosion, sediment inputs, as well as turbidity.

The likelihood of these impacts occurring are however relatively low due to the geographical location of the proposed development footprint (within a relatively low lying flat to slightly sloping landscape). The potential risk and significance of this impact will furthermore be significantly reduced through the implementation and maintenance of the recommended buffer areas. The potential for these impacts to occur can also furthermore be eluded with diligent and effective mitigation measures in place.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Short-term (1)
Magnitude	Moderate (6)	Small (0)
Probability	Improbable (2)	Very improbable (1)
Significance	**Low (24)**	**Low (2)**
Status (positive or negative)	Negative	Neutral – Slightly Negative
Reversibility	Low	High
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, 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 (monitoring and inspections done by the Operations and Management Team).
- All mitigation measures pertaining to erosion should be strictly adhered to and promptly executed, which include regular monitoring.
- Due to the low gradient of most of the development area any accidental spill or leakage of hazardous or harmful substances can be effectively contained around the source of the spillage and in the case of such an accidental spillage prompt and effective action is required in order to prevent the spillage from spreading and to successfully rehabilitate the contaminated area.

Residual Impacts:

By avoiding the identified wetland areas and recommended buffer zones, residual impacts are unlikely to be present.

Power Line: Construction Phase Impacts

Nature: *Potential impacts on vegetation and listed protected plant species*

There are only a few listed and protected species present at the project site and within the power line corridor, and it is highly likely that some of these would be impacted by the development. Vegetation clearing during construction will lead to the loss of currently intact habitat within the development footprint and is an inevitable consequence of the development.

	Alternative 1		**Alternative 2**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**

Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)	Small (1)	Small (0)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (21)**	**Low (18)**	**Low (15)**
Status (positive or negative)	Negative	Negative	Negative	Slightly Negative
Reversibility	Moderate	High	Moderate	High
Irreplaceable loss of resources?	Limited loss of resources	Very limited loss of resources	Very limited loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent.			

Mitigation:

» Pre-construction walkthrough of the final power line alignment for species of conservation concern 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 greatheadii, Babiana hypogea* 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 walkthrough survey, and according to the recommended ratios. Permits from the relevant provincial authorities, i.e. the North West Department of Rural, Environment and Agricultural Development (READ), will be required to relocate and/or disturb listed plant species.
» Any individuals of protected species affected by and observed within the development footprint (including the power line corridor) during construction should be translocated under the supervision of the ECO and/or 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.
» ECO and/or 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 on demarcated roads and no unnecessary driving in the veld outside these areas should be allowed.
» Regular dust suppression during construction, if deemed necessary, must be undertaken in exposed areas, especially along access roads.
» No plants may be translocated or otherwise uprooted or disturbed for rehabilitation or other purpose without express permission from the ECO and or Contractor's EO.
» No fires should be allowed on-site.

Residual Impacts:

Some loss of vegetation is inevitable and cannot be avoided.

Nature: *Faunal impacts due to construction activities*

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.

Disturbance could have a negative impact on the breeding activities of various species, particularly if this occurs

during a sensitive period in the breeding cycle. Species of concern are predominantly Kori Bustards. Other small avian species do occur within the development footprint but these species are non-Red Data species.

The proposed site is located within an agricultural habitat close to National and Domestic roads. Therefore, species within this landscape often experience disturbance. As a result, disturbance of birds by the proposed power line construction activities is anticipated to be of low significance as birds will move away from the area temporarily. The relatively small scale of the development (in relation to the large agricultural landscape in the region) is unlikely to have a significant impact on avifauna. However, species are particularly sensitive to disturbance during the breeding season and this must be borne in mind during the construction phase.

	Alternative 1		**Alternative 2**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Medium-term (3)	Short-term (2)	Medium-term (3)	Short-term (2)
Magnitude	Low (4)	Minor (2)	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (15)**	**Low (18)**	**Low (15)**
Status (positive or negative)	Negative	Slightly Negative	Slightly Negative	Slightly Negative
Reversibility	Medium	High	High	High
Irreplaceable loss of resources?	Slight loss of resources	Unlikely	Very slight loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent.			

Mitigation:

- Site access must be controlled and no unauthorised persons must be allowed onto the site.
- Any fauna directly threatened by the construction activities must be removed to a safe location by the ECO or other suitably qualified person.
- The collection, hunting or harvesting of any plants or animals at the site must be strictly forbidden. Personnel must not be allowed to wander off the demarcated construction site.
- Fires must not be allowed on site.
- All hazardous materials must be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site must be cleaned up in the appropriate manner as related to the nature of the spill.
- All construction vehicles must 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:

Residual impacts would be very low with a very slight loss of natural habitat for faunal species.

Nature: *Potential increased erosion risk during construction*

During construction, there will be disturbed and loose soil within the power line corridor which will render the area vulnerable to erosion.

	Alternative 1		**Alternative 2**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Medium-term (3)	Short-term (2)	Medium-term (3)	Short-term (2)
Magnitude	Low (4	Minor (2)	Minor (2)	Small (0)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (15)**	**Low (18)**	**Low (9)**
Status (positive or negative)	Negative	Slightly Negative	Negative	Slightly Negative
Reversibility	Medium	High	High	High
Irreplaceable loss of resources?	Slight loss of	Very slight loss of	Very slight loss of	Unlikely

	resources	resources	resources	
Can impacts be mitigated?	Yes, to a large extent.			

Mitigation:

» Any erosion problems observed within the power line servitude or along access roads as a result of the power line development must be rectified immediately and monitored thereafter to ensure that they do not re-occur.
» All bare areas (excluding agricultural land) resulting from the development must be re-vegetated with locally occurring species, to bind the soil and limit erosion potential.
» 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).
» Roads and other disturbed areas within the power line servitude must be regularly monitored for erosion problems and problem areas must 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:

With appropriate avoidance and mitigation, residual impacts will be very low and may be limited to very limited and local area containing some erosion features with little potential to spread beyond the point of origin.

Power Line: Operation Phase Impacts

Nature: *Increased alien plant invasion during operation*

The disturbed and bare ground that is likely to be present at the site after construction will leave the site vulnerable to alien plant invasion for some time, and pose a potential threat to surrounding grasslands and wetlands.

	Alternative 1		**Alternative 2**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Medium-term (3)	Short-term (2)	Medium-term (3)	Short-term (2)
Magnitude	Minor (3)	Minor (2)	Small (1)	Small (0)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (15)**	**Low (15)**	**Low (9)**
Status (positive or negative)	Negative	Slightly Negative	Slightly Negative	Slightly Negative
Reversibility	Medium	High	High	High
Irreplaceable loss of resources?	Slight loss of resources	Very slight loss of resources	Very slight loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent.			

Mitigation:

» A site-specific eradication and management programme for alien invasive plants must be included in the Environmental Management Programme (EMPr).
» Regular monitoring by the operation and maintenance team for alien plants within the power line servitude must occur and could be conducted simultaneously with erosion monitoring.
» 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.

Nature: *Increased erosion risk during operation*

Increased erosion risk as a result of soil disturbance and loss of vegetation cover as well as increased runoff generated from compacted, hard and/or impenetrable surfaces (i.e. compacted service and access roads and compacted and cleared areas around the pylons).

	Alternative 1		**Alternative 2**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Medium-term (3)	Short-term (2)	Medium-term (3)	Short-term (2)
Magnitude	Minor (3)	Minor (2)	Minor (2)	Small (0)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (15)**	**Low (18)**	**Low (9)**
Status (positive or negative)	Negative	Slightly Negative	Negative	Slightly Negative
Reversibility	Medium	High	High	High
Irreplaceable loss of resources?	Slight loss of resources	Very slight loss of resources`	Very slight loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent			

Mitigation:

- All roads and other hardened surfaces within the power line servitude should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.
- Regular monitoring for erosion within the power line servitude and along access roads must be undertaken after construction to ensure that no erosion problems have developed as a result of the disturbance.
- All erosion problems observed within the power line servitude and along access roads as a result of the development should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
- All cleared areas within the power line servitude should be revegetated, preferably with indigenous perennial grasses (no invasive plants may be used).

Residual Impacts:

If erosion at the site is controlled, then there will be no residual impact.

7.3.4. Comparative Assessment of Power Line Alternatives

Power Line Alternative 2 is preferred from an ecological perspective due to the fact that the power line route will be very short and therefore impacts on the near-natural habitat will be limited. This alternative is also located in an already transformed and degraded area and therefore minimal additional habitat disturbance and vegetation destruction will occur. Furthermore, by locating the proposed power line near existing power line infrastructure, the total surface area that may contain infrastructure which may result in faunal disturbance and habitat destruction, will be greatly reduced. Even though Power Line Alternative 1 is a slightly longer route, it is mostly located within a medium to low sensitive area with no high and very high sensitive areas. The potential impacts associated with this alternative will be relatively low. It is therefore considered acceptable from an ecological perspective.

From a hydrological perspective both alternatives are regarded as suitable and are deemed equally preferred.

Aspect	Alternative 1	Alternative 2
Ecology	» Aligned mostly along the Mookodi – Magopela 132kV power line to be constructed. » Located near existing infrastructure (N18 and railway line). » Mostly located within a medium to low sensitive area. » Minimal additional habitat disturbance and vegetation destruction should the alignment be along existing infrastructure. » Least preferred but acceptable.	» Impacts on near-natural habitat are limited due to short length of power line alternative. » Located within area already transformed and degraded. » Minimal additional habitat disturbance and vegetation destruction. » Located near existing infrastructure. » Located within a medium to low sensitive area. » Preferred.
Hydrology	» Avoids all wetlands and/or surface hydrological features. » Acceptable	» Avoids all wetlands and/or surface hydrological features. » Acceptable

7.3.5. Implications for Project Implementation

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of ecological and hydrological impacts of the Moeding Solar PV Facility can be reduced to low. From the outcomes of the studies undertaken, it is concluded that the solar energy facility and associated infrastructure can be developed. On-site mitigation is viewed as the most practical and appropriate action, and viable options for reducing the overall impact of the development on these areas is detailed below:

» A pre-construction walkthrough of the final development footprint and power line alignment 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. Outcomes of the walk-through survey must inform the final design where required to minimise impacts on the environment.
» Since most of the identified conservation worthy species with the project site are geophytes and succulents with relative shallow rooting systems (e.g. *Boophone disticha, Babiana hypogea, Ammocharis coranica, Nerine laticoma and Aloe greatheadii*), the potential for successful translocation is high. 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 walkthrough survey. Permits from the relevant provincial authorities, i.e. the North-West Department of Rural, Environment and Agricultural Development (READ), must be obtained before the individuals are disturbed.
» Few alien invasive plants have been observed on the project site, but several grow in close proximity along major access routes. For all species, there is a very high risk of spread throughout the project area following disturbance. This implies that a detailed Invasive Plant Management Plan will have to be in place prior to the commencement of the activity and be diligently followed and updated throughout the project cycle up to the decommissioning phase.

7.4. Potential Impacts on Avifauna

The significance of the impacts on avifauna expected with the development of the Moeding Solar PV Facility has been assessed as medium to low, depending on the impact being considered, with the implementation of mitigation measures. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E** for more details).

7.4.1. Results of the Avifauna Impact Assessment

Habitat units comprising potential avifauna sensitive elements have been identified within the project site and 300m power line corridor (refer to Chapter 6 for details). These sensitive elements have been classified as being of a low, medium to low, medium and high sensitivity. These sensitive elements are described below.

» Areas of high sensitivity
These habitat units are represented by ephemeral pans with woody peripheries. These habitats provide a source of surface water in the area and support a number of large trees, which could potentially be important for roosting and nesting.

» Areas of medium sensitivity
These represent habitat units of relatively small natural Tree Savannah and Savannah Woodland. Both of these habitat units are fairly limited in extent with the Savannah Woodland forming a small isolated patch within the project site. These two habitat types combined, contributed to the area's general habitat and niche diversity and relative to its size, contained a significant species diversity and abundance (higher density of avifaunal species than the Savannah Grassland). This diversity and abundance are due to the structural and compositional variation in the vegetation.

» Areas of medium to low sensitivity
These habitat units includes Savannah Grassland, Savannah Shrubland and the Tree Savannah Habitat occurring on historically cultivated areas (Secondary Tree Savannah). Both the Savannah Shrubland and Secondary Tree Savannah have been subjected to disturbances and habitat transformation and is characterised by a low diversity and abundance of bird species. The Savannah Grassland habitat unit supported the highest species diversity within the project site, due to the structural variation provided by the composition of trees, shrubs and grass patches. However, this habitat type has a very broad distribution throughout the region and from a broad geographical perspective are more homogenous.

» Areas of low sensitivity
These areas are considered to be of low sensitivity due to the general absence of suitable habitat for avifauna and include:
- Highly trampled and severely overgrazed areas;
- All areas containing infrastructure such as buildings, cattle kraals, cement dams etc.;
- The existing power line and water pipeline servitude; and
- Sand and gravel quarries.

Figure 7.4 provides an avifaunal sensitivity map for the project site, inclusive of the proposed development footprint and 300m power line corridor being assessed for the Moeding Solar PV Facility.

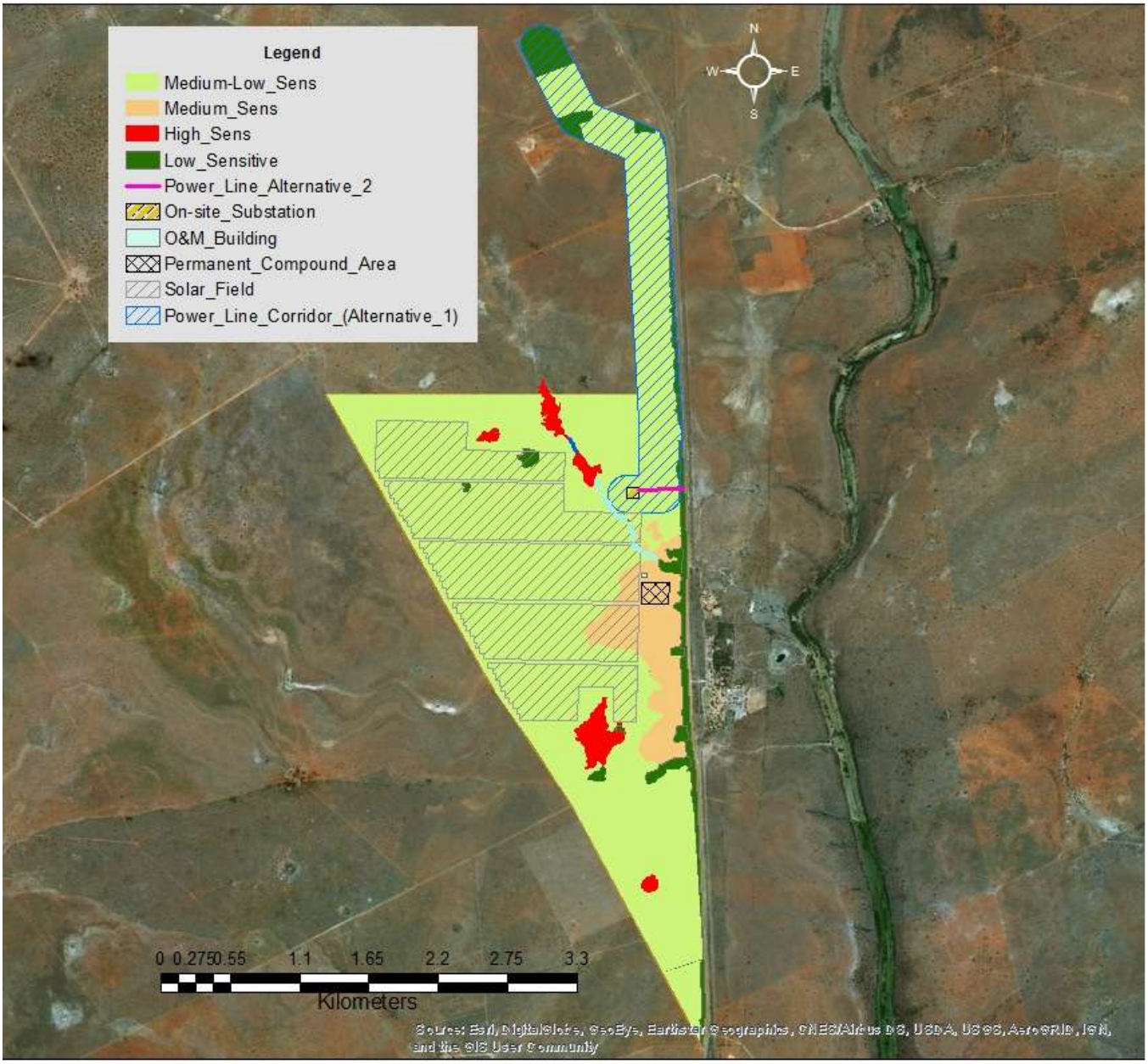

Figure 7.4: Map illustrating the avifaunal sensitivity within the Moeding Solar's project site and power line corridor overlain with the proposed development footprint.

7.4.2. Description of Avifaunal Impacts

Negative avifauna impacts expected to occur with the development of the Moeding Solar PV Facility includes a loss of habitat, disturbance and displacement of birds, mortality, the creation of "new" avian habitat and bird pollution, collision and interaction with the power line.

» *Loss of habitat*
Although the degree of this impact is dependent on the location and scale of the development, this is potentially the most significant impact associated with the construction and operation (maintenance) of solar energy facilities. Extensive areas of vegetation (habitat) are cleared to accommodate the considerable amount of infrastructure required, reducing the amount of habitat available to birds for

foraging, roosting and breeding (Smallie, 2013). Given the considerable space requirements of commercially viable facilities (> 200 ha), this effect could be significant in some instances, particularly given the possibility that the initial footprint of successful facilities may be expanded over time, and allowing for the possible cumulative effects of multiple facilities in one area. This impact is likely to affect smaller bird species (i.e. larks and pipits) with small home ranges, as entire territories could be removed during construction activities.

» *Disturbance and displacement*
Construction of solar energy facilities requires a significant amount of machinery and labour to be present on-site for a period of time. For shy, sensitive species or ground-nesting birds resident in the area, construction activities are likely to cause a temporary disturbance or even result in displacement from the site entirely. In addition, species commuting around the site may become disorientated by the reflected light and consequently fly longer distances to avoid the area, potentially resulting in displacement and energy implications (Smallie, 2013). Similarly, but to a lesser extent, ongoing maintenance activities at the operational facility are likely to cause some degree of disturbance to birds in the general vicinity.

» *Mortality*
Bird mortality has been shown to occur due to direct collisions with solar panels. Species affected include waterbirds, small raptors, doves, sparrows and warblers (Kagan et al., 2014). The reflective surfaces of PV panels may confuse approaching birds and in some cases act as an attractant, being mistaken for large water bodies, resulting in injuries and/or mortalities when birds attempt to land on the installations.

» *Human conflict*
Certain bird species may seek to benefit from the installations, using the erected structures as prominent perches, sheltered roost sites or even nesting sites, and possibly foraging around the infrastructure in response to changes in the distribution of preferred foods (i.e. plants growing under the paneling and other animals attracted to the facility). This may result in the fouling of critical components in the solar array, bringing local bird populations into conflict with facility operators.

» *Collision with overhead power lines*
Power lines pose a significant collision risk to birds, affecting a particular suite of collision prone species. These are mostly heavy-bodied birds such as bustards, cranes, storks, large eagles and various species of waterbirds that have limited manoeuvrability in flight, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (Anderson, 2001; van Rooyen 2004a; Jenkins et al., 2010).

» *Electrocution on power line and power infrastructure*
Avian electrocutions occur when a bird perches or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the gap between live components and/or live and earthed components (van Rooyen, 2004b; Lehman *et al.,* 2007). Electrocution risk is strongly influenced by the power line voltage and the design of the pole structure and mainly affects larger, perching species such as vultures, eagles and storks that are capable of spanning the spaces between energised components.

7.4.3. Impact tables summarising the significance of impacts on avifauna during construction and operation (with and without mitigation)

Solar Energy Facility: Construction Phase Impacts

Nature: *Loss of habitat due to construction*

The extensive space required by the Moeding Solar PV Facility (300 ha) will result in the loss of avian micro-habitats located within the development footprint. Due to the nature of the development, the majority of the site will be transformed. This impact will be amplified as more solar energy facilities are developed in the area, resulting in cumulative effects of multiple facilities within the area.

It is envisaged that the only Red Data species that will be displaced by the habitat transformation that will take place as a result of the construction of the proposed solar facility is Kori Bustard, of which a single individual was recorded during the site survey. The impact on smaller, non-Red Data species that are potentially breeding in the area will be local in extent, and will not have a significant effect on regional or national populations. The area proposed for the solar energy facility is not a unique habitat within the landscape.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (44)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Highly Probable	Moderate Probability
Can impacts be mitigated?	Yes. However, due to the extensive space required for the development, some land and avian microhabitats will be impacted.	

Mitigation:

- The development footprint should be kept to a minimum.
- The boundaries of the development footprint areas must be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint area.
- Any bird nests that are found during the construction period must be reported to the Environmental Officer (EO) and where deemed necessary an appropriate buffer should be placed around the nest. If uncertain on the size of such a buffer, the ECO may contact an avifaunal specialist for advice.
- The above measures must be included in a site specific EMPr and monitored by an ECO

Residual Impacts:

Moderate. The vegetation within the development footprint can be rehabilitated after the life time of the project if proposed mitigation measures are put in place.

Nature: *Disturbance due to construction*

The disturbance of avifauna during the construction of the Moeding Solar PV Facility may occur. Species sensitive to disturbance include ground-nesting species (e.g. bustards and korhaans) resident within the development footprint. Disturbance can also influence the community structure of avifauna within close proximity to the development although this may only occur to a very limited extent.

Disturbance could have a negative impact on the breeding activities of various species, particularly if this occurs during a sensitive period in the breeding cycle. Kori Bustard is the predominant species of concern. Other small avian species do occur within the development footprint but these species are non-Red Data species.

The proposed development is located within an agricultural habitat close to National and Domestic roads. Therefore, species within this landscape often experience disturbance. As a result, disturbance of birds by the proposed solar energy facility is anticipated to be of moderate significance as birds will move away from the area temporarily during construction activities. However, species are particularly sensitive to disturbance during the breeding season and this must be borne in mind during both the construction and operational (maintenance) phases.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (7)	Minor (3)
Probability	Highly Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	Moderate Probability	Low Probability
Can impacts be mitigated?	Noise and disturbance during the construction phase 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:

» Strict control must be maintained over all activities during construction, in line with an approved construction EMPr.
» During construction, if any of the Red Data species identified in the Avifauna Impact Assessment Report (refer to Appendix E) are observed to be roosting and/or breeding in the vicinity of the development footprint, the EO must be notified and where deemed necessary an appropriate buffer should be placed around the nests and/or roosting areas. If uncertain on the size of such buffer the ECO may contact an avifaunal specialist for advice.
» Contractors and working staff should stay within the development area and movement outside these areas especially into avian micro-habitats must be restricted.
» Driving must take place on existing and new access roads and a speed limit of 30km/h must be implemented on all roads traversing the project site during the construction phase.
» Breeding, egg lying and incubation occur typically between October and February for Kori bustard and most of the sensitive ground nesting avifaunal species. During these months disturbances within natural and near-natural habitats should be limited as far as possible.

Residual Impacts:

Moderate. Some disturbance during the construction phase is inevitable. It is likely that some species will be disturbed and potentially displaced by the development.

Solar Energy Facility: Operation Phase Impacts

Nature: *Disturbance during operation*

The disturbance of avifauna during the operation of the solar facility may occur. Species sensitive to disturbance include ground-nesting species resident within the development footprint. It may be likely that nesting and incubation may occur throughout the operation phase especially where some vegetation have re-established however the degree of likelihood is low. Disturbance can also influence the community structure of avifauna within close proximity to the development although this may only occur to a very limited extent.

Disturbance could have a negative impact on the breeding activities of various species, particularly if this occurs during a sensitive period in the breeding cycle. Kori Bustard is the predominant species of concern. Other small avian species do occur within the development footprint but these species are non-Red Data species.

The proposed development is located within an agricultural habitat close to National and Domestic roads. Therefore, species within this landscape often experience disturbance. As a result, disturbance of birds by the Moeding Solar PV Facility is anticipated to be of moderate significance as birds will move away from the area temporarily during

maintenance activities (through the noise and movement of maintenance equipment and personnel). However, species are particularly sensitive to disturbance during the breeding season and this must be borne in mind during the operational (maintenance) phase.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (40)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Moderate Probability	Low Probability
Can impacts be mitigated?	Noise and disturbance during the construction phase 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:

» If birds are nesting on the infrastructure of the facility and cannot be tolerated due to operational risks of fire, electrical short, soiling of panels or other problems, birds must be prevented from accessing nesting sites by using mesh or other manner of excluding them. Birds must not be shot, poisoned or harmed as this is not an effective control method and has negative ecological consequences. Birds already with eggs and chicks must be allowed to fledge their chicks before nests are removed.
» If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice on further mitigation.
» Working staff must stay within the development area and movement outside these areas especially into avian micro-habitats must be restricted.
» Driving must take place on existing and new access roads and a speed limit of 30km/h must be implemented on all roads running through the project site during the operation phase.
» Breeding, egg lying and incubation occur typically between October and February for Kori bustard and most of the sensitive ground nesting avifaunal species. During these months disturbances should be limited as far as possible.

Residual Impacts:

Moderate. Some disturbance during the operational phase is inevitable. It is likely that some species will be disturbed and potentially displaced by the development.

Nature: *Collisions with solar panel infrastructure*

The solar energy facility is comprised of panelling occupying a large area. Avifaunal species can be disorientated by the absorbent light, and consequently be displaced from an area more extensive than just the developed footprint of the facility. Certain bird species may be attracted to the solar arrays. Waterbirds (especially waterfowl and cormorants) may mistake the reflective surface for an expanse of water, and attempt to land on the panels resulting in injuries from colliding with the solar infrastructure. This impact has been termed as the "lake effect". This impact has not yet been recorded in South Africa.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Low (27)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Low (birds may be injured or	Low (birds may be injured or

	killed)	killed)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Possible.	

Mitigation:

» The impact should be monitored by the Operation and Maintenance Manager (O&M Manager) and should this be found to be a significant impact a suitably qualified avifaunal specialist should be consulted to recommend suitable mitigation.

Residual Impacts:

None. The solar panels will be decommissioned after 20 years and when this occurs the impact will cease.

Power Line: Construction Phase Impacts

Nature: *Habitat loss due to power line construction*

During the construction of the power line, some habitat destruction and alteration will occur.

The disturbance and destruction of unimpacted, near-natural habitat will be significantly reduced for Power Line Alternative 2 as this alignment will only extend for a very short distance (324m) through such habitat, after which the power line will turn into the Mookodi – Magopele 132kV power line to be constructed parallel to the N18 Road.

Power Line Alternative 1 is proposed to be aligned across ~3.2km of near-natural habitat and as such it is expected that habitat destruction will be higher than Power Line Alternative 2. The area impacted is however considered to have a medium to low sensitivity and the impacts are still expected to be moderately low. Subsequently these activities may have a very slight impact on foraging, breeding and roosting ecology of avian species within the area through modification of habitat.

It is envisaged that the only Red Data species that will be potentially displaced by the habitat transformation that will take place as a result of the construction of the power line is Kori Bustard. This displacement will only be from a very restricted area due to the small size of the area affected by the power line alternatives. The impact on smaller, non-Red Data species that are potentially breeding in the area will be local and very restricted in extent, and will not have a significant effect on regional or national populations.

	Alternative 1		**Alternative 2**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Long-term (4)	Medium-term (3)	Long-term (4)	Short-term (2)
Magnitude	Low (4)	Minor (3)	Minor (3)	Minor (2)
Probability	Highly Probable (4)	Probable (3)	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (21)**	**Low (24)**	**Low (15)**
Status (positive or negative)	Negative	Negative	Negative	Slightly Negative
Reversibility	Moderate	High	High	High
Irreplaceable loss of resources?	Very limited loss of resources	Very limited loss of resources	Very limited loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent			

Mitigation:

» All construction activities must be carried out according to the generally accepted environmental best practise.
» The development footprint should be kept to a minimum.
» The boundaries of the development footprint areas are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint area.
» Existing roads must be used as much as possible for access during construction.
» Provide adequate briefing for site personnel on the possible important (Red Data) species occurring and/or nesting in the area and the procedures to be followed (for example notification of ECO and avoidance of area until appropriate recommendations has been provided by ECO).

» Any bird nests that are found during the construction phase must be reported to the Environmental Officer (EO).
» The above measures must be included in a site specific EMPr and monitored by an ECO.

Residual Impacts:
Moderate. The vegetation within the development area can be rehabilitated after the life time of the facility if proposed mitigation measures are put in place.

Nature: *Disturbance due to power line construction activities*
Species sensitive to disturbance include ground-nesting species resident within the development footprint. Disturbance can also influence the community structure of avifauna within close proximity to the development as certain species will be displaced and forced to find alternative territories.

Disturbance could have a negative impact on the breeding activities of various species, particularly if this occurs during a sensitive period in the breeding cycle. Kori Bustard is the predominant species of concern. Other small avian species do occur within the development footprint but these species are non-Red Data species.

The project site is located within an agricultural habitat close to National and Domestic roads. Therefore, species within this landscape often experience disturbance. As a result, disturbance of birds by the proposed power line is anticipated to be of low significance as birds will move away from the area temporarily. The relatively small scale of the development (in relation to the large agricultural landscape) is unlikely to have a significant impact on avifauna. However, species are particularly sensitive to disturbance during the breeding season and this must be borne in mind during the construction phase.

	Alternative 1		**Alternative 2**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Low (4)	Minor (2)	Minor (2)
Probability	Highly Probable (4)	Probable (3)	Probable (3)	Improbable (2)
Significance	**Low (28)**	**Low (21)**	**Low (15)**	**Low (10)**
Status (positive or negative)	Negative	Negative	Slightly Negative	Slightly Negative
Reversibility	Moderate	High	High	High
Irreplaceable loss of resources?	Very limited loss of resources	Very limited loss of resources	Very limited loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent			

Mitigation:
» Strict control must be maintained over all activities during construction, in line with an approved construction EMPr.
» During construction, if any of the Red Data species identified in the Avifauna Impact Assessment Report (refer to Appendix E) are observed to be roosting and/or breeding in the vicinity, the EO must be notified and were deemed necessary an appropriate buffer should be placed around the nests and/or roosting areas. If uncertain on the size of such buffer the ECO may contact an avifaunal specialist for advice.
» The construction equipment camps must be as close to the site as possible.
» Contractors and working staff should remain within the development area and movement outside these areas especially into avian micro-habitats must be restricted.
» Driving must take place on existing and new access roads and a speed limit of 30 km/h must be implemented on all internal roads.
» Breeding, egg lying and incubation occur typically between October and February for Kori bustard and most of the sensitive ground nesting avifaunal species. During these months disturbances within natural and near-natural habitats should be limited as far as possible.

Residual Impacts:
Low. Some disturbance during the construction phase is inevitable. It is likely that some species will be disturbed and potentially displaced by the development.

Power Line: Operation Phase Impacts

Nature: *Disturbance along the power line route*

The disturbance of avifauna during the operation of the power line may occur. Species sensitive to disturbance include ground-nesting species resident within the development footprint. Disturbance can also influence the community structure of avifauna within close proximity to the development as certain species will be displaced and forced to find alternative territories. Disturbance could have a negative impact on the breeding activities of various species, particularly if this occurs during a sensitive period in the breeding cycle. Species of concern are predominantly Kori Bustards. Other small avian species do occur within the development footprint but these species are non-Red Data species.

The proposed development is located within an agricultural habitat close to National and Domestic roads. Therefore, species within this landscape often experience disturbance. As a result, disturbance of birds by the proposed power line is anticipated to be of low significance as birds will move away from the area temporarily. The relatively small scale of the development (in relation to the large agricultural landscape) is unlikely to have a significant impact on avifauna. However, species are particularly sensitive to disturbance during the breeding season and this must be borne in mind during the operational (maintenance) phase.

	Alternative 1		**Alternative 2**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Medium-term (3)	Short-term (2)	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)	Minor (3)	Minor (2)
Probability	Probable (3)	Probable (3)	Probable (3)	Improbable (2)
Significance	**Low (24)**	**Low (15)**	**Low (18)**	**Low (10)**
Status (positive or negative)	Negative	Slightly Negative	Slightly Negative	Slightly Negative
Reversibility	Moderate	High	High	High
Irreplaceable loss of resources?	Very limited loss of resources	Unlikely	Very limited loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent			

Mitigation:

- Strict control must be maintained over all activities during operation (maintenance), in line with an approved EMPr.
- Birds must not be shot, poisoned or harmed as this is not an effective control method and has negative ecological consequences. Birds already with eggs and chicks should be allowed to fledge their chicks before nests are removed.
- If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice on further mitigation.
- Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted.
- Vehicle movements must be restricted to existing and newly constructed access roads and a speed limit of 30km/h must be implemented on all roads running through the project site during the operational phase.

Residual Impacts:

Low. Some disturbance during the operational phase is inevitable. It is likely that some species will be disturbed and potentially displaced by the development.

Nature: *Electrocution of birds*

Electrocutions of birds on associated power infrastructure results in injuries or death and could potentially affect large, perching species in the area such as raptors and storks. Avian electrocutions occur when a bird perches or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the gap between live components and/or live and earthed components (van Rooyen, 2004b; Lehman *et al.,* 2007).

The impact of electrocution are considered to be of moderate significance, and low significance after the implementation of mitigation in the form of bird friendly structures. Of the priority species, Martial Eagle and White-backed Vulture could potentially be affected by this impact. No individuals of these species were recorded during the survey but due to habitat suitability it is highly likely that these species may occur from time to time within the study area.

	Alternative 1		**Alternative 2**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (2)	Local (2)	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)	Low (4)	Small (2)
Probability	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)
Significance	**Moderate (36)**	**Low (20)**	**Low (30)**	**Low (14)**
Status (positive or negative)	Negative	Negative	Negative	Slightly Negative
Reversibility	Low (birds will be injured or killed)	Low (birds will be injured or killed)	Low (birds will be injured or killed)	Low (birds will be injured or killed)
Irreplaceable loss of resources?	Limited loss of resources	Very Limited loss of resources	Limited loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent			

Mitigation:

- A "Bird Friendly" structure, with a bird perch (as per standard Eskom guidelines) must be used for the tower infrastructure.
- All relevant perching surfaces must be fitted with bird guards and perch guards as deterrents (Hunting, 2002).
- Installation of artificial bird space perches and nesting platforms, at a safe distance from energised components (Goudie, 2006; Prinsen et al., 2012).

Residual Impacts:

Low. The power line will be within the area over a long period of time if not permanent. However, if the power line is removed the impacts associated (avian mortalities) will cease.

Nature: *Collision with the power line*

Collisions are the biggest single threat posed by transmission power lines to birds in Southern Africa (van Rooyen 2004). Avian species most susceptible and impacted upon are bustards, storks and cranes (especially bustards which have been confirmed are at risk within the project site). These species are heavy-bodied birds with limited manoeuvrability (as a result of high wing loading), which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (Van Rooyen 2004, Anderson 2001). Many of the collision sensitive species are considered threatened in Southern Africa.

The Red Data species that are vulnerable to power line collisions are generally long living, slow reproducing species. Furthermore, various species require specific conditions for breeding, resulting in very few successful breeding attempts and breeding might be restricted to very small areas. Consistent high adult mortality over an extensive period could have a serious long term effects on the population.

Potential collision impacts (risk) with the proposed power line by certain species such as Kori Bustard and Secretarybird are possible. No individuals were recorded during the survey but due to habitat suitability it is highly likely that these

species may occur from time to time within the study area. This is particularly true for the Bustards which have low manoeuvrability once in flight. Bustards, storks and cranes have been recorded within the top ten avian species in South Africa prone to collisions with overhead power lines.

Overall, the impact assessment found this risk impacts to be of moderate to low significance. However, this is related to the amount and frequency large avifaunal species such as bustard and korhaan inhabit or visit the traversed habitat.

	Alternative 1		**Alternative 2**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (2)	Local (1)	Low (1)	Local (1)
Duration	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)	Low (3)	Small (2)
Probability	Highly Probable (4)	Probable (3)	Probable (3)	Improbable (2)
Significance	**Moderate (48)**	**Low (27)**	**Low (24)**	**Low (14)**
Status (positive or negative)	Negative	Negative	Negative	Slightly Negative
Reversibility	Low (birds will be injured or killed)	Low (birds will be injured or killed)	Low (birds will be injured or killed)	Low (birds will be injured or killed)
Irreplaceable loss of resources?	Limited loss of resources	Limited loss of resources	Limited loss of resources	Very limited loss of resources
Can impacts be mitigated?	Yes, to a large extent			

Mitigation:

» Construction of the power line in close proximity to the existing line will reduce the cumulative impacts and collision risk.
» All relevant perching surfaces must be fitted with bird guards and perch guards as deterrents (Hunting 2002).
» Bird deterrent devices such as "bird diverters" and "flappers" can be used.

Residual Impacts:

Low. The power line will be within the area over a long period of time if not permanent. However, if the power line is removed the impacts associated (avian mortalities) will cease.

7.4.4. Comparative Assessment of Power Line Alternatives

Alternative 2 is considered as the preferred power line alternative. Alternative 1 is however deemed acceptable from an avifaunal perspective due to its alignment with the Mookodi – Magopele 132kV power line to be constructed along the N18 and that most sections of the power line is located within a medium to low sensitive area.

Aspect	**Alternative 1**	**Alternative 2**
Avifauna	» Aligned mostly along the Mookodi – Magopela 132kV power line to be constructed. » Mostly located within a medium to low sensitive area. » Least preferred but acceptable.	» Extend over a very short distance within unimpacted habitat. » Located within area already transformed and degraded. » Minimal additional habitat disturbance » Reduced collision risk should power line infrastructure be placed as close as possible to existing infrastructure. » Located within a medium to low sensitive area. » Preferred.

7.4.5. Implications for Project Implementation

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of avifauna impacts associated with the Moeding Solar PV Facility will be medium to low with only a small portion of the development occurring within some medium sensitivity areas.

Based on the finding and results obtained from the Avifauna Impact Assessment (refer to **Appendix E**) as well as monitoring results obtained for the Sendawo 1 Solar PV Energy Facility (a PV facility located west of the Moeding Solar PV Facility and within a very similar habitat type), it was concluded that the proposed area contains a relative low diversity of faunal species within a relatively extensive and more or less homogenous vegetation cover, and subsequently the Moeding Solar PV Facility will affect a limited to small avifaunal community. The impacts associated with the Moeding Solar PV Facility on the local avifaunal community is regarded as relatively small in nature and scale and is therefore considered to be a low risk site (Regime 1). The implementation of Stage 3 and 4 Assessments and monitoring, according to the "Best Practice Guidelines: Birds & Solar Energy" will therefore not be necessary.

From the outcomes of the studies undertaken, it is concluded that the solar energy facility can be developed and impacts on avifauna managed by taking the following into consideration:

- Contractors and working staff should remain within the development area and movement outside these areas especially into avian micro-habitats must be restricted.
- Bird friendly structures with a bird perch (as per standard Eskom guidelines) should must be used for the tower infrastructure. All relevant perching surfaces should be fitted with bird guards and perch guards as deterrents (Hunting, 2002).
- If any of the Red Data species identified in the Avifauna Impact Assessment are observed to be roosting and/or breeding in the vicinity of the development footprint, the EO must be notified and where deemed necessary an appropriate buffer should be placed around the nests and/or roosting areas.
- Breeding, egg lying and incubation occur typically between October and February for Kori Bustard and most of the sensitive ground-nesting avifaunal species. During these months disturbances should be limited as far as possible.

7.5. Assessment of Impacts on Land Use, Soil and Agricultural Potential

The impact of the Moeding Solar PV Facility on the soils, land use, land capability and agricultural potential has been assessed as low to medium (after mitigation), depending on the impact being considered. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix F** – Soils Impact Assessment for more details).

7.5.1. Results of the Land Use, Soil and Agricultural Potential Study

The majority of the project site has a very low to moderately low land capability and is considered suitable for livestock grazing with management practices in place. A small area consisting of 1.8ha situated within Portion 4 of the Farm Waterloo 730 adjacent to the southern boundary has a moderate agricultural potential and is considered to be suitable for arable agriculture. Although the soil form present within this area (i.e. Hutton) is suitable for arable agriculture in other areas of the country, this small area is not

considered to be appropriate for crop production due to the absence of irrigation boreholes and supporting irrigation infrastructure. The grazing capacity of the veld in the project site and powerline corridor area is 10 to 12 hectares per large animal unit or large stock unit (LSU) (ARC-ISCW). The project site (642 ha) therefore has grazing veld available for 53 to 64 head of cattle and the powerline corridor area (97 ha) for 8 to 10 head of cattle whilst maintaining the quality of the field. Cattle farming is a viable long-term land use for the project site as long as the field quality is maintained by never exceeding the grazing capacity. The landowner for the properties affected by the project site is Tiger Kloof Educational Institute, and the income will be an investment for the educational trust to further the educational activities of the school.

7.5.2. Description of Land Use, Soil and Agricultural Potential Impacts

The undertaking of the specific activities required for the development of the Moeding Solar PV Facility will disrupt the natural soil horizon distribution and will subsequently impact on the current soil hydrological properties and functionality of the soils present within the project site proposed for the development. The following impacts on soils have been identified and assessed for the construction phase:

» Soil erosion is possible due to slope and vegetation clearance. The impacts of soil erosion are both direct and indirect. The direct impacts are the reduction in soil quality which results from the loss of nutrient-rich upper layers of the soil and the reduced water-holding capacity of severely eroded soils. The off-site indirect impacts of soil erosion include the disruption of riparian ecosystems and sedimentation.

» Soil chemical pollution due to the storage of hazardous chemicals, concrete mixing, temporary sanitary facilities and potential oil and fuel spillages from vehicles. This impact will be localised within the site boundary.

» In areas of permanent changes such as roads and the erection of infrastructure, rock spoil material discard site and topsoil stockpiles, the current land capability and land use will be lost permanently. This impact will also be localised within the site boundary.

During the operation phase the impacts related to loss of land use and land capability will stay the same as during the construction phase. Areas under temporary buildings, substations, transformers and other covered surfaces are no longer susceptible to erosion, but hard surfaces will increase run-off during rain storms onto bare soil surfaces.

Soil chemical pollution during the operation phase will be minimal. Possible sources are oil that needs to be replaced and oil and fuel spillage from maintenance vehicles. This impact will be localised within the site project site boundary and development footprint.

Although wind erosion may have an impact before revegetation on adjacent areas, the loss of soil as a resource will be restricted to the actual footprint of the Moeding Solar PV facility. The only impact that may have effects beyond the development footprint is erosion which may cause the sedimentation of the adjacent wetlands located outside of the development footprint.

7.5.3. Impact tables summarising the significance of impacts on Land Use, Soil and Agricultural Potential during construction and operation (with and without mitigation)

Nature: *Increased risk of soil erosion due to construction and operation of the solar PV facility*

The construction of the PV facility, access road, camp site and laydown area will require the clearing and levelling of a limited area of land. The following construction activities will result in the bare soil surfaces that will be at risk of erosion:

» vegetation removal during site clearing;
» creating impenetrable surfaces during the construction phase that will increase run-off onto bare soil surfaces; and
» leaving soil surfaces uncovered during the rainy season during the construction phase.

During the operation phase the impenetrable surfaces such as paved areas and compacted roads stay intact, however, the impact of increased run-off persists on surrounding areas.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:

» Land clearance must only be undertaken immediately prior to construction activities.
» Unnecessary land clearance must be avoided.
» Soil stockpiles must be dampened with dust suppressant or equivalent.
» Soil stockpiles must be located away from any waterway or preferential water flow path in the landscape, to minimise soil erosion from these.
» Geo-textiles or similar material must be used to stabilise soil stockpiles and uncovered soil surfaces during the construction phase and to serve as a sediment trap to contain as much soil as possible that might erode away.
» The Stormwater Management Plan (SWMP) should provide for a drainage system sufficiently designed to prevent water run-off from the solar panels to cause soil erosion.
» Where discharge of rainwater on roads will be channeled directly into the natural environment, the application of diffuse flow measures must be included in the design.
» Revegetate cleared areas as soon as possible after construction activities.

Residual:

The residual impact from the construction and operation of the Moeding Solar PV Facility, access road, and auxiliary buildings on the susceptibility to erosion will be negligible.

Nature: *Chemical pollution due to construction and operation of the PV facility*

The following construction activities can result in the chemical pollution of the soil:

» Hydro-carbon spills by machinery and vehicles during earthworks and the mechanical removal of vegetation during site clearing.
» 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 and operational workers.
» Spills from fuel storage tanks during construction.
» Polluted water from wash bays and workshops during the construction phase.
» Accidental spills of other hazardous chemicals used and stored on site.

» Pollution from concrete mixing.

The operation of the PV facility can result in the chemical pollution of the soil:
» Spills from vehicles transporting workers and equipment to and from the operation site.
» The generation of domestic waste by operational workers.
» Accidental spills of other hazardous chemicals used and stored on site.

	Without mitigation	**With mitigation**
Extent	High (3)	Low (1)
Duration	Medium-term (3)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	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	

Mitigation:
» High level maintenance must be undertaken on all vehicles and construction machinery to prevent hydrocarbon spills;
» Impermeable and bunded surfaces must be used for storage tanks and to park vehicles on;
» Site surface water and wash water must be contained and treated before reuse or discharge from site;
» Spills of fuel and lubricants from vehicles and equipment must be contained using a drip tray with plastic sheeting filled with adsorbent material;
» Waste disposal at the construction site must be avoided by separating, trucking out and recycling of waste;
» Potentially contaminating fluids and other wastes must be contained in containers stored on hard surface levels in bunded locations; and
» Accidental spillage of potentially contaminating liquids and solids must be cleaned up immediately by trained staff with the correct equipment and protocols as outlined in the EMPr.

Residual:
The residual impact from the construction and operation of the proposed project will be low to negligible.

Nature: *Loss of land capability as a result of the development*
The land capability of the project site where soil layers are changed and construction of infrastructure is done, will be lost. The impact remains present through the operational phase. The following activities can result in the loss of land capability within the project development footprint:
» The removal of vegetation during site clearing;
» Earthworks which destroy the natural layers of the soil profiles; and
» The construction of access roads and photovoltaic power plant (frame structures and installation of modules onto frames) and infrastructure which will cover soil surfaces.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (3)	Permanent (3)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (4)	Probable (4)
Significance	**Medium (40)**	**Medium (32)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:

» Keep the project footprint as small as possible; and » Avoid areas with wetland land capability.
Residual: The residual impact from the construction and operation of the Moeding Solar PV Facility and supporting infrastructure will be of low significance.

7.5.4. Comparative Assessment of Power Line Alternatives

Power Line Corridor Alternative 2 is the shortest alternative and will therefore have the lowest impact on soil and land capability. Power Line Alternative 2 is considered as the preferred alternative from a soils perspective

Aspect	Alternative 1	Alternative 2
Land Use, Soil and Agricultural Potential	» Highest impact on in situ soil profiles that has grazing land capability. » Longest alternative » Acceptable	» Lowest impact on in situ soil profiles that has grazing land capability. » Preferred.

7.5.5. Implications for Project Implementation

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of impacts of the Moeding Solar PV Facility can be reduced to medium and low, depending on which impact is being considered. From the outcomes of the studies undertaken, it is concluded that the solar energy facility can be developed and impacts on soils managed by taking the following into consideration:

» Land clearance must only be undertaken immediately prior to construction activities.
» Geo-textiles or similar material must be used to stabilise soil stockpiles and uncovered soil surfaces during the construction phase and to serve as a sediment trap to contain as much soil as possible that might erode away.
» A purpose-designed drainage system for water running from the solar panels must be installed.
» Where discharge of rainwater on roads will be channeled directly into the natural environment, the application of diffuse flow measures must be included in the design.
» The project footprint must be kept as small as possible.
» The Stormwater Management Plan (SWMP) should provide for a drainage system sufficiently designed to prevent water run-off from the solar panels to cause soil erosion.

7.6. Assessment of Visual Impacts

Negative impacts on visual receptors will occur during the undertaking of construction activities and the operation of the Moeding Solar PV Facility. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix G**).

7.6.1. Results of the Visual Impact Assessment

The area that is likely to be affected by the visual impact associated with the Moeding Solar PV Facility will be limited to the area immediately to the south of the urban area of Vryburg. This area is largely impacted

by urban and urban fringe development. Due to the ridgeline located to the south of the solar energy facility, the development will not impact visually on areas to the south that have a more cohesive rural in character and where the landscape character is not influenced by development.

It is likely that broken views into the development will be possible from the N18 to the east and the edge of the Huhudi Township to the north. There are also a small number of homesteads in close proximity to the development that could be affected and may be sensitive to change in their views. This includes two homesteads on the project site, one homestead within another site on which a solar PV project is planned and two homesteads on agricultural land to the west. The Tiger Kloof Combined School is located close to the south eastern corner of the development area. The ZTV analysis indicates that this receptor may be affected, however, due to the presence of tall vegetation between the development and the school, visibility is likely to be limited.

The Visual Absorption Capacity (VAC) of the landscape is related to both vegetation and topography.

» Views of the array and on-site infrastructure and buildings:
  - Dense roadside vegetation and vegetation in valley lines to the south of Vryburg between the urban area and the proposed development is likely to soften views of the development from areas to the north.
  - The low ridgeline immediately to the south of the proposed development area will screen the development from more cohesive rural areas to the south.
  - Existing vegetation and landform will help to soften views of the development from the urban area and affected sections of the N18.
  - Vegetation is likely to at least partially screen views of the development from the adjacent section of the N18 and Tiger Kloof Combined Schools.

» Views of the Grid Connection

  A new 132kV overhead power line along the alignment of an existing power line servitude along the N18 to the Mookodi MTS will be required (Alternative 1). **Figure 7.5** indicates an existing 132kV overhead power line. The view is taken during a period of good visibility along the line of towers which have a spacing of ~250m. In total 9 towers are visible along the line before it connects to another power line. The last tower in the line which is a solid pole structure is just visible at ~2.5km. From **Figure 7.5** and considering the backdrop, it can be concluded that the visual mass of the overhead power line is unlikely to be obvious from distances greater than 2.5km, and has therefore been adopted as the Approximate Limit of Visibility of the proposed power line alternatives.

Figure 7.5: View of a 132kV overhead power line similar to Power Line Alternative 1. The pylons on the horizon (~2.5km distance) are barely visible.

7.6.2. Visual Assessment

Key viewpoints that are adjudged to provide an indication of typical views towards the proposed development and are representative of views of the identified visual receptors / LCAs are illustrated in **Figure 7.6**. These viewpoints (VP) include:

1. VP1 is a view from the N18 at Huhudi. This view indicates the nature of likely views from the urban edge This view is indicative of distance views from higher ground (refer to **Figure 7.7**). The section of the project that is likely to be visible will be at least partly screened by existing infrastructure and vegetation. At this distance and considering the screening, it is unlikely that the project will be obvious from this viewpoint.
2. VP2 is a view from the N18 ~2km to the north of the project site (refer to **Figure 7.8**). It is likely that existing vegetation will partially screen the development. Power Line Alternative 1 will be seen to the right of the road situated parallel with the existing power line. Power Line Alternative 2 is unlikely to be obvious from this viewpoint.
3. VP3 is located on the N18 immediately adjacent to the project site (refer to **Figure 7.9**). It indicates the likely nature of impacts of people located in close proximity to the project including homesteads and travellers on the N18. The solar energy facility will be obvious from the N18. It will be viewed in side elevation and therefore the frames on which the PV panels are supported will be seen. Power Line Alternative 1 will be seen to the right of the road situated parallel with the existing power line. Power Line Alternative 2 will also be obvious from this viewpoint.
4. VP4 is located on the N18 immediately adjacent to the access road to the Tiger Kloof Combined School (refer to **Figure 7.10**). It is representative of views from the School as well as this section of the N18. Existing vegetation will largely screen the proposed solar array from this section of the road. The development will not be obvious from this viewpoint.

5. VP5 is located ~8km to the south of the project site (refer to **Figure 7.11**). It is included in order to highlight the screening effect of the existing landform. Because the development is located over the ridgeline which forms the horizon, the Moeding Solar PV Facility will be screened from the south and will not be visible from this viewpoint.

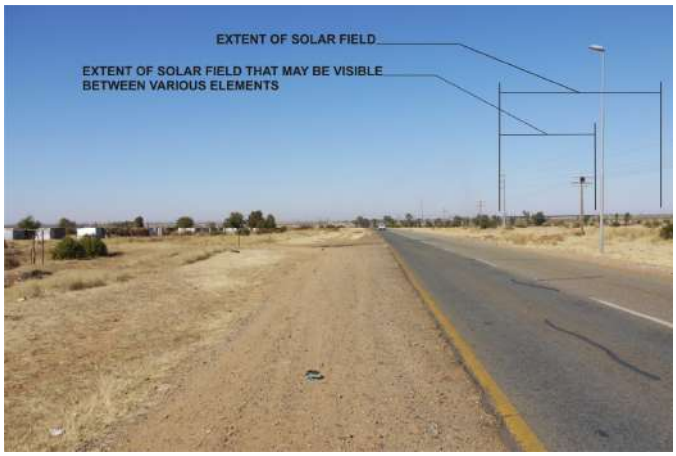

Figure 7.7: VP1 located on the N18 on the southern edge of Vryburg close to Huhudi ~4.7km from the northern edge of the development. The Moeding Solar PV Facility may be seen as a thin dark line on the horizon.

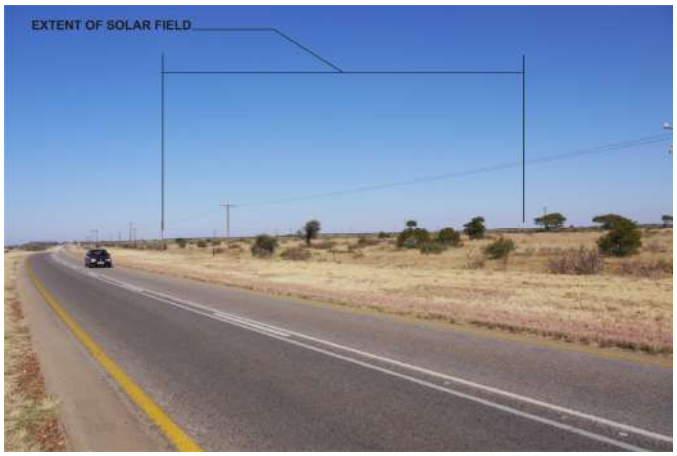

Figure 7.8: VP2 located on the N18 ~1.9km to the north of the project site. The Moeding Solar PV Facility will be viewed as a dark line on the horizon to the right of the road.

Figure 7.10: VP3 located on the N18 adjacent to the north eastern corner of the development area.

Figure 7.9: VP4 located on the N18 adjacent to the entrance to Tiger Kloof Combined School, facing north along the N18. The Moeding Solar PV Facility will be located to the left of the road, ~300m from the road edge.

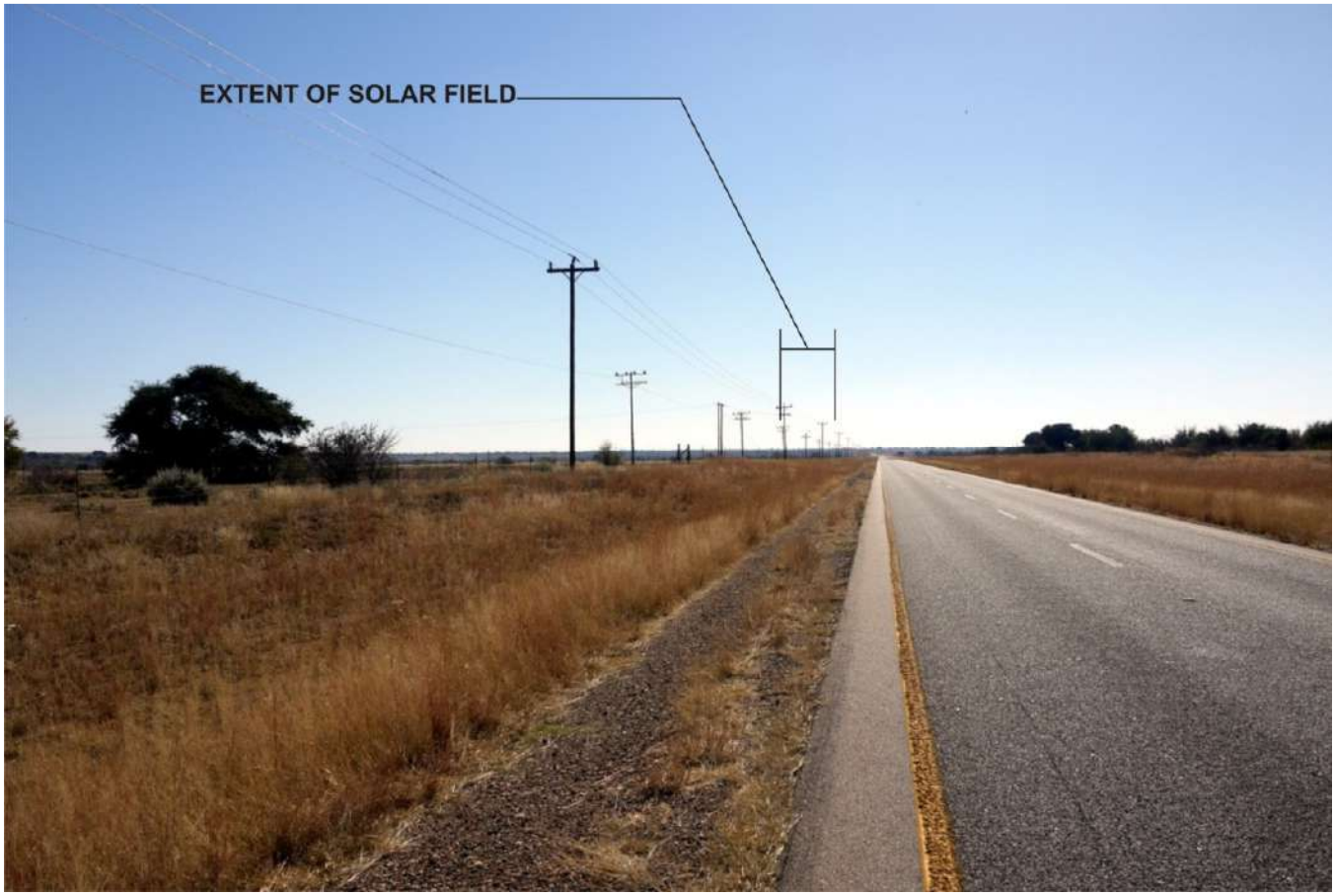

Figure 7.11: VP5 located on the N18 ~5.4km south of the project site and ~8.3km to the south of the proposed array.

Visual impacts will occur during the construction and operation phases of the Moeding Solar PV Facility. The following impacts are assessed in detail in section 7.6.3:

- The general change in character of the landscape due to the proposed development.
- The likely change in views that is likely to result for small holdings to the north east.
- Visual impacts on the R34 regional road located approximately 9.5km east of the project site.
- Visual impacts on homesteads outside the marked area of small holdings.
- Visual impact on the Tiger Kloof Combined School.
- The impact on views as seen from the urban edge of Vryburg which includes Huhudi.
- The visual impact on the adjacent N18 which is adjacent to the eastern boundary of the project site.
- The visual impact of Power Line Alternative 1.
- The visual impact of Power Line Alternative 2.
- The impact of lighting.
- Glint and glare from the PV panels for adjacent sections of the N18 and the southerly approach to the Vryburg airstrip.

Overall, the significance of the visual impacts is expected to be low as the area within which the project is proposed has a strong visual influence from urban and urban fringe development and changes to the landscape quality are unlikely to be problematic.

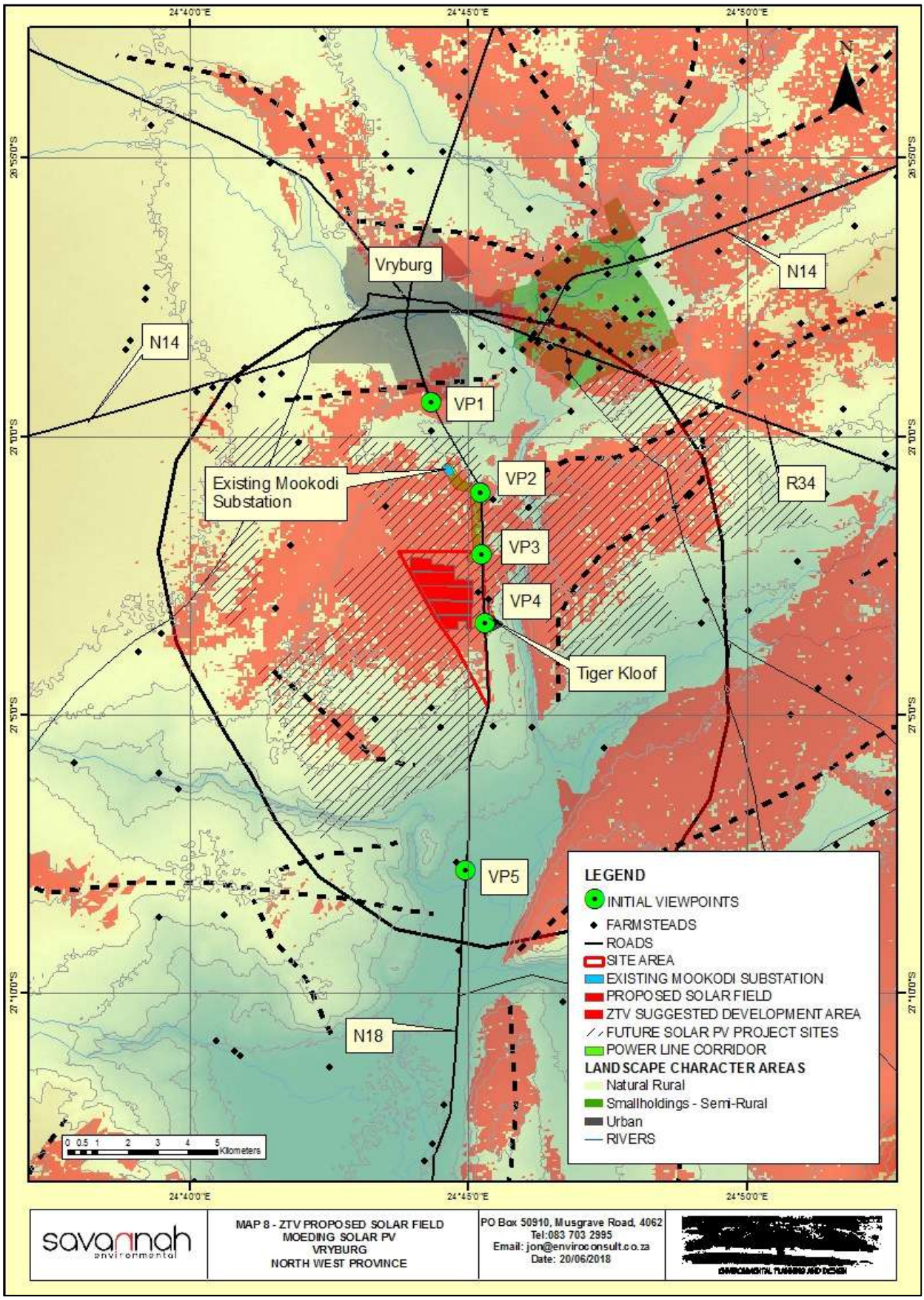

Figure 7.6: A map illustrating the zone of theoretical visibility (ZTV) and the typical views towards the Moeding Solar PV Facility.

7.6.3. Impact tables summarising the significance of visual impacts during construction and operation (with and without mitigation)

Solar Energy Facility Impacts

Nature: *Impact on General Landscape Character*

The Moeding Solar PV Facility will introduce industrial elements into the rural landscape immediately to the south of Vryburg. This area is already highly influenced by infrastructure development and with the development of currently authorised projects this influence is likely to increase.

The majority of receptors will view the project from the N18 which is located along the eastern boundary of the project site, north from where the fronts of the PV panels will be visible. From the south the development is largely screened by landform. Views of the proposed development are also likely to be possible from the Tiger Kloof Combined School that are located on the eastern side of the N18 close to the southern extent of the proposed development.

From most viewpoints to the north, there is a degree of VAC which is provided by existing vegetation and for areas close to the southern edge of Vryburg by other infrastructure development. This will help to soften the view of the development until the viewer is close to the northern edge of the proposed development. There will be no high level overview of the project possible although from some areas an acute angle overview will be possible.

The above factors will result in the project being seen as an obvious hard geometric form that extends the developed area. It has to be considered however that the character of the affected area is already influenced by infrastructure development including a railway line, the N18, several power lines and the existing Mookodi MTS. There are also a number of other solar PV projects proposed in the area which will transform the landscape.

It is obvious therefore that the rural character of the landscape has been and will be highly modified. The proposed development will not therefore impact on relatively cohesive rural character areas.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small to minor (1)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (16)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss. However, given the likely long term nature of the project, it is possible that a proportion of stakeholders will view the loss of view as irreplaceable.	No irreplaceable loss
Can impacts be mitigated?	Yes.	

Mitigation:

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;

» Plan to maintain the height of structures as low as possible;

» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;
» Retain natural buffer areas adjacent to the N18 and on the northern boundary.

Operation:
» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.
» Maintain natural buffer areas adjacent to the R34 and on the northern boundary.

Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the site;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Residual Impacts:
The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *Impact on an area of small holdings to the north east (Huhudi)*
The issue relates to the fact that this is a mixed development area with some sites used for social uses such as a church, others used for light industrial and transport related activities and others have been developed as residential properties. It is the residential use that is likely to be most sensitive to possible industrialisation of the landscape that the properties overlook.

The ZTV indicates that a portion of the area of small holdings ~6.6km to the north east of the proposed development could be affected. In reality the majority of houses are set amongst trees which will help to screen them from the development. There are also extensive areas of other solar PV development proposed between the proposed project and the small holdings. Given the distance and the nature of future development, it is highly unlikely that the proposed project will be visible from this area.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small to minor (1)	Small (0)
Probability	Improbable (2)	Very improbable (1)
Significance	**Low (14)**	**Low (6)**
Status (positive or negative)	The character of the rural outlook from the closest properties is highly unlikely to be modified in any significant way. With mitigation it is unlikely that the proposed development will be visible. Neutral to negative	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss.	No irreplaceable loss.
Can impacts be mitigated?	Yes.	

Mitigation:

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;
» Retain natural buffer areas adjacent to the N18 and on the northern boundary.

Operation:

» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.
» Maintain natural buffer areas adjacent to the N18 and on the northern boundary.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site;
» Rehabilitate areas to their natural state;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Residual Impacts:

The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *Change the character of the landscape as seen from the urban edge of Vryburg*

The proposed development may be visible but is unlikely to be obvious from the southern edge of Vryburg (Huhudi). It is also likely that other authorised solar PV projects will be developed between the proposed project and the southern edge of Vryburg. The proposed grid connection will not be visible.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Improbable (2)	Very improbable (1)
Significance	**Low (16)**	**Low (6)**
Status (positive or negative)	It is unlikely that there will be a significant change in the character of the view from the southern edge of Vryburg. Neutral to negative impact	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss.	No irreplaceable loss.
Can impacts be mitigated?	Yes.	

Mitigation:

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;

» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development.

Operation:
» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.

Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the site;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Residual Impacts:
The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *Impact on a short length (approximately 6.0km) of the N18*
The N18 is situated along the eastern boundary of the project site. Views of the development are likely to be obvious for motorists travelling in both directions along sections of this road. Views may be possible from approximately 2.3km north of the project site close to the existing Mookodi MTS to a position adjacent to the site just south of the Tiger Kloof Combined School.

A buffer area of ~300m between the road and the edge of the solar field exists and softens views from the road. From the northern end of this buffer for ~1km extending to the position of the proposed on-site substation there is little woody vegetation with any height that will help screen the project. Over this section of road, the development is likely to be obvious. The on-site substation to the south, for the full extent of road from which the ZTV indicates that the project could be visible, there is sufficient tall woody vegetation within the 300m buffer which largely screen the solar field.

In effect therefore, the project is likely to be obvious for 3.3km of the road, only ~1.0km of which will be adjacent to the project. It is likely that mitigation including extending tall woody vegetation into the area to the north of the proposed on-site substation could further decrease the extent of visibility of the proposed project.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor - Low (3)	Small - Minor (1)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (36)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	The proposed development can be dismantled. There will therefore be no irreplaceable loss.	No irreplaceable loss.
Can impacts be mitigated?	Yes.	

Mitigation:
Planning:
» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;

» Retain natural buffer areas adjacent to the N18 and on the northern boundary;
» Plan to augment and manage woody vegetation within the buffer area to provide screening of the development from the road.

Operation:
» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area;
» Maintain natural buffer areas adjacent to the N18 and on the southern boundary; and
» Maintain woody vegetation within the natural buffer area adjacent to the N18.

Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the site;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Residual Impacts:
The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *Impact on the R34*
The ZTV indicates that the project could be visible from ~9.5km of the R34. However, these possible views will occur close to the Approximate Limit of Visibility. It is also likely that other solar PV projects will be developed close to the affected sections of the R34 which will effectively screen the proposed project. Given the distance and the nature of future development, the grid connection will not be visible and it is also highly unlikely that the proposed solar project will be visible from this area.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small to Minor (1)	Small (0)
Probability	Improbable (2)	Very improbable (1)
Significance	**Low (14)**	**Low (6)**
Status (positive or negative)	It is unlikely that there will be a significant change in the character of the view from the southern edge of Vryburg. Neutral to negative impact	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss.	No irreplaceable loss.
Can impacts be mitigated?	Yes.	

Mitigation:
Planning:
» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development.

Operation:
» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.

Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the site;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Residual Impacts:
The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *Impact on homesteads*
The ZTV indicates that there are approximately five homesteads that could be affected within the Approximate Limit of Visibility. Of these:
» One is within a site on which another solar PV project is proposed;
» One is within the proposed project site; and
» Two are located between 3.5 and 4.5km to the west of the proposed project site. There are however other authorised solar PV projects on intervening properties.

The proposed grid connection is unlikely to be visible to homesteads. The proposed solar project may be visible.

It is noted that there are trees surrounding the two homesteads to the west that are likely to largely screen views of the proposed development. The homestead on the project property is outside the development footprint and close to the N18. It is assumed that the homestead within the site is owned by /used by people that are likely to be involved in the proposed development. It is also assumed that the one homestead on land that is likely to be affected by another solar PV project is owned / used by people involved in that project.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor to Low (3)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss. However, given the likely long term nature of the project, it is possible that a proportion of stakeholders will view the loss of view as irreplaceable.	No irreplaceable loss.
Can impacts be mitigated?	Yes.	

Mitigation:

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development.

Operation:

» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Residual Impacts:

The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *Impact on the Tiger Kloof Combined School*

The Tiger Kloof Combined School is located on the opposite side of the N18 to the proposed project site and close to the southern extent of the development footprint. A buffer area of approximately 300m exists between the road and the edge of the solar field and softens the views of the development from the road and from Tiger Kloof Combined School.

The on-site substation, full extent of road and the Tiger Kloof School, from which the ZTV indicates that the project could be visible, there is sufficient tall woody vegetation within the 300m buffer to largely screen the solar field. The project is therefore likely to be largely screened. It may be possible to see small sections of the solar field between and over vegetation, however, this is very unlikely to be obvious from the School.

It is likely that mitigation including maintaining and augmenting tall woody vegetation in the buffer area will further decrease the extent of visibility of the proposed project.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Improbable (2)	Very Improbable (1)
Significance	**Low (16)**	**Low (6)**
Status (positive or negative)	Negative	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	The proposed development can be dismantled. There will therefore be no irreplaceable loss.	No irreplaceable loss.
Can impacts be mitigated?	Yes.	

Mitigation:

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;

» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;
» Retain natural buffer areas adjacent to the N18 and on the northern boundary;
» Plan to maintain and manage woody vegetation within the buffer area to provide screening of the development from the road.

Operation:
» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area;
» Maintain natural buffer areas adjacent to the N18 and on the southern boundary; and
» Maintain woody vegetation within the natural buffer area adjacent to the N18.

Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the site;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Residual Impacts:
The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *Glare from the proposed project could cause nuisance on the adjacent N18 and for flightpaths associated with the Vryburg airstrip*
Research indicates that glint and glare problems are most likely to occur to the west and north-west of a facility in the morning, and to the east and north-east in the afternoon and evening. It needs to be understood that if these impacts do occur, they will be dependent on appropriate conditions that are likely to occur during specific months of the year and time of day. The impacts are therefore likely to be intermittent and not ongoing. Whilst PV panels are designed to absorb light energy, light is often reflected when the angle of incidence is acute as happens when the sun is bright and low in the sky.

Given the fact that the N18 to the east of the project site is at approximately the same level as the site, it is unlikely that sections of this road will be affected. Given that the flight path into the airstrip to the north is directly over the proposed array, it is also highly unlikely that glint and glare will affect pilots' vision on approach or take off from this airstrip.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small to minor (1)	Small (0)
Probability	Very Improbable (1)	Very Improbable (1)
Significance	**Low (7)**	**Low (6)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	There will be no irreplaceable loss.	No irreplaceable loss.
Can impacts be mitigated?	Yes.	

Mitigation:
Operation:
» The use of non-reflective finishes and coatings to the surface of PV panels.

» The use of a natural buffer area between the N18 and the facility. » Should problems occur on the N18, screen fencing or additional planting must be used.
Residual Impacts: No residual risk has been identified.

Nature: *The potential visual impact of operational, safety and security lighting of the facility at night on observers*

The area surrounding the site is currently affected by lighting from the adjacent urban area, the existing Mookodi MTS and the Tiger Kloof Combined School. It is therefore not considered to be a dark area at night. No specific detail has been provided regarding the lighting to be implemented other than confirmation of the need for lighting at sufficient level to enable security cameras to be used at night. This is likely to result in the development adding to existing light impacts in the area.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small to minor (1)
Probability	Definite (5)	Improbable (2)
Significance	**Medium (50)**	**Low (12)**
Status (positive or negative)	The appearance of a large lit area may be accepted by most people because it is so close to a well-lit urban environment. It is likely however that adjacent residents will see a new brightly lit area close to their property as a negative factor.	If the lights are generally not visible then the occasional light is unlikely to be seen as negative.
Reversibility	High	High
Irreplaceable loss of resources?	It would be possible to change the lighting / camera system so the impact cannot be seen as an irreplaceable loss.	No irreplaceable loss.
Can impacts be mitigated?	Yes.	

Mitigation:

» Use low key lighting around buildings and operational areas that is triggered only when people are present;
» Plan to utilise infra-red security systems or motion sensor triggered security lighting;
» Ensure that lighting is focused on the development with no light spillage outside the site; and
» Keep lighting low, no tall mast lighting should be used.

Residual Impacts:

No residual risk has been identified.

Power Line: Construction, Operation and Decommissioning Phase Impacts

Nature: *Visual impact of the grid connection alternatives on travellers on the N18*

From affected sections of the N18 to the north of the project, views over the site and proposed grid connection alternatives will be partially screened by existing vegetation and other infrastructure development.

Power Line Alternative 1 will be visible from this road. The ZTV mapping indicates that it will be visible for up

to 5.5km north of the site but in effect this is likely to be largely screened for ~2.5km by existing infrastructure and vegetation including the existing Mookodi Substation. This alternative will be visible from relatively close quarters as it is proposed to be aligned adjacent to the road. It will also add to the impact of the planned Mookodi - Magopela 132kV power line.

By comparison Power Line Alternative 2 will be visible for approximately 2.4km of the road. The viewer will gradually approach it from a distance. It therefore will be less obvious than Power Line Alternative 1.

	Alternative 1		**Alternative 2**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (4)	Small - Minor (1)	Small - Minor (1)
Probability	Improbable (2)	Improbable (2)	Very improbable (1)	Very improbable (1)
Significance	**Low (16)**	**Low (16)**	**Low (7)**	**Low (7)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	High	High	High	High
Irreplaceable loss of resources?	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss. However, given the likely long term nature of the project, it is possible that a proportion of stakeholders will view the loss of view as irreplaceable.	No	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss. However, given the likely long term nature of the project, it is possible that a proportion of stakeholders will view the loss of view as irreplaceable.	No
Can impacts be mitigated?	No			

Mitigation:

» No mitigation measures

Residual Impacts:

The residual risk relates to the infrastructure being left in place on decommissioning of the solar project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *Visual impact on the landscape character*

The proposed grid connection will introduce industrial elements into the rural landscape immediately to the south of Vryburg. This area is already highly influenced by infrastructure development and with the development of currently authorised projects this influence is likely to increase. The majority of receptors will view the project from the N18 which runs between the Mookodi MT and the project site.

From the north, there is a degree of VAC which is provided by existing vegetation and for areas close to the southern edge of Vryburg by other infrastructure development. This will help to soften / screen the view of Alternative 1 until the viewer is close to the Mookodi MTS. From this section of the road Alternative 2 is unlikely to be visible.

Alternative 1 will be visible for the entire length of road between the Mookodi MTS and the northern section of the project site. It will be seen in the context of existing power lines and the proposed Mookodi - Magopela 132kV power line which will also run parallel to the road.

Alternative 2 will only be visible from the section of road immediately to the north and to the south of the northern site boundary. Alternative 2 will also be viewed in the context of existing power lines as well as the proposed Mookodi - Magopela 132kV power line.

Both alternatives will impact an area that is already impacted by infrastructure development. It will therefore intensify the influence of development.

	Alternative 1		**Alternative 2**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)	Small - Minor (1)	Small - Minor (1)
Probability	Improbable (2)	Improbable (2)	Very Probable (1)	Very Probable (1)
Significance	**Low (16)**	**Low (16)**	**Low (7)**	**Low (7)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	High	High	High	High
Irreplaceable loss of resources?	No	No	No	No
Can impacts be mitigated?	No			

Mitigation:

» The construction of Power Line Alternative 2 will lower this impact.

Residual Impacts:

The residual risk relates to the infrastructure being left in place on decommissioning of the solar project. It is therefore critical that effective rehabilitation is undertaken.

7.6.4. Comparative Assessment of Power Line Alternatives

The comparative ZTV analysis of the power line alternatives indicates that theoretically both alternatives might be visible over a similar area. However, when the Approximate Limit of Visibility of the two alternatives is considered, it is obvious that Power Line Alternative 2 will be less obvious than Power Line Alternative 1 as it will generally be seen from a greater distance. Power Line Alternative 2 is considerably shorter than Alternative 1, thereby reducing the area of potential visual exposure, and subsequent potential visual impact. This alternative is therefore considered to be the preferred alternative from a visual perspective.

Aspect	Alternative 1	Alternative 2
Visual	» Visual impact is of medium significance. » Visible for 5.5km from the site » Aligned mostly along the Mookodi – Magopela 132kV power line to be constructed. » Located near existing infrastructure (N18 and railway line). » Least preferred but acceptable.	» Visual impact is of low significance. » Visible for 2.4km from the site » Located near existing infrastructure. » No additional parallel 132kV power line running parallel with the planned Mookodi - Magopela 132kV Power Line » Preferred.

7.6.5. Implications for Project Implementation

Overall, the significance of the visual impacts is expected to range from low with the implementation of mitigation measures. The following mitigation is possible:

»
» Augmentation and management of vegetation within the buffer area between the development footprint and the N18 National Road.
» Reinstate any areas of vegetation that have been disturbed during construction.
» Plan and maintain lighting associated with the facility in such a way as to minimise impacts on the surrounding areas.

7.7. Assessment of Impacts on Heritage Resources

Negative impacts on heritage resources will be due to loss of archaeological and palaeontological resources during construction activities of the Moeding Solar PV Facility. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix H** for the Heritage Impact Assessment and to **Appendix I** for the Palaeontological Impact Assessment).

7.7.1. Results of the Heritage Impact Assessment (including archaeology and palaeontology)

Heritage resources present on the affected properties were identified through a field survey, archival research and evaluation of aerial photography. During the field assessment 34 significant heritage sites were identified within the project site and included:

» Twenty one find spots;
» One erosion site exposing Stone Age materials;
» Five significant Stone Age sites;
» One pan like site with extensive exposure of Stone Age artefacts;
» Three historical sites;
» One burial ground;
» One area of stacked stones; and
» One possible grave.

Of these sites listed above, four sites fall within the 300m power line corridor (Alternative 1) and none within the development footprint of the solar energy facility. As these sites have a site significance of GP.B, a

20m no-go area has been established around each site. With the implementation of mitigation measures, the potential impact on heritage resources will be low.

The north-eastern portion of the project site is underlain by a small section of the Vryburg Formation of the Transvaal Supergroup (geologically older than 2.6 billion year-old) while the remaining portion of the project site is primarily underlain by the Schmidtsdrift Subgroup, Ghaap Group of the Transvaal Supergroup. The Schmidtsdrift Subgroup has a high palaeontological sensitivity, while the Vryburg Formation has a moderate palaeontological sensitivity. Stromatolite assemblages are recorded within both the Schmidtsdrift Subgroup and Vryburg Formation. The project site consists of characteristic flat-lying terrain and vegetation cover of grassy thornveld. Poorly- to fairly well-preserved stromatolite assemblages were recorded within the project site. With the implementation of mitigation measures, the potential impact on palaeontological resources will be low.

7.7.2. Description of the Heritage Impacts

7.7.2.1. Palaeontological resources:

Stratigraphic and geographical distribution of Late Archaean stromatolites within the Schmidtsdrift Subgroup and Vryburg Formation of the Transvaal Supergroup is present in the development footprint. Excavations and site clearance will involve substantial excavations into the superficial sediment cover as well as locally into the underlying bedrock. These excavations will modify the existing topography and may disturb damage, destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific research.

Should the project progress without due care to the possibility of fossils being present at the proposed development footprint within the Vryburg Formation the resultant damage, destruction or inadvertent relocation of any affected fossils will be permanent and irreversible. Therefore, any fossils occurring within the development area are potentially scientifically and culturally significant and any negative impact on them would be of high significance.

7.7.2.2. Archaeology resources:

Site 035 (refer to **Figure 7.12**):
The site is located adjacent to the northern boundary of the project site and within the 300m power line corridor (Power Line Alternative 1). A large slightly raised 50 x 100 m area with a considerable deflated surface concentration of colluvial gravels and pebbles, in amongst outcropping dolomite bedrock. Artefacts occur sporadically amongst these natural gravels and include a selection of flakes and cores on both chert and quartzite. Edge damage is common, suggesting their long-term exposure at the surface, yet artefact condition is fresh. All materials are in secondary context and artefact burial at depth is unlikely given the local exposures of bedrock. A large quantity of geofacts also occurs in this area. Heritage significance: Generally Protected B (GP.B).

Site 036 (refer to **Figure 7.12**):
The site is located adjacent to the northern boundary of the project site and within the 300m power line corridor (Power Line Alternative 1). A large slightly raised area (at least 30 m wide) with a considerable deflated surface concentration of colluvial gravels, pebbles, cobbles and calcrete nodules; this area is adjacent to a low-lying depression (possible pan). Artefacts occur sporadically amongst these natural

gravels and include a selection of flakes and cores on quartzite. Edge damage is common, suggesting their long-term exposure at the surface. All materials are in secondary context and artefact burial at depth is uncertain. Heritage significance: Generally Protected B (GP.B).

Site 037, 038 and 039 (refer to **Figure 7.12**):
These sites are located north of the northern boundary of the project site and within the 300m power line corridor (Power Line Alternative 1). A very large area (100 x 200 m) with a continuous deflated surface concentration of colluvial gravels, pebbles, cobbles and calcrete nodules; this area is adjacent to a low-lying depression (possible pan; chert and dolomite outcrops occur here). Artefacts occur sporadically amongst these natural gravels and include a selection of flakes and cores on chert, all generally in fresh condition. Edge damage is common, suggesting their long-term exposure at the surface. All materials are in secondary context and artefact burial at depth is uncertain, given that bedrock outcrops occur in the area. Heritage significance: Generally Protected B (GP.B).

Site 041 (refer to **Figure 7.12**):
This site is located north of the northern boundary of the project site and within the 300m power line corridor (Power Line Alternative 1). A very large raised area (at least 200 m long) with a continuous deflated surface concentration of colluvial gravels, pebbles and cobbles; bedrock in the form of chert also occurs here. Artefacts occur sporadically amongst these natural gravels and include a selection of flakes and cores on chert and quartzite, all generally in fresh condition. All materials are in secondary context and artefact burial at depth is uncertain, given that bedrock outcrops occur in the area. Generally Protected B (GP.B).

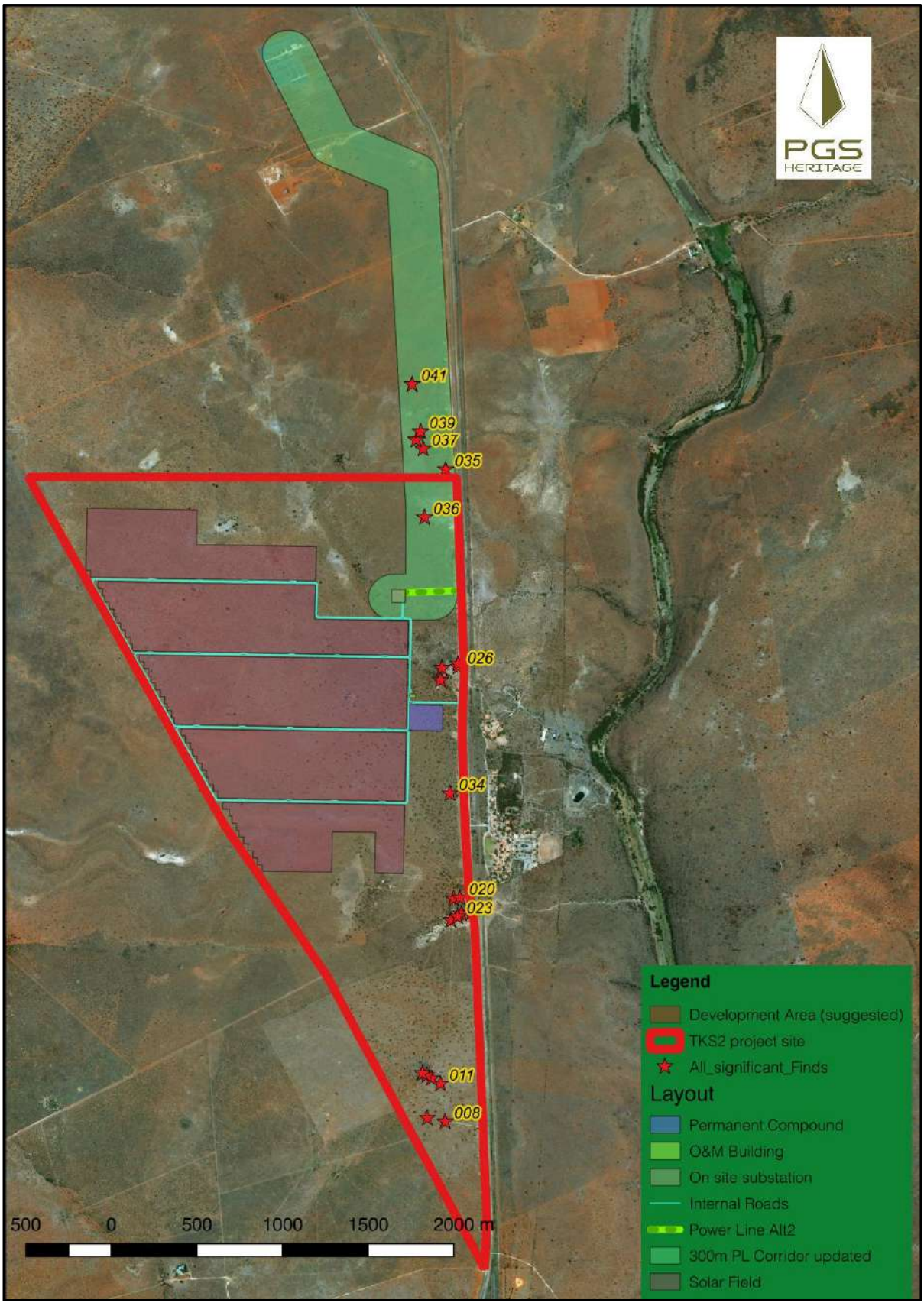

Figure 7.12 Map indicating the position of all significant heritage finds in relation to the project layout. Feature 037, 038 (located between 037 and 039) and 039 are considered to be one find.

7.7.3. Impact tables summarising the significance of impacts on heritage related to the PV facility and associated infrastructure during construction and operation (with and without mitigation)

7.7.3.1. Palaeontological resources:

The tables below are applicable to all alternatives under consideration for the project infrastructure and the solar energy facility.

Nature: *Impact on Palaeontological Resources*
*T*he excavations and clearing of vegetation during the construction phase will consist of digging into the superficial sediment cover as well as underlying deeper bedrock. These excavations will change the existing topography and may possibly disturb, destroy or even permanently close-in fossils at or below the ground surface. These fossils will then be lost for research.

Impacts on Palaeontological Heritage are likely to happen only within the construction phase. No impacts are expected to occur during the operation phase or decommissioning phase.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long term/permanent (5)	Long term/permanent (5)
Magnitude	Moderate (6)	Minor (1)
Probability	Probable (4)	Improbable (1)
Significance	**Medium (48)**	**Low (7)**
Status (positive or negative)	Negative	Neutral
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes.	

Mitigation:

» Mitigation is recommended which usually involves the sampling, collection and recording of fossils as well as obtaining relevant data concerning the surrounding sedimentary matrix within the proposed development footprint by a palaeontologist. This should take place after the initial vegetation removal has taken place but *before* the ground is levelled for construction. Excavation of this fossil heritage will require a permit from SAHRA and the material must be housed in a permitted institution. All fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA. These recommendations should be incorporated into the Environmental Management Plan for the Moeding Solar PV Facility.

Residual Impacts:
Loss of Palaeontological Heritage.

Nature: *Impact on Palaeontological Resources associated with the power line infrastructure*
*T*he excavations and clearing of vegetation during the construction phase of the power line will consist of digging into the superficial sediment cover as well as underlying deeper bedrock. These excavations will change the existing topography and may possibly destroy or even permanently close-in fossils at or below the ground surface. These fossils will then be lost for research.

Impacts on Palaeontological Heritage due to the construction of the power line are only likely to happen within the construction phase. No impacts are expected to occur during the operation phase or decommissioning phase.

	Alternative 1		**Alternative 2**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)

Duration	Long-term / Permanent (5)	Long-term / Permanent (5)	Long-term / Permanent (5)	Long-term / Permanent (5)
Magnitude	Moderate (2)	Moderate (1)	Moderate (2)	Moderate (1)
Probability	Improbable (2)	Improbable (1)	Improbable (2)	Improbable (1)
Significance	**Low (16)**	**Low (7)**	**Low (16)**	**Low (7)**
Status (positive or negative)	Negative	Neutral	Negative	Neutral
Reversibility	Irreversible	Irreversible	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	No	Yes	No
Can impacts be mitigated?	Yes			
Mitigation: » Implementation of the chance find procedure. » The EO will close off the chance find procedure and would be required to implement any requirements issued by the Authority and to add it to the operational management plan.				
Residual Impacts: Loss of Fossil Heritage				

7.7.3.2. Archaeological resources:

The tables below are applicable to the power line alternatives and the solar energy facility under consideration for the project infrastructure.

Nature: *Impact on Archaeological Sites* Four sites fall within the 300m corridor and none within the development footprint of the solar energy facility. These sites have a site significance of GP.B. Archaeological resources are generally protected by the NHRA through S35 and any alteration, excavations or destruction of such site can only be done after the issuing a permit by the SAHRA.				
	Alternative 1 including the PV Facility		**Alternative 2 including the PV Facility**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (3)	Local (3)	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)	Very short (1)	Very short (1)
Magnitude	High (10)	Low (4)	Small (0)	Small (0)
Probability	Most Likely (4)	Improbable (2)	Very improbable (1)	Very improbable (1)
Significance	**High (72)**	**Low (24)**	**Low (2)**	**Low (2)**
Status (positive or negative)	Negative	Neutral	Neutral	Neutral
Reversibility	Low	Low	High	High
Irreplaceable loss of resources?	Yes	No	No	No
Can impacts be mitigated?	Yes			
Mitigation: » Demarcate Site 035 – 039 and 041 with a 20 meter buffer during construction. These sites may not be disturbed or destroyed without an appropriate permit from SAHRA.				
Residual Impacts: The impact may result in the irreplaceable loss of resources of high value (services and/or functions) should archaeological sites not be avoided.				

Nature: *Impact on Burial Grounds* One burial ground was identified within the project site but not within the development footprint. Due to the social and cultural significance of burial grounds and graves, a high heritage significance is given to such sites.

	Alternative 1 including the PV Facility		Alternative 2 including the PV Facility	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Very short (1)	Very short (1)	Very short (1)	Very short (1)
Magnitude	Small (0)	Small (0)	Small (0)	Small (0)
Probability	Very improbable (1)	Very improbable (1)	Very improbable (1)	Very improbable (1)
Significance	**Low (2)**	**Low (2)**	**Low (2)**	**Low (2)**
Status (positive or negative)	Neutral	Neutral	Neutral	Neutral
Reversibility	High	High	High	High
Irreplaceable loss of resources?	No	No	No	No
Can impacts be mitigated?	Yes			

Mitigation:

» Site 021 will need to be demarcated and avoided during the construction phase.
» A 50m buffer must be provided around the cemetery.
» In the event of any graves or burial grounds being uncovered, SAHRA should be contacted and a qualified archaeologist appointed to evaluate the finds and make appropriate recommendations on mitigation.

Residual Impacts:
No residual impacts are expected to occur with the implementation of mitigation measures.

Nature: *Impact on Historical Structures*
These buildings may relate to the original initial occupation in the area by Reverend William Charles Willoughby. As such these structures would need to be fully documented. None of these structures occur within the development footprint.

	Alternative 1 including the PV Facility		Alternative 2 including the PV Facility	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Very short (1)	Very short (1)	Very short (1)	Very short (1)
Magnitude	Small (0)	Small (0)	Small (0)	Small (0)
Probability	Very improbable (1)	Very improbable (1)	Very improbable (1)	Very improbable (1)
Significance	**Low (2)**	**Low (2)**	**Low (2)**	**Low (2)**
Status (positive or negative)	Neutral	Neutral	Neutral	Neutral
Reversibility	High	High	High	High
Irreplaceable loss of resources?	No	No	No	No
Can impacts be mitigated?	Yes			

Mitigation:

» Demarcate with a 20 meter buffer around these structures during construction.

Residual Impacts:
No residual impacts are expected to occur with the implementation of mitigation measures.

7.7.4. Comparative Assessment of Power Line Alternatives

Both power line alternatives are underlain by the Vryburg Formation of the Transvaal Supergroup and therefore have a similar geology. There is no preferences between the alternatives and both are considered to be acceptable from a palaeontological perspective.

Four sites considered to be of heritage significance have been identified within the 300m corridor for Power Line Alternative 1 while no sites of heritage significance were identified along Power Line Alternative

2. Therefore, Alternative 2 is considered to be the preferred alternative from an archaeological perspective.

Aspect	Alternative 1	Alternative 2
Palaeontology	» Similar geology to Alternative 2. » Acceptable.	» Similar geology to Alternative 1. » Acceptable.
Archaeology	» Longest alternative. » Four sites of heritage significance identified within 300m corridor. » Least preferred.	» Shortest Alternative. » No sites of heritage significance identified along power line route. » Preferred.

7.7.5. Implications for Project Implementation

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of impacts of the Moeding Solar PV Facility will be low on heritage. From the outcomes of the studies undertaken, it is concluded that the solar energy facility can be developed and impacts on heritage managed by taking the following into consideration:

» Four sites of heritage significance have been identified and should be avoided. Should these sites not be avoided by the final alignment of Alternative 1 (if implemented), the sites will need to be documented with sites being fully excavated before a destruction permit can be applied for at the provincial heritage authority (North West Province).
» A chance find procedure 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.

7.8. Assessment of Social Impacts

Potential social impacts and the relative significance of the impacts associated with the development of the Moeding Solar PV Facility are summarised below (refer to **Appendix J**).

7.8.1. Results of the Social Impact Assessment

Traditionally, the construction phase of a PV solar development is associated with the majority of social impacts. Many of the social impacts are unavoidable and will take place to some extent, but can be managed through the careful planning and implementation of appropriate mitigation measures. A number of potential positive and negative social impacts have been identified for the project, however an assessment of the potential social impacts indicated that there are no perceived negative impacts that are sufficiently significant to allow them to be classified as "fatal flaws".

Based on the social impact assessment, the following general conclusions and findings can be made:

» The potential negative social impacts associated with the construction phase are typical of construction related projects and not just focussed on the construction of solar PV projects (these relate to an influx of non-local workforce and jobseekers, intrusion and disturbance impacts (i.e. noise and dust, wear and tear on roads) and safety and security risks), and could be reduced with the

implementation of the mitigation measures proposed. The significance of such impacts on the local communities can therefore be mitigated.

» The development will introduce employment opportunities during the construction phase (temporary employment) and a limited number of permanent employment opportunities during operation phase.
» The proposed project could assist the local economy in creating entrepreneurial growth and opportunities, especially if local business is involved in the provision of general material, goods and services during the construction and operational phases. This positive impact is likely to be compounded by the cumulative impact associated with the development of several other solar facilities within the surrounding area, and as a result of the projects location within REDZ 6 which has been earmarked for the development of large scale solar PV energy facilities.
» The proposed development also represents an investment in infrastructure for the generation of clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.
» It should be noted that the perceived benefits associated with the project which include renewable energy generation, and local economic and social development outweigh the perceived impacts associated with the project.

7.8.2. Description of Social Impacts

The following positive and negative impacts have been identified and assessed for the Moeding Solar PV Facility.

Positive social impacts associated with the construction phase of the Moeding Solar PV Facility:
» Direct and indirect employment opportunities and skills development
» Economic multiplier effects

Negative social impacts associated with the construction phase of the Moeding Solar PV Facility:
» Influx of jobseekers and change in population
» Safety and security impacts
» Impacts on daily living and movement patterns
» Nuisance impacts (noise and dust)
» Visual impacts and sense of place

Positive social impacts associated with the operation phase of the Moeding Solar PV Facility:
» Direct and indirect employment opportunities and skills development
» Development of non-polluting, renewable energy infrastructure
» Contribution to Local Economic Development (LED) and social upliftment

Negative social impacts associated with the operation phase of the Moeding Solar PV Facility:
» Visual and sense of place impacts
» Impacts associated with the loss of agricultural land

7.8.3. Impact tables summarising the significance of social impacts during construction and operation (with and without mitigation measures)

Construction Phase Impacts

Nature: *Direct and indirect employment opportunities and skills development*

The creation of direct and indirect employment opportunities during the construction phase of the project. It is anticipated that the proposed project will result in the creation of approximately 800 employment opportunities at the peak of construction. Of the approximately 800 employment opportunities likely to be generated, approximately 60% (i.e. 480) would accrue to unskilled workers. Employment opportunities generated as a result of the project will be temporary in nature, and will last for the duration of the construction period (i.e. approximately 12 to 18 months). The project proponent anticipates that the majority of the general labour force will as far as possible be sourced from the local labour pool. Where relevant skills are unavailable from the local labour pool, these would need to be sought elsewhere.

	Without enhancement	**With enhancement**
Extent	Local-Regional (3)	Local-Regional (3)
Duration	Short term (2)	Short term (2)
Magnitude	Minor (2)	Moderate (6)
Probability	Highly probable(4)	Definite (5)
Significance	**Low (28)**	**Medium (55)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Enhancement:

» A local employment policy should be adopted to maximise opportunities made available to the local labour force.
» Labour should be sourced from the local labour pool, and only if the necessary skills are unavailable, should labour be sourced from (in order of preference) the greater Naledi LM, Dr Ruth Segomotsi Mompati DM, North West Province, South Africa, or elsewhere.
» Where feasible, training and skills development programmes should be initiated prior to the commencement of the construction phase.
» As with the labour force, suppliers should also as far as possible be sourced locally.
» As far as possible local contractors that are compliant with Broad-Based Black Economic Empowerment (B-BBEE) criteria should be used.
» The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.

Residual Impacts:

» Improved pool of skills and experience in the local area.
» Economic growth for small-scale entrepreneurs.
» Temporary employment during the construction phase will result in job losses and struggles for construction workers to find new employment opportunities.

Nature: *Economic multiplier effects*

Significance of the impact from the economic multiplier effects from the use of local goods and services. There are likely to be opportunities for local businesses and service providers to provide services and materials for, and in doing so benefit from, the construction phase of the proposed project. Off-site accommodation in the nearest town (i.e. Vryburg) may be required for contract workers and certain employees. The economic multiplier effects from the use of local goods and services will include, but is not limited to, construction materials and equipment, and workforce essentials such as catering, trade clothing, safety equipment, accommodation, transportation and other goods.

	Without enhancement	**With enhancement**
Extent	Local-Regional (3)	Local-Regional (3)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Moderate (6)
Probability	Highly probable (4)	Definite (5)

Significance	**Medium (36)**	**Medium (55)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Enhancement:

» It is recommended that a local procurement policy is adopted to maximise the benefit to the local economy.
» A database of local companies, specifically Historically Disadvantaged Individuals (HDIs) which qualify as potential service providers (e.g. construction companies, security companies, catering companies, waste collection companies, transportation companies etc.) should be created and companies listed thereon should be invited to bid for project-related work where applicable.
» Local procurement is encouraged along with engagement with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods and products from local suppliers where feasible.

Residual Impacts:

» Improved local service sector which will result in a growth in local business.

Nature: *Influx of jobseekers and change in population*

In-migration of labourers in search of employment opportunities, and a resultant change in population, and increase in pressure on local resources and social networks, or existing services and infrastructure. An influx of jobseekers into an area, could lead to a temporary increase in the level of crime, cause social disruption and put pressure on basic services. This includes municipal services such as sanitation, electricity, water, waste management, health facilities, transportation and the availability of housing. It could also potentially create conflict between locals and outsiders due to potential differences in racial, cultural and ethnic composition. A further negative impact that could result due to an influx of jobseekers into an area is an increase in unemployment levels due to an oversupply of available workforce, particularly with respect to semi and unskilled workers.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Low (4)
Probability	Very Improbable (1)	Very Improbable (1)
Significance	**Low (7)**	**Low (7)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Develop and implement a local procurement policy which prioritises "locals first" to prevent the movement of people into the area in search of work.
» Engage with local community representatives prior to construction to facilitate the adoption of the locals' first procurement policy.
» Provide transportation for workers (from Vryburg and surrounds) to ensure workers can easily access their place of employment and do not need to move closer to the project site.
» Working hours should be kept between daylight hours during the construction phase, and / or as any deviation that is approved by the relevant authorities.
» Compile and implement a grievance mechanism.
» Appoint a Community Liaison Officer (CLO) to assist with the procurement of local labour.
» Prevent the recruitment of workers at the project site.
» Implement a method of communication whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.

- Establish clear rules and regulations for access to the proposed site.
- Appoint a security company and implement appropriate security procedures to ensure that workers do not remain onsite after working hours.
- Inform local community organisations and policing forums of construction times and the duration of the construction phase.
- Establish procedures for the control and removal of loiterers from the construction site.

Residual Impacts:

- Possibility of outside workers remaining in the area after construction is completed and subsequent pressures on local infrastructure, resources and services.

Nature: *Safety and security impacts*

Temporary increase in safety and security concerns associated with the influx of people during the construction phase. The commencement of construction activities can be associated with an increase in crime within an area. The perceived loss of security during the construction phase of a project due to an influx of workers and / or outsiders to the area (as in-migration of newcomers, construction workers or jobseekers are usually associated with an increase in crime), may have indirect effects such as increased safety and security concerns for neighbouring properties, damage to property, increased risk of veld fire, stock theft, poaching, crime and so forth.

Given the fact that a main camp will not be established onsite, and the labour force will therefore not permanently reside within the area, or have any reason to be onsite after hours, it is anticipated that the probability and significance of such safety and security impacts occurring will be reduced.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	High (8)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

- Working hours should be kept within daylight hours during the construction phase, and / or as any deviation that is approved by the relevant authorities.
- Provide transportation for workers (from Vryburg and surrounds) to prevent loitering within or near the project site outside of working hours.
- The perimeter of the construction site should be appropriately fenced off and secured to prevent any unauthorised access to the site. The fencing of the site should be maintained throughout the construction period.
- The appointed EPC Contractor must appoint a security company to ensure appropriate security procedures and measures are implemented.
- Access in and out of the construction site should be strictly controlled by a security company appointed to the project.
- CLO should be appointed as a grievance mechanism. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.
- The implementation of a stakeholder management plan by the EPC contractor to address neighbouring farmer concerns regarding safety and security.

Residual Impacts:

None anticipated

Nature: *Impacts on daily living and movement patterns*

Temporary increase in traffic disruptions and movement patterns during the construction phase. Increased traffic due to construction vehicles could cause disruptions to the local community and increase safety hazards. The use of local roads and transport systems may cause road deterioration and congestion. This impact will be magnified since farm roads are not designed to carry heavy traffic and are prone to erosion. Noise, vibrations, dust and visual pollution from heavy vehicle traffic during the construction phase could also negatively impact local residents and road users.

	Without mitigation	**With mitigation**
Extent	Local-Regional (3)	Local-Regional (3)
Duration	Short term (2)	Short term (2)
Magnitude	High (8)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium (39)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Working hours to be appropriately arranged during the construction phase, and / or as any deviation that is approved by the relevant authorities.
» All vehicles must be road worthy and drivers must be qualified, obey traffic rules, follow speed limits and made aware of the potential road safety issues.
» Heavy vehicles should be inspected regularly to ensure their road safety worthiness.
» Provision of adequate and strategically placed traffic warning signs and control measures along the N18 and gravel farm access roads to warn road users of the construction activities taking place for the duration of the construction phase. Warning signs must be visible at all times, and especially at night.
» Implement penalties for reckless driving as a way to enforce compliance to traffic rules.
» Avoid heavy vehicle activity during "peak" hours (when children are taken to school, or people are driving to work).
» The developer and EPC contractor must ensure that all fencing along access roads is maintained in the present condition or repaired if disturbed due to construction activities.
» The developer and EPC Contractor must ensure that the roads utilised for construction activities are either maintained in the present condition or upgraded if disturbed due to construction activities.
» The developer and EPC Contractor must ensure that any damage / wear and tear to the roads caused by construction related traffic / project activities is repaired.
» A method of communication must be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.

Residual Impacts:

None anticipated

Nature: *Nuisance impacts (dust and noise)*

Nuisance impacts in terms of temporary increase in noise and dust, and wear and tear on access roads to the site. Impacts associated with construction related activities include noise, dust, and possible disruption to adjacent properties. Site clearing activities increase the risk of dust and noise being generated, which can in turn negatively impact on adjacent properties. The movement of heavy construction vehicles and construction activities and equipment also have the potential to create noise at the project site, as well as along the N18 national road, and other local access roads. The primary sources of noise during construction would be from construction equipment, vehicle / truck traffic, and ground vibration. Noise levels can be audible over a large distance however are generally short in duration. Dust would be generated from construction activities as well as trucks / vehicles driving on gravel access roads.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (36)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» The movement of heavy vehicles associated with the construction phase should be timed to avoid weekends, public holidays and holiday periods where feasible.
» The contractor must ensure that damage / wear and tear caused by construction related traffic to the access roads is repaired before the completion of the construction phase.
» Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.
» Ensure all vehicles are road worthy, drivers are qualified and are made aware of the potential noise and dust issues.
» A CLO should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.

Residual Impacts:

» Only damage to roads that is not fixed could affect road users.

Nature: *Visual impacts and sense of place*

Intrusion impacts from construction activities will have an impact on the area's "sense of place". Intrusion impacts such as aesthetic pollution (i.e. building materials, construction vehicles, etc.), noise and light pollution, and impacts on the rural nature of the site will impact the "sense of place" for the local community.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Low (28)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Implement mitigation measures identified in the Visual Impact Assessment (VIA) prepared for the project.
» Limit noise generating activities to normal daylight working hours and avoid weekends and public holidays.
» The movement of heavy vehicles associated with the construction phase should be timed to avoid weekends, public holidays and holiday periods where feasible.
» Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.
» 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.
» Communication, complaints and grievance channels must be implemented and contact details of the CLO must be provided to the local community in the study area.

Residual Impacts:
None anticipated

Operation Phase Impacts

Nature: *Direct and indirect employment opportunities and skills development*

The creation of employment opportunities and skills development opportunities during the operation phase for the country and local economy. It is anticipated that the operation of the project is likely to create 8 to 10 skilled employment opportunities, while training opportunities would be available for local community members for areas such as security, electricians, etc. These employment opportunities will include highly skilled, semi-skilled and unskilled opportunities. The employment opportunities generated as a result of the project will be long term and will last for the duration of operation (i.e. approximately 20 years). None of the employment opportunities will be permanently stationed on site.

	Without enhancement	**With enhancement**
Extent	Local-Regional (3)	Local-Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly probable(4)	Definite (5)
Significance	**Medium (44)**	**Medium (55)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Enhancement:

- It is recommended that local employment policy is adopted to maximise the opportunities made available to the local community.
- The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.
- Vocational training programs should be established to promote the development of skills.

Residual Impacts:

- Improved pool of skills and experience in the local area.

Nature: *Development of non-polluting, renewable energy infrastructure*

Increasing the contribution of the renewable energy sector to the local economy would contribute to the diversification of the local economy and provide greater economic stability. The growth in the renewable energy sector as a whole could introduce new skills and development into the area. This is especially true with regards to solar power specifically considering the number of other solar power projects proposed within the broader area.

	Without enhancement	**With enhancement**
Extent	Local-Regional-National (4)	Local-Regional-National (4)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Medium (50)**	**Medium (50)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	Yes
Irreplaceable loss of resources?	Yes (impact of climate change)	Yes (impact of climate change)
Can impacts be mitigated?	No	
Enhancement:		

None identified

Residual Impacts:

» Reduce carbon emissions through the use of renewable energy and contribute to reducing global warming.

Nature: *Contribution to Local Economic Development (LED) and social upliftment*

Contribution to LED and social upliftment during the operation of the project. Projects which form part of the DoE's REIPPP Programme are required as part of their bidding requirements to contribute towards LED and social upliftment initiatives within the area in which they are proposed. In addition, they are required to spend a percentage of their revenue on socio-economic and enterprise development, as well as allocate ownership shares to local communities that benefit previously disadvantaged communities around the project. A portion of the dividends generated by each development also need to be invested into LED projects and programmes.

	Without enhancement	**With enhancement**
Extent	Local-Regional-National (4)	Local-Regional-National (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate to High (7)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (56)**	**High (60)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Enhancement:

» A Community Needs Assessment (CAN) must be conducted to ensure that the LED and social upliftment programmes proposed by the project are meaningful.
» Ongoing communication and reporting is required to ensure that maximum benefit is obtained from the programmes identified, and to prevent the possibility for such programmes to be misused.
» The programmes should be reviewed on an ongoing basis to ensure that they are best suited to the needs of the community at the time (bearing in mind that these are likely to change over time).

Residual Impacts:

» Social upliftment of the local communities through the development and operation of the project.

Nature: *Visual and sense of place impacts*

Visual impacts and sense of place impacts associated with the operation phase of the Moeding Solar PV Facility. An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light. The social impacts associated with the impact on sense of place relate to the change in the landscape character and visual impact of the Moeding Solar PV Facility. The alteration of the sense of place in view of the local residents and road users will start during the construction phase and remain for the projects operational lifetime.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:
» Implement mitigation measures identified in the Visual Impact Assessment report prepared for the project.
Residual Impacts:
» The visual impact of the Moeding Solar PV Facility will remain if the facility is not decommissioned and dismantled after the end of its operational life.

Nature: *Impacts associated with the loss of agricultural land*

Loss of agricultural land and overall productivity as a result of the operation of the proposed project on an agricultural property. The development of the proposed project on an agricultural property would result in the area of land required to support the development footprint being removed from potential agricultural production. This could threaten jobs of workers employed in the agricultural activities.

	Without mitigation	**With mitigation**
Extent	Site (1)	Site (1)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (5)	Low (3)
Probability	Definite(5)	Probable(3)
Significance	**Medium (50)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» The following mitigation measures were provided in the Soil, Land Use and Land Capability Assessment Report:
  * Keep the project footprint as small as possible.
  * Avoid areas with wetland land capability.

Residual Impacts:

» Economically unviable portions of agricultural land which may reduce overall productivity.

7.8.4. Comparative Assessment of Power Line Alternatives

Power Line Alternative 1 entails the development of a power line from the project's on-site substation to the Mookodi Main Transmission Substation (MTS), located within the northern portion of the project site on the Remaining Extent of the Farm Rosendal 673. The power line corridor and overhead power line would be mostly aligned along the Mookodi – Magopela 132kV power line to be constructed.

Power Line Alternative 2 entails a turn-in turn-out to the Mookodi - Magopela 132kV power line to be constructed along the eastern boundary of the project site.

Based on the nature of impacts identified for the project from a social perspective, Power Line Alternative 2 has the shortest length and may lead to fewer disruptions on a farming area. Both proposed power line alternatives are however considered to be acceptable.

Aspect	**Alternative 1**	**Alternative 2**

Visual	» Aligned mostly along the Mookodi – Magopela 132kV power line to be constructed. » Located near existing infrastructure (N18 and railway line). » Acceptable.	» Located near existing infrastructure. » No additional parallel 132kV power line running parallel with the planned Mookodi - Magopela 132kV Power Line » Acceptable.

7.8.5. Implications for Project Implementation

The significance of the positive impacts associated with the socio-economic aspects that will be affected by the Moeding Solar PV Facility ranges from high to medium with the implementation of the enhancement measures recommended. These enhancement measures include:

» A local employment policy should be adopted to maximise opportunities made available to the local labour force.
» Labour should be sourced from the local labour pool, and only if the necessary skills are unavailable, should labour be sourced from (in order of preference) the greater Naledi LM, Dr Ruth Segomotsi Mompati DM, North West Province, South Africa, or elsewhere.
» A database of local companies, specifically Historically Disadvantaged Individuals (HDIs) which qualify as potential service providers (e.g. construction companies, security companies, catering companies, waste collection companies, transportation companies etc.) should be created and companies listed thereon should be invited to bid for project-related work where applicable.
» Vocational training programmes should be established to promote the development of skills.
» A Community Needs Assessment (CAN) must be conducted to ensure that the LED and social upliftment programmes proposed by the project are meaningful.

The significance of the negative impacts associated with the social aspects that will be affected by the Moeding Solar PV Facility ranges from medium to low with the implementation of the recommended mitigation measures. The mitigation measures include:

» Develop and implement a local procurement policy which prioritises "locals first" to prevent the movement of people into the area in search of work.
» Engage with local community representatives prior to construction to facilitate the adoption of the locals' first procurement policy.
» Appoint a Community Liaison Officer (CLO) to assist with the procurement of local labour.
» Implement a method of communication whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.
» The appointed EPC Contractor must appoint a security company to ensure appropriate security procedures and measures are implemented
» All vehicles must be road worthy and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues.
» Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.
» Limit noise generating activities to normal daylight working hours and avoid weekends and public holidays.

7.9. Impacts Related to the Storage and Handling of Dangerous Goods

During the construction and operation phase, the Moeding Solar PV Facility will require the storage of materials, which may be considered to be dangerous goods.
"Dangerous goods" is defined under the Listing Notices of the EIA Regulations (2014) that deal with the torage, or storage and handling, of dangerous goods. "Dangerous goods" are defined as:

"Goods containing any of the substances as contemplated in South African National Standard No. 10234, supplement 2008 1.00: designated "List of classification and labelling of chemicals in accordance with the Globally Harmonized Systems (GHS)" published by Standards South Africa, and where the presence of such goods, regardless of quantity, in a blend or mixture, causes such blend or mixture to have one or more of the characteristics listed in the Hazard Statements in section 4.2.3, namely physical hazards, health hazards or environmental hazards".

The above definition makes specific reference to SANS 10234. South Africa has implemented the Globally Harmonized System of Classification and Labelling of Chemicals by issuing this national standard. The dangerous goods likely to be stored or handled on site would mainly include grease and fuels.

7.9.1. Description of the Impacts associated with the Storage and Handling of Dangerous Goods

The construction and operation of the Moeding Solar PV Facility requires the storage of dangerous goods, including fuels for everyday construction, operation and maintenance. The facilities or infrastructure for storage and handling of a dangerous good will be located in containers with a combined capacity of 30m^3 but not exceeding 80m^3 (cubic metres). These dangerous goods will be stored on-site in appropriate storage vessels within bunded areas/ on impervious surfaces. The storage and handling of dangerous goods has the potential to result in soil and/or water contamination should any spillages/leakages occur. This is considered to be the most significant risk, other than a direct risk to personnel on site, which is an occupational health and safety issue and is considered in line with the Occupational Health and Safety Act. While not all materials to be stored on site are considered to be hazardous (or have a hazard rating), materials such as fuel and oils are flammable and also have the potential to cause fires, explosions, damage to infrastructure, as well as injuries of staff.

The proposed project will require the construction of facilities or infrastructures for the storage of the dangerous goods. The construction phase will require the handling and storage of materials including hydraulic oil, fuel and cement no exceeding 80m^3.

7.9.2. Impact tables summarising the significance of the storage and handling of dangerous goods (with and without mitigation measures)

Nature of impact: Soil and water contamination due to the handling and storage of dangerous goods during the construction and operation phases.		
	Without mitigation	**With mitigation**
Extent	Local (5)	Local (5)
Duration	Short-term (2)	Short-term (1)
Magnitude	High (8)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (45)**	**Low (20)**

Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation

- Any spillages of dangerous substances must be contained as soon as possible, and remedial and clean-up actions initiated immediately.
- Regular inspections of the permanent bunded areas for storage of dangerous goods must be undertaken throughout the life cycle of the project.
- Appropriate spill kits must be available on site.
- Maintenance vehicles must have access to spill kits.
- An emergency spill response plan must be developed for implementation during the construction and the operational phase. Personnel should be suitably trained to attend to any spills that may occur.
- A fire management plan must be developed for implementation during the construction and the operational phase Personnel must be suitably trained to manage any fires which may occur on site.
- Flammable substances must be stored in enclosed containers away from heat, sparks, open flames, or oxidizing materials.
- Develop a monitoring and leak detection procedure for monitoring of the chemical spillages.

Residual Impacts

If spillages occur and are not cleaned up, contamination can result in impacts which remain after decommissioning of the project

7.10. Assessment of the 'Do Nothing' Alternative

The 'do-nothing' alternative (i.e. no-go alternative) is the option of not constructing the Moeding 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 a solar energy facility.

a) Land use and agriculture

The majority of the project site has a very low to moderately low land capability and is considered suitable for livestock grazing with management practices in place. The grazing capacity of the veld in the project site is 8 – 10 hectares ha per large animal unit or large stock unit (LSU). The entire project site (~642ha) has the capacity for 28 to 34 head of cattle to graze on. Cattle farming is a viable long-term land use for the project site as long as the field quality is maintained by never exceeding the grazing capacity. Cattle and game farming may also be viable land use options for the project site.

The proposed development of the Moeding Solar PV Facility would allow the on-going current agricultural activities to continue on areas of the project site that will not house PV facility infrastructure, this is specifically relevant for the implementation. The development footprint of the Moeding Solar PV Facility is 68% of the total extent of the project site and is located within areas of low agricultural potential. Therefore the current land-use will be retained, while also generating renewable energy from the solar resource available for the area. The impact on agricultural activities as a result of the project is, therefore, expected to be low to medium.

The implementation of the 'do-nothing' alternative would leave the land-use restricted to the current agricultural activities, losing out on the opportunity to generate renewable energy from solar energy as additive thereto (i.e. current agricultural activities would continue). 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 project site which allows the current land-use activities to continue.

In addition, the landowner would obtain an income from the facility (as the developer would pay a percentage of the revenue generated to the landowner in accordance with the lease agreement for the use of the land). This would contribute towards the financial stability of the landowner which could in turn contribute to the financial viability of the farming practices on the project site. The implementation of the 'do nothing' alternative would retain the current land-use, fore-going the opportunity to generate renewable energy from the solar resource and supplementing of the income of the landowner.

The 'do nothing' alternative would result in a lost opportunity for the landowner (in terms of implementing a compatible alternative land use option, while still retaining the current land use, as well as a loss in long-term revenue) and the country (in terms of renewable energy). From this perspective the no-go alternative is not preferred when considering land use and agricultural potential of the project site.

b) Geographical Location

The Moeding Solar PV Facility falls within the Vryburg REDZ which was selected by the Department of Environmental Affairs as an area highly suitable for large scale wind and solar photovoltaic projects that contribute to the National Development Plan and which are supported by strategic planning, endorsed by government, embraced by stakeholders and attractive to investors. These areas are of strategic importance for large scale wind and solar photovoltaic development in terms of Strategic Integrated Project 8, and in which significant negative impacts on the natural environment are limited and socio-economic benefits to the country are enhanced.

It is therefore considered desirable for the development of a solar PV energy facility such as the Moeding Solar PV Facility within the Vryburg REDZ.

c) Socio-economic impact

Social: The impacts of pursuing the no-go alternative are both positive and negative as follows:

» The benefits would be that there is no disruption from an influx of jobseekers into the Vryburg area, nuisance impacts (noise and dust during construction), visual impacts and safety and security impacts. The impact is therefore neutral.
» There would also be an opportunity lost in terms of job creation, skills development and associated economic business opportunities for the local economy, as well as a loss of the opportunity to generate energy from a renewable resource without creating detrimental effects on the environment.

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.

New Business: Some of the positive spin off effects that are to ensue from the project expenditure will be localised in the communities located near the site, such as the town of Vryburg and the residential area of Huhudi. The local services sector and specifically the trade, transportation, catering and accommodation, renting services, personal services and business services are expected to benefit the most from the project activities during the construction phase. New business sales that will be stimulated as a result of the establishment of the solar energy facility, albeit for a temporary period, will be lost with the implementation of the 'do nothing' alternative. Therefore from a business perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of new business opportunities.

Employment: Approximately 800 full time equivalent jobs will be created during the construction phase. Of those employment opportunities likely to be generated, approximately 60% (i.e. 480) will accrue to low skilled workers. The development of the Moeding Solar PV Facility within the Naledi Local Municipality will aid in a reduction of the unemployment rate, however if the facility is not developed then the unemployment rate will not be positively influenced by the proposed development. The upliftment and socio-economic benefits for individuals within local communities would be forfeited with the implementation of the 'do nothing' alternative. Therefore, from an employment perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of employment opportunities.

Skills development: The establishment of the Moeding Solar PV Facility will offer numerous opportunities for skills transfer and development. This is relevant for both on-site activities and manufacturing activities. Various PV facilities are proposed to be developed in the area and in the North West Province, which means that the transfer of skills from foreign experts to the local engineers and construction workers will take place, similar to what has taken place where PV facilities have been constructed and operated within the Province and the rest of the country. The skills training and transfer benefits for individuals within local communities would be forfeited with the implementation of the 'do nothing' alternative.

Municipal goals: The implementation of the Moeding Solar PV Facility would contribute towards addressing the Naledi Local Municipality's key issue regarding high levels of poverty and unemployment, skills shortage, and inequalities, through the creation of employment opportunities, the provision of skills training opportunities, and local economic growth, including growth in personal income levels of those community members who would be employed on the project.

The no-go alternative will therefore result in the above economic benefits not being realised and a subsequent loss of income and opportunities to local people. From this perspective the no-go alternative is not preferred.

Investment in education: As the landowner for the properties affected by the project site is Tiger Kloof Educational Institute, the income will be an investment for the educational trust to further the educational activities of the school.

d) Regional scale impact

At a broader scale, the benefits of additional capacity to the electricity grid and those associated with the introduction of renewable energy would not be realised. The North West has an ample solar resource. Although the Moeding Solar PV Facility is only proposed to contribute a contracted capacity of up to100MW to the grid capacity, this 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.

At present, South Africa is some way off from fully exploiting the diverse gains from renewable energy and from achieving a considerable market share in the renewable energy industry. South Africa's electricity supply remains heavily dominated by coal-based power generation. The current promulgated Integrated Resource Plan (IRP) 2010 includes 17.8GW of renewables, 9.6GW of nuclear, 6.25GW of coal, and approximately 8.9GW of other generation sources such as hydro, and gas. Based on the Draft IRP 2018 there is currently 1 474MW of installed PV capacity, while an additional 814MW has been committed between 2020 and 2022, and an additional 5 670MW capacity has been allocated between 2025 and 2030. This plan is however yet to be finalised and promulgated but it is unlikely that the contribution of renewable energy to the electricity generation mix will be reduced in the final plan. The IRP essentially drives the assortment of energy to be implemented for South Africa which is known as the energy mix of the country, considering various generation technologies.

e) 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. However, as the project site experiences ample solar resource and is located within a REDZ, not developing the Moeding Solar PV Facility would see such an opportunity being lost. As current land use activities can continue on the project site once the project is operational, the loss of the land to this project during the operation phase (68% of the larger project site) is not considered significant. In addition, the North West Province will not benefit from additional generated power being evacuated directly into the Province's grid. Therefore, from a regional perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of benefits for the regional area.

From the specialist studies undertaken, no environmental fatal flaws were identified to be associated with the Moeding Solar PV Facility. All impacts associated with the project can be mitigated to acceptable levels. If the solar energy facility is not developed the following positive impacts will not be realised:
» Job creation from the construction and operation phases.
» Economic benefit to participating landowners due to the revenue that will be gained from leasing the land to the developer.
» Meeting of energy generation mix in a most economic and rapid manner.
» Provision of clean, renewable energy in an area where it 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 the Moeding Solar PV Facility.

CHAPTER 8 ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS

As identified and assessed in Chapter 7, a solar energy facility may have effects (positive and negative) on natural resources, the social environment and on the people living in a project area. The preceding impact assessment chapter has reported on the assessment of the impacts associated with the Moeding Solar PV Facility largely in isolation (from other similar developments).

The DoE, under the REIPPP Programme, released in 2011 a request for proposals (RFP) to contribute towards Government's renewable energy target and to stimulate the industry in South Africa. The REIPPP Programme has been rolled out in bid windows (rounds) over the past 7 years, 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 (largely in the Northern Cape and latterly in North West Provinces), with a number of PV facilities selected as Preferred Bidder projects and 45 PV facilities currently operational (Energyblog, 2018[13]). It is, therefore, important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts[14] are considered and avoided where possible.

The Moeding Solar PV Facility falls within the Vryburg REDZ which has been identified by the DEA as an area highly suitable for PV facilities given a range of factors considered. Therefore, DEA envisage dealing with multiple applications and cumulative issues within a REDZ area. The REDZ are of strategic importance for large scale wind and solar photovoltaic development in terms of Strategic Integrated Project (SIP) 8. These zones are considered to be areas where significant negative impacts on the environment are limited and socio-economic benefits to the local area and the country can be enhanced.

This chapter assesses the potential for the impacts associated with the project to become more significant when considered in combination with the other known or proposed PV facility projects within the area.

8.1. Legal Requirements as per the EIA Regulations, 2014 (as amended)

This chapter of the BA report includes the following information required in terms of the EIA Regulations, 2014 - Appendix 1: Content of basic assessment reports:

[13]https://www.energy.org.za/data-and-tools

[14] Cumulative impacts in relation to an activity are defined in the Environmental Impact Assessment Regulations (Government Notice R326) as the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

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 development of the Moeding Solar PV Facility are included and assessed within this chapter.

8.2. Approach taken to Assess Cumulative Impacts

The cumulative impacts that have the potential to be compounded through the development of the solar energy 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 Moeding Solar PV Facility within the project site being considered for the development:

- Unacceptable loss of threatened or protected vegetation types, habitat or species through clearing, resulting in an impact on the conservation status of such flora, fauna or ecological functioning;
- Unacceptable risk to hydrological features through disturbance associated with construction activities and increased runoff and erosion during the operation phase;
- Unacceptable risk to avifauna through habitat loss, displacement, collision and interaction with power infrastructure;
- Unacceptable loss of high agricultural potential areas presenting a risk to food security and increased soil erosion;
- Unacceptable loss of heritage resources;
- Complete or whole-scale change in sense of place and character of an area and unacceptable visual intrusion; and
- 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 solar energy facility developments throughout South Africa, while the significance of the cumulative impact on visual amenity may only be influenced by solar energy 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.

Figure 8.1 indicates the location of the Moeding Solar PV Facility in relation to all other known and viable (i.e. projects with a valid Environmental Authorisation) solar energy facilities located within a radius of 30km from the project site. These projects were identified using the Department of Environmental Affairs Renewable Energy Database and current knowledge of projects being proposed in the area. In the case of the Moeding Solar PV Facility, there are seven (23) solar energy (PV) facilities located within a 30km radius of the project site (refer to **Figure 8.1** and **Table 8.1**), all at various stages of approval. At the time of writing this EIA Report twenty three (23) facilities had been authorised, of which one is preferred bidder project. The potential for cumulative impacts is summarised in the sections which follow and has been considered within the specialist studies (refer to **Appendices D – J**).

Table 8.1: Solar energy facilities located within the broader area (within a 30km radius) of the Moeding Solar PV Facility project site.

Project Name	Location	Approximate distance from the project site	Project Status
Sediba Solar Energy Facility (Rosendal)	Remaining Extent of the Farm Rosendal 673	Located within the project site	Authorised
Tiger Kloof Solar Energy Facility	Remaining Extent of Portion 3 and Portion 4 of the Farm Waterloo 730	Located within the project site	Authorised
Khubu Solar Power Plant	Portion 5 of Champions Kloof 731	Located adjacent (south east)	Authorised
Waterloo Solar Park	Remaining Extent of Farm Waterloo 992	Located adjacent (east)	Authorisation granted (Preferred Bidder Round 4)
Protea Solar Power Plant	Remaining Extent of the Farm Hartsboom 734	Located adjacent (west)	Authorised
Sendawo PV 1 Facility	Portion 1 of Farm Edinburgh 735	Located adjacent (west)	Authorised
Sendawo PV 2 Facility	Portion 1 of Farm Edinburgh 735	Located adjacent (west)	Authorised
Sendawo PV 3 Facility	Portion 1 of Farm Edinburgh 735	Located adjacent (west)	Authorised
Gamma Solar Power Plant	Portion 4 of Farm Champions Kloof	5,9km east of the site	Authorised
Vryburg Solar 1	Portion 2 of Farm Frankfort 672	5km west of the site	Authorised
Vryburg Solar 2	Portion 1 of Farm Retreat 671	7.7km north west of the site	Authorised
Vryburg Solar 3	Portion 1 of Farm Retreat 671	8.3km north west of the site	Authorised
Sonbesie Solar Power Plant	Remaining Extent of the farm Retreat 671	6,2km north west of the site	Authorised
Woodhouse Solar 1 PV Facility	Remaining Extent of the Farm Woodhouse 729	8km east of the site	Authorised
Woodhouse Solar 2 PV Facility	Remaining Extent of the Farm Woodhouse 729	8km east of the site	Authorised
Klondike PV1 Facility	Remaining Extent of the Farm Klondike 670	8,5km north west of the site	Authorised
Klondike PV2 Facility	Remaining Extent of the Farm Klondike 670	8,5km north west of the site	Authorised
Klondike PV3 Facility	Remaining Extent of the Farm Klondike 670	8,5km north west of the site	Authorised
60MW Carocraft PV Solar Park	Remaining Extent of Farm Weltevrede 681	19km north east of the site	Authorised
Carocraft Solar Park	Remaining Extent of Farm	19km north east of the site	Authorised

Project Name	Location	Approximate distance from the project site	Project Status
	Weltevrede 681		
Renewable Energy Generation Project	Remaining Extent or Farm Elma 575	22.5km north of the affected properties	Authorised
Meerkat Solar Power Plant	Portion 3 of Vyflings Pan 598	28,5km west of the site	Authorised
Alpha Solar Power Plant	Remaining Extent of farm Middelpan 605	30km west of the site	Authorised

It should be noted that not all the solar energy facilities presently under consideration by various solar energy developers will be built for operation. Not all proposed developments will be granted the relevant permits by the relevant authorities (DEA, DOE, NERSA and Eskom) due to the following reasons:

- 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 solar energy 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.

As there is therefore a level of uncertainty as to whether all the above-mentioned solar energy facilities will be implemented, this results in it being difficult to quantitatively assess the potential cumulative impacts. The cumulative impacts of other known solar energy (PV) facilities in the broader area and the Moeding Solar PV Facility are therefore qualitatively assessed in this Chapter. The following potential impacts are considered:

- Cumulative Impacts on Ecological and Hydrological Processes
- Cumulative Impacts on Avifauna
- Cumulative Impacts on Land use, soil and agricultural potential
- Cumulative Impacts on Heritage Resources
- Cumulative Visual Impacts
- Cumulative Socio-economic Impacts

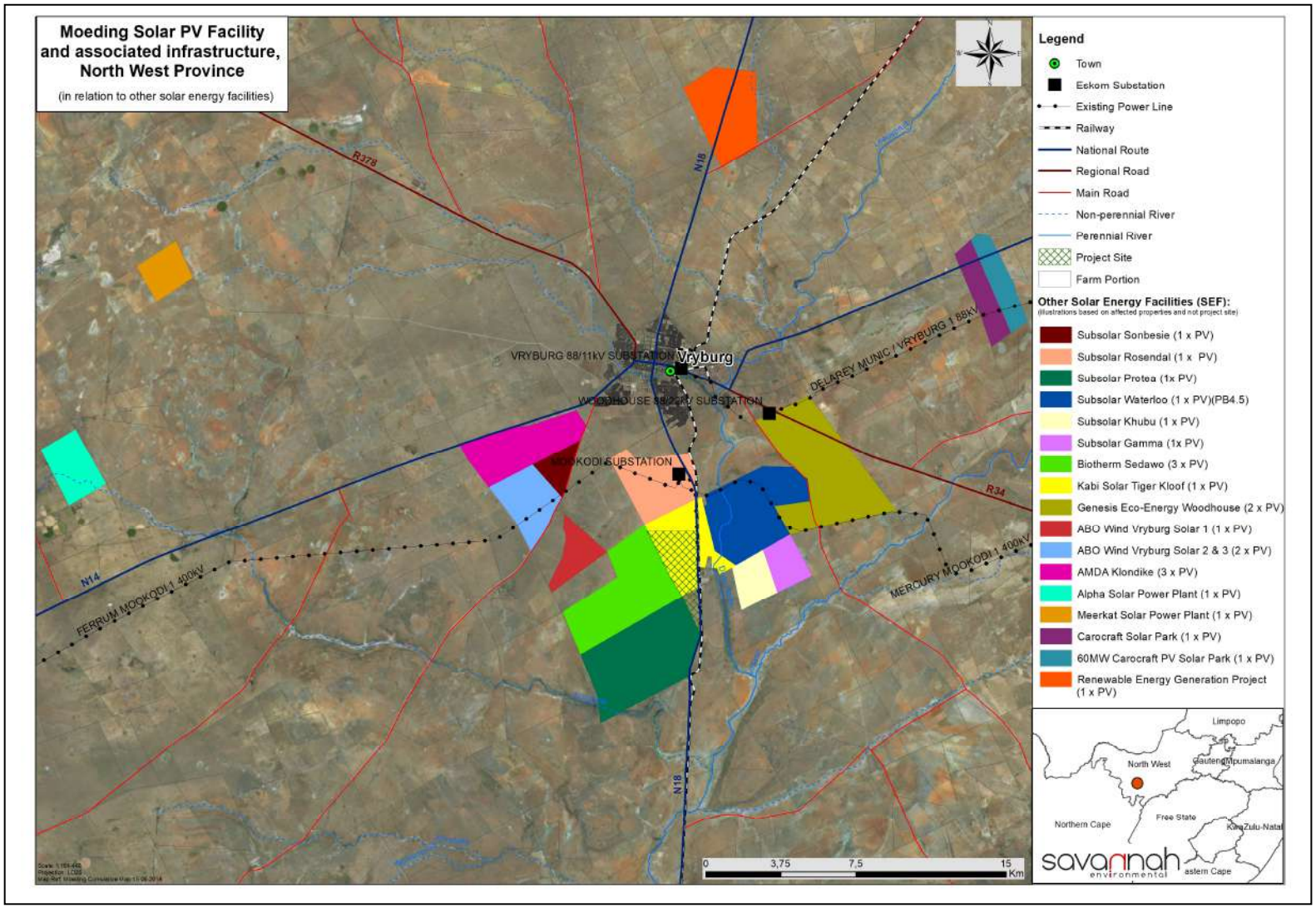

Figure 8.1: Identified PV facility projects located within a 30km radius of the Moeding Solar PV Facility project site that are considered as part of the cumulative impact assessment for the project.

8.3. Cumulative Impacts on Ecological and Hydrological Processes

Ecosystems consist of a mosaic of many different patches. The size of natural patches affects the number, type and abundance of species they contain. At the periphery of patches, influences of neighbouring patches become apparent, known as the 'edge effect'. Patch edges may be subjected to increased levels of heat, dust, desiccation, disturbance, invasion of exotic species and other factors. Edges seldom contain species that are rare, habitat specialists or species that require larger tracts of undisturbed core habitat. Fragmentation due to development reduces core habitat and greatly extends edge habitat, which causes a shift in the species composition, which in turn puts great pressure on the dynamics and functionality of ecosystems (Perlman & Milder 2005).

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 this is not possible, different sections of a development be kept as close together as possible. Therefore, new power lines should follow routes of existing servitudes if such exist, renewable energy facilities should be constructed as close as possible to existing infrastructure or substations, and if several developments are planned within close proximity to one another, these developments should be situated as close together as possible, not scattered throughout the landscape.

Cumulative impacts associated with the Moeding Solar PV Facility and the proposed associated infrastructure have been identified to include (refer to **Appendix D**):

- Transformation of intact, sensitive habitats could compromise the ecological functioning of these habitats and may 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.
- Excessive clearing of slow growing trees such as *Acacia erioloba* could significantly impact local and regional population dynamics and microhabitats and resources associated with these species available to other fauna and flora species. Clearing of such trees, must be kept to the absolute minimum, and large vigorous specimens should be a priority for conservation and exclusion from development footprints.
- Excessive clearing of vegetation will influence runoff and stormwater flow patterns and dynamics, which could cause excessive accelerated erosion of plains, small ephemeral to larger intermittent drainage lines, wetlands and rivers, and this could also have detrimental effects on the lower lying Dry Harts River.
- Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasive species into adjacent agricultural land and rangelands.
- The loss of and transformation of intact habitats could compromise the status and ecological functioning of the Ecological Support Areas (ESAs) and may fracture and disrupt the connectivity of these ESAs, impacting the Province's ability to meet its conservation targets.

The ecological and hydrological impacts associated with the Moeding Solar PV Facility will be of a medium to low significance, depending on the cumulative impact being considered.

Nature: *Reduced ability to meet conservation obligations and targets*

The loss of unprotected vegetation types on a cumulative basis from the broader area impacts the Province's ability to meet its conservation targets.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (3)
Duration	Long Term (4)	Long-Term (4)
Magnitude	Small (1)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	**Low (12)**	**Medium (33)**
Status (positive or negative)	Neutral – Slightly Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	Likely
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:

» The development footprints of the various facilities in the area must be kept to a minimum and natural vegetation must be encouraged to return to disturbed areas following completion of construction.
» An open space management plan should be developed for each individual development, which must include management of biodiversity within the fenced area.
» Reduce the footprint of the facilities within sensitive habitat types as much as possible.

Nature: *Impacts on Ecological Support Areas and Broad-Scale Ecological Processes*

Transformation of intact habitat could potentially compromise ecological processes of Ecological Support Areas (ESAs) as well as ecological functioning of important habitats, and would contribute to the fragmentation of the landscape which could 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 in 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 (positive or negative)	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 footprints of the individual facilities must be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas following the completion of construction.
» An open space management plan should be developed for the individual developments, which must include management of biodiversity within the fenced area.
» Reduce the footprints of the facilities within sensitive habitat types as much as possible.
» Small to medium sized mammals must be allowed to move between the different development footprints and surrounding areas by creating artificial passageways underneath boundary fences.

Nature: Cumulative impacts due to nearby renewable energy developments – Large-scale disturbance of indigenous vegetation

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 affected vegetation type, 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 therefore reducing "genetic health" which may in turn lead to weaker species incapable to adapt and react to potential environmental changes and consequently also a reduction in biodiversity and the extinction of some species from certain areas.
- Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasive species into adjacent agricultural land and rangelands.

	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	Long Term (4)	Long Term (4)
Magnitude	Minor (2)	Moderate (6)
Probability	Very Improbable (1)	Probable (3)
Significance	**Low (7)**	**Medium (36)**
Status (positive or negative)	Neutral	Slightly Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	Moderate Probability
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:

- The development footprints of the individual facilities must be kept to a minimum and natural vegetation must be encouraged to return to disturbed areas following the completion of construction. This must be undertaken by each respective applicant.
- An open space management plan must be developed for the individual developments by each respective applicant, which must include management of biodiversity within the fenced area.
- Reduce the footprint of the facilities within sensitive habitat types as far as possible. This must be undertaken by each respective applicant.

Nature: *Cumulative impacts due to nearby renewable energy developments – Influence on runoff and stormwater flow patterns and dynamics due to the excessive clearing of vegetation*

The interception of rain by the impervious surface of the solar panels produces an "umbrella effect" that covers a sheltered area. By contrast, its contour receives the collected fluxes, whose intensity or amounts may locally exceed those of the natural conditions, depending on the dimensions, height and tilting angle of the panels as well as on wind velocity and direction. Cumulatively this alteration could cause excessive accelerated erosion of plains, lower lying small ephemeral to larger intermittent drainage lines, wetlands and river systems (located outside of the Moeding Solar PV Facility project site) and this may ultimately have an effect on the lower lying Dry Harts River.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (3)
Duration	Long Term (4)	Long Term (4)
Magnitude	Small (1)	High (7)
Probability	Very Improbable (1)	Improbable (2)

Significance	**Low (6)**	**Low (28)**
Status (positive or negative)	Neutral	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	Moderate Probability
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:

» The development footprints of the individual developments must be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas following the completion of construction. This must be undertaken by each respective applicant.
» An open space management plan must be developed for the individual developments by each respective applicant, which must include management of biodiversity within the fenced area.

The following on-site mitigation measures are recommended throughout the operation phase in order to minimise the contribution of this development to the described impact:

» 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 plant species; therefore re-establishment must be monitored and species composition adapted if vegetation fails to establish sufficiently.
» Soil surfaces where no revegetation seems possible must 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 footprint must be adequately landscaped and rehabilitated to contain expected accelerated erosion.
» Runoff may have to be specifically channelled or stormwater adequately controlled to prevent localised rill and gully erosion.
» Any erosion problems observed as a result of the project must be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
» Roads and other disturbed areas must be regularly monitored for erosion problems and problem areas must receive follow-up monitoring to assess the success of the remediation.

8.4. Cumulative Impacts on Avifauna

Cumulative impacts from an avifauna perspective include exacerbated displacement and loss of habitat. Although the degree of this impact is dependent on the location and scale of the development, this is the most significant cumulative impact associated with the construction and operation (maintenance) of solar energy facilities. Extensive areas of vegetation (habitat) are cleared to accommodate the considerable amount of infrastructure required at these facilities, reducing the amount of habitat available to birds for foraging, roosting and breeding (Smallie, 2013). Given the considerable space requirements of commercially viable facilities (> 200 ha), this effect could be significant in some instances, particularly given the possibility that the initial footprint of successful facilities may be expanded over time, and allowing for the possible cumulative effects of multiple facilities in one area. This impact is likely to affect smaller bird species (i.e. larks and pipits) with small home ranges, as entire territories could be removed during construction activities.

In addition, the grid connection (via overhead power lines) of numerous solar energy facilities with high voltage lines will increase the probability of bird strikes with power lines and avian mortalities due to collision and electrocution.

The cumulative avifauna impacts, considering the development of the Moeding Solar PV Facility and the PV facilities within the surrounding area will be of a low to medium significance, depending on the impact being considered.

Nature: *Habitat loss* Cumulative impact on avifauna in the area as a result of habitat loss and increased risk associated with PV facilities and associated grid connection infrastructure.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (2)	Regional (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (3)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	**Low (27)**	**Medium (52)**
Status (positive or negative)	Slightly Negative	Negative
Reversibility	Moderate Potential	Low Potential
Irreplaceable loss of resources?	Yes (birds may be displaced, injured or killed)	Yes (birds may be displaced, injured or killed)
Can impacts be mitigated?	Yes, to a large extent	
Mitigation: » All construction activities must be carried out according to the generally accepted environmental best practise. » The footprint of each development must be kept to a minimum. » The boundaries of the development footprint areas are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint areas. » Existing roads must be used as far as possible for access during construction and operation. » Provide adequate briefing for site personnel on the possible important (Red Data) species occurring and/or nesting in the area and the procedures to be followed (for example notification and avoidance of area until appropriate recommendations has been provided by the EO and/or specialist). » Any bird nests that are found during the construction phase must be reported to the Environmental Control Officer (ECO) for the development. An appropriate buffer should be placed around the nest. If uncertain on the size of such a buffer, the ECO may contact an avifaunal specialist for advice. » The above measures must be included in a site specific EMPr and monitored by an ECO for each development.		

Nature: *Disturbance to avifauna* Cumulative impact on avifauna in the area as a result of disturbance and increased risk associated with PV facilities and associated grid connection infrastructure.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (3)
Duration	Long-term (4)	Long-Term (4)
Magnitude	Minor (3)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	**Low (24)**	**Medium (52)**
Status (positive or negative)	Slightly Negative	Negative
Reversibility	Moderate Potential	Low Potential
Irreplaceable loss of resources?	Yes (birds may be displaced)	Yes (birds may be displaced)
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:

- Strict control must be maintained over all activities during construction, in line with an approved construction EMPr for each facility.
- During construction, if any of the Red Data species are observed to be roosting and/or breeding in the vicinity of each individual facility, the ECO must be notified and where deemed necessary an appropriate buffer should be placed around the nests and/or roosting areas. If uncertain on the size of such buffer the ECO may contact an avifaunal specialist for advice.
- The construction equipment camps must be located as close to the site as possible.
- Contractors and working staff should remain within each development area and movement outside these areas especially into avian micro-habitats must be restricted.
- Driving must take place on existing and newly constructed access roads (for each facility) and a speed limit of 30 km/h must be implemented on all internal roads.

Nature: *Electrocution of birds due to overhead power lines*

Cumulative impact on avifauna in the area as a result of electrocution due to overhead power lines and increased risk associated with an increase in grid connection infrastructure.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (4)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	**Low (27)**	**Medium (52)**
Status (positive or negative)	Slightly Negative	Negative
Reversibility	Moderate Potential	Low Potential
Irreplaceable loss of resources?	Low (birds will be injured or killed)	Moderate possibility (birds will be injured or killed)
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:

- Bird friendly structures, with a bird perch (as per standard Eskom guidelines) must be used for the tower infrastructure.
- All relevant perching surfaces should be fitted with bird guards and perch guards as deterrents (Hunting, 2002).
- Installation of artificial bird space perches and nesting platforms, at a safe distance from energised components (Goudie, 2006; Prinsen et al., 2012).

Nature: *Collisions of Birds with overhead power lines*

During the operation phase of the Moeding Solar PV Facility and other PV facilities in the area avian electrocution related to the overhead power lines are expected to occur.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (3)
Duration	Long Term (4)	Long-Term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	**Low (27)**	**Medium (52)**
Status (positive or negative)	Slightly Negative	Negative
Reversibility	Moderate Potential	Low Potential

Irreplaceable loss of resources?	Low (birds will be injured or killed)	Moderate possibility (birds will be injured or killed)
Can impacts be mitigated?	Yes, to some extent	

Mitigation:

» Mark sections of the lines in High to Medium-High sensitive areas with anti-collision marking devices (diurnal and nocturnal diverters) to increase the visibility of the power line and reduce likelihood of collisions. Marking devices should be spaced 10m apart, and must be installed as soon as the conductors are strung.
» These line marking devices include spiral vibration dampers, strips, Bird Flight Diverters, bird flappers, aerial marker spheres, ribbons, tapes, flags and aviation balls (Prinsen et al. 2012).
» Construction of the power lines in close proximity to the existing power line is recommended as far as possible as this will reduce the cumulative impacts and collision risk.
» All relevant perching surfaces should be fitted with bird guards and perch guards as deterrents (Hunting 2002).

8.5. Cumulative Impacts on Land Use, Soil and Agricultural Potential

Cumulative impacts from a soils perspective are related to an increase in the loss of agricultural land used for livestock farming, as well as an increased risk of erosion. These impacts can be reduced by keeping the footprints of the solar energy facilities minimised where possible and strictly following soil management measures pertaining to erosion control and management and monitoring of any possible soil pollution sources such as vehicles traversing over the sites.

Currently, twenty three (23) projects are authorised within 30km from the Moeding Solar PV Facility project site. There will also be several linear developments (grid connections) required to feed the electricity generated at these projects into the national grid. Such a large number of projects will change the dominant current land use of the area from livestock farming to electricity generation. In addition to this, cumulative impacts will be associated with an increased risk for soil erosion when vegetation is removed and possible pollution of soil resources.

The significance of the cumulative soil impacts will be medium.

Nature: *Cumulative impact on livestock farming*
The main cumulative impact expected to occur with the development of the Moeding Solar PV Facility and the other solar energy facilities within the area is a decrease in land capability for livestock 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	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor to Low (3)
Probability	Highly Probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Medium (40)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No

Mitigation:

» The only mitigation measures for this impact is to keep the footprints of all solar energy facilities as small as possible and to manage the soil quality by avoiding far-reaching soil degradation such as erosion.

Nature: *Cumulative impact associated with soil erosion*

Increase in areas susceptible to soil erosion as a result of the Moeding Solar PV Facility and other solar energy facilities within a 30km radius.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local to Regional (2)
Duration	Medium-term (3)	Permanent (5)
Magnitude	Moderate (6)	Minor to Low (3)
Probability	Probable (3)	Highly Probable (4)
Significance	**Medium (30)**	**Medium (40)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No

Mitigation:

Each of the projects should adhere to the highest standards for soil erosion prevention and management such as:

- Land clearance must only be undertaken immediately prior to construction activities;
- Unnecessary land clearance must be avoided;
- Soil stockpiles must be dampened with dust suppressant or equivalent;
- Soil stockpiles must be located away from any waterway or preferential water flow path in the landscape, to minimise soil erosion from these;
- Geo-textiles or similar measures must be used to stabilise soil stockpiles and uncovered soil surfaces during the construction phase and to serve as a sediment trap to contain as much soil as possible that might erode away;
- The Storm water Management Plan (SWMP) for each facility should provide for a drainage system sufficiently designed to prevent water run-off from the solar panels to cause soil erosion;
- Where discharge of rainwater on roads will be channeled directly into the natural environment, the application of diffuse flow measures must be included in the design of each facility; and
- Revegetate cleared areas as soon as possible after construction activities.

Nature: *Cumulative impact associated with the increase risk of soil pollution*

Increase in soil pollution as a result of the Moeding Solar PV Facility and other solar energy facilities within a 30km radius.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local to Regional (3)	Local to Regional (2)
Duration	Medium-term (3)	Permanent (5)
Magnitude	Moderate (6)	Minor to Low(3)
Probability	Probable (3)	Highly Probable (4)
Significance	**Medium (36)**	**Medium (40)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No

Mitigation:

Each of the projects should adhere to the highest standards for soil erosion prevention and management such as:

- High level maintenance must be undertaken on all vehicles and construction machinery to prevent hydrocarbon spills at each site;
- Impermeable and bunded surfaces must be used for storage tanks and to park vehicles on;

- Site surface water and wash water must be contained and treated before reuse or discharge from each site;
- Spills of fuel and lubricants from vehicles and equipment must be contained using a drip tray with plastic sheeting filled with adsorbent material;
- Waste disposal at the construction site must be avoided by separating, trucking out and recycling of waste;
- Potentially contaminating fluids and other wastes must be contained in containers stored on hard surface levels in bunded locations; and
- Accidental spillage of potentially contaminating liquids and solids must be cleaned up immediately by trained staff with the correct equipment and protocols as outlined in the EMPr.

8.6. Cumulative Impacts on Heritage (including archaeology and palaeontology)

8.6.1. Palaeontological resources

Stratigraphic and geographical distribution of Late Archaean stromatolites within the Schmidtsdrift Subgroup and Vryburg Formation of the Transvaal Supergroup is present in the development footprint and the surrounding area. Excavations and site clearance for the Moeding Solar PV Facility and other solar energy facilities within the surrounding area will involve substantial excavations into the superficial sediment cover as well as locally into the underlying bedrock. These excavations will modify the existing topography and may disturb damage, destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific research. Any fossils occurring within the project site and surrounding area are potentially scientifically and culturally significant.

The palaeontological cumulative impacts associated with the Moeding Solar PV Facility will be of a low significance.

Nature: *Cumulative impacts on palaeontology*		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (1)	Moderate (6)
Probability	Improbable (1)	Very Probable (4)
Significance	**Low (7)**	**Medium (56)**
Status (positive or negative)	Neutral	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	No	Unknown
Can impacts be mitigated?	Yes	

Mitigation:

Mitigation will be necessary for each project, especially when fossils are present within the development sites. Mitigation comprises of the collection and recording of fossils as well as obtaining data of the surrounding sedimentary matrix within the proposed development footprints by a palaeontologist. This should take place after the preliminary vegetation removal but *before* the ground is levelled for construction. Excavation of this fossil heritage will require a permit from the South African Heritage Resource Agency (SAHRA) and the material must be housed in a permitted institution. All fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA. These recommendations should be incorporated into the Environmental Management Programme (EMPr) for the Moeding Solar PV Facility and other solar energy facilities in the surrounding area.

8.6.2. Archaeological resources

An analysis of completed studies within a 30km radius from the project site has been undertaken be the specialist. The findings indicate that the area is characterised by numerous Stone Age find spots and archaeological resources. Many of these find spots were concentrated around pans and outcrops in a landscape where water, food and shelter came at a premium. The sites around the pans and the outcrops were in most cases given a medium to high heritage significance on a local scale and in the majority of the cases were recommended as being no-go areas or extensive mitigation is required.

Overall, the project site does contain many instances of Historical and Stone Age heritage resources of which only a few will be directly impacted. While there are a fair number of sites, there are few that have high heritage significance. The Moeding Solar PV Facility and power line alternatives will have a low impact on heritage resources after mitigation and that the additional impact on heritage resources will be low. Therefore, it is unlikely that the proposed Moeding Solar PV Facility will result in unacceptable risk, unacceptable loss or unacceptable increase in impact.

Nature: *Cumulative impacts on archaeological resources*		
	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	Very short (1)	Very short (1)
Magnitude	Small (0)	Small (0)
Probability	Very improbable (1)	Very improbable (1)
Significance	**Low (2)**	**Low (2)**
Status (positive or negative)	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Implement specific recommendations for each project site to reduce the impact on the larger landscape's heritage resources. Recommendations for the Moeding Solar PV Facility include: » Demarcate Site 035 – 039 and 041 with a 20m buffer during construction. These sites may not be disturbed or destroyed without an appropriate permit from SAHRA.		

Nature: *Cumulative impacts on burial grounds*		
	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	Very short (1)	Very short (1)
Magnitude	Small (0)	Small (0)
Probability	Very improbable (1)	Very improbable (1)
Significance	**Low (2)**	**Low (2)**
Status (positive or negative)	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	No	No

Can impacts be mitigated?	Yes
Mitigation: Implement specific recommendations for each project site to reduce the impact on the larger landscape's heritage resources. Recommendations for the Moeding Solar PV Facility include: » Site 021 will need to be demarcated and avoided during the construction phase. » A 50m buffer must be provided around the cemetery. » In the event of any graves or burial grounds being uncovered, SAHRA should be contacted and a qualified archaeologist appointed to evaluate the finds and make appropriate recommendations on mitigation.	

Nature: *Cumulative impacts on Historical Resources*		
	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	Very short (1)	Very short (1)
Magnitude	Small (0)	Small (0)
Probability	Very improbable (1)	Very improbable (1)
Significance	**Low (2)**	**Low (2)**
Status (positive or negative)	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Demarcate historical structures with a 20m buffer during construction to reduce the impact on the larger landscape's heritage resources.		

8.7. Cumulative Visual Impacts

The proposed Moeding Solar PV Facility is located in an area where there is a cluster of twelve other solar PV energy projects in close proximity to the project site (~8km radius). As these projects are located in close proximity to each other, there is potential for a cumulative visual impact as they may either be seen in the same view or in relatively rapid succession for travellers on roads passing through the area. Due to the distance from other projects in the REDZ6, there is no potential for them to contribute to a cumulative visual impact associated with the Moeding Solar PV Facility.

Cumulative impacts associated with existing and planned developments against which the Moeding Solar PV Facility will be set will have a medium to low significance. The contribution to cumulative impacts associated with the proposed development including the Moeding Solar PV Facility and the alternative grid connections have been assessed as having a low significance, which is considered to be acceptable from a visual perspective. Both the proposed solar project and the proposed grid connection are likely to have an impact on general landscape character.

Solar Energy Facility: Cumulative Impacts

Nature: *Potential cumulative visual impact on landscape character* The proposed project will extend the general influence of solar projects on the character of the landscape surrounding Vryburg. However, development will occur within an area where landscape character is already strongly influenced by urban and infrastructure development. More cohesive rural areas to the south of the proposed project

will be unaffected. Due to roadside vegetation and topography, the proposed project is anticipated to have a relatively low visibility.

A detailed visual analysis of other solar projects in the area has not been undertaken, however, it is likely that a number of projects may be visible at any one time from certain viewpoints. Again, largely due to topography, the areas from which multiple projects are visible are likely to be limited. With appropriate mitigation the contribution to cumulative impact is likely to be low.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	**Low (16)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:
The following measures should be implemented for each project in the area:

Planning:
» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the developments;
» Retain natural buffer areas adjacent to the R34 and on the northern boundary.

Operation:
» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development areas;
» Maintain natural buffer areas adjacent to the R34 and the southern boundary.

Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the sites;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Nature: *Potential cumulative visual impact on small holdings*
A detailed visual analysis of other solar projects in the area has not been undertaken due to limited information being available for these facilities. However, it is likely that, due to distance, existing vegetation and the fact that other solar PV projects have been authorised between the proposed site and these receptors, the proposed project is likely to result in a negligible cumulative effect. It is likely that only the PV project will have any visual influence over the distance involved. Grid connection alternatives will not be visible. With appropriate mitigation the contribution to cumulative impact is likely to be low.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**

Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small (0)	Minor to low (3)
Probability	Very improbable (1)	Probable (3)
Significance	**Low (6)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

The following measures should be implemented for each project in the area:

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the developments;
» Retain natural buffer areas adjacent to the R34 and on the northern boundary.

Operation:

» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development areas;
» Maintain natural buffer areas adjacent to the R34 and the southern boundary of the project site.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the sites;
» Rehabilitate areas to their natural state;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Nature: *Potential cumulative visual impact on the urban edge of Vryburg*

A detailed visual analysis of other solar projects in the area has not been undertaken due to limited information being available for these facilities. However, it is likely that, due to distance, existing vegetation and the fact that other solar PV projects have been authorised between the proposed site and these receptors, the proposed project is likely to result in a negligible cumulative effect. It is likely that only the PV project will have any visual influence over the distance involved. Grid connection alternatives will not be visible. With appropriate mitigation the contribution to cumulative impact is likely to be low.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small (0)	Low (4)
Probability	Very improbable (1)	Probable (3)
Significance	**Low (6)**	**Medium (30)**
Status (positive or negative)	Neutral	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, to a minor degree	

Mitigation:
The following measures should be implemented for each project in the area:

Planning:
» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the developments.

Operation:
» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development areas.

Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the sites;
» Rehabilitate areas to their natural state;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Nature: *Potential cumulative visual impact on the R34*
A detailed visual analysis of other solar projects in the area has not been undertaken due to limited information being available for these facilities. However, it is likely that, due to distance, existing vegetation and the fact that other solar PV projects have been authorised between the proposed site and these receptors, the proposed project is likely to result in a negligible cumulative effect. It is likely that only the PV project will have any visual influence over the distance involved. Grid connection alternatives will not be visible. With appropriate mitigation the contribution to cumulative impact is likely to be low.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small (0)	Minor to low (3)
Probability	Very improbable (1)	Probable (3)
Significance	**Low (6)**	**Low (27)**
Status (positive or negative)	Neutral	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, to a small degree	

Mitigation:
The following measures should be implemented for each project in the area:

Planning:
» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the developments.

Operation:
» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;

» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development areas.

Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the sites;
» Rehabilitate areas to their natural state;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Nature: *Potential cumulative visual impact on the R34*

A detailed visual analysis of other solar projects in the area has not been undertaken due to limited information being available for these facilities. However, it is likely that, due to distance, existing vegetation and the fact that other solar PV projects have been authorised between the proposed site and these receptors, the proposed project is likely to result in a negligible cumulative effect. It is likely that only the PV project will have any visual influence over the distance involved. Grid connection alternatives will not be visible. With appropriate mitigation the contribution to cumulative impact is likely to be low.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small (0)	Minor to low (3)
Probability	Very improbable (1)	Probable (3)
Significance	**Low (6)**	**Low (27)**
Status (positive or negative)	Neutral	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, to a small degree	

Mitigation:

The following measures should be implemented for each project in the area:

Planning:
» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the developments.

Operation:
» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development areas.

Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the sites;
» Rehabilitate areas to their natural state;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Nature: *Potential cumulative visual impact on the N18*

A detailed visual analysis of other solar projects in the area has not been undertaken due to limited information being available for these facilities. However, due to the fact that the proposed project is relatively close to the road and other projects are likely to be visible from the same road, it is possible that it could add to the industrialisation of views from the road. With appropriate mitigation / screening, the proposed project is likely to be largely screened. With appropriate mitigation the contribution to cumulative impact is likely to be low.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small - Minor (1)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No irreplaceable loss.	No irreplaceable loss.
Can impacts be mitigated?	Yes	

Mitigation:

The following measures should be implemented for each project in the area:

Planning:

- Plan levels to minimise earthworks to ensure that levels are not elevated;
- Plan to maintain the height of structures as low as possible;
- Minimise disturbance of the surrounding landscape and maintain existing vegetation around the developments;
- Retain natural buffer areas adjacent to the N18 and on the northern boundary of the project site.
- Plan to augment and manage woody vegetation within the buffer area to provide screening of the development from the road.

Operation:

- Reinstate any areas of vegetation that have been disturbed during construction;
- Remove all temporary works;
- Monitor rehabilitated areas post-construction and implement remedial actions;
- Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development areas;
- Maintain natural buffer areas adjacent to the N18 and on the southern boundary; and
- Augment woody vegetation within the natural buffer area adjacent to the N18.

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use of the sites;
- Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Nature: *Potential cumulative visual impact on homesteads*

A detailed visual analysis of other solar projects in the area has not been undertaken due to limited information being available for these facilities. However, there are a number of homesteads on the properties that will be affected by other solar projects. The proposed project will also extend the general influence of solar projects on the character of the landscape. It is likely therefore that the probability of an impact will increase. Whilst the overall cumulative impact is assessed as having a medium significance, the contribution to cumulative impacts is anticipated as being low.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**

Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Highly probable (4)
Significance	**Low (24)**	**Medium (32)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No irreplaceable loss.	No irreplaceable loss.
Can impacts be mitigated?	Yes, to a small degree	

Mitigation:

The following measures should be implemented for each project in the area:

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the developments.

Operation:

» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development areas.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the sites;
» Rehabilitate areas to their natural state;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Nature: *Potential cumulative visual impact on the Tiger Kloof Educational Institution*

It is assessed that impact on the Tiger Kloof Educational Institution is likely to be low. Whilst a detailed visual analysis of other solar projects in the area has not been undertaken, it is also unlikely that other solar projects will be visible from the Schools. The cumulative impact is therefore assessed as low.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small (0)	Small (0)
Probability	Very Improbable (1)	Improbable (2)
Significance	**Low (6)**	**Low (12)**
Status (positive or negative)	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	No irreplaceable loss.	No irreplaceable loss.
Can impacts be mitigated?	Yes, to a small degree	

Mitigation:

The following measures should be implemented for each project in the area:

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;

- » Plan to maintain the height of structures as low as possible;
- » Minimise disturbance of the surrounding landscape and maintain existing vegetation around the developments;
- » Retain natural buffer areas adjacent to the N18 and on the northern boundary;
- » Plan to augment and manage woody vegetation within the buffer area to provide screening of the development from the road.

Operation:

- » Reinstate any areas of vegetation that have been disturbed during construction;
- » Remove all temporary works;
- » Monitor rehabilitated areas post-construction and implement remedial actions;
- » Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development areas;
- » Maintain natural buffer areas adjacent to the N18 and on the southern boundary; and
- » Augment woody vegetation within the natural buffer area adjacent to the N18.

Decommissioning:

- » Remove infrastructure not required for the post-decommissioning use of the sites;
- » Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Nature: *Potential cumulative visual impact of glare*

Whilst a detailed glare analysis of other solar projects in the area has not been undertaken, due to the number of projects in the area, the probability of glare being an issue will increase to probable. The proposed project is unlikely to add to glare issues associated with solar PV development in the area.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small to minor (1)	Small to minor (1)
Probability	Very Improbable (1)	Probable (3)
Significance	**Low (7)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No irreplaceable loss.	No irreplaceable loss.
Can impacts be mitigated?	Yes	

Mitigation:

The following measures should be implemented for each project in the area:

- » The use of non-reflective finishes and coatings to the surface of PV panels.
- » The use of a natural buffer area between the R34 and the facility.
- » Should the issue of glare occur on the N18, screen fencing should be used.

Nature: *Potential cumulative visual impact of night time lighting*

Currently lighting in the area is comprised of urban lighting. This is not generally an area that is likely to be sensitive to lighting impacts, however, immediate neighbours may be sensitive. There is potential for security lighting and operational lighting associated with solar energy projects to further impact on the area but this is likely to be of low significance.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in**

		the area
Extent	Site (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Small to minor (1)	Small to minor (1)
Probability	Improbable (2)	Probable (3)
Significance	**Low (12)**	**Low (18)**
Status (positive or negative)	If the lights are generally not visible then the occasional light is unlikely to be seen as negative.	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No irreplaceable loss.	No irreplaceable loss.
Can impacts be mitigated?	Yes	

Mitigation:

The following measures should be implemented for each project in the area:

» Use low key lighting around buildings and operational areas that is triggered only when people are present.
» Plan to utilise infra-red security systems or motion sensor triggered security lighting;
» Ensure that lighting is focused on the development with no light spillage outside the site; and
» Keep lighting low, no tall mast lighting should be used.

Power Lines: Cumulative Impacts

Nature: *Potential cumulative visual impact on the general landscape character associated with the power line infrastructure*

The proposed grid connections will affect an area that is already impacted by major electrical infrastructure including power lines and the Mookodi Main Transmission Substation. However, development will occur within an area where landscape character is already strongly influenced by urban and infrastructure development. More cohesive rural areas to the south of the proposed project will be unaffected. Whilst Cumulative Impact levels associated with both alternatives is indicated as medium, the contribution to this impact associated with Power Line Alternative 2 is likely to be significantly lower than Power Line Alternative 1. With appropriate mitigation the contribution to cumulative impact is likely to be low.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Alternative 1 Site and immediate surroundings, (2) Alternative 2 Site and immediate surroundings, (2)	Alternative 1 Site and immediate surroundings (2) Alternative 2 Site and immediate surroundings (2)
Duration	Alternative 1 Long term, (4) Alternative 2 Long term, (4)	Alternative 1 Long term, (4) Alternative 2 Long term, (4)
Magnitude	Alternative 1 Minor, (2) Alternative 2 Small to minor, (1)	Alternative 1 Moderate, (6) Alternative 2 Moderate, (6)
Probability	Alternative 1 Improbable (2) Alternative 2 Very improbable (1)	Alternative 1 Probable, (3) Alternative 2 Probable, (3)
Significance	Alternative 1	Alternative 1

	Low, (16) Alternative 2 **Low, (7)**	**Medium, (36)** Alternative 2 **Medium, (36)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

The following measures should be implemented for each project in the area:

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the developments;
» Retain natural buffer areas adjacent to the R34 and on the northern boundary.

Operation:

» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development areas;
» Maintain natural buffer areas adjacent to the R34 and the southern boundary.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the sites;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Nature: *Potential cumulative visual impact on the N18 associated with the power line infrastructure*

The proposed grid connections will affect an area to the north of the site that is already impacted by major electrical infrastructure including power lines and the Mookodi Main Transmission Substation. A detailed visual analysis of other solar projects in the area has not been undertaken, however, in addition to there being significant impact already, other planned projects will add to the impact of electrical infrastructure in this area. Whilst cumulative impact levels associated with both alternatives is indicated as medium, the contribution to this impact associated with Power Line Alternative 2 is likely to be significantly lower than Power Line Alternative 1.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Alternative 1 Site and immediate surroundings (2) Alternative 2 Site and immediate surroundings (2)	Alternative 1 Site and immediate surroundings (2) Alternative 2 Site and immediate surroundings (2)
Duration	Alternative 1 Long term (4) Alternative 2 Long term (4)	Alternative 1 Long term (4) Alternative 2 Long term (4)
Magnitude	Alternative 1 Minor (2) Alternative 2 Small to minor (1)	Alternative 1 Moderate (6) Alternative 2 Moderate (6)

Probability	Alternative 1 Improbable (2) Alternative 2 Very improbable (1)	Alternative 1 Probable (3) Alternative 2 Probable (3)
Significance	Alternative 1 **Low (16)** Alternative 2 **Low (7)**	Alternative 1 **Medium (36)** Alternative 2 **Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

The following measures should be implemented for each project in the area:

Planning:

» Plan levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the developments;
» Retain natural buffer areas adjacent to the R34 and on the northern boundary.

Operation:

» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development areas;
» Maintain natural buffer areas adjacent to the R34 and the southern boundary.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the sites;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

8.8. Cumulative Social Impacts

The potential for social cumulative impacts to occur is likely. Potential cumulative social impacts identified for the Moeding Solar PV Facility include positive impacts on the economy, business development, and employment, as well as negative impacts such as an influx jobseekers and change in the area's sense of place.

The Moeding Solar PV Facility and the establishment of other solar power projects within the area has the potential to result in significant positive cumulative impacts, specifically with regards to the creation of a number of socio-economic opportunities for the region, which in turn, can result in positive social benefits. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. The cumulative benefits to the local, regional, and national economy through employment and procurement of services are more considerable than that of the Moeding Solar PV Facility alone.

While the development of a single solar energy facility may not result in a major influx of people into an area, the development of several projects may have a cumulative impact on the in-migration and movement of people. In addition, the fact that the project is proposed within REDZ 6, which has specifically been earmarked for the development of large scale solar PV energy facilities, implies that the surrounding area is likely to be subject to considerable future applications for solar PV energy facilities. Levels of unemployment, and the low level of earning potential may attract individuals to the area in search of better employment opportunities and standards of living.

It is very difficult to control an influx of people into an area, especially in a country where unemployment rates are high. It is therefore important that the project proponent implement and maintain strict adherence with a local employment policy in order to reduce the potential of such an impact occurring, as well as to be able to communicate the process for employment so that people know how and where to apply.

Nature: *Cumulative impacts of employment opportunities, business opportunities and skills development*
An increase in employment opportunities, skills development and business opportunities with the establishment of more than one solar energy facility at one time.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local-Regional (3)	Local-Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate to High ()
Probability	Highly probable(4)	Highly Probable (4)
Significance	**Medium (44)**	**Medium (56)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impacts be mitigated?	Yes	

Enhancement:

» The establishment of a number of solar energy facilities under the REIPPP Programme in the area has the potential to have a positive cumulative impact on the area in the form of employment opportunities, skills development and business opportunities. The positive benefits will be enhanced if local employment policies are adopted and local services providers are utilised by the developers to maximise the project opportunities available to the local community.

Nature: *Cumulative impact with large-scale in-migration of people*
Negative impacts and change to the local economy with an in-migration of labourers, businesses and jobseekers to the area.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local-Regional (3)
Duration	Short-term (2)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Very improbable (1)	Probable (3)
Significance	**Low (7)**	**Medium (39)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible

Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Develop a recruitment policy / process (to be implemented by contractors), which will source labour locally. The recruitment policy / process should also provide information on the recruitment process, to prevent people from going to the project site in search of employment. » Work together with government agencies to ensure service provision is in line with the development needs of the local area. » Form joint ventures with community organisations, through Trusts, which can provide local communities with benefits, such as employment opportunities and services.		

8.9. Conclusion regarding Cumulative Impacts

Cumulative impacts are expected to occur with the development of the Moeding Solar PV Facility throughout all phases of the project life cycle and within all areas of study considered as part of this BA Report. The main aim for the assessment of cumulative impacts considering the Moeding Solar PV Facility 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 assessment of the cumulative impacts was undertaken through the consideration of the Moeding Solar PV Facility impacts in isolation and compared to the cumulative impacts of the Moeding Solar PV Facility and other PV facilities within a 30km radius from the proposed project site.

The significance of the cumulative impacts associated with the development of the Moeding Solar PV Facility rages from low to medium, depending on the impacts being considered. A summary of the cumulative impacts are included in **Table 8.2** below.

Table 8.2: Summary of the cumulative impact significance for the Moeding 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 and Hydrology	Low	Low to Medium (depending on the impact being considered)
Avifauna	Low	Medium
Land use, soil and agricultural potential	Medium	Medium
Heritage - Archaeology	Low	Low
Heritage - Palaeontology	Low	Medium
Visual	Solar Energy Facility – Low Power Lines - Low	Solar Energy Facility – Low to Medium (depending on the impact being considered) Power Lines - Medium
Socio-Economic	Low to Medium (depending on the impact being considered)	Medium

The following can be concluded regarding the cumulative impacts of the Moeding Solar PV Facility:

- ***Ecological and Hydrological processes:*** Cumulative impacts associated with the Moeding Solar PV Facility on ecological and hydrological processes includes a reduced ability to meet conservation obligations and targets, impacts on Ecological Support Areas and Broad-Scale Ecological Processes, large-scale disturbance of indigenous vegetation and an influence on runoff and stormwater flow patterns (including the impact on the surrounding hydrological features, such as the lower lying Dry Harts River) and dynamics due to the excessive clearing of vegetation. These cumulative impacts will be of a medium to low significance. No impacts of a high significance were identified. There will be no unacceptable loss of threatened or protected vegetation types, habitats or species due to the development of the Moeding Solar PV Facility and other solar energy facilities within the surrounding area provided that recommended mitigation measures are implemented.
- **Avifauna:** Cumulative impacts associated with the Moeding Solar PV Facility from an avifauna perspective includes habitat loss and disturbance, collision with PV panels and power lines, and electrocution associated with grid infrastructure. The significance of the cumulative impacts with the development of the Moeding Solar PV Facility and other solar PV energy facilities within the surrounding areas ranges from low to medium. No impacts of a high significance were identified. The cumulative impacts are not considered to pose an unacceptable risk or impact to the development of the Moeding Solar PV Facility provided that recommended mitigation measures are implemented.
- **Land Use, Soils and Agricultural Potential:** Cumulative impacts on land-use, soil and agricultural potential have been identified and assessed which relates to a decrease in land capability for livestock farming, soil erosion and the increased risk of soil pollution. The significance of the cumulative impact will be medium with the development of the Moeding Solar PV Facility and other solar PV energy facilities within the surrounding area. There will be no unacceptable loss of land capability for livestock farming due to the development of the Moeding Solar PV Facility and other solar PV energy facilities within the surrounding areas. This is largely due to the fact that farming activities can continue on the areas of the properties not affected by the solar developments.
- **Heritage (including archaeology and palaeontology):** Cumulative impacts on heritage have been identified and assessed which relates to the loss of archaeological resources, impacts to burial grounds and historical structures. The significance of the cumulative impact will be low due to a lack of significant archaeological and heritage resources. Cumulative impacts which relates to the loss of palaeontology is expected to be medium as a result of fossil heritage present within the development area. There will be no unacceptable loss of heritage resources associated with the development of the Moeding Solar PV Facility and other PV facilities within the surrounding areas provided that recommended mitigation measures are implemented.
- **Visual:** The proposed Moeding Solar PV Facility is located in an area where there is a cluster of twelve other solar PV energy projects in close proximity to the project site (~8km radius). As these projects are located in close proximity to each other, there is potential for a cumulative visual impact as they may either be seen in the same view or in relatively rapid succession for travellers on roads passing through the area. Based on the specialist cumulative assessment and findings, the development of the Moeding Solar PV Facility and its contribution to the overall impact of all solar PV energy facilities to be developed within a 30km radius, it can be concluded that the Moeding Solar PV Facility cumulative impacts will be of a low to medium significance. There will be no unacceptable impact on the visual quality of the landscape associated with the development of the Moeding Solar PV Facility and other solar PV energy facilities within the surrounding area provided that recommended mitigation measures are implemented.

» **Social environment:** One positive and one negative social cumulative impact has been identified and assessed for the Moeding Solar PV Facility. The positive impact relates to employment opportunities, business opportunities and skills development. Positive impacts will be enhanced with the development of numerous developments in the area. The negative impact relates to a large-scale in-migration of people. The significance of the impacts will be medium with the development of the Moeding Solar PV Facility and other solar energy facilities within the surrounding area. There will be no unacceptable risk or impacts to the social aspects and characteristics of the town of Vryburg with the development of the Moeding Solar PV Facility and other solar energy facilities within the surrounding area provided that recommended mitigation measures are implemented.

Based on the specialist cumulative assessment and findings regarding the development of the Moeding Solar PV Facility and its contribution to the overall impact of all solar PV energy facilities to be developed within a 30km radius, it can be concluded that the cumulative impacts associated with the Moeding Solar PV Facility will be of a low to medium significance. There are however no impacts or risks identified to be considered as unacceptable with the development of the facility and other solar energy facilities within the surrounding area provided that recommended mitigation measures are implemented. In addition, no impacts which will result in whole-scale change is expected.

CHAPTER 9 CONCLUSIONS AND RECOMMENDATIONS

Moeding Solar (Pty) Ltd proposes the construction of a photovoltaic (PV) solar energy facility (known as the Moeding Solar PV Facility) situated on a site approximately 8km south from the town of Vryburg. Moeding Solar PV Facility comprises a solar energy facility and is intended to form part of the Department of Energy's (DoE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. Moeding Solar will be designed to have a contracted capacity of up to 100MW, and will make use of photovoltaic (PV) solar technology. Portion 1 of the Farm Champions Kloof 731, Portion 4 and the Remaining Extent of Portion 3 of the Farm Waterloo 730 were identified and assessed as the project site for the development of Moeding Solar. The project will comprise the following key infrastructure and components:

- Arrays of PV solar panels with a contracted capacity of up to 100MW.
- Mounting structures to support the PV panels (utilising either fixed-tilt / static, single-axis tracking, or double-axis tracking systems).
- On-site inverters to convert power from Direct Current (DC) to Alternating Current (AC), and a 132kV on-site substation to facilitate the connection between the solar facility and the Eskom grid connection point.
- A new 132kV power line between the on-site substation and the Eskom grid connection point. Two alternatives are currently being considered in this regard:
  - Alternative 1 – a direct connection to the existing Mookodi Main Transmission Substation located north of the project site on the Remaining Extent of the Farm Rosendal 673. A new 132kV power line will be constructed over a distance of ~4km. A 300m power line corridor has been assessed for Alternative 1.
  - Alternative 2 - a turn-in turn-out connection into the proposed Mookodi - Magopela 132kV power line (to be constructed along the eastern boundary of the project site). A new turn-in and out 132kV power line will be constructed over a distance of ~335m.
- Cabling between the project's components, to be laid underground where practical.
- Battery storage with up to 6 hours of storage capacity.
- Offices and workshop areas for maintenance and storage.
- Laydown areas.
- Internal access roads and fencing around the development area.

Moeding Solar (Pty) Ltd has confirmed that the project site is suitable for a solar energy development from a technical perspective due to the available solar resources, access to the electricity grid, current land use, land availability and site-specific characteristics including accessibility.

A summary of the recommendations and conclusions for the proposed project as determined through the BA process is provided in this Chapter.

9.1. Legal Requirements as per the EIA Regulations, 2014 (as amended)

This chapter of the BA report includes the following information required in terms of the EIA Regulations, 2014 - Appendix 1: Content of basic assessment reports:

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 the Moeding Solar PV Facility has been included in section 9.2.
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 the Moeding Solar PV Facility has been included as section 9.6. An Environmental Sensitivity and Preferred Layout Map of Moeding Solar has been included as **Figure 9.4** which overlays the development footprint of the solar energy facility with the environmental sensitive features. A summary of the positive and negative impacts associated with the Moeding Solar has been included in section 9.5.
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 Moeding Solar PV Facility has been included in section 9.7.
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 the Moeding Solar PV Facility should be authorised has been included in section 9.7.

9.2. Evaluation of Moeding Solar

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 the Moeding Solar PV Facility. This chapter concludes the environmental assessment of the solar energy facility by providing a summary of the results and conclusions of the assessment of both the project site and alternatives proposed for the Moeding Solar PV Facility. In so doing, it draws on the information gathered as part of the BA 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 sensitive features within the project site and the undertaking of monitoring, as specified by the specialists.

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

» Impacts on ecology, flora, fauna and hydrological features.
» Impacts on avifauna.
» Impacts to soils, land-use and agricultural potential.
» Impacts on heritage resources, including archaeology and palaeontology.
» Visual impacts on the area imposed by the components of the facility.
» Positive and negative socio- economic impacts.

9.2.1. Impacts on Ecology and Hydrology

The Ecological and Hydrological Impact Assessment assessed the impact of the Moeding Solar PV Facility on the sensitive ecological and hydrological[15] features present within the project site and 300m power line corridor for the life-cycle of the project. The assessment identified impacts within the construction and operation phases of the project.

During the construction phase, the impacts expected to occur include impacts on vegetation and listed protected plant species, faunal impacts, an increased erosion risk and increased alien plant invasion. The significance of the construction phase impacts ranges from medium to low, following the implementation of the recommended mitigation measures by the specialist. No impacts of a high significance were identified prior to the implementation of mitigation.

During the operation phase, the anticipated impacts include altered runoff patterns due to rainfall interception by the PV panel infrastructure and compacted areas resulting in high levels of erosion, increased alien plant invasion, an increased erosion risk and faunal impacts. The significance of the impacts for the operation phase ranges from medium to low, following the implementation of the recommended mitigation measures by the specialist. No impacts of a high significance were identified for the project.

From the findings of the Ecological and Hydrological Impact Assessment (**Appendix D**) it can be concluded that no impacts of high ecological or hydrological significance were identified which would hinder the development of the Moeding Solar PV Facility and its associated infrastructure within the project site and power line corridor. The proposed development is considered to be appropriate and acceptable from an ecological and surface hydrological perspective and will not result in detrimental impacts to ecosystems and habitat features present within the project site and within the surrounding properties. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures.

[15] It must be noted that no sensitive hydrological features have been identified and confirmed within the development footprint of Moeding Solar by the specialist.

Power Line Alternative 2 is the preferred alternative from an ecological perspective due to the fact that the power line route will be very short and therefore impacts on the near-natural habitat will be limited. Even though Power Line Alternative 1 is a slightly longer route, it is mostly located within a medium to low sensitive area with no high and very high sensitive areas. The potential impacts associated with this alternative will be relatively low and is also considered to be acceptable. From a hydrological perspective both alternatives are regarded as suitable and are deemed equally preferred.

9.2.2. Impacts on Avifauna

The Avifauna Impact Assessment (**Appendix E**) identified that although the proposed Moeding Solar PV Facility will have an impact on avifauna due to the extensive spatial requirements of the development, the project site is not considered unique (also classified as low sensitive REDZ within the Strategic Environmental Assessment) and is furthermore not considered critical for the conservation of Red Data species. The project site is also located within a Low Risk Site (Regime 1) and it can be concluded that the implementation of Stage 3 and 4 assessments and monitoring, according to the Best Practice Guidelines: Birds & Solar Energy, will not be necessary.

The avifauna impacts identified to be associated with the Moeding Solar PV Facility is unlikely to be long-term significant impacts. During the construction phase of the facility a loss of habitat and disturbance due to clearance of vegetation is expected to occur. The significance of this impact can be reduced to low with the implementation of the recommended mitigation measures provided by the specialist.

During the operation phase, the anticipated impacts include disturbance, collisions with solar panels and power line infrastructure and electrocution. The significance of the impacts for the operation phase can be reduced to low, following the implementation of the recommended mitigation measures by the specialist. No impacts of a high significance were identified for the project.

From the results of the avifauna assessment, it can be concluded that no fatal-flaws will be associated with the development of the Moeding Solar PV Facility from an avifaunal perspective. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures. The preferred power line alternative from an avifauna perspective is Power Line Alternative 2 with minimal additional habitat disturbance. Power Line Alternative 1 is considered to be least preferred but acceptable.

The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures.

9.2.3. Impacts on Land Use, Soil and Agricultural Potential

The proposed Moeding Solar PV Facility infrastructure is located on shallow, rocky soils with low to moderate-low land capability. The construction and operation of a PV facility on the project site is considered acceptable from a soils perspective as it will supplement and stabilise the landowner's income in an area where farming is susceptible to periodic droughts. The construction and operation of a PV facility on the project site is therefore considered acceptable from a soils perspective. As the landowner for the properties affected by the project site is Tiger Kloof Educational Institute, the income will be an investment for the educational trust to further the educational activities of the school.

Impacts have been identified for both the construction and operation phases for the Moeding Solar PV Facility (**Appendix F**). The impacts associated with land use, soil and agricultural potential include an increased risk of soil erosion, potential chemical pollution and loss of land capability. The significance of the impacts ranges from low to medium with the implementation of the mitigation measures recommended by the specialist. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures. The nominated preferred power line alternative from a soils and agricultural potential perspective is Power Line Alternative 2.

9.2.4. Impacts on Heritage Resources

Through a field survey, archival research and evaluation of aerial photography of the sites, several heritage resources have been identified within the project site and the 300m power line corridor (Alternative 1). These sites have a site significance of GP.B.

The Heritage Impact Assessment (**Appendix H**) identified impacts associated with the construction and operation of the Moeding Solar PV Facility and associated infrastructure. These include impacts on burial grounds, impacts on historical structures and impacts on archaeological sites. With the implementation of mitigation measures, the potential impacts on heritage resources will be low. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures. The nominated preferred power line alternative from a heritage perspective is Power Line Alternative 2.

Considering the palaeontology of the project site, it was identified that the area in question is underlain by a small portion of the Vryburg Formation of the Transvaal Supergroup (geologically older than 2.6 billion year-old) and the Schmidtsdrift Subgroup, Ghaap Group of the Transvaal Supergroup. Stromatolite assemblages are recorded within both the Schmidtsdrift Subgroup and Vryburg Formation. Poorly- to fairly well-preserved, stromatolite assemblages were recorded within the project site.

Impacts on palaeontological resources are expected to occur during the construction phase of the Moeding Solar PV Facility (refer to **Appendix I** for the Palaeontological Impact Assessment). The impacts relate to the excavations required for the construction of the facility and will occur only in the event that a palaeontological resource is present. The significance of the impact will be low with the implementation of mitigation measures proposed by the specialist. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures. Both power line alternatives are underlain by the Vryburg Formation of the Transvaal Supergroup and therefore have a similar geology. There is no preferences between the power line alternatives and both are considered to be acceptable from a palaeontological perspective.

9.2.5. Visual Impacts

The Visual Impact Assessment (**Appendix G**) identified negative impacts on visual receptors during the undertaking of construction activities and the operation phase of the Moeding Solar PV Facility.

The area that is likely to be affected by the visual impact associated with the solar energy facility will be limited to the area immediately to the south of the urban area of Vryburg. This area is largely impacted by

urban and urban fringe development. Due to the ridgeline located to the south of the solar energy facility, the development will not impact on areas to the south that have a more cohesive rural in character and where the landscape character is not influenced by development. The Moeding Solar PV Facility will mainly impact visually on an area where there currently is a strong visual influence from urban and urban fringe development, changes to the landscape quality are unlikely to be problematic.

The construction and operation phase of the Moeding Solar PV Facility will impact on the general landscape character of the area, on small holdings north east (Huhudi), travellers on the N18 and R34, homesteads, the Tiger Kloof Educational Institution and the Vryburg airstrip. The significance of the visual impacts will be low with the implementation of the recommended mitigation measures. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures.

Power Line Alternative 2 is considerably shorter than Alternative 1, thereby reducing the area of potential visual exposure, and subsequent potential visual impact. This alternative is therefore considered to be the preferred alternative from a visual perspective.

9.2.6. Social Impacts

Traditionally, the majority of social impacts are associated with the construction phase of a PV solar development. Many of the social impacts are unavoidable and will take place to some extent, but can be managed through the careful planning and implementation of appropriate mitigation measures. A number of potential positive and negative social impacts have been identified for the project, however an assessment of the potential social impacts indicated that there are no perceived negative impacts that are sufficiently significant to allow them to be classified as fatal flaws.

The Social Impact Assessment (**Appendix J**) identified positive and negative impacts which are expected to occur during the construction and operation phases of the Moeding Solar PV Facility. The assessment identified that the expected benefits associated with the project, which include generation of electricity from renewable sources and local economic and social development, outweigh the perceived impacts associated with the project.

During the construction phase the positive impacts expected to occur includes direct and indirect employment opportunities and skills development and economic multiplier effects. The significance of these impacts are medium with the implementation of the recommended enhancement measures. The negative social impacts expected to occur during the construction phase includes an influx of jobseekers and change in population, safety and security impacts, impacts on daily living and moving patterns, nuisance impacts (i.e. noise and dust) and visual impacts. The significance of the negative construction phase impacts will be low to medium with the implementation of the recommended mitigation measures

During the operation phase the positive impacts expected to occur includes direct and indirect employment opportunities and skills development, development of non-polluting, renewable energy infrastructure and a contribution to Local Economic Development (LED) and social upliftment. The significance of the positive operation impacts will be medium to high with the implementation of the recommended enhancement measures. The negative impacts expected during the operation phase includes a visual and sense of place impact and impacts associated with the loss of agricultural land. The significance of the negative operation impacts will be low to medium with the implementation of the

recommended mitigation measures. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures. From a social perspective, both power line alternatives are considered to be acceptable.

9.2.7. Assessment of Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site-specific developments. The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The Moeding Solar PV Facility falls within the Vryburg REDZ which has been identified by the DEA as an area highly suitable for solar PV energy facilities given a range of factors considered. Within a 30km radius of the Moeding Solar PV Facility project site, there are twenty three (23) PV facilities which were considered as part of the cumulative impact assessment. Of these, only the Waterloo Solar Park is certain to become operational as it is a preferred bidder project in terms of the REIPPP Programme. The cumulative impacts associated with Moeding Solar have been assessed to be acceptable, with no unacceptable loss or risk expected (refer to **Table 9.1** and Chapter 8).

Table 9.1: Summary of the cumulative impact significance for Moeding Solar

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 and Hydrology	Low	Low to Medium (depending on the impact being considered)
Avifauna	Low	Medium
Land use, soil and agricultural potential	Medium	Medium
Heritage - Archaeology and palaeontology)	Low	Low
Heritage - Palaeontology	Low	Medium
Visual	Low	Low to Medium (depending on the impact being considered)
Socio-Economic	Low to Medium (depending on the impact being considered)	Medium

Based on the specialist cumulative assessment and findings regarding the development of the Moeding Solar PV Facility and its contribution to the overall impact of all solar energy facilities to be developed within a 30km radius, it can be concluded that the cumulative impacts associated with the Moeding Solar PV Facility will be of a low to medium significance. There are however no impacts or risks identified to be considered as unacceptable with the development of the Moeding Solar PV Facility and other solar energy facilities within the surrounding area. In addition, no impacts which will result in whole-scale change are expected.

9.3. Environmental Sensitivity Mapping

From the specialist investigations undertaken for the Moeding Solar PV Facility, the following sensitive areas/environmental features have been identified and demarcated within the project site and power line corridor and avoided by the development footprint (where necessary) (refer to **Figure 9.1** and **Figure 9.2** and **Appendix N**):

» **Ecology and Hydrology** – The majority of the project site and power line corridor has been identified as being of a medium to low ecological sensitivity based on the presence of Open Vaalbos Shrubland, Tall Vaalbos Shrubland, Short Griekwa Karee Shrubland and Tall Karee Woodland. Areas of medium ecological sensitivity include a Palaeo-Drainages, Tall Mixed Woodland Patch and Tall Woodland Fringe *A. erioloba* (Declining) was occasionally observed. The development footprint and power line alternatives avoids all areas considered to be Tall Woodland Fringe vegetation. Areas of very high ecological sensitivity includes depression wetlands (pans) situated directly north and south of the development area. These areas and the 35m associated buffer zones are avoided by the development footprint and power line alternatives.

» **Bird Habitat and Sensitive Areas** – The majority of the project site (including the power line corridor) has been assessed as a medium to low sensitivity from an avifaunal perspective. The sensitive areas include the Savannah Grassland, Savannah Shrubland and the Tree Savannah Habitat occurring on historically cultivated areas (Secondary Savannah).

The relatively small natural Tree Savannah and Savannah Woodland are considered to be of medium sensitivity. Both of these habitat units are fairly limited in extent with the Savannah Woodland forming a small isolated patch within the project site. A portion of the solar field will expand into this habitat type as well as the compound area. These activities and the extent of their impacts within the medium sensitive habitat types are regarded as acceptable.

The ephemeral pans with the woody peripheries are considered to be of high avifauna sensitivity. These habitats provide a source of surface water in the area and support a number of large trees, which could potentially be important for roosting and nesting. The development footprint and power line alternatives avoids all ephemeral pans.

» **Heritage:** Four sites of heritage significance were identified within the 300m corridor and none within the development footprint of the solar energy facility. These sites have a site significance of GP.B and a 20m no-go buffer area has been established around these sites by the specialist. The project site also consists of characteristic flat-lying terrain and vegetation cover of grassy thornveld and poorly- to fairly well-preserved stromatolite assemblages were recorded within the project site. The specialist recommended that the collection and recording of fossils as well as obtaining data of the surrounding sedimentary matrix within the proposed development footprint must be undertaken by a palaeontologist after the preliminary vegetation removal but before the ground is levelled for construction.

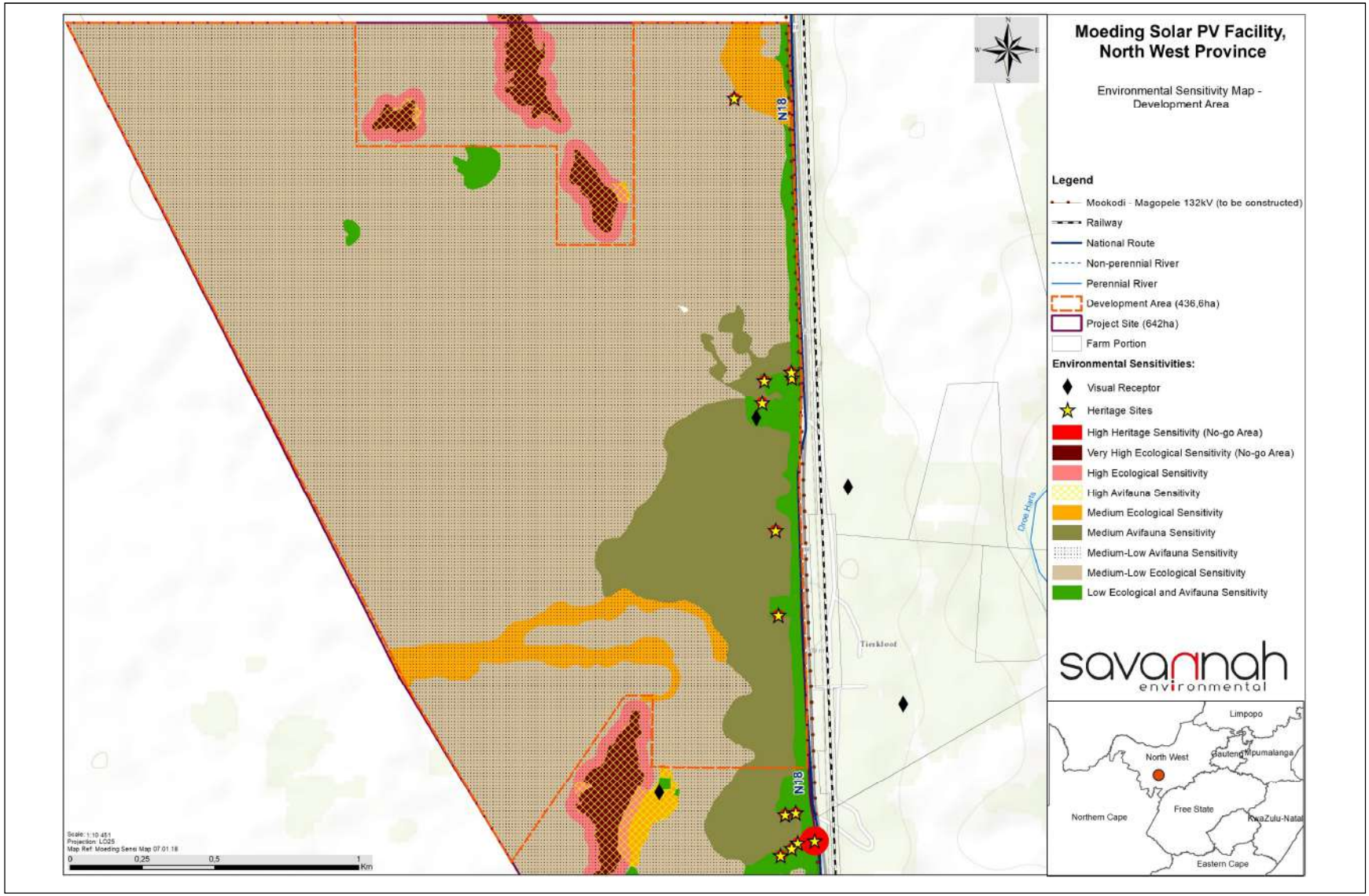

Figure 9.1: Environmental sensitivity map of the development area for the Moeding Solar PV Facility.

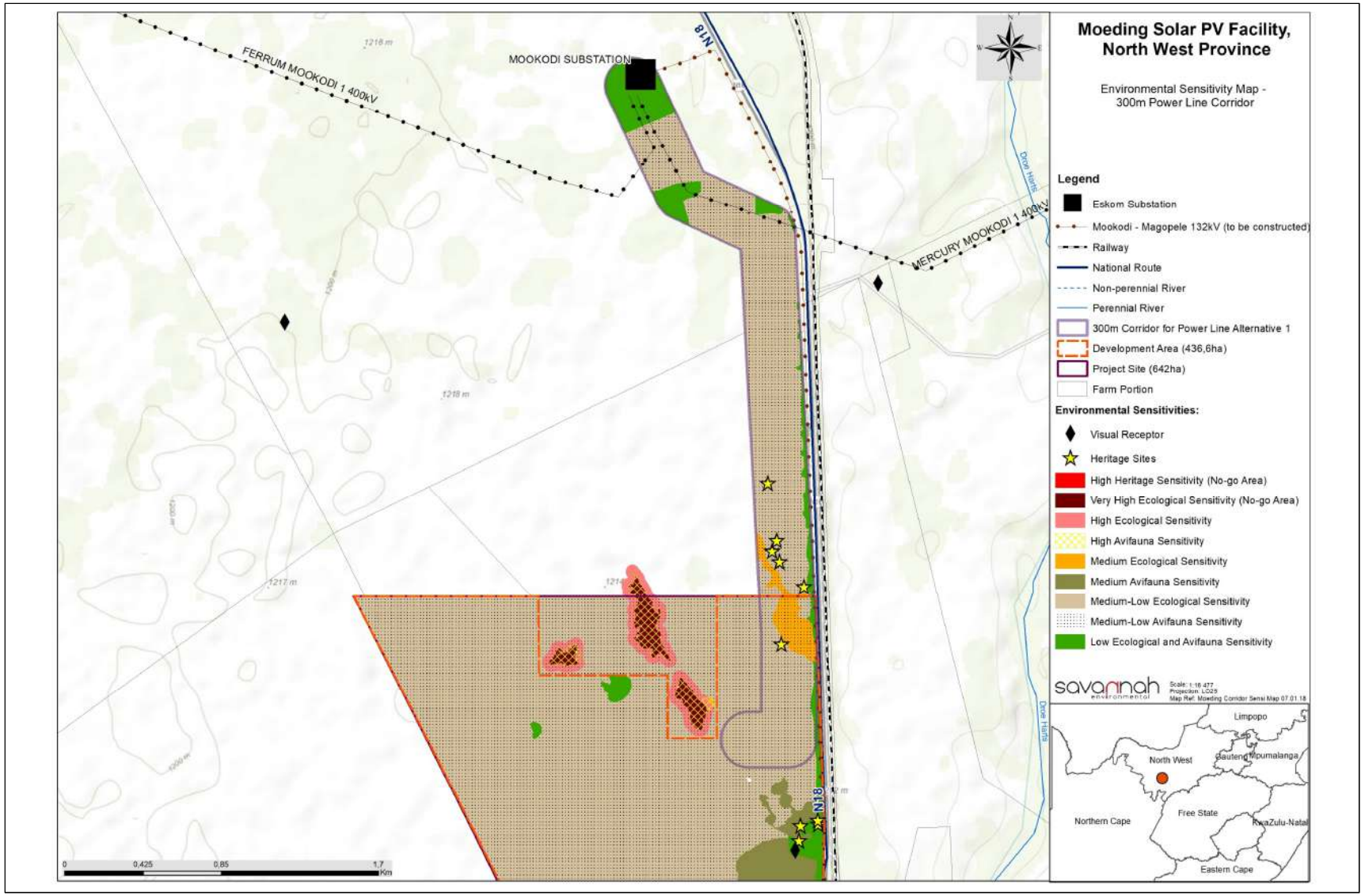

Figure 9.2: Environmental sensitivity map of the power line alternatives considered for the Moeding Solar PV Facility.

9.4. Assessment of Alternatives and the Identification of the Preferred Alternatives

As part of the BA process undertaken for the Moeding Solar PV Facility two power line alternatives have been identified and assessed on the same level for the development. The assessment of the alternatives and the acceptability of the alternatives for implementation as part of the Moeding Solar PV Facility was considered by the specialists for the project and was assessed comparatively as part of the impact assessment chapter (Chapter 7) of this BA Report. These power line alternatives include:

» Alternative 1 – a direct connection to the existing Mookodi Main Transmission Substation located north of the project site on the Remaining Extent of the Farm Rosendal 673. A new 132kV power line will be constructed over a distance of ~4km. A 300m power line corridor has been assessed for Alternative 1.
» Alternative 2 - a turn-in turn-out connection into the proposed Mookodi - Magopela 132kV power line (to be constructed along the eastern boundary of the project site). A new turn-in and out 132kV power line will be constructed over a distance of ~335m

A 300m corridor has been assessed for Power Line Alternative 1 which will have a servitude of 31m. Power Line Alternative 2 is located within the development area assessed for the solar energy facility and will also has a servitude of 31m. The table below (**Table 9.2**) provides the results of the comparative assessment undertaken for the power line alternatives from an environmental perspective, and identifies the preferred alternative for Moeding Solar from an environmental acceptability perspective.

Table 9.2: Results of the comparative assessment undertaken and the identification of the preferred alternative from an environmental perspective.

Specialist field	Power Line Alternative 1	Power Line Alternative 2
Ecology	Least preferred but acceptable	Preferred
Hydrology	Acceptable	Acceptable
Avifauna	Least preferred but acceptable	Preferred
Land use, soil and agricultural potential	Acceptable	Preferred
Heritage - Palaeontology	Acceptable	Acceptable
Heritage - Archaeology	Least preferred.	Preferred
Visual	Least preferred.	Preferred
Social	Acceptable	Acceptable

Considering the results of the comparative assessment, it can be concluded that Power Line Alternative 2 is preferred from an environmental perspective and is therefore assigned as part of the preferred development footprint for the Moeding Solar PV Facility.

9.5. Environmental Costs of the PV Facility versus Benefits of the PV Facility

Environmental costs (including those to the natural environment, economic and social environment) can be anticipated at a local and site-specific level, and are considered acceptable provided the mitigation measures as outlined in the BA Report and the EMPr are implemented and adhered to. No fatal flaws have been identified. These environmental costs could include:

» *A loss of biodiversity, flora and fauna due to the clearing of land for the construction and utilisation of land for the solar energy facility* - The cost of loss of biodiversity is considered to be limited due to the

placement of infrastructure within vegetation considered to be of a medium and medium to low sensitivity and the avoidance of areas of high and very high sensitivity.

» *Visual impacts associated with the solar energy facility* - The development of the Moeding Solar PV Facility may have a visual impact which will be of a low significance with the implementation of the recommended mitigation measures as a result of the strong visual influence from urban and urban fringe development. The location of the facility in relation to other industrial-type developments is expected to limit the impact which the PV facility would have on the visual quality of the area.
» *Change in land-use and loss of land available for agricultural activities within the development footprint* - The cost in this regard is expected to be limited due to the low agricultural potential of the property and the fact that current grazing activities can continue on the remainder of the property during construction and operation.

The costs of the Moeding Solar PV Facility are expected to occur at a local scale and can be largely avoided or mitigated.

Benefits of the Moeding Solar PV Facility include the following:

» *Socio-economic development:* The project will result in important economic benefits at the local (specifically Vryburg and Huhudi) and regional scale through job creation, income and other associated downstream economic development. These will persist during the pre-construction, construction, operation and decommissioning phases of the project.
» *Alignment with Provincial and Local Planning:* The project contributes towards the Provincial and Local goals for the development of renewable energy as outlined in the respective IDPs.
» *Contribution towards renewable energy gaols at a national level:* The project serves to diversify the economy and electricity generation mix of South Africa through the addition of solar energy development.
» *Limited resource use:* The water requirement for a solar energy facility is negligible compared to the levels of water used by coal-based technologies. This generation technology is therefore supported in dry climatic areas.
» *Positive contribution towards climate change goals:* South Africa's per capita greenhouse gas emissions are amongst the highest in the world due to the reliance on fossil fuels. The Moeding Solar PV Facility will contribute to achieving goals for implementation of renewable energy and sustaining a 'green' economy within South Africa.

The benefits of the Moeding Solar PV Facility are expected to occur at a national, regional and local level. As the costs to the environment at a site-specific level have been largely limited through the appropriate placement of infrastructure on the project site within areas considered to be acceptable for the proposed development, the benefits of the project are expected to outweigh the environmental costs of the solar energy facility.

9.6. Overall Conclusion (Impact Statement)

The construction and operation of a solar PV energy facility with a contracted capacity of up 100MW on a project site located near Vryburg in the Naledi Local Municipality, of the greater Dr Ruth Segomotsi Mompati District Municipality has been proposed by Moeding Solar (Pty) Ltd. A technically viable project site and development footprint was proposed by the developer and assessed as part of the BA process. The assessment of the development footprint (through the consideration of layout alternatives) within the

project site was undertaken by independent specialists and their findings have informed the results of this BA Report.

The specialist findings have indicated that there are no identified environmental fatal flaws associated with the implementation of the Moeding Solar PV Facility within the affected properties. The developer has proposed technically viable and suitable power line alternatives which has been assessed as part of the independent specialist studies. Through this assessment the preferred alternative from an environmental perspective has been identified, and assigned as part of the preferred layout map for the Moeding Solar PV Facility. The preferred alternative from an environmental perspective identified through this BA process is therefore considered as the most appropriate alternative to form part of the development footprint for the Moeding Solar PV Facility and associated infrastructure, and is considered to be acceptable within all fields of specialist study undertaken for the project. All impacts associated with the preferred power line alternative and development footprint of the solar energy facility can be mitigated to acceptable levels or enhanced through the implementation of the recommended mitigation or enhancement measures. The preferred layout map (including the details of the project) and the preferred layout map overlain by environmental sensitivities are included as **Figure 9.3 and Figure 9.4**.

Through the assessment of the development of the Moeding Solar PV Facility within the project site it can be concluded that the development of the solar energy facility is environmentally acceptable (subject to the implementation of the recommended mitigation measures).

9.7. Overall Recommendation

Considering the findings of the independent specialist studies, the impacts identified, the development footprint proposed by the developer, the avoidance of the 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 Moeding Solar PV Facility is acceptable within the landscape and can reasonably be authorised (**Figure 9.3**).

The following infrastructure would be included within an authorisation issued for the project:

- Arrays of PV solar panels with a contracted capacity of up to 100MW.
- Mounting structures to support the PV panels (utilising either fixed-tilt / static, single-axis tracking, or double-axis tracking systems).
- On-site inverters to convert power from Direct Current (DC) to Alternating Current (AC), and a 132kV on-site substation to facilitate the connection between the solar facility and the Eskom grid connection point.
- A new 132kV power line between the on-site substation and the Eskom grid connection point. A turn-in and turn-out of the Mookodi - Magopela 132kV power line to be constructed along the eastern boundary of the project site is preferred.
- Cabling between the project's components, to be laid underground where practical.
- Battery storage with up to 6 hours of storage capacity.
- Offices and workshop areas for maintenance and storage.
- Temporary laydown areas.
- Internal access roads and fencing around the development area.

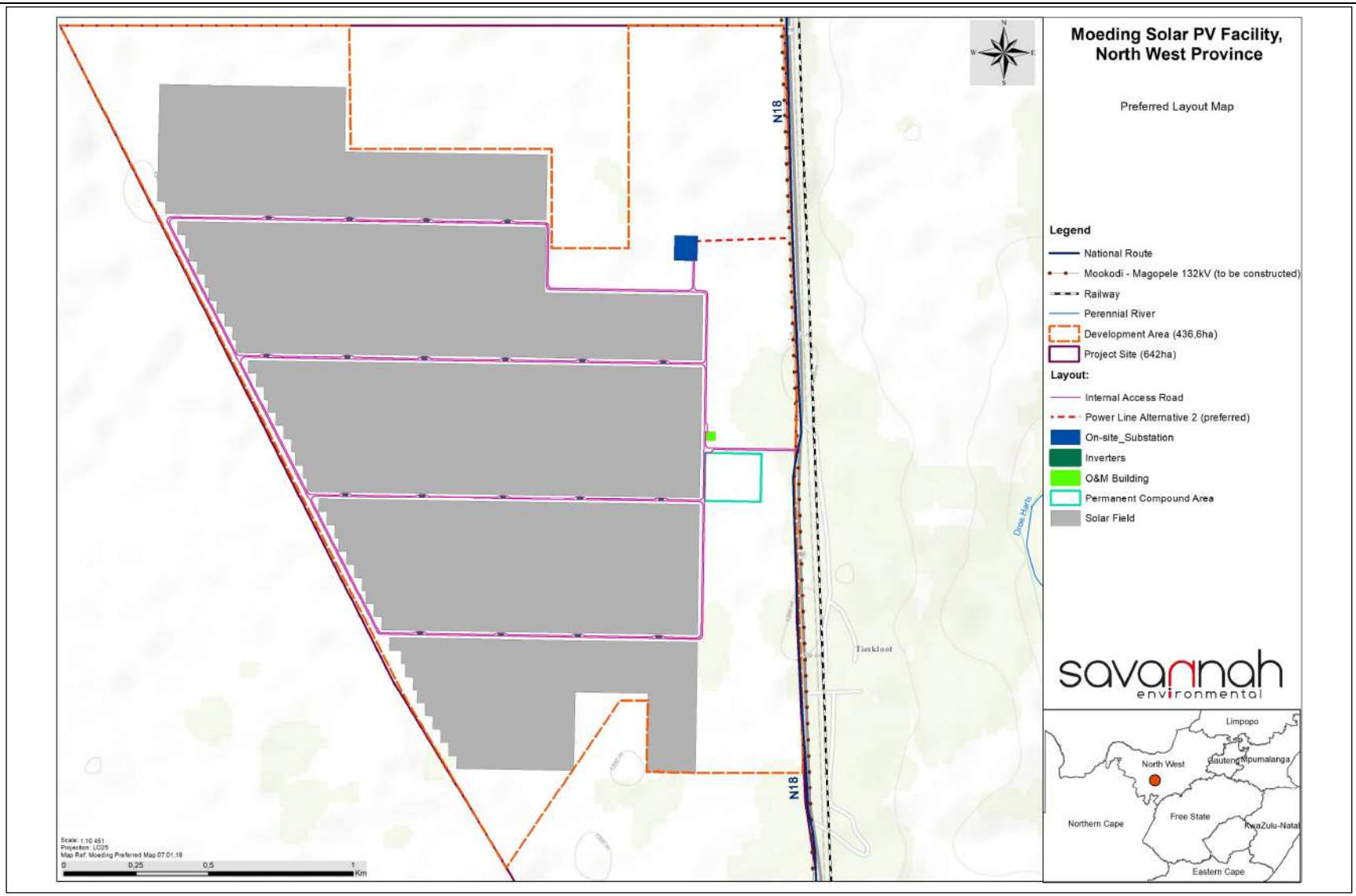

Figure 9.3: Final preferred layout map of the preferred development footprint for the Moeding Solar PV Facility, as was assessed as part of the BA process (A3 map included in **Appendix N**)

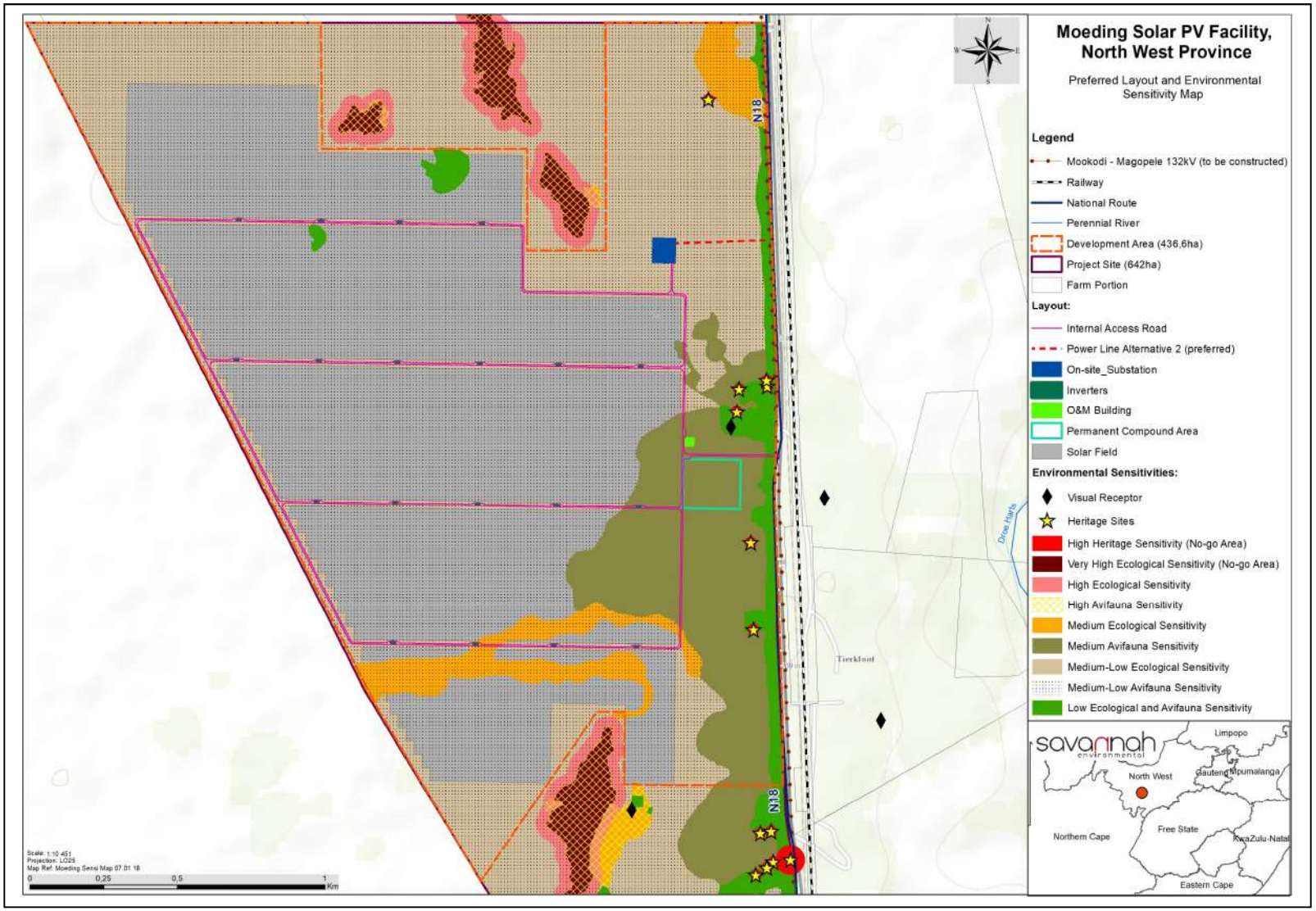

Figure 9.4: Final preferred layout map overlain by the environmental sensitivities for the Moeding Solar PV Facility (A3 map included in **Appendix N**)

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

- The preferred development footprint avoiding identified sensitive areas must be implemented.
- Power Line Alternative 2 is the preferred alternative.
- All mitigation measures detailed within this BA Report, as well as the specialist reports contained within **Appendices D to J**, are to be implemented.
- The EMPr as contained within **Appendix K** of this BA Report should form part of the contract with the Contractors appointed to construct and maintain the solar energy facility in order to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of Moeding Solar is considered key in achieving the appropriate environmental management standards as detailed for this project.
- The project footprint must be kept as small as possible.
- 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.
- Following the final design of the Moeding Solar PV Facility, a final layout must be submitted to DEA for review and approval prior to commencing with construction. No development is permitted within the identified no-go areas as detailed in **Figure 9.1** and **Figure 9.2.**
- Since most of the identified conservation worthy species within the project site are geophytes and succulents with relative shallow rooting systems (i.e. *Boophone disticha, Babiana hypogea, Ammocharis coranica, Nerine laticoma* and *Aloe greatheadii*), 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 rations. Permits from the relevant provincial authorities, i.e. the North West Department of Rural, Environment and Agricultural Development (READ) before the individuals are disturbed.
- A detailed Invasive Plant Management Plan will have to be in place prior to commencement of activity and be diligently followed and updated throughout the project cycle up to the decommissioning phase.
- The Stormwater Management Plan (SWMP) should provide for a drainage system sufficiently designed to prevent water run-off from the solar panels to cause soil erosion.
- A chance find procedure 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.

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