SAN SOLAR PV FACILITY AND ASSOCIATED INFRASTRUCTURE NORTHERN CAPE PROVINCE

Environmental Impact Assessment Report

Final Report

DFFE Ref: 14/12/16/3/3/2/2144

August 2022

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PROJECT DETAILS

DEFF Reference	:	14/12/16/3/3/2/2144
Title	:	Environmental Impact Assessment Process Environmental Management Programme: San Solar PV facility, Northern Cape Province
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Client	:	San Solar Energy Facility (Pty) Ltd
Report Status	:	Final Environmental Impact Assessment Report
Date	:	August 2022

When used as a reference this report should be cited as: Savannah Environmental (2022) Final Environmental Impact Assessment Report for the San Solar PV Facility and associated infrastructure, Northern Cape Province.

PURPOSE OF THE EIA REPORT

San Solar Energy Facility (Pty) Ltd has appointed Savannah Environmental as the independent environmental consultant to undertake the Scoping and Environmental Impact Assessment Process for the San Solar PV Facility. The EIA 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). This Scoping report has been compiled in accordance with Appendix 2 of the EIA Regulations, 2014 (as amended) and consists of the following sections:

This EIA Report consists of ten chapters, which include:

- **Chapter 1** provides background to the San Solar PV facility project and the environmental impact assessment.
- **Chapter 2** provides a project description of San Solar PV facility.
- **Chapter 3** outlines strategic regulatory and legal context for energy planning in South Africa and specifically relating to the project.
- **Chapter 4** describes the need for, and alternatives considered for the San Solar PV facility.
- **Chapter 5** outlines the approach to undertaking the EIA process.
- **Chapter 6** describes the existing biophysical and social environment within and surrounding the study and development area.
- **Chapter 7** provides an identification and evaluation of the potential issues associated with the proposed solar PV facility and associated infrastructure.
- **Chapter 8** presents the conclusions of the EIA process evaluation for the Solar PV facility.
- **Chapter 9** describes the Plan of Study (PoS) for the EIA phase.
- **Chapter 10** provides references used to compile the EIA report.

The EIA Report was made available for review from **Tuesday, 28 June 2022** to **Thursday, 28 July 2022** at (https://savannahsa.com/public-documents/energy-generation/).

All comments submitted during the 30-day review period have been included, considered and addressed where relevant within this Final EIA Report (refer to Comments & Response Report in Appendix C9).

This report is submitted for the consideration of the National Department of Forestry, Fisheries and the Environment (DFFE).

EXECUTIVE SUMMARY

San Solar Energy Facility (Pty) Ltd is proposing the construction of a photovoltaic (PV) solar energy facility (known as San Solar PV) located on a site approximately 16km north-west of the town Kathu in the Northern Cape Province. The development area falls within the jurisdiction of the Gamagara Local Municipality within the John Taolo Gaetsewe District Municipality. The solar energy facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 100MW. The facility will be located within Remaining extent of the Farm Wincanton 472 (refer to **Figure 1**).

A development area of 205ha has been identified within the broader project site by the proponent for the development of San Solar PV and associated infrastructure, which has been fully considered within this Scoping/EIA process and assessed in terms of its suitability from an environmental and social perspective within this EIA Report.

The project will comprise the following key infrastructure and components:

- PV modules and mounting structures
- Inverters and transformers
- Cabling between the panels, to be laid underground where practical
- Battery Energy Storage System (BESS)
- Site and internal access roads (up to 8m wide)
- Laydown area
- Operation and maintenance buildings including a gate and security building, control centre, offices, warehouse, and workshop areas for maintenance and storage.
- Grid connection solution including a 132kV facility substation, 132kV switching station to be connected via a Loop-in-Loop out (LILO) connection to the Fox-Umtu 132kV overhead power line located south of the site.

The associated infrastructure consisting of the BESS, Laydown Area, and Ancillary building, is located within development area that has been assessed during the scoping and EIA phase. 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 no-go features (i.e. 10m heritage no-go areas) within the project development area by the development footprint and the undertaking of monitoring, as specified by the specialists.

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

- Impacts on ecology, flora and fauna.
- Impacts on avifauna.
- Impacts to soils and agricultural potential.
- Impacts on heritage resources, including archaeology and palaeontology.
- Visual impacts on the area imposed by the components of the facility.
- Social impacts.

Impacts on Ecology (including flora and fauna)

The Terrestrial Ecology Assessment (**Appendix D**) undertaken determined that there are no impacts associated with the San Solar PV facility and associated grid line corridor that cannot be mitigated to an acceptable level and as such, the assessed layout was considered acceptable. The majority of the site consists of typical Kathu Bushveld dominated by *Senegalia mellifera* and *Tarchonanthus camphoratus*, which is considered low sensitivity on account of the generally low abundance of species of concern. In the south of the site, there is an area of deeper sands with a higher abundance of *Vachellia erioloba* which is considered High sensitivity, and which should be avoided by the PV development. Across the rest of the site there are several pans present, which are considered Very High sensitivity. Given the ecological role that pans play in the landscape, these are considered sensitive features that are not suitable for development. There are no pans within the final development footprint.

The verified plant species theme sensitivity show that the PV facility is restricted to the low sensitivity parts of the site. The grid connection runs through areas that are also classified as low sensitivity. Although there are some small pans along the power line corridor, these have been avoided under the current layout and can also be avoided should there be any changes to the exact routing of the power line.

The majority of the site is considered low sensitivity for fauna. The pans and the deeper sands in the south-east of the site are considered to be moderate sensitivity and contribute to the habitat diversity of the site. There are no areas at the site which are considered specifically high sensitivity for terrestrial fauna. As such, the San Solar site is considered acceptable for the development of the PV facility and grid connection from a terrestrial fauna perspective. There are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding.

Impacts on Avifauna

The Avifauna Impact Assessment (Appendix E), which considered the results of two seasons of pre-construction bird monitoring, determined the significance of potential avifauna impact to be moderate to low after mitigation (depending on the type of impact). The open Kathu Bushveld, the dense Kathu Bushveld and ephemeral pans habitat units comprising of potential sensitive avifauna features have been observed on the project site. The following avifauna sensitivities have been identified:

Areas of high sensitivity
The high sensitivity habitat units include the open Kathu Bushveld, ephemeral pans and artificial watering points.

- The open Kathu Bushveld and ephemeral pans are considered to be of high avifaunal sensitivity. The open Kathu Bushveld is an area which was historically transformed, and now with a less dense vegetation cover provides potential foraging habitat for large terrestrial bird species such as the Kori Bustard (Ardeotis kori).
- The ephemeral pans provide ephemeral foraging opportunities for waterbirds and shorebird taxa, which are rare or absent in the area when these are dry. Many of these species are highly nomadic in the area may become disorientated by the "lake effect" caused by the PV panels which may result in bird colliding with the panels (and also powerlines).
- The artificial livestock watering points often attract large numbers of granivore passerine and non-passerine bird species, of which many need to drink water on a daily basis (e.g. sandgrouse). The placement of electrical and PV infrastructure in close proximity to these areas could increase potential

avian collisions with the infrastructure. These areas are therefore of artificial origin but could be relocated to other areas.

Areas of medium sensitivity
The medium sensitivity habitat units include the Kathu Bushveld (including Kathu Bushveld on deep red sands).

- These are prominent in the region and provides potential suitable foraging habitat for some collision-prone bird species, including the Northern Black Korhaan (Afrotis afraoides) and Red-crested Korhaan (Lophotis ruficrista) with the potential to interact (e.g., collide) with the proposed electrical infrastructure. In addition, reporting rates for threatened and near threatened bird species are anticipated to be relatively low in this unit, thereby suggesting a medium sensitivity rating instead of a high sensitivity even though the majority of the habitat is natural. In addition, Kathu Bushveld is widespread in the region.
- The Kathu Bushveld on deep red sands is expected to sustain a higher number of bird species when compared to the other units.

No fatal flaws were identified during the assessment of the PV Facility. Impacts related to avian collision and electrocution with the overhead power line were also considered to not be a fatal flaw and can be mitigated. The specialist has recommended mitigation measures and monitoring protocols to be implemented during the construction and operational phase of the project.

Impacts on Soil and Agricultural Potential

There are no crop fields within the development area. Even though the area is suitable for livestock farming, the long-term grazing of the entire development area is 13 ha/LSU, which is a low-moderate grazing potential and livestock numbers must be strictly controlled, especially during periods of drought, to avoid overgrazing and land degradation.

The low agricultural potential of the site is further confirmed by the absence of any High Potential Agricultural Areas (HPAAs) in the vicinity of the development area.

Considering the soil properties, land capability and agricultural potential of the development area, the entire PV Facility development area as well as the grid connection corridor, have Low Agricultural Sensitivity. Soil in the project area will have Low to Medium sensitivity, depending on the successful implementation of mitigation measures to prevent soil erosion, compaction and pollution.

Impacts on Heritage Resources (archaeological and paleontological)

Although the palaeosensitivity was identified as very high in terms of the SAHRIS Palaeontological Sensitivity Map, Almond and Pether (2009) describe these specific formations as having a low sensitivity for fossils. The Palaeosensitivity was identified as high in terms of the SAHRIS Palaeontological Sensitivity Map the geological structures suggest that the rocks are unlikely to contain fossils. Taking account of the defined criteria, the potential impact to fossil heritage resources is likely to be of a low significance. As such, the development is unlikely to negatively impact significant palaeontological heritage resources.

Very few heritage resources of significance were identified during the archaeological field assessment. Three observations of Middle Stone Age scatters of low density noted were all associated with a wetland that is located well-outside of the development footprint, and therefore not impacted. These observations

have been graded IIIC for their contextual scientific significance. No other observations were considered to be conservation worthy.

From a heritage and paleontological perspective, both the facility and grid connection are considered acceptable.

Visual Impacts

The anticipated visual impacts associated with the construction and operation phases of the San Solar PV Facility and associated infrastructure range from moderate to low significance. These anticipated visual impacts on sensitive visual receptors, if and where present, in close proximity to the facility are not considered to be a fatal flaw. Visibility zones of the PV Facility mostly falls within vacant open space and agricultural land but does include some farm dwellings and residences. Potentially sensitive visual receptors include Haakbosskerm homestead and restaurant, the Limebank, Flatlands and Halliford homesteads, and viewers from sections of the R380 main road. Although the proposed infrastructure may be visible does not necessarily imply a high visual impact.

The San Solar PV facility is located 6.7km north-west of the Sishen airfield. The findings of a Glint and Glare assessment indicate that the glare analysis found no "yellow" glare (potential for after-image). For configurations employing module surfaces with smooth or lightly textured glass, which is in line with the proposed configuration, no glint or glare was predicted. Based on this, the potential visual impact related to solar glint and glare as an air travel hazard is expected to be of low significance. No mitigation of this impact is considered were considered necessary.

Social Impacts

The social impacts identified (including all positive and negative impacts) will be either of a low or medium significance. No negative impacts with a high significance rating have been identified to be associated with the development of the San Solar PV Facility and associated infrastructure. All negative social impacts are within acceptable limits with no impacts considered as unacceptable from a social perspective. The recommendations proposed for the project are appropriate and suitable for the mitigation of the negative impacts and the enhancement of the positive impacts. San Solar PV Facility and its associated grid connection is supported at a national, provincial, and local level, and that the proposed project will contribute positively towards a number of targets and policy aims.

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 and within the surrounding areas of the development area. 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.

Based on the specialist cumulative assessment and findings (Appendix D to Appendix J and Chapter 8 of the EIA), the development of San Solar PV and its contribution to the overall impact of all existing and

proposed solar energy facilities within a 30km radius (which includes the site being adjacent to two solar PV facilities, collectively forming a renewable energy node in this area north of Kathu), it can be concluded that cumulative impacts 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 San Solar PV and other solar energy facilities within the surrounding area. In addition, no impacts which will result in whole-scale change are expected.

Overall Conclusion & Recommendations

Considering the findings of the independent specialist studies, the impacts identified, the development footprint proposed by the developer within the development site, 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 San Solar PV facility is acceptable within the landscape and can reasonably be authorised. The proposed layout as provided by the Applicant (**Figure 2**) is considered to be the most appropriate from an environmental perspective as it avoids identified sensitivities and recommended buffer areas.

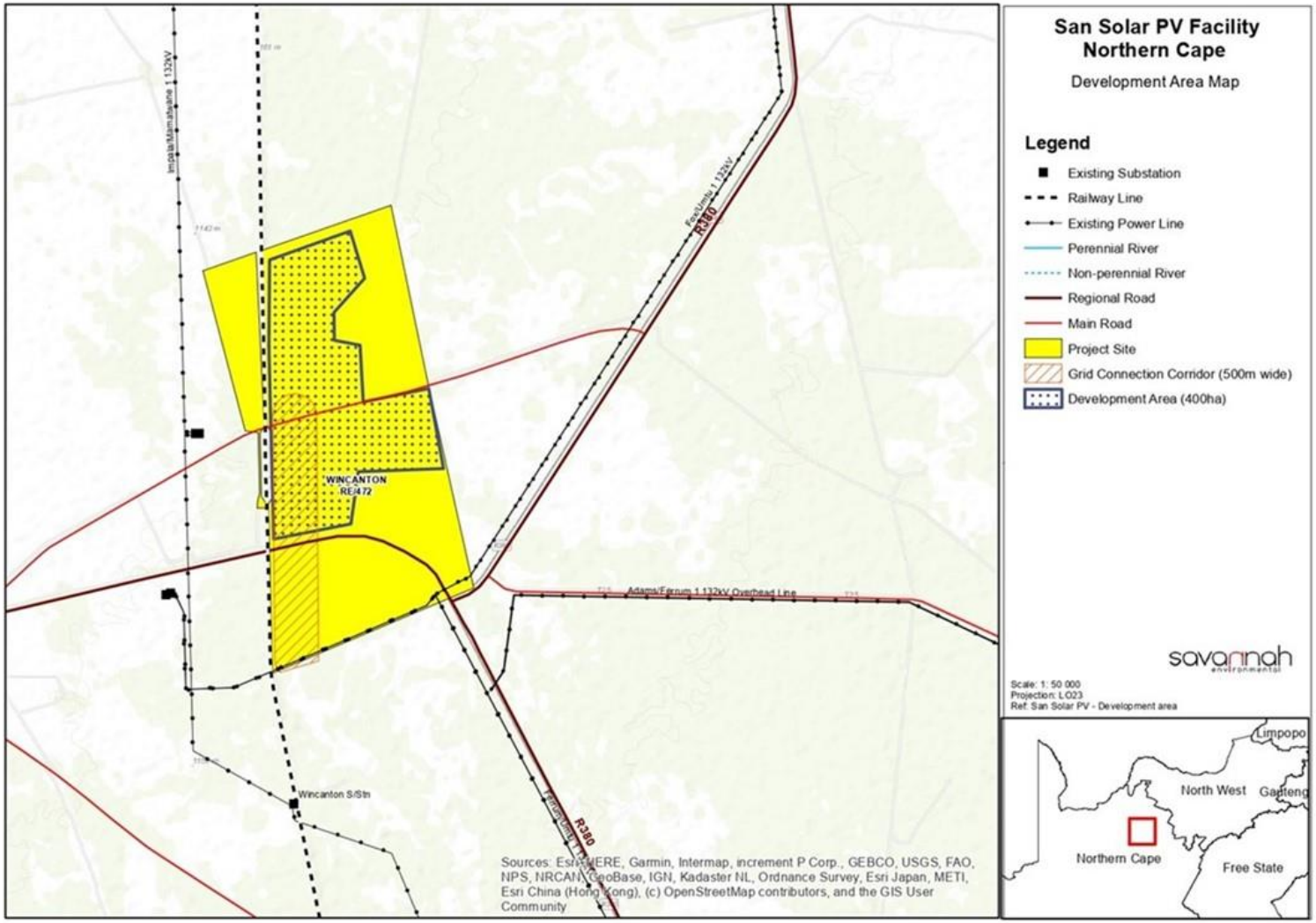


Figure 1.: Locality map illustrating the location of the San Solar PV development area within the larger project site, including the grid connection corridor alternatives (refer to **Appendix O** for map).

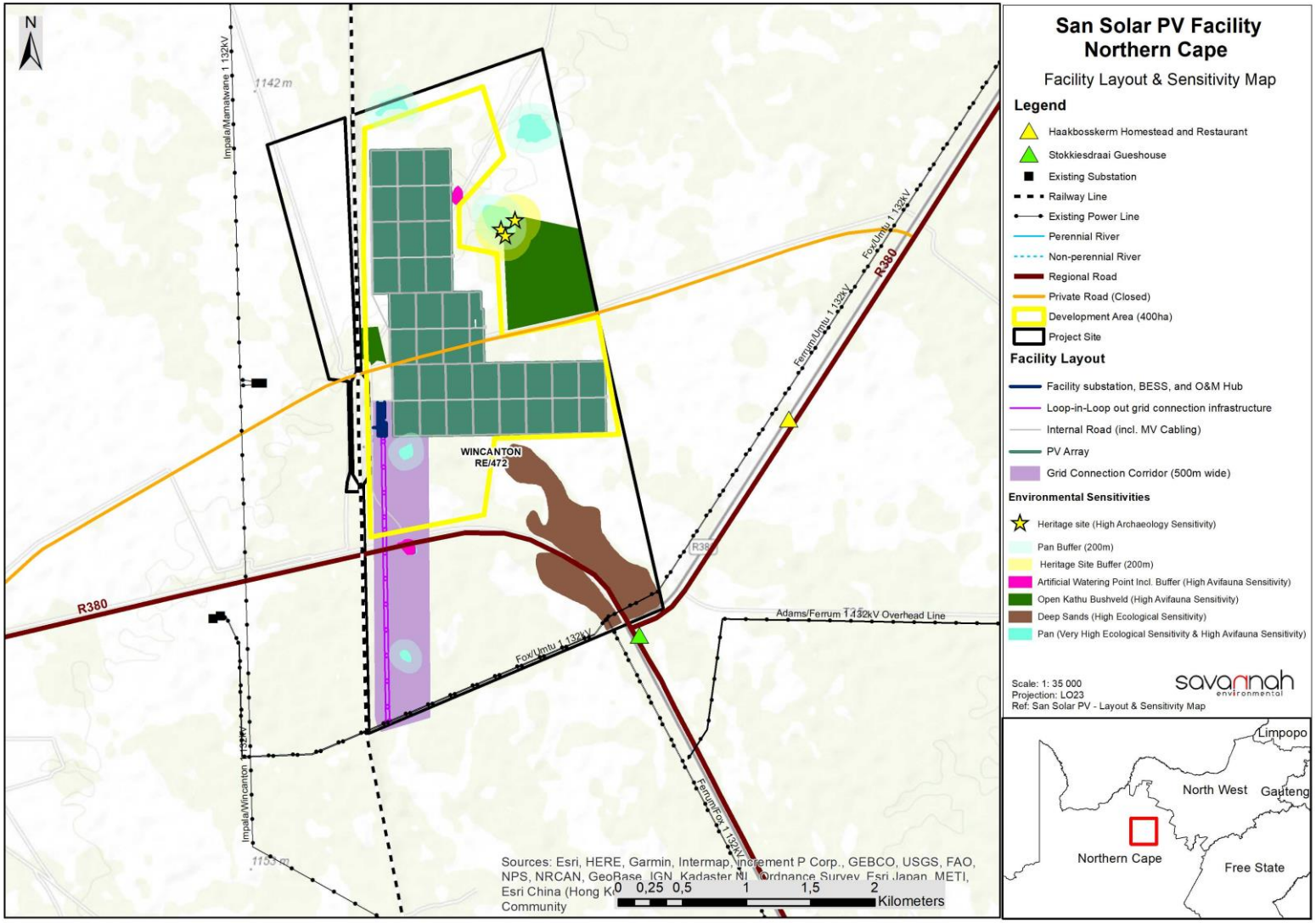


Figure 2: Layout and sensitivity map of the preferred development footprint and grid connection corridor for the San Solar PV Facility, as was assessed as part of the EIA process (**A3 map is included in Appendix O**)

DEFINITIONS AND TERMINOLOGY

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

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

Commercial Operation date: The date after which all testing and commissioning has been completed and is the initiation date to which the seller can start producing electricity for sale (i.e. when the project has been substantially completed).

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

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

Cumulative impacts: Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

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

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.

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).

Rotor: The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at a constant speed of about 15 to 28 revolutions per minute (rpm).

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

ACRONYMS

BGIS	Biodiversity Geographic Information System
CBA	Critical Biodiversity Area
DFFE	Department of Forestry, Fisheries, and the Environment (National)
DWS	Department of Water and Sanitation
CBA	Critical Biodiversity Area
CR	Critically Endangered
CSIR	Council for Scientific and Industrial Research
DM	District Municipality
DMRE	Department of Mineral Resources Energy
EAP	Environmental Assessment Practitioner
EGIS	Environmental Geographic Information System
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan
EMPr	Environmental Management Programme
EN	Endangered
EP	Equator Principles
ESA	Ecological Support Area
GA	General Authorisation
GHG	Greenhouse Gas
IBA	Important Bird Area
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IEP	Integrated Energy Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
IRP	Integrated Resource Plan
IUCN	International Union for Conservation of Nature
I&AP	Interested and Affected Party
km	Kilometre
kWh	Kilowatt hour
LC	Least Concern
LM	Local Municipality
m	Metre
m^2	Square meters
m^3	Cubic meters
m amsl	Metres Above Mean Sea Level
MW	Megawatts
NDP	National Development Plan
NEMA	National Environmental Management Act (No. 107 of 1998)
NEM:AQA	National Environmental Management: Air Quality Act (No. 39 of 2004)
NEM:BA	National Environmental Management: Biodiversity Act (No. 10 of 2004)
NEM:WA	National Environmental Management: Waste Act (No. 59 of 2008)
NFA	National Forests Act (No. 84 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act (No. 25 of 1999)

NT	Near Threatened
NWA	National Water Act (No. 36 of 1998)
ONA	Other Natural Area
PA	Protected Area
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SAIAB	South African Institute for Aquatic Biodiversity
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
TOPS	Threatened or Protected Species
VU	Vulnerable

TABLE OF CONTENTS

PAGE

APPENDICES LIST

CHAPTER 1: INTRODUCTION

The Applicant, San Solar Energy Facility (Pty) Ltd is proposing the construction of the San Solar photovoltaic (PV) facility, planned to be located on a site located approximately 16km north-west of the town of Kathu in the Northern Cape Province (refer to **Figure 1.1**). The development area falls within the jurisdiction of the Gamagara Local Municipality within the John Taolo Gaetsewe District Municipality.

The solar PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 100MW. A project site consisting of the farm Remaining extent of the Farm Wincanton 472 is being considered for the San Solar PV facility. A development area of approximately 400ha has been identified within the project site for the construction and operation of the San Solar PV and its associated infrastructure, and the full extent of this development area is assessed within this EIA Report.

The grid connection for the facility will consist of underground cabling, a facility substation, an Eskom switching substation to be connected via a loop-in loop-out (LILO) power line to the Fox-Umtu 132kV overhead power line located south of the site.

The PV facility is planned to be located within an area previously authorised for a 75MW PV project, also known as the San Solar PV project (DEA ref no: 14/12/16/3/3/2/273 EA issued on 02 July 2013), which Environmental Authorisation lapsed in 2021. This application for Environmental Authorisation is considered on the same property.

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

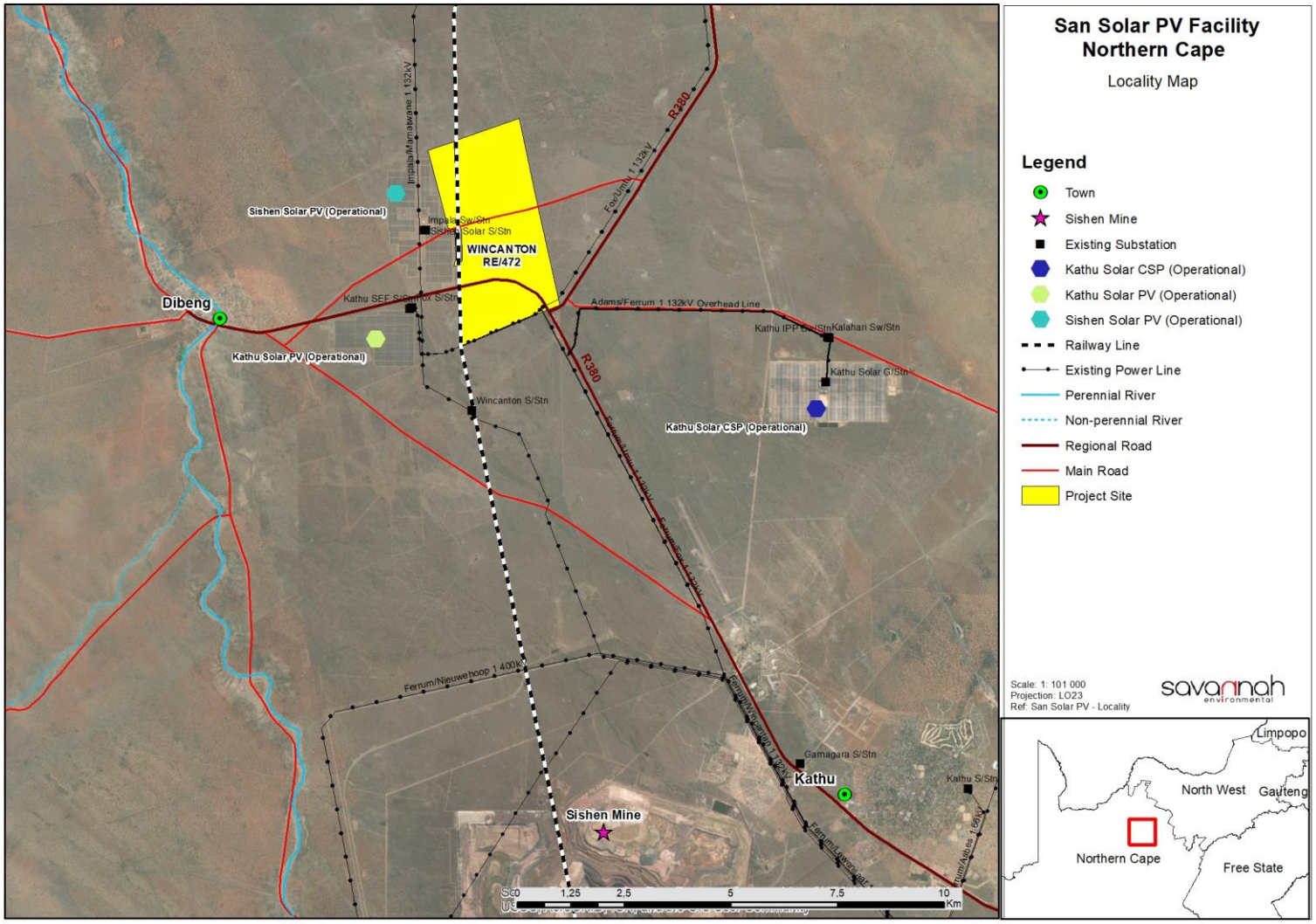


Figure 1.1: Development area map illustrating the San Solar PV development area (refer to **Appendix O** for A3 map)

1.1 Project Overview

The project site has been identified by the applicant as a technically feasible site which has the potential for the development of a solar PV facility, including a Battery Energy Storage System (BESS) and other associated infrastructure. During the scoping phase, the full extent of the project site (i.e., approximately 991.5ha) was evaluated, within which the development area[1] for the project (approximately 400ha) was appropriately located from a technical perspective.

The purpose of assessing the full extent of the development area during the Scoping Phase was to determine the suitability from an environmental and social perspective, and to identify areas that should be avoided in development planning. Based on the scoping assessment, areas of environmental sensitivity were identified within the development area. In order to avoid these areas of potential sensitivity identified during the Scoping Phase and to ensure that potential detrimental environmental impacts are minimised as far as possible, the developer identified a suitable development footprint within the development area and planned the PV infrastructure for San Solar PV to be located. An overview of the project development site is provided in **Table 1.1**

Project site	**the Remaining extent of the Farm Wincanton 472 (991,5ha in extent).**
Development area	that identified area (to be located within the project site) where the San Solar PV facility is planned to be positioned. This area will be selected as a practicable location option for the facility, considering technical preference and environmental constraints. The development area is ~400ha in extent and was demarcated as a result of the findings of the Scoping phase.
Development footprint (facility layout)	the defined area (located within the development area) where the PV panel array and other associated infrastructure for San Solar PV facility is planned to be constructed. This is the facility footprint (~205ha), and the area which would be disturbed by project-related infrastructure.

Table 1.1: A detailed description of the San Solar PV project site

Province	**Northern Cape Province**
District Municipality	John Taolo Gaetsewe District Municipality
Local Municipality	Gamagara Local Municipality
Ward Number (s)	Ward 7
Nearest town(s)	Kathu (~16km north-west)
Farm name(s) and number(s) of properties affected by the Solar PV Facility	Farm Wincanton 472
Farm Portion(s), Name(s) and Number(s) associated with the PV Facility	Remaining extent of the Farm Wincanton 472
Farm Portion(s), Name(s) and Number(s) of properties affected by the Solar PV substation and LILO grid connection	Remaining extent of the Farm Wincanton 472
SG 21 Digit Code (s) for all properties	C04100000000047200000

[1] The development area is that identified area (located within the project extent 991.5ha) where the San Solar PV facility is planned to be located. This area has been selected as a practicable option for the facility, considering technical preference and constraints. The development area is ~400ha in extent.

Current zoning	Agricultural (grazing of cattle)		
Current land use	Grazing (mainly cattle)		
Extent of Project site	991,5 ha		
Development Area	~ 400ha within the project site		
Development Footprint	~ 203ha		
Site Coordinates (project site)		**Latitude:**	**Longitude:**
	Northern point	27°33'33.73"S	22°56'35.89"E
	Eastern point	27°34'34.73"S	22°57'35.32"E
	Southern point	27°35'58.32"S	22°57'7.60"E
	Western point	27°34'43.23"S	22°56'16.95"E
	Centre point	27°34'48.99"S	22°57'2.07"E

San Solar PV will have a contracted capacity of up to 100MW and will include specific infrastructure, namely:

- PV modules and mounting structures
- Inverters and transformers
- Cabling between the panels, to be laid underground where practical
- Battery Energy Storage System (BESS)
- Site and internal access roads (up to 8m wide)
- Laydown area
- Operation and maintenance buildings including a gate and security building, control centre, offices, warehouse, and workshop areas for maintenance and storage.
- Grid connection solution including a 132kV facility substation, 132kV switching station to be connected via a Loop-in-Loop out (LILO) connection to the Fox-Umtu 132kV overhead power line located south east of the site.

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

1.2 Requirement for an Environmental Impact Assessment Process

Section 24 of South Africa's National Environmental Management Act (No. 107 of 1998) (NEMA) pertains to Environmental Authorisations (EA), and requires that the potential consequences for, or impacts of, listed or specified activities on the environment be considered, investigated, assessed, and reported on to the Competent Authority. The 2014 Environmental Impact Assessment (EIA) Regulations, as amended (GNR 326) published under NEMA prescribe the process to be followed when applying for Environmental Authorisation (EA), while the Listing Notices (Listing Notice 1 (GNR 327), Listing Notice 2 (GNR 325), and Listing Notice 3 (GNR 324)) contain those activities which may not commence without Environmental Authorisation from the Competent Authority.

Various aspects of San Solar PV are listed as activities that may have a detrimental impact on the environment. The primary listed activity triggered by San Solar PV is Activity 1 of Listing Notice 2 (GN R325) which relates to the development of facilities or infrastructure for the generation of electricity from a

renewable resource where the generating capacity is 20MW or more. San Solar PV will have a contracted capacity of 100MW.

The San Solar PV facility requires Environmental Authorisation from the National Department of Forestry, Fisheries and the Environment (DFFE) subject to the completion of a full Scoping and Environmental Impact Assessment (S&EIA), as prescribed in Regulations 21 to 24 of the 2014 EIA Regulations (GNR 326).

In terms of GNR 779 of 01 July 2016, the DFFE has been determined as the Competent Authority for all projects which relate to the Integrated Resource Plan for Electricity (IRP) 2010 – 2030, and any updates thereto. Through the decision-making process, the DFFE will be supported by the Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAEARD&LR) as the commenting authority.

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

This EIA Report has been prepared in accordance with the requirements of the EIA Regulations 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 EIA Report includes the following information required in terms of Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Report:

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

This EIA Report consists of ten chapters, which include:

- **Chapter 1** provides background to the San Solar PV facility project and the environmental impact assessment.
- **Chapter 2** provides a project description of San Solar PV facility.

- **Chapter 3** outlines strategic regulatory and legal context for energy planning in South Africa and specifically relating to the project.
- **Chapter 4** describes the need for, and alternatives considered for the San Solar PV facility.
- **Chapter 5** outlines the approach to undertaking the EIA process.
- **Chapter 6** describes the existing biophysical and social environment within and surrounding the study and development area.
- **Chapter 7** provides an identification and evaluation of the potential issues associated with the proposed solar PV facility and associated infrastructure.
- **Chapter 8** presents the conclusions of the EIA process evaluation for the Solar PV facility.
- **Chapter 9** describes the Plan of Study (PoS) for the EIA phase.
- **Chapter 10** provides references used to compile the EIA report.

1.4 Overview of this Environmental Impact Assessment (EIA) Process

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

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

- The **Scoping Phase** includes the identification of potential issues associated with the project through a desktop study (considering existing information) and consultation with affected parties and key stakeholders. This phase considers the broader project site in order to identify and delineate any environmental fatal flaws, no-go and / or sensitive areas. Following a public review period of the Scoping report, this phase culminates in the submission of a final Scoping Report and Plan of Study for the EIA to the Competent Authority for consideration and acceptance.

- The **EIA Phase** involves a detailed assessment of the potentially significant positive and negative impacts (direct, indirect, and cumulative) identified in the Scoping Phase. This phase considers a proposed development footprint within the project site and includes detailed specialist investigations as well as public consultation. Following a public review period of the EIA Report, this phase culminates in the submission of a final EIA Report and an Environmental Management Programme (EMPr), including recommendations of practical and achievable mitigation and management measures, to the Competent Authority for final review and decision-making.

1.5 Appointment of an Independent Environmental Assessment Practitioner (EAP)

In accordance with Regulation 12 of the 2014 EIA Regulations (GNR 326), the applicant has appointed Savannah Environmental (Pty) Ltd as the independent environmental consultant responsible for managing the Application for Environmental Authorisation (EA) and supporting Scoping and Environmental Impact Assessment (S&EIA) process; inclusive of comprehensive, independent specialist studies. The application for EA and S&EIA process will be managed in accordance with the requirements of NEMA, the 2014 EIA Regulations (GNR 326), and all other relevant applicable legislation.

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

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

The Savannah Environmental team for this project includes:

» **Rendani Rasivhetshele** is the principle author of this report. She is a registered EAP with the Environmental Assessment Practitioners Association of South Africa (EAPASA), and she holds a Bachelor of Science Honours in Environmental Management. She has experience in conducting Environmental Impacts Assessments, public participation, and Environmental Management Programmes for a wide range of projects, including renewable energy projects. She is responsible for overall compilation of the report, this includes specialist engagement, reviewing specialists reports and incorporating specialist studies into the Environmental Impact Assessment report and its associated Environmental Management Programme.

» **Karen Jodas** holds a Master of Science Degree from Rhodes University and is registered as a Professional Natural Scientist 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.

» **Nondumiso Bulunga** is a Social, GIS and Stakeholder Engagement Specialist at Savannah Environmental. Nondumiso has eight (8) years working experience in project management and facilitation in various industries such as environmental services field including but not limited to recycling, industrial, energy, mining, and agriculture. Working for small and large organisations, Nondumiso has gained exposure in research, collection of data, critical analysis, GIS, and environmental solutions. Nondumiso has worked on projects in South Africa and Malawi. Nondumiso is very well versed in the IFC Environmental and Social Performance Standards (including IFC PS 2012) and the associated Equator Principles, which have informed the approach and standard for projects regarding ESIA. Nondumiso is skilled at organising and driving effective project teams at a scale relevant to the project's requirements. She has technical experience and can quickly identify the most pertinent issues of a particular project whilst focussing on driving project success by rigorously implementing project management tools.

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

1.6 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 EIA Report (refer to **Table 1.2**). CVs detailing the expertise of the independent specialists and their relevant experience are provided in **Appendix A**.

Table 1.2: Independent Specialists that contribute to the EIA Report

Company	Specialist Area of Expertise	Specialist Name
3Foxes Biodiversity Solutions	Ecology	Simon Todd
Pachnoda Consulting	Avifauna	Lukas Niemand
Terra Africa Environmental Consultants	Agricultural Assessment	Marinè Pienaar
LOGIS	Visual	Lourens du Plessis
CTS Heritage	Heritage and Palaeontology	Jenna Lavin
Savannah Environmental and Dr Neville Bews & Associates.	Social environment	Nondumiso Bulunga and peer reviewed by Tony Barbour.
Global Green	Glint and Glare Impact Assessment	Dr Dirk Cilliers

CHAPTER 2: PROJECT DESCRIPTION

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

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

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

Requirement	Relevant Section
(d)(ii) a description of the activities to be undertaken including associated structures and infrastructure	A description of the associated infrastructure is included in **Section 2.4**. Activities to be undertaken during the various project development phases is included in **Section 2.6**.
(g)(ix) the outcome of the site selection matrix	**Section 2.3** includes a description of the selection of the project site.

2.2 Project and Site Description

The project site identified for the development of the San Solar PV facility is located on the Farm Remaining extent of the Farm Wincanton 472, approximately 16km north-west of the town Kathu, within ward 1 of the Gamagara Local Municipality with the John Taolo Gaetsewe District Municipality in the Northern Cape Province. The total extent of the project site property is 991.5ha. The identified development area[2] for the solar PV facility is 400ha in extent and a dedicated development footprint of ~205ha has been demarcated for the placement of the San Solar PV. The project site can be accessed via the R380 provincial route which branches off the N14 National Road, to the south of Kathu town.

The project site was previously authorised for the development of a 75MW PV project, also known as the San Solar PV project. This application for Environmental Authorisation is considered on the same property which contributes to the selection of the project site for the development of a solar PV energy facility.

The Applicant is the owner of the property/project site. The property has been owned since 2015, and the current land use is grazing (through a lease with a third party). The site is also adjacent to other solar PV facilities, collectively forming a renewable energy node in this area north of Kathu. Three (3) solar facilities have been constructed in the broader area. These include the Sishen Solar PV and Kathu Solar PV facilities

[2] The development area is that identified area (located within the project site) where the San Solar PV facility is planned to be located. This area is selected as a practicable option for the facility, considering technical preference and environmental constraints. The development area will be ~400ha in extent.

located immediately west of the farm Remaining extent of the Farm Wincanton 472. The Kathu Solar facility is a CSP facility located to the east of the study area.

Despite the predominantly rural and natural character of the study area, there are a large number of overhead power lines in the study area, associated mainly with the Ferrum Substation located at the mine. These include:

- Ferrum-Wincanton 1 132kV
- Ferrum-Fox 1 132kV
- Adams-Ferrum 1 132kV
- Fox-Umtu 1 132kV
- Impala-Mamatwane 1 132kV

The full extent of the 400ha development area, including the grid connection corridor has been considered within this EIA Report with the aim of determining the suitability from an environmental and social perspective and identifying areas that should be avoided in development planning. Within this identified development area, a development footprint[3] of approximately 205ha has been defined based on the findings of the Scoping Study and will be further assessed within this EIA Report.

From a technical perspective, the Kathu area is considered favourable for the development of commercial solar energy facilities by virtue of the prevailing climatic conditions, relief and aspect, the extent of the project site and development area, the availability of a direct grid connection (i.e. point of connection to the national Eskom grid), and the availability of land on which development can take place.

The type of technology selected for implementation, will be based on the outcomes of the EIA process, and the completion of additional technical studies (e.g. geotechnical and other surveys) to be conducted as part of the detailed design phase and will ultimately influence the final project layout and development footprint. The extent of the project site under investigation allows for layout design and site-specific alternatives to be identified considering the environmental sensitivities present.

Grid connection infrastructure for the San Solar PV facility will be located outside the PV development area within a 500m wide corridor ~2.5km in length to enable a LILO with the Fox-Umtu 132kV power line. The grid connection will consist of a 132kV facility substation, switching substation and Loop-In Loop-Out Tern line from the 132kV switching substation to Fox-Umtu 132kV line (at a point approximately 5.5km from Eldoret Substation).

Figure 2.1 provides a map of the San Solar PV facility development area, including the grid connection corridor.

Table 2.1 provides the details of San Solar PV facility, including the main infrastructure components and services that will be required during the project life cycle

[3] The development footprint is the defined area (located within the development area) where the PV panel array and other associated infrastructure for San Solar PV facility is planned to be constructed. This is the actual footprint of the facility, and the area which would be disturbed.

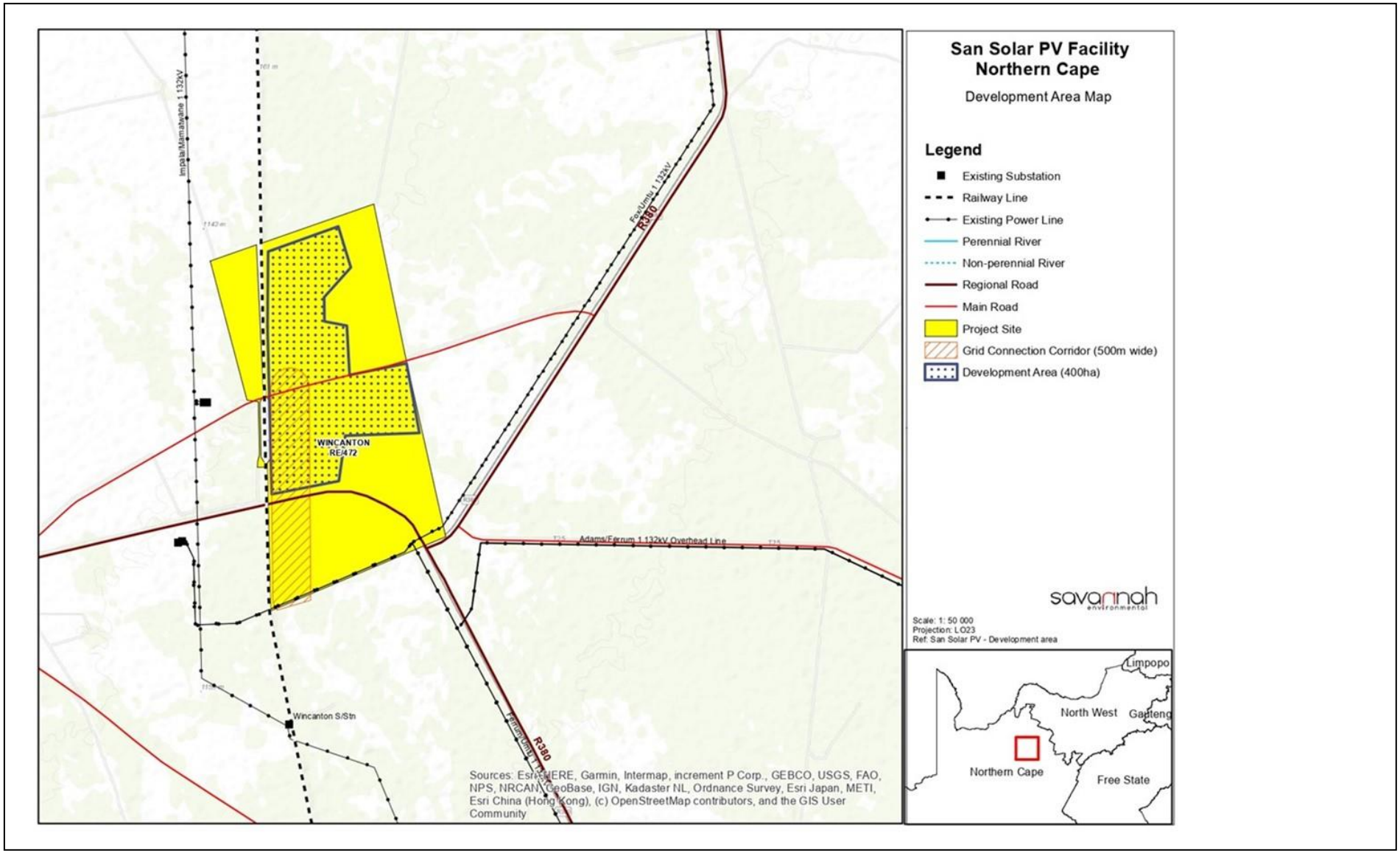


Figure 2.1: Development area map illustrating the San Solar PV development area (refer to Appendix D for A3 map)

Table 2.1 provides the details of San Solar PV facility, including the main infrastructure components and services that will be required during the project life cycle.

Table 2.1: Details of San Solar PV facility and associated infrastructure.

Component	Description / Dimensions
Project site - Total extent of the affected property	~991,5ha
Total extent of the Development area	~400ha
Development Footprint	~205ha
Contracted capacity of the facility	100MW
Technology	» Solar PV » Monofacial or Bifacial PV panels, mounted on either fixed-tilt, single-axis tracking, and/or double-axis tracking systems
PV panels	» Height: ~2.5m from ground level (installed) » Panel area: <200ha
Battery Energy Storage System (BESS)	» Approximately 1ha in extent » The BESS Facility proposes to use solid-state technology as a preferred technology
Permanent and construction laydown areas	» ~3ha
Facility Substation	» On-site facility substation with a 132kV capacity » <1ha in extent
Eskom Switching Substation	» Eskom switching substation with a 132kV capacity » <1ha in extent
Grid Connection	» 132kV grid connection LILO » Double Circuit line ~2.5km in length » Grid connection corridor (approximately 500m in width) run down the length of the western boundary of the property, enabling a LILO connection to the Fox-Umtu 132kV power line. » 33kV cabling connecting PV array to facility substation
Site and internal access	» Access to the project site will be via the R380 regional road. » An 8m wide main gravel/hard surfaced access road will be constructed to provide direct access to the development area. » A network of gravel internal access roads, each with a width of 5m will be constructed to provide access to the various components of the San Solar PV facility development.

Other infrastructure	» Operations and Maintenance buildings » Gate house » Security building » Control centre » Office buildings » Warehouse » Workshop
Services required	» Refuse material disposal - all generated refuse material will be collected by a private contractor and will be disposed of at a licensed waste disposal site off site. This service will be arranged with the municipality when required. » Sanitation – All sewage/effluent water will be managed utilising temporary portable chemical toilets. Any other effluent discharge during construction will be stored in sealed containers/tanks and collected (honey-sucker) and treated by a service provider (the LM/ Contractor) at an approved facility off site. These facilities will be maintained and serviced regularly by an appropriate waste contractor. » Water supply – construction water will be sourced from the Gamagara Local Municipality (by tanker)

2.3 Summary of Site Selection Process

The broader study area (i.e. the greater Kathu area) was identified by the applicant as having the potential to support a 100MW PV facility on the basis of key technical criteria being met, including the solar resource, accessibility of the site, accessibility to the Eskom grid, and local site topography. The Northern Cape has the Global Horizon Irradiation (GHI) of approximately 2240 kWh/m^2 /annum, and is highly favourable for the development of a solar farm.

Other factors contributing to the selection of the site:

- The project site was previously authorised for the development of a 75MW PV project (EA has since lapsed).
- The Applicant is the owner of the property/project site. The property has been owned since 2015.
- The current land use is grazing (through a lease with a third party) and there is compatability with planned land use.
- The site is adjacent to three other solar PV facilities, collectively forming a renewable energy node in this area north of Kathu. These include the Sishen Solar PV and Kathu Solar PV facilities located immediately west of the farm Remaining extent of the Farm Wincanton 472. The Kathu Solar facility is a CSP facility located to the east of the study area

The detail regarding site-specific characteristics which aided in the selection of the site is provided below:

Project site extent, conditions and land availability: Availability of relatively level land of sufficient extent can be a restraining factor to PV development, as a 100 MW solar PV development and associated infrastructure requires sufficient land space.

The following are key considerations in this regard:

- The project site and development area conditions are optimal for a development of this nature, with the site being of a suitable gradient for the development of a PV facility.
- The development area, within which the project development footprint will be located, is ~ 400ha, which is less than half of the total extent of the property (being 991.5ha). This 400ha area is considered to be sufficient for the planned 100MW PV facility and provides an opportunity for the avoidance of sensitive environmental features and areas.
- The region within which the project site is located can be described as plains and elevations range from 1, 105m in the north-west to 1,195m in the south-east. The project site has a very even (flat) slope with slope from the south-east to the north-west. The site itself is located at an average elevation of 1,143m above sea level.

Site access: The area in which the project site is located can be accessed via the R380 provincial route which branches off the N14 National Road. Within the facility development area itself, access will be required from new / existing roads for construction purposes (and limited access for maintenance during operation).

Land use considerations: The majority of land in the Kathu area is agriculture and land reserved for related mining activities. The Remaining extent of the Farm Wincanton 472 is owned by the Applicant and has sufficient space available for solar PV development. Within the proposed San Solar PV facility project site, there is no cultivated agricultural land, and the land is currently used for livestock grazing.

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. San Solar PV facility is intended to connect to the National Grid via a loop-in and loop out (LILO) to the Fox – Umtu 132kV overhead powerline located south of the site. Having a grid connection point in close proximity to the project site reduces the necessary grid infrastructure and therefore addresses Eskom's concerns for lower cost connection alternatives given current funding constraints. A shorter grid solution will also ensure that potential environmental impacts are kept to a minimum.

Eskom's response to a concept phase study indicated the Fox – Umtu 132kV line as the preferred connection point to the national grid. The grid connection solution would include a 132kV Switching Station and a Loop-In Loop-Out Tern line from the 132kV Switching Station to the Fox-Umtu 132kV line (i.e. ±1km double circuit grid line from the San Solar switching substation to the Fox–Umtu 132kV line (located about 5.5km from Eldoret Substation).

Considering the above, the project site was considered acceptable by the Applicant, and supported as a suitable area within which the solar PV facility can be placed from a technical perspective.

2.4 Description of the Associated Infrastructure

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

The project will comprise solar panels which, once installed, will stand less than ~2.5m above ground level. The solar panels will include centralised inverter stations, or string inverters mounted above ground. If centralised inverter stations are used, Mega Volt (MV) distribution transformers are located internally, whereas string inverters are containerised with switchgear. The main transformer capacity varies according to detailed design and project-specific requirements.

2.4.1 Water Supply

San Solar PV facility will utilise water during both the construction and operation phases of development. Water is required during construction for dust suppression, and potable water will be required on site for the construction crew. During operations, water is required to clean the PV panels, for human consumption, and for use in the auxiliary buildings (i.e. for use in the office building, ablutions, and canteen). Approximately 27 163,32 m³ of water per year may be required over a 12 to 18-month period during construction, and approximately 3250,5m³ of water may be required per year over the 25-year operational lifespan of the project.

A request for confirmation of water availability for the construction and operation of the solar energy facility has been submitted to the Department of Water and Sanitation based on a groundwater resource assessment (SRK, 2013). The SRK report indicated the yield tests conducted on borehole WNE1 indicate a

long-term sustainable yield of 4 l/s at continuous pumping, i.e. 345.6 m3/d, which is more than adequate to supply the anticipated demand of the proposed facility.

The DWS confirmed the availability of more than the current water supply requirements (refer to Appendix R), and a formal process will be initiated once the water requirements are confirmed.

2.4.2 Energy Storage

The general purpose and utilisation of the Battery Energy Storage System (BESS) will be to save and store excess electrical output from the facility as it is generated, allowing for a timed release to the national grid when the capacity is required. The BESS will, therefore, provide flexibility in the efficient operation of the electricity grid through decoupling of the energy supply and demand and will allow for longer generating periods of the solar PV facility. Furthermore, the development of the BESS for the project is of importance as the system will ensure that electricity is fed into the national grid when required and excess amounts stored. This will allow for extended hours of generation from the 75MW solar energy facility. The BESS will be contained within insulated containers and will connect to the on-site facility substation via underground cabling which will follow the internal access roads of the facility. Figure 2.2 provides a general illustration of a BESS.

Figure 2.2: Example of battery storage units installed by Tesla (Source: fastcompany.com)

2.4.3 Panel Cleaning

It is anticipated that the PV panels will be washed twice a year during operation. Only clean water (i.e. with no cleaning products), or non-hazardous biodegradable cleaning products will be utilised for the washing of panels. Wastewater generated by washing panels will either be collected and recycled for future use, or alternatively, in the event that an environmentally friendly non-hazardous biodegradable cleaning product is utilised, wastewater can be allowed to run-off under the panels.

2.4.4 Effluent and Wastewater

During construction, chemical toilets will be used. These will be serviced regularly, and effluent will be disposed of at a registered wastewater treatment works. Any other effluent discharge during construction

will be stored in sealed containers/tanks and collected (honey-sucker) and treated by a service provider (the LM/ Contractor) at an approved facility off site. These facilities will be maintained and serviced regularly by an appropriate waste contractor.

2.4.5 Waste

Solid waste generated during construction will mainly be in the form of construction material, excavated substrate and domestic solid waste. Waste will be disposed of in either waste skips and/or scavenger proof recycling bins (where possible) and temporarily placed in a central location for removal by an appropriate contractor. Where possible, waste will be recycled. Non-recyclable solid construction waste will be temporarily held in skips or other appropriate waste containers to be disposed of at an appropriately licensed landfill site. Any other waste and excess material will be removed once construction is complete and disposed of at a registered waste facility.

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

2.5 Technology considered for the Solar Energy Facility and the Generation of *Electricity*

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

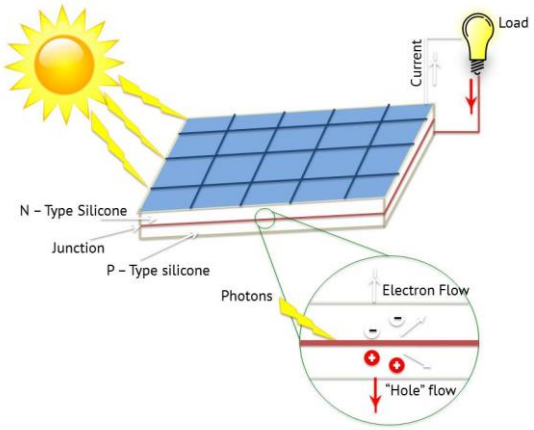


Figure 2.3: Diagram illustrating the Photovoltaic Effect (Source: Centre for Sustainable Energy)

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

Photovoltaic Cells

A PV cell is made of silicone that acts as a semi-conductor used to produce the Photovoltaic Effect. PV cells are arranged in multiples / arrays and placed behind a protective glass sheet to form a PV panel (refer to

Figure 2.4). Each PV cell is positively charged on one side and negatively charged on the opposite side, with electrical conductors attached to either side to form a circuit. This circuit captures the released electrons in the form of an electric current (i.e. Direct Current (DC[4])).

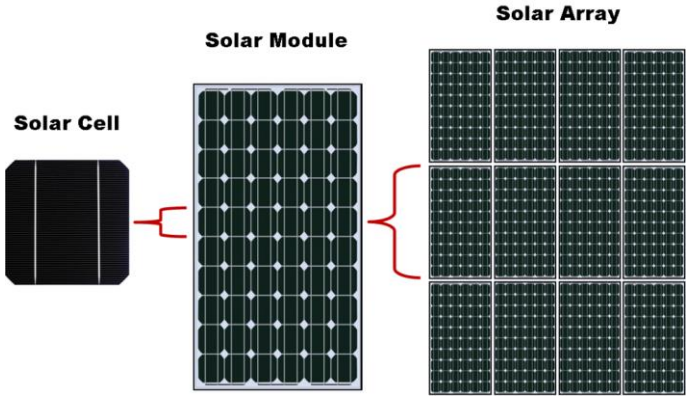


Figure 2.4: Overview of a PV cell, module and array / panel (Source: pveducation.com)

Support Structures

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

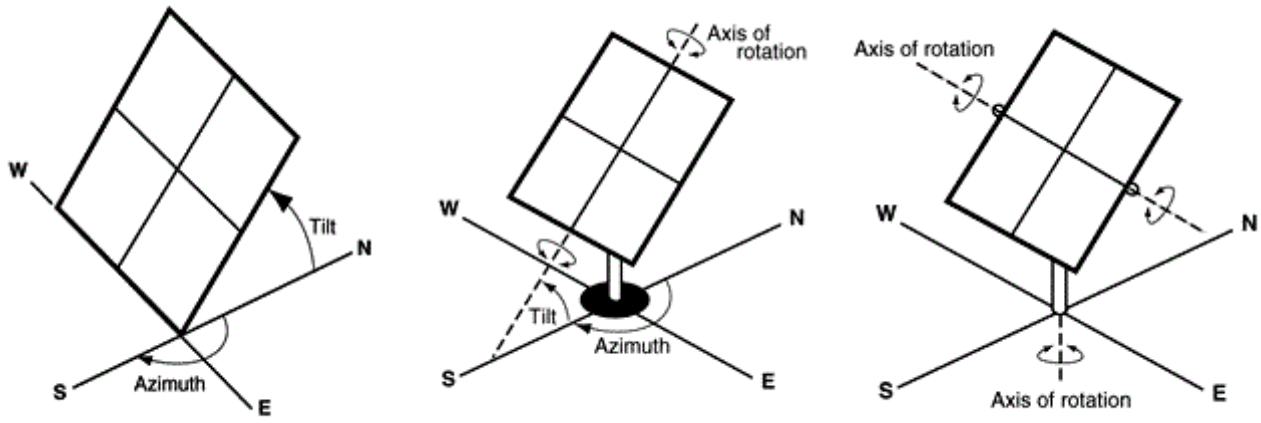


Figure 2.5: Overview of different PV tracking systems (from left to right: fixed-tilt, single-axis tracking, and double-axis tracking (Source: pveducation.com)).

[4] 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).

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

Battery Energy Storage System (BESS)

The need for a BESS stem from the fact that electricity is only produced by the Renewable Energy Facility while the sun is shining, while the peak demand may not necessarily occur during the daytime. Therefore, the storage of electricity and supply thereof during peak-demand will mean that the facility is more efficient, reliable and electricity supply more constant.

The BESS will:

» Store and integrate a greater amount of renewable energy from the Solar PV Facilities into the electricity grid;
» This will assist with the objective to generate electricity by means of renewable energy to feed into the National Grid which will be procured under either the Renewable Energy Independent Power Producer Procurement Program (REIPPPP), other government run procurement programmes; or for sale to private entities (private PPAs).

2.6 Activities during the Project Development Stages

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

2.6.1 Design and Pre-Construction Phase

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

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

2.6.2 Construction Phase

The construction phase will take approximately 12 to 18 months to complete, and will entail a series of activities including:

Procurement and employment

At the peak of construction, the project is likely to create a maximum of 350 employment opportunities. These employment opportunities will be temporary and will last for a period of approximately 12 to 18 months

(i.e. the length of construction). Employment opportunities generated during the construction phase will include low skilled, semi-skilled, and skilled opportunities. Solar PV projects make use of high levels of unskilled and semi-skilled labour so there will be good opportunity to use local labour, where available. Employment opportunities will peak during the construction phase and significantly decline during the operation phase. The injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area. The majority of the labour force is expected to be sourced from the surroundings towns.

Establishment of an Access Road

Access to the development area will be established for the construction and operation of the San Solar PV facility. Access to the project site is via the R380 regional road. Within the development footprint itself, access will be required from new/existing roads for construction purposes (and limited access for maintenance during operation).

Undertake Site Preparation

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

Transport of Components and Equipment to Site

The national, regional, secondary and proposed internal access roads will be used to transport all components and equipment required during the construction phase. Some of the components (i.e. substation transformer) may be defined as abnormal loads in terms of the National Road Traffic Act (No. 93 of 1996) (NRTO)[5] by virtue of the dimensional limitations. Typical civil engineering construction equipment will need to be brought to the project site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.) as well as components required for the mounting of the PV support structures, construction of the on-site facility substation and site preparation.

Establishment of Laydown Areas on Site

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

Erect PV Panels and Construct Substation and Invertors

The construction phase involves installation of the PV solar panels, structural and electrical infrastructure required for the operation of San Solar PV. In addition, preparation of the soil and improvement of the access roads are likely to continue for most of the construction phase. For array installations, vertical support posts will be driven into the ground. Depending on the results of the geotechnical report, a different foundation method, such as screw pile, helical pile, micropile or drilled post/piles could be used. The posts will hold the support structures (tables) on which the PV modules would be mounted. Brackets will attach the PV modules to the tables. Trenches are to be dug for the underground AC and DC cabling, and the foundations of the inverter enclosures and transformers will be prepared. While cables are being laid and

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

combiner boxes are being installed, the PV tables will be erected. Wire harnesses will connect the PV modules to the electrical collection systems. Underground cables and overhead circuits will connect the Power Conversion Stations (PCS) to the on-site AC electrical infrastructure, and ultimately the facility substation.

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

Establishment of Ancillary Infrastructure

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

Undertake Site Rehabilitation

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

2.6.3 Operation Phase

San Solar PV is expected to operate for a minimum of 25 years. The facility will operate continuously, 7 days a week, and will include battery storage. While the solar facility will be largely self-sufficient, monitoring and periodic maintenance activities will be required. Key elements of the Operation and Maintenance (O&M) plan include monitoring and reporting the performance of the solar energy facility, conducting preventative and corrective maintenance, receiving visitors, and maintaining security.

The operation phase will create approximately 50 full-time equivalent employment positions which will include low-skilled, semi-skilled and skilled personnel. Employees that can be sourced from the local municipal area include the less skilled and semi-skilled personnel (such as safety and security staff and certain maintenance crew). Highly skilled personnel may need to be recruited from outside the local area where these resources are not available within the area.

2.6.4 Decommissioning Phase

Depending on the continued economic viability of San Solar PV following the initial 25-year operation lifespan, the solar energy facility will either be decommissioned, or the operation phase will be extended. If it is deemed financially viable to extend the operation phase, existing components would either continue to operate or be dissembled and replaced with new, more efficient technology / infrastructure available at the time. If the decision is made to decommission the facility, the following decommissioning activities will take place:

Site Preparation

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

Disassembly and removal of existing components

When the solar energy facility is ultimately decommissioned, the equipment to be removed will depend on the land use proposed for the project site at the time. All above ground facilities that are not intended for future use will be removed. Much of the above ground wire, steel, and PV panels of which the system is comprised are recyclable materials and would be recycled to the extent feasible. The components of the solar energy facility would be de-constructed and recycled or disposed of in accordance with applicable regulatory requirements. The site will be rehabilitated where required and can potentially be returned to a beneficial land-use.

Future plans for the site and infrastructure after decommissioning

The generation capacity of the facility would have degraded by approximately 15% over the 20-year operational lifespan. The solar energy facility will potentially have the opportunity to generate power for a Merchant Market operation (i.e. the client would sell power on a bid basis to the market). Another option for the site after decommissioning is for agricultural activities to resume.

CHAPTER 3: POLICY AND LEGISLATIVE CONTEXT

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

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

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

Requirement	Relevant Section
(e) a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process.	Chapter 3 provides an overview of the policy and legislative context which is considered to be associated with the development of the San Solar PV facility. The regulatory and planning context has been considered at national, provincial and local levels. A description of the policy and legislative context within which San Solar PV facility is proposed is included in **sections 3.3, 3.4, 3.5** and **3.6.**

3.2 Strategic Electricity Planning in South Africa

The need to expand electricity generation capacity in South Africa is based on national policy and informed by on-going strategic planning undertaken by the Department of Mineral Resources and Energy (DMRE). The hierarchy of policy and planning documentation that support the development of renewable energy projects such as a solar energy facility is illustrated in **Figure 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 San Solar PV facility.

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

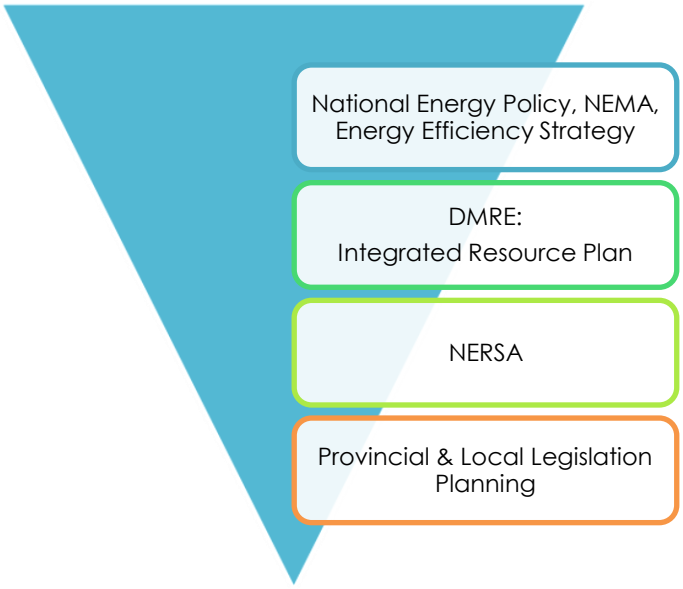


Figure 3.1: Hierarchy of electricity and planning documents

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

- **Department of Mineral Resources and Energy (DMRE):** This Department is responsible for policy relating to all energy forms and for compiling and approving the Integrated Resource Plan (IRP) for electricity. Furthermore, the Department is also responsible for granting approvals for the use of land which is contrary to the objects of the Mineral and Petroleum Resource Development Act (Act No. 28 of 2002) (MPRDA) in terms of Section 53 of the Act. Therefore, in terms of the Act, approval from the Minister is required to ensure that proposed activities do not sterilise mineral resources that may occur within the project site and development area.
- **National Energy Regulator of South Africa (NERSA):** NERSA is responsible for regulating all aspects of the electricity sector and will ultimately issue licenses for IPP projects to generate electricity.
- **Department of Forestry, Fisheries, and the Environment (DFFE):** This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations, 2014 (GN R326) as amended. DEA is the Competent Authority for this project (as per GN R779 of 01 July 2016), and is charged with granting the EA for the project under consideration.
- **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 Human Settlements, Water and Sanitation (DHSWS):** This Department is responsible for effective and efficient water resources management to ensure sustainable economic and social development. This Department is also responsible for evaluating and issuing licenses pertaining to water use (i.e. Water Use Licenses (WUL) and General Authorisation).
- **The Department of Agriculture, Rural Development and Land Reform (DARDLR):** This Department is the custodian of South Africa's agricultural resources and is primarily responsible for the formulation and implementation of policies governing the agriculture sector.

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

» **Provincial Government of the Northern Cape – *Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAEARD&LR)*:** This Department is the commenting authority for the EIA process for the project and is responsible for issuing of biodiversity and conservation-related permits. DAEARD&LR's involvement relates specifically to sustainable resource management, conservation of protected species and land care.
» ***Northern Cape Department of Transport, Safety and Liaison: (NC DTSL)*:** This Department provides effective co-ordination of crime prevention initiatives, provincial police oversight, traffic management and road safety towards a more secure environment.
» ***Ngwao-Boswa Ya Kapa Bokone (NBKB):*** This Department is responsible for the identification, conservation and management of heritage resources, as well as commenting on heritage related issues within the 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 Northern Cape Province, both the local and district municipalities play a role. The local municipality includes the Gamagara Local Municipality which forms part of the John Taolo Gaetsewe 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.

The relevant legislation and policies listed and discussed below are relevant to the San Solar PV facility development.

3.3 Policy and Planning Considerations on International, National, Provincial and Local Levels

3.3.1 Policy and planning on an International Level

South Africa has committed to various international policies which relate to environmental concerns, specifically that of climate change and global warming. **Table 3.1** below provides a summary of the international policies and plans that South Africa has made commitments towards, and how the proposed development of the San Solar PV facility aligns with the thinking or commitments of these agreements.

Table 3.1: International policies and plans relevant to the San Solar PV facility

Policy or Plan	Is the development of the San Solar PV facility aligned with this policy or plan?
The Kyoto Protocol, 1997	Yes. The protocol calls for the reduction of South Africa's greenhouse gas emissions through actively cutting down on using fossil fuels, or by utilising more renewable resources. The development of San Solar PV facility will enable the evacuation of additional capacity to the renewable energy sector of the country and strengthen the commitment and action plan to achieve the requirements as set out in the protocol.
United Nations Framework Convention on Climate Change and COP21 – Paris Agreement	Yes. South Africa supports the adoption of the Paris Agreement which has the main objective of addressing the climate change issue and marks the first international political response to climate change. South Africa has set out a goal of 17GW of renewable energy by 2030 within the IRP of 2019. Through the development of renewable energy projects (including San Solar PV facility) additional renewable energy will be made available to the country, which in turn will demonstrate the contribution that South Africa is making to the global response to climate change specifically relating to the development of the renewable energy sector.

Policy or Plan	Is the development of the San Solar PV facility aligned with this policy or plan?
The Equator Principles 4 (October 2020)	Yes. The Equator Principles 4 constitute a financial industry benchmark used for determining, assessing, and managing a project's environmental and social risks. The Equator Principles (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. 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. The San 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.
International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability, January 2012	Yes. The overall objectives of the IFC performance standards are to fight poverty, do no harm to people or the environment, fight climate change by promoting low carbon development, respect human rights, promote gender equality, provide information prior to project development, collaborate with the project developer in order to achieve the performance standard, provide advisory services and notify countries of trans boundary impacts. When considering the development of the grid connection infrastructure associated with the development of San Solar PV facility the following performance standards are anticipated to be applicable at this stage of the BA process: » *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 6:* Biodiversity Conservation and Sustainable Management of Living Natural Resources » *Performance Standard 8:* Cultural Heritage

3.3.2 Policy and planning on a National Level

Further to the South African government's commitment in August 2011 to support the development of renewable energy capacity, the DMRE initiated the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) to procure renewable energy from the private sector in a series of rounds. To date, the Department has procured 6 422MW of renewable energy capacity from 112 independent power producers (IPPs), with 4 742MW operational and made available to the grid[6]. National policies have to be considered for the construction and operation of the solar PV facility to ensure that the development is in line with the planning of the country.

[6]http://www.nersa.org.za/wp-content/uploads/2021/05/Monitoring-of-Renewable-Energy-Performance-of-Power-Plants-%E2%80%93-Performance-of-Power-Plants-in-2020

A brief review of the most relevant national policies is provided below in **Table 3.2**. The development of San Solar PV facility is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor.

Table 3.2: Relevant national legislation and policies relevant to the San Solar PV facility

Relevant legislation or policy	Relevance to San Solar PV facility
Constitution of the Republic of South Africa, 1996	Section 24 of the Constitution pertains specifically to the environment. It states that everyone has the right to an environment that is not harmful to their health or well-being, and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. The Constitution outlines the need to promote social and economic development. Section 24 of the Constitution therefore requires that development be conducted in such a manner that it does not infringe on an individual's environmental rights, health, or well-being. This is especially significant for previously disadvantaged individuals who are most at risk to environmental impacts.
National Environmental Management Act (No. 107 of 1998) (NEMA)	This piece of legislation is South Africa's key piece of environmental legislation and sets the framework for environmental management in South Africa. NEMA is founded on the principle that everyone has the right to an environment that is not harmful to their health or well-being as contained within the Bill of Rights. The national environmental management principles state that the social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment. The need for responsible and informed decision-making by government on the acceptability of environmental impacts is therefore enshrined within NEMA.
White Paper on the Energy Policy of the Republic of South Africa (1998)	The White Paper on Energy Policy places emphasis on the expansion of energy supply options to enhance South Africa's energy security. This can be achieved through increased use of RE and encouraging new entries into the generation market. The policy states that the advantages of RE 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.
White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)	The White Paper on Renewable Energy Policy supplements Government's predominant policy on energy as set out in the White Paper on the Energy Policy of the Republic of South Africa (DME, 1998). The policy recognises the potential of RE and aims to create the necessary conditions for the development and commercial implementation of RE technologies. The White Paper on RE sets out Government's vision, policy principles, strategic goals, and objectives for promoting and implementing RE in South Africa. The country relies heavily on coal to meet its energy needs due to its abundant, and fairly accessible

Relevant legislation or policy	Relevance to San Solar PV facility
	and affordable coal resources. However, massive RE resources that can be sustainable alternatives to fossil fuels, have so far remained largely untapped. The White Paper on Renewable Energy of 2003 set a target of 10 000GWh to be generated from RE by 2013 to be produced mainly from biomass, wind, solar and small-scale hydro. The target was subsequently reviewed in 2009 during the RE summit of 2009. The policy supports the investment in RE facilities as they contribute towards ensuring energy security through the diversification of energy supply, reducing GHG emissions and the promotion of RE sources.
National Energy Act (No. 34 of 2008)	The purpose of the National Energy Act (No. 34 of 2008) is to ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, while taking environmental management requirements into account. In addition, the Act also provides for energy planning, and increased generation and consumption of Renewable Energies (REs). The Act provides the legal framework which supports the development of RE facilities for the greater environmental and social good and provides the backdrop against which South Africa's strategic planning regarding future electricity provision and supply takes place.
The Electricity Regulation Act (No. of 2006)	The Electricity Regulation Act of 2006, replaced the Electricity Act (No. 41 of 1987), as amended, with the exception of Section 5B, which provides funds for the energy regulator for the purpose of regulating the electricity industry. The Act establishes a national regulatory framework for the electricity supply industry and introduces the National Energy Regulator (NERSA) as the custodian and enforcer of the National Electricity Regulatory Framework. The Act also provides for licences and registration as the manner in which the generation, transmission, distribution, trading, and import and export of electricity are regulated.
Integrated Energy Plan (IEP), 2015	The Integrated Energy Plan (IEP) (which was developed under the National Energy Act (No. 34 of 2008)), recognises that energy is essential to many human activities, and is critical to the social and economic development of a country. The purpose of the IEP is essentially to ensure the availability of energy resources, and access to energy services in an affordable and sustainable manner, while minimising associated adverse environmental impacts. Energy planning therefore needs to balance the need for continued economic growth with social needs, and the need to protect the natural environment.
Integrated Resource Plan for Electricity (IRP) 2010-2030 (2019)	The Integrated Resource Plan (IRP) for Electricity 2010 – 2030 is a subset of the IEP and constitutes South Africa's National electricity plan. The primary objective of the IRP is to determine the long-term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing and cost. The IRP also serves as input to other planning functions, including amongst others, economic development and funding, and environmental and social policy formulation. On 27 August 2018, the then Minister of Energy published a draft IRP which was issued for public comment. The lengthy public participation and consultation process has culminated in the issue of the overdue IRP 2019 which updates the energy forecast from the current period to the year 2030. Since the promulgated IRP 2010, the following capacity developments have taken place:

Relevant legislation or policy	Relevance to San Solar PV facility
	» A total of 6 422MW has been procured thus far under the REIPPP Programme, with 3 876MW being currently operational and made available to the grid. In addition, IPPs have commissioned 1005MW from two (2) Open Cycle Gas Turbines (OCGT) peaking plants; and » Under the Eskom Build Programme, 1 332MW has been procured from the Ingula Pumped Storage Project, 1 588MW and 800MW from the Medupi and Kusile power stations and 100MW from the Sere Wind Farm. Provision has been made for the following new capacity by 2030: » 1 500MW of coal; » 2 500MW of hydro; » 6 000MW of solar PV; » 14 400MW of wind; » 1 860MW of nuclear; » 2 088MW of storage; » 3 000MW of gas/diesel; and » 4 000MW from other distributed generation, co-generation, biomass and landfill technologies. Based on the IRP 2019, 1 474MW has been installed for solar PV facilities, whereas, 814MW has already been procured. In addition, 1 000MW has been allocated for solar PV facilities from 2022 to 2030. This will bring the total installed capacity of solar PV facilities by 2030 to 8 288MW. Therefore, the development of the San Solar PV facility is supported by the IRP 2019.
Renewable Energy Policy in South Africa	Yes. Support for the Renewable Energy Policy is guided by a rationale that South Africa has a very attractive range of renewable energy resources, particularly solar and wind, and that renewable applications are, in fact, the least cost energy service in many cases from a fuel resource perspective (i.e. the cost of fuel in generating electricity from such technology); more so when social and environmental costs are taken into account. However, the National Energy Policy acknowledges that the development and implementation of renewable energy applications has been largely neglected in South Africa. Challenges regarding the implementation of renewable energy have been identified. Through the development of renewable energy projects (including the San Solar PV facility), additional renewable energy will be made available which will assist with the further growth and development of the renewable energy sector.
National Development Plan 2030 (2012)	The National Development Plan (NDP) 2030 is a plan prepared by the National Planning Commission in consultation with the South African public which is aimed at eliminating poverty and reducing inequality by 2030. In terms of the Energy Sectors role in empowering South Africa, the NDP envisages that, by 2030, South Africa will have an energy sector that promotes: » Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates, while supporting economic growth through job creation. » Social equity through expanded access to energy at affordable tariffs and through targeted, sustainable subsidies for needy households. » Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change.

Relevant legislation or policy	Relevance to San Solar PV facility
	The NDP aims to provide a supportive environment for growth and development, while promoting a more labour-absorbing economy. The development of San Solar PV facility Supports the NDP through the development of energy-generating infrastructure which will not lead to the generation of GHGs and will result in economic development and growth of the area surrounding the development area.
Strategic Integrated Projects (SIPs)	The Presidential Infrastructure Coordinating Commission (PICC) is integrating and phasing investment plans across 18 Strategic Integrated Projects (SIPs) which have 5 core functions, including to unlock opportunity, transform the economic landscape, create new jobs, strengthen the delivery of basic services and support the integration of African economies. SIP 8 of the energy SIPs supports the development of RE projects as follows: 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 development of San Solar PV facility is aligned with SIP 8 as it constitutes a green energy initiative that would contribute clean energy in accordance with the IRP 2010 – 2030.
New Growth Path (NGP) Framework, 2010	Yes. The purpose of the New Growth Path (NGP) Framework is to provide effective strategies towards accelerated job-creation through the development of an equitable economy and sustained growth. The target of the NGP is to create 5 million jobs through the green economy. With economic growth and employment creation as the key indicators identified in the NGP. To achieve this, government will seek to, amongst other things, identify key areas for large-scale employment creation, as a result of changes in conditions in South Africa and globally, and to develop a policy package to facilitate employment creation in these areas. The San Solar PV facility will assist with the creation of both temporary and permanent employment opportunities during the construction and operation phases, which will contribute, albeit to a limited extent, to the economy and sustainable growth.
National Climate Change Response Policy, 2011	The Conference of the Parties (COP) 21 was held in Paris from 30 November to 12 December 2015. From this conference, an agreement to tackle global warming was reached between 195 countries. This Agreement is open for signature and subject to ratification, acceptance or approval by States and regional economic integration organisations that are Parties to the Convention from 22 April 2016 to 21 April 2017. Thereafter, this Agreement shall be open for accession from the day following the date on which it is closed for signature. The agreement can only be sanctioned once it has been ratified by 55 countries, representing at least 55% of emissions. South Africa signed the Agreement in April 2016 and ratified the agreement on 01 November 2016. The Agreement was assented to by the National Council of Provinces on 27 October 2016, and the National Assembly on 1 November 2016. The Agreement was promulgated on 04 November 2016, thirty days after the date on which at least 55 Parties to the Convention, which account for at least 55% of the total global greenhouse gas emissions have deposited their instruments of ratification, acceptance, approval or accession with the Depositary.

Relevant legislation or policy	Relevance to San Solar PV facility
	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 policy provides support for San Solar PV, which will contribute to managing climate change impacts, supporting the emergency response capacity, as well as assist in reducing GHG emissions in a sustainable manner.
Climate Change Bill, 2018	On 08 June 2018, the Minister of Environmental Affairs published the Climate Change Bill ("the Bill") for public comment. The Bill provides a framework for climate change regulation in South Africa aimed at governing South Africa's sustainable transition to a climate resilient, low carbon economy and society. The Bill provides a procedural outline that will be developed through the creation of frameworks and plans. San Solar PV facility consists of a renewable energy generation facility and would not result in the generation or release of emissions during its operation.

3.3.3 Policy and planning at a Provincial Level

A brief review of the most relevant provincial policies is provided below in **Table 3.3**. The development is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor.

Table 3.3: Relevant provincial legislation and policies for the San Solar PV facility

Relevant policy	Relevance to San Solar PV facility
Northern Cape Provincial Spatial Development Framework (PSDF) 2012	The Northern Cape Provincial Spatial Development Framework (PSDF) 2012 states that the overarching goal for the province is to enable sustainability through sustainable development. The province considers social and economic development as imperative in order to address the most significant challenge facing the Northern Cape, which is poverty. The PSDF identifies key sectoral strategies and plans which are considered to be the key components of the PSDF. Sectoral Strategy 19 refers to a provincial renewable energy strategy. Within the PSDF a policy has been included which states that renewable energy sources (including the utilisation of solar energy) are to comprise 25% of the province's energy generation capacity by 2020. The overall energy objective for the province also includes promoting the development of renewable energy supply schemes which are considered to be strategically important for increasing the diversity of domestic energy supply and avoiding energy imports, while also minimising the detrimental environmental impacts. The implementation of sustainable renewable energy is also to be promoted within the province through appropriate financial and fiscal instruments.

Relevant policy	Relevance to San Solar PV facility
	The development of San Solar PV Facility supports the overall energy objective of the province to have 25% of its electricity from renewable energy sources.
Northern Cape Provincial Spatial Development Framework (PSDF) 2018 Review	The review of the Northern Cape PSDF (2018) refers to infrastructure investment and that a balance must be maintained between investments aimed at meeting the social needs of communities and investment aimed at promoting economic development and job creation. The Spatial Development Strategy identified in the PSDF for basic infrastructure includes the achieving the provision of green infrastructure which includes renewable energy. As part of the Vision 2040 of the PSDF key opportunities are identified for the province. The strengthening of the development triangle that is formed by the linking of Kimberley, Vryburg, Upington and De Aar. The development triangle sustains a diverse economy with strong mining, agricultural and renewable energy sectors. It is stated in the PSDF that a sustainable and viable economic network must be driven within the development triangle to improve the return of public investment in the Province. The development of San Solar PV Facility will contribute to the economic network of the province specifically in terms of the renewable sector, albeit it does not fall within the development triangle.
The Northern Cape Climate Change Response Strategy	The key aspects of the Northern Cape Climate Change Response Strategy (NCCCRS) Report are summarised in the MEC's (NCPG: Environment and Nature Conservation) 2011 budget speech: "*The Provincial Climate Change Response Strategy will be underpinned by specific critical sector climate change adaptation and mitigation strategies that include the Water, Agriculture and Human Health sectors as the 3 key Adaptation Sectors, the Industry and Transport alongside the Energy sector as the 3 key Mitigation Sectors with the Disaster Management, Natural Resources and Human Society, livelihoods and Services sectors as 3 remaining key. Sectors to ensure proactive long-term responses to the frequency and intensity of extreme weather events such as flooding and wildfire, with heightened requirements for effective disaster management*". Key points from the MEC address include the NCPG's commitment to develop and implement policy in accordance with the National Green Paper for the National Climate Change Response Strategy (2010), and an acknowledgement of the Northern Cape Province's extreme vulnerability to climate-change driven desertification. The development and promotion of a provincial green economy, including green jobs, and environmental learnership is regarded as an important provincial intervention in addressing climate change. The renewable energy sector, including solar and wind energy (but also biofuels and energy from waste), is explicitly indicated as an important element of the Provincial Climate Change Response Strategy. The development of San Solar PV Facility will assist in achieving (although only to a limited extent) the promotion of the provincial green economy of the Northern Cape.
Northern Cape Province Green Document	The NCP Green Document (2017-2018) was prepared by the Northern Cape Department of Economic Development and Tourism and provides an impact assessment of IPPs on the communities in the province located within a 50km radius from existing facilities. The document notes that the NCP is nationally a leader in commercial-scale renewable energy projects. By 2018, a total of 23 IPP projects in the province had been integrated into the national grid. These projects include Solar PV, Concentrated Solar, and Wind Energy Facilities. The document notes that through their economic development

Relevant policy	Relevance to San Solar PV facility
	obligations, these projects have already made a significant positive contribution to affected communities. Much of the effort has been directed at supporting local education. The document also notes that, as these projects are committed to 20-year minimum lifespans, they collectively hold a tremendous potential for socio-economic upliftment. The development of the San Solar PV facility will contribute towards further socio-economic upliftment in the Northern Cape Province.

3.3.4 Policy and planning at a Local Level

The local tiers of government relevant to the San Solar PV facility project are the Gamagara Local Municipality and the John Taolo Gaetsewe District Municipality. Instruments and/or policies at both the district and local level contain objectives which align with the development of San Solar PV facility. These include, economic growth, job creation, community upliftment and poverty alleviation.

Table 3.4: Relevant district and local legislation and policies for San Solar PV facility

Relevant policy	Relevance to San Solar PV facility
John Taolo Gaetsewe District Municipality Phase 5 Draft Spatial Development Framework (SDF) (2017)	The main economic sectors applied within the John Taolo Gaetsewe District Municipality include eco-tourism, agriculture, mining and community services. Even though the development of renewable energy is not specifically mentioned as part of the framework, the development of a solar energy facility within the area will add to the current economic sectors. That specifically includes community services, as the development of a solar energy facility will aid in the provision of electricity, as well as employment opportunities and skills development on a local level. The SDF states that one of the key objectives for the District Municipality is to attract new business. With the development of a SEF within the area, other developers might be encouraged to consider the area as a viable location for further development. This could attract new business to the area and promote financial and socio-economic development within the District Municipality.
John Taolo Gaetsewe District Municipality Final Draft Integrated Development Plan (IDP) 2021 – 2022	The vision of the John Taolo Gaetsewe District Municipality (DM) as contained within its IDP 2021 – 2022 is: "*Working together for a better life for all in the district*." The mission statement of John Taolo Gaetsewe District Municipality reflects what the DM will do in an on-going manner to strive towards achieving its vision. The mission of the John Taolo Gaetsewe District Municipality is: "*Accelerating the implementation of integrated development initiatives and providing support to local municipalities*." In terms of development priorities, the IDP (2021-2022) determined that the results of the 2016 Community Survey suggested that the number of people residing within the District Municipality is increasing, as a direct result of mining related activities. Implications for the DM in this regard include: » The scope and extent of the District Municipality 's Spatial Development Framework (SDF).

Relevant policy	Relevance to San Solar PV facility
	» Service delivery demands placed on the District Municipality and its local municipalities. » The grading of the local municipalities, and the resources (i.e. grants and subsidies) made available to them. The activities of the District Municipality need to reflect its population demographics, both in terms of service delivery, as well as in terms of employment equity. Gender, racial and disability population demographics have been identified as being of particular importance in this regard. As a result, special interest groups, such as the youth, women and persons with disabilities require specific focus in the strategic priorities of the DM. The implementation of San Solar PV facility would contribute towards addressing some of the John Taolo Gaetsewe DM's development priorities through the creation of new employment opportunities which could support a portion of the increasing population, while the increase in revenue from the project could assist in the municipality in addressing service delivery demands.
Gamagara Local Municipality Integrated Development Plan (IDP), 2021 – 2022	The vision statement for the Gamagara Local Municipality as contained within the IDP 2021 – 2022 is as follows: "*Building prosperous and sustainable communities*," adopted in February and 2018 and still remains relevant. The development trajectory of the municipality is to build an industrial city by 2030 and a manufacturing hub of the Northern Cape, the country, and the region by 2060. In building towards the IDP present the Six Strategic Objectives to ensure that dream to an industrial city and ultimately manufacturing city by 2060, while" building prosperous and sustainable communities" of Gamagara: » Improve life for all through sustainable infrastructure investment and development. » To ensure the financial sustainability of the municipality is in order and to adhere to statutory requirements. » To promote good governance through enhanced stakeholder participation. » To provide an effective and efficient resources by aligning our institutional arrangements to our overall strategy in order to deliver quality services » To facilitate the development of the community pro-active identification prevention, mitigation and fire disaster risks. » Create a conducive environment for economic development in the municipality. Electrification remains a challenge due to continuous growth of informal settlements and lack of funding within the Gamagara LM and the following opportunities stands to be undertaken to address the challenges: » The municipality is located near Solar Farms and the possibility of being provided with electricity directly instead of from Eskom needs to be investigated. The supply at night is however still a problem. » Request more funds or assistance from external funders like mines, solar farms, government departments to speed up planned projects. » Possibility of handover of the Ditloung Electrical network in Olifantshoek by Eskom to Gamagara municipality to implement proper credit controls » New 132Kv intake substation and line be funded by Department of Energy. » Electrification of stands within the Municipal area.

Relevant policy	Relevance to San Solar PV facility
	The implementation of San Solar PV **f**acility would contribute towards supporting the Gamagara LM vision specifically towards local economic development and addressing the key issues regarding electricity. In addition, the REIPPP Programme requires preferred bidders to make minimum contributions towards local economic development and social upliftment, to be focused on benefitting local communities within the vicinity of the project site.

CHAPTER 4: NEED AND DESIRABILITY & ALTERNATIVES

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

This Chapter provides an overview of the suitability of the San 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. This Chapter provides an overview of the various alternatives considered for San Solar PV facility as part of the Scoping & EIA Process.

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

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

Requirement	Relevant Section
(f) a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted scoping report. (g) a motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report.	The need and desirability for the development of San Solar PV facility is included and discussed within this chapter. The need and desirability for the development of the PV facility has been considered from an international, national, regional and site-specific perspective.
(h)(i) details of the development footprint alternatives considered	The details of the alternatives considered as part of San Solar PV facility and as part of the Scoping & EIA Process have been included in **Section 4.7**.
(h)(ix) if no alternative development footprints for the activity were investigated, the motivation for not considering such. (h)(x) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report.	The details of the alternatives considered as part of San Solar PV facility and as part of the Scoping & EIA Phase have been included in **Section 4.7**. Where no alternatives are being considered a motivation has been included.

4.2 Need and Desirability from an International Perspective

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

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

Targets		Indicators	
7.1	By 2030, ensure universal access to affordable, reliable and modern energy services.	7.1.1 7.1.2	Proportion of population with access to electricity. Proportion of population with primary reliance on clean fuels and technology.
7.2	By 2030, increase substantially the share of renewable energy in the global energy mix.	7.2.1	Renewable energy share in the total final energy consumption.
7.3	By 2030, double the global rate of improvement in energy efficiency.	7.3.1	Energy intensity measured in terms of primary energy and GDP.
7.A	By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.	7.A.1	Mobilised amount of United States dollars per year starting in 2020 accountable towards the $100 billion commitment.
7.B	By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support.	7.B.1	Investments in energy efficiency as a percentage of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services.

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

- 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 Mineral Resources and Energy's Renewable Energy (RE) IPP and Coal Baseload IPP Procurement Programmes, found that solar PV and wind were 40% cheaper than new baseload coal (i.e. R0.62/kWh for PV and wind vs R1.03 for coal).

- PV technology is one of the cleanest electricity generation technologies, as it does not result in the release of emissions during its operation.

» By contributing towards South Africa's total generation capacity, specifically through the utilisation of renewable energy resources.

4.3 Need and Desirability from a National Perspective

From a national perspective, the need and desirability of the San Solar PV facility can largely be linked from the project's alignment with national government policies, plans, and programmes which have relevance to energy planning and production (as discussed in detail in **Chapter 3**). The following key plans have been developed by National Government to consider South Africa's current energy production, projected future demands, and provides the necessary framework within which energy generation projects can be developed:

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

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

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

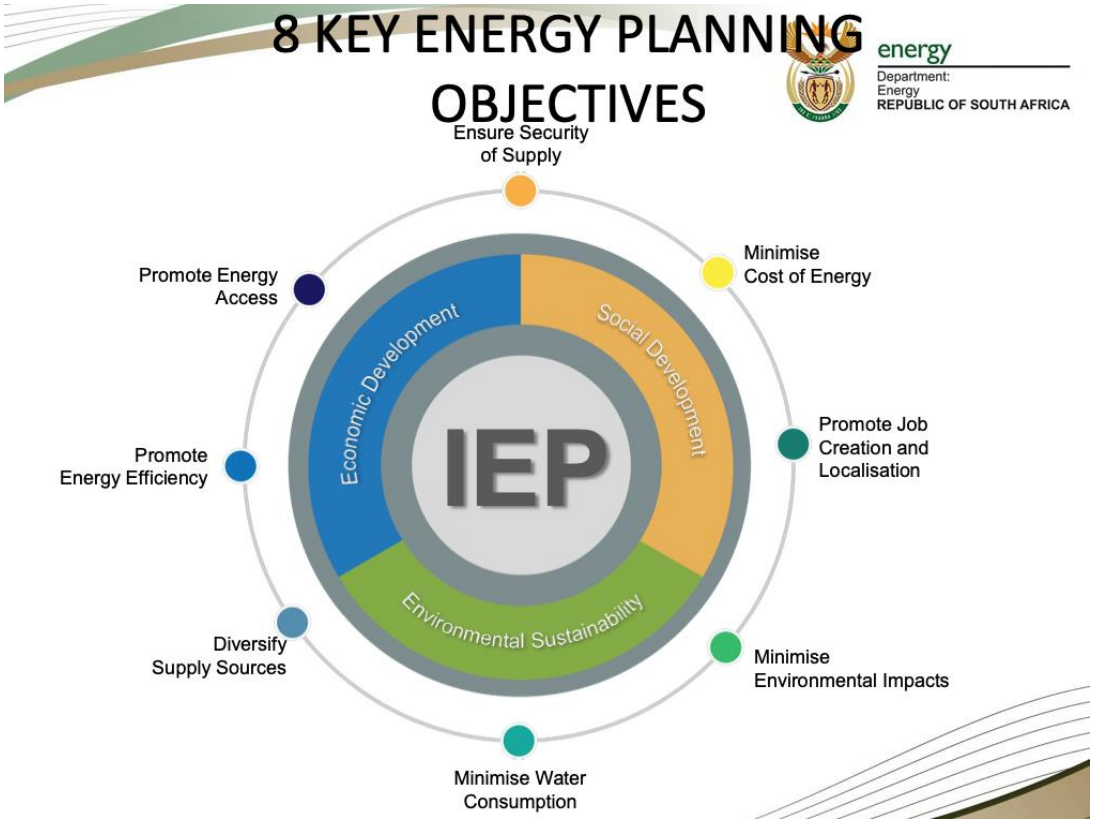


Figure 4.1: Eight key energy objectives as listed in the IEP, 2016 (extract from DOE presentation, December 2016)

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

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

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

» *Solar should play a much more significant role in the electricity generation mix than it has done historically and constitutes the greatest share of primary energy (in terms of total installed capacity) by 2050. The contribution of solar in the energy mix comprises both CSP and solar PV. Solar PV includes*

large scale installations for power generation which supply to the grid and individual, off-grid solar home systems and rooftop panels.

- *Several interventions which could enhance the future solar energy landscape are recommended as follows: –Large scale CSP projects with proven thermal storage technologies and hybridisation / industrial steam application projects should be incentivised in the short to medium term. In the long term, the existing incentives could be extended to promote locally developed CSP technology storage solutions and large-scale solar fuel projects.*
- *A thorough solar resource assessment for South Africa should continue to be undertaken in the Northern Cape Province and extended to other provinces deemed to have high solar radiation levels.*
- *Investments should be made to upgrade the grid in order to accommodate increasing solar and other renewable energy contributions.*

The Integrated Resource Plan 2019 is South Africa's current gazetted energy plan. The purpose of the plan is to ensure sustainable electricity development which takes into consideration technical, economic, and social constraints, and identifies investments in the electricity sector which are required to meet the country's forecasted electricity demands at minimum costs. The consideration of GHG emissions in the determination of the energy generation mix indicates government's commitment to international obligations under the Paris Agreement.

A number of IPP Procurement Programmes have been initiated to secure electricity generated from a range of resources from the private sector (i.e., from Independent Power Producers, or IPPs). Provision has been made for new additional capacities in the IRP 2019 (refer to **Table 4.1**).

Table 4.1: Overview of the total installed capacity expected by 2030

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

Renewable resources are valuable in contributing towards electricity generation and diversifying South Africa's electricity mix, while contributing towards South Africa's response to Climate Change. The project will assist with the objective to generate electricity by means of renewable energy to feed into the national grid which will be procured under either the Renewable Energy Independent Power Producer Procurement Program (REIPPPP), other government run procurement programmes; or for sale to private entities (private PPAs). Under the REIPPPP, the DMRE intends to secure 14 725MW of electricity from renewable energy generation facilities utilising either onshore wind, concentrated solar thermal, solar photovoltaic (PV), biomass, biogas, landfill gas, or hydro across a number of bidding windows, while simultaneously contributing towards socio-economic development. A total of 1 474MW[7] of PV generated electricity has been awarded

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

to preferred bidders across four (4) rounds of bidding to date, with 814MW still remaining to be allocated in subsequent bidding rounds. Preferred bidders identified under any IPP Procurement Programme, 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, IPP Procurement Programmes also contribute positively towards socio-economic development of a region, over and above job creation.

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

» The utilisation, application and investment in renewable energy resources in South Africa is considered to be an essential means of reducing the carbon footprint of the country,
» Diversifying the national economy,
» Reducing poverty, and
» Providing critical additional energy to that provided by Eskom.

Government has compiled an Economic Reconstruction and Recovery Plan which was presented to Parliament in October 2020. According to this plan, the economic survey will rely on a massive investment in infrastructure, including energy, telecommunications, ports and rail. The core elements of the Economic Reconstruction and Recovery Plan are as follows:

1. Priority interventions for economic recovery: the plan sets out eight priority interventions that will ignite South Africa's recovery and reconstruction effort. These are the flagship initiatives that all of society will rally around to build a new economy (refer to **Figure 4.2**).
2. Enabling conditions for growth: these are growth-enhancing reforms and other preconditions for an inclusive, competitive and growing economy.
3. Macroeconomic framework: economic reconstruction and recovery requires careful mobilisation of resources to ensure fiscal sustainability.
4. Institutional arrangements: the plan focuses on execution and is supported by enhanced institutional arrangements to ensure implementation and accountability.

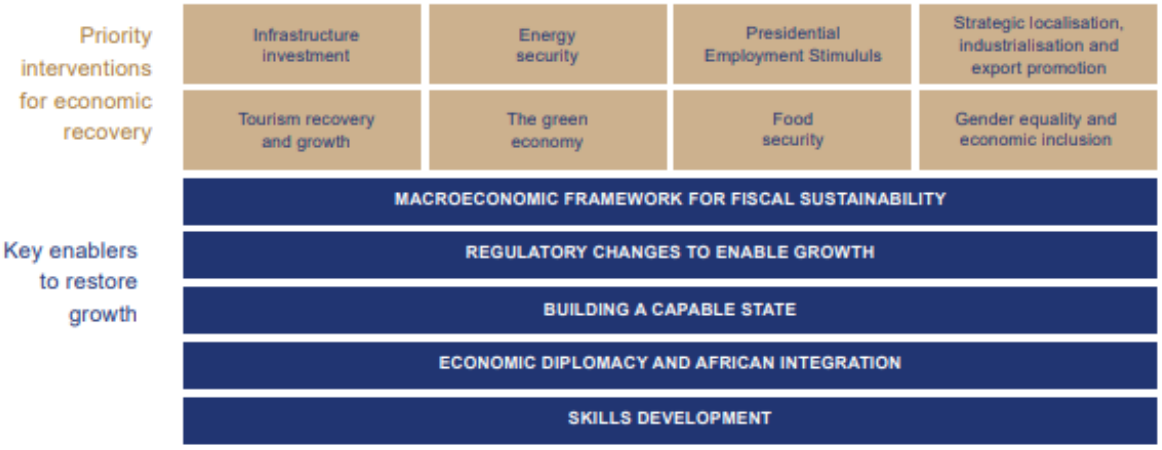


Figure 4.2: Core elements of the Economic Reconstruction and Recovery Plan (source: Building a new economy - Highlights of the Reconstruction and Recovery Plan, Presidency of the Republic of South Africa)

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

The need for new power generation from solar PV facilities has been identified and assessed by government at a national scale considering the national energy requirements as well as international commitments under the Paris Agreement; therefore, provision has been made for the inclusion of new PV power generation capacity in South Africa's energy mix. The implementation of San Solar PV facility has the potential to contribute positively towards the identified need, while simultaneously contributing to job creation and socio-economic development, identified as a need for the country within the National Development Plan (NDP).

San Solar PV facility will make use of renewable energy technology and would contribute positively towards reducing South Africa's GHG emissions and ensure compliance with all applicable legislation and permitting requirements. In addition, by making use of PV technology, San Solar PV facility would have reduced water requirements when compared with some other generation technologies in alignment with one of the vision 2030 themes of the then-Department of Water and Sanitation's (now the Department of Human Settlements, Water and Sanitation) National Water Resource Strategy 2 (2013) (i.e., transitioning to a low carbon economy through stimulating renewable energy and retrofitting buildings).

4.4 Need and Desirability of the project from a Regional Perspective

South Africa's electricity generation mix has historically been dominated by coal. However, up to 2030 a new capacity demand will be driven by the decommissioning of existing coal-fired power stations. A further 24 100MW (**Figure 4.3**) of coal power is expected to be decommissioned in the period 2030 to 2050. Therefore, additional capacity will be required from renewable energy sources, particularly solar with 6 000MW being allocated for the period up to 2030.

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

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

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

Figure 4.3: A snapshot of the updated Energy Mix as per the IRP 2019

Although the majority of South Africa's electricity generation infrastructure (coal-fired power stations) is currently located within Mpumalanga due to the location of coal resources within this province, the Northern Cape Province has been identified as an area where electricity generation from solar energy facilities is highly feasible and a viable option. The location of the study area and project site within the Northern Cape is therefore considered to support the Province/Region's generation targets. The Kathu area is also considered as a hub for the development of solar energy projects due to the viability of the solar resource for the area and the number of projects proposed in the area.

The overarching objective for the solar energy facility is to maximise electricity production through exposure to the solar resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts. From a regional site selection perspective, this region is considered to be preferred for solar energy development by virtue of its annual solar irradiation values. The GHI for the area derived from the World Bank Group's Global Solar Atlas is approximately 2 240 kWh/m^2/annum, equivalent to the highest GHI values in the country (refer to **Figure 4.4**).

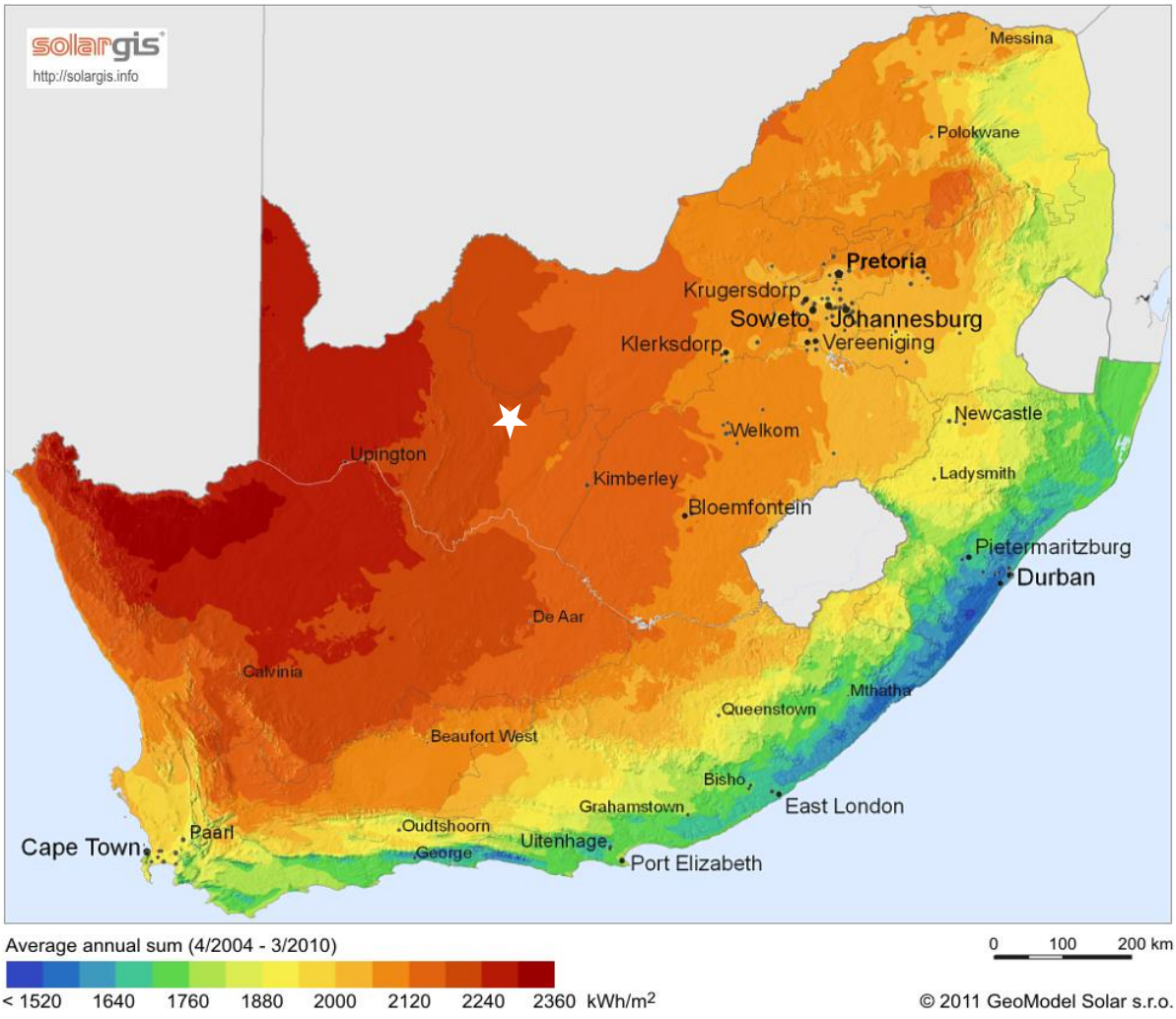


Figure 4.4: Solar irradiation map for South Africa, with the position of San Solar PV shown by the white star (Source: GeoModel Solar)

4.5 Receptiveness of the proposed development area for the establishment of San Solar PV

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

» **Solar resource**: The economic viability of a solar PV facility is directly dependent on the annual direct solar irradiation values. The Global Horizontal Irradiation (GHI) for this geographic location is in the region of approximately 2 240 kWh/m^2/annum, which is considered favourable for the development of a solar PV facility.

» **Topography**: Sites that facilitate easy construction conditions, (i.e. relatively flat topography, lack of major rock outcrops, limited watercourse crossings, etc.) are favoured by developers during the site

selection process. As a result, the development area for San Solar PV consists of a flat gently undulating topography, and with an average elevation of ~1105m in the north-west to 1195m in the south-east of the project site. There are no prominent hills within the project site. These characteristics are preferred for the development of a solar PV facility as construction efforts and costs are minimised, and therefore the study area is considered to be preferable and acceptable for the development of San Solar PV.

» **Site extent and land availability:** Availability of relatively level land of sufficient extent can be a restraining factor to PV development, as a 100MW solar PV development and associated infrastructure requires sufficient land space. The total extent of the property (being 991.5ha) which is owned by the applicant is considered to be sufficient for the planned 100MW PV facility and provides an opportunity for the avoidance of sensitive environmental features and areas.

» **Access to road infrastructure and site access**: The area in which the project site is located can be readily accessed via the R380 Regional Road which branches off the N14 National Road, approximately 3km south of Kathu. The Sishen Airport lies along the R380. As material and components would need to be transported to the development area during the construction phase, accessibility to the project site is a key factor in determining the viability of San Solar PV facility, particularly taking transportation costs (direct and indirect) into consideration and the impact of this on the project economics.

» **Grid access:** A key factor in the siting of any solar PV facility is that the project must have a viable grid connection in order to evacuate the generated electricity to the national grid. San Solar PV facility is intended to connect to the National Grid via a loop-in and loop out (LILO) to the Fox–Umtu 132kV overhead power line located south of the site. Having a grid connection point in close proximity to the project site reduces the necessary grid infrastructure and therefore addresses Eskom's concerns for lower cost connection alternatives. A shorter grid solution will also ensure that potential environmental impacts are kept to a minimum.

» **Land suitability and land use activities:** The current land use of the development area is an important consideration in site selection in terms of limiting disruption to existing land use practices. The Applicant is the owner of the property/project site. The property has been owned since 2015, and the current land use is grazing (through a lease with a third party. The site is also adjacent to other solar PV facilities, collectively forming a renewable energy node in this area north of Kathu. Three (3) solar facilities have been constructed in the broader area. These include the Sishen Solar PV and Kathu Solar PV facilities located immediately west of the farm Remaining extent of the Farm Wincanton 472. The Kathu Solar facility is a CSP facility located to the east of the study area.

» **Land availability:** The selection of a site where the landowner is supportive of the development of renewable energy is essential for ensuring the success of the project. The applicant is the landowner of the Farm Wincanton 472 and has held the property since 2015.

Taking into consideration the solar resource, grid access, land suitability, the applicant's ownership the property, access to road infrastructure, the current land use, in conjunction with other solar facilities including the Sishen Solar PV, Kathu Solar PV and the Kathu CSP facility that have been constructed within the vicinity of the project site, the development of San Solar PV is therefore considered to be desirable and will ultimately contribute to, and further develop the successful power generation activities already being undertaken within the area.

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

4.6 Benefits of Renewable Energy and the Need and Desirability

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

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

Increased energy security: Given that renewables can often be deployed in a short timeframe and in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality in the short-term, while reducing expensive distribution losses. As a result of the power constraints in the first half of 2015, power generators meant to be the "barely-ever-used" safety net for the system (diesel-fired gas turbines) were running at >30% average load factor in the first half of 2015. Load shedding occurred during 82 days in the first half of 2015 (out of 181 days). Results of a CSIR Energy Centre study for the period January to June 2015 (CSIR, August 2015), concluded that the already implemented renewable projects (wind and solar) within the country avoided 203 hours of so-called 'unserved energy'. During these hours the supply situation was such that some customers' energy supply would have had to be curtailed ('unserved') had it not been for the renewables. The avoidance of unserved energy cumulated into the effect that for 15 days, from January to June 2015, load shedding was avoided entirely, delayed, or a higher stage of load shedding prevented due to the contribution of renewable wind and PV projects[8]. More recently, power generated from renewable energy sources have assisted Eskom in alleviating the need for rolling blackouts when aging power stations have been offline for maintenance.

Resource saving: It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres per annum. As an already water-stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly due to the detrimental effects of climate change on water availability. Renewable energy also translates into revenue savings, as fuel for renewable energy facilities is free, while compared to the continual purchase of fuel for conventional power stations. Results of a CSIR Energy Centre study for January – June 2015 (CSIR,

[8] (http://ntww1.csir.co.za/plsql/ptl0002/PTL0002_PGE157_MEDIA_REL?MEDIA_RELEASE_NO=7526896)

August 2015) have quantified the contribution from renewable energy to the national power system and the economy over the first 6 months of 2015 compared to the 12 months of 2014:

2015 (6 months)	2014 (12 months)
R3.60 billion saving in diesel and coal fuel costs	R3.64 billion saving in diesel and coal fuel costs
200 hours of unserved energy avoided, saving at least an additional R1.20 billion–R4.60 billion for the economy	120 hours of unserved energy avoided, saving at least an additional R1.67 billion for the economy
Generated R4.0 billion more financial benefits than cost	Generated R0.8 billion more financial benefits than cost

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

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

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

Climate friendly development: The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of GHG emissions. South Africa is estimated to currently be responsible for approximately 1% of global GHG emissions (and circa half of those for which Africa is responsible) and is currently ranked 9th worldwide in terms of per capita carbon dioxide emissions. Since its inception, the REIPPPP has achieved carbon emission reductions[9] of 25.3 million tonnes of CO_2 (IPP Office, March 2018). The development of San Solar PV, and the associated electricity generated as a result of the facility, will result in considerable savings on tons of CO_2 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 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. In the short period, the REIPPPP has attracted R209.4 billion in committed private sector investment, resulting in 38 701 jobs for the youth and women from surrounding communities[10].

[9] Carbon emission reduction is calculated based on a displacement of power, from largely coal-based to more environmentally friendly electrical energy generation, using a gross Eskom equivalent emissions factor of 1.015 tons CO_2/MWh.
[10] https://www.sanews.gov.za/south-africa/renewable-energy-programme-attracts-r2094-billion-sa-economy

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

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

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

4.7 Alternatives Considered during the Scoping & EIA Process

In accordance with the requirements of Appendix 3 of the 2014 Environmental Impact Assessment (EIA) Regulations (GNR 326), reasonable and feasible alternatives including but not limited to site and technology alternatives, as well as the "do-nothing" alternative should be considered. Several other solar renewable energy facilities are planned within the broader study area, supporting the suitability of the area for solar PV projects.

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

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

In this instance, 'the project' refers to San Solar PV, a solar PV facility with capacity of up to 100MW$_{AC}$ and associated infrastructure proposed to be developed by an Independent Power Producer (IPP) and intended to form part of the DMRE's REIPPP Programme.

4.7.1 Consideration of Fundamentally Different Alternatives

Fundamentally different alternatives are usually assessed at a strategic level and, as a result, project specific EIAs are therefore limited in scope and ability to address fundamentally different alternatives. At a strategic level, electricity generating alternatives have been addressed as part of the DMRE's current Integrated Resource Plan for Electricity 2010 – 2030 (IRP)[11], and will continue to be addressed as part of future revisions. In this regard, the need for renewable energy power generation from solar PV facilities has been identified as part of the technology mix for power generation in the country for the next 20 years. Therefore, fundamentally different alternatives to the proposed project are not considered within this EIA process.

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

4.7.2 Consideration of Incrementally Different Alternatives

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

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

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

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

i. Property or Location Alternatives

The placement of a solar PV facility is dependent on several other factors including land suitability, climatic conditions (solar irradiation levels), topography, the location and extent of the study area, availability of grid connection infrastructure and the need and desirability of the project. San Solar PV (Pty) Ltd as the Applicant as well as the landowner considers the preferred development area placed within the study area as being highly favourable and suitable for the establishment of a solar PV facility. The project site was previously authorised for the development of a 75MW PV project, also known as the San Solar PV project. This application for Environmental Authorisation is considered on the same property which contributes to the selection of the project site for the development of a solar PV energy facility.

Based on those site-specific attributes discussed in Section 4.5, the Applicant considers the development area as highly preferred. The project site is within a developing hub of renewable energy projects, and the San Solar PV facility will be able to draw on synergies with the projects proposed and/or currently authorised within the vicinity of the study area. As a result, no property/location alternatives have been assessed further as part of this EIA process.

ii. Design and Layout Alternatives

A project site consisting of the Remaining extent of the Farm Wincanton 472 (991,5ha in extent) has been considered for the San Solar PV facility. Findings from specialist assessments and field surveys undertaken were considered through this Scoping & EIA process in order to provide site specific information regarding the project site considered for the San Solar PV facility.

Areas to be avoided that were identified during the scoping phase, and present within the project site have been utilised as a tool by the developer to identify and locate the development area for the 100MW PV facility. This has been undertaken with the aim of avoiding possible sensitive areas within the project site so as to limit impacts associated with the development which would result in unacceptable loss.

The development area of 400ha is sufficient for the proposed development, and therefore reduces the need to consider alternative locations for the PV facility and the associated infrastructure. Potential environmentally sensitive areas have been identified as part of the Scoping & EIA Phase (refer to Chapter 9). The environmental sensitivity identification process informed the layout design for the PV facility, avoiding sensitive areas as far as possible, and thereby ensuring that the layout plan taken forward for assessment during the EIA Phase is considered to be the most optimal from an environmental perspective.

4.7.3 Technology Alternatives

4.7.3.1 PV Technology Alternatives

The Kathu area has been identified for the development of solar and wind energy renewable facilities. Few technology options are available for solar facilities, and the use of those that are considered are usually differentiated by weather and temperature conditions that prevail in the area, so that optimality is obtained by the final site selection. Solar energy is considered to be the most suitable renewable energy technology for this area, based on the site location, ambient conditions and energy resource availability.

Solar PV was determined as the most suitable option for further assessment. The IRP (2019) excludes the procurement of power from CSP facilities until 2030, whereas new additional capacity of approximately 6 000MW will be required from solar PV facilities. Therefore, PV technology was identified as being the preferred option for the study area and consists of a lower visual profile and limited water requirements when compared to the CSP technology alternative. Given the allocations in the IRP (2019), solar PV is considered as the most appropriate technology option. Furthermore, the development of San Solar PV facility provides an opportunity to optimally use a site that was previously earmarked for energy generation through making use of solar PV technology (with projects previously authorised on this footprint).

Therefore, considering the above, no other technology alternatives are being assessed for the development of San Solar PV facility. When considering PV as a technology choice, several types of panels are available, including *inter alia*:

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

The primary difference between PV technologies available relate to the extent of the facility, as well as the height of the facility (visual impacts), however the potential for environmental impacts remain similar in magnitude. Fixed mounted PV systems are able to occupy a smaller extent and have a lower height when compared to tracking PV systems, which require both a larger extent of land, and are taller in height. However, both options are considered to be acceptable for implementation from an environmental perspective. Bifacial solar PV panels offer many advantages over monofacial PV panels, as power can be produced on both sides of the module, increasing total energy generation. The preference will therefore be determined on the basis of technical considerations and the site conditions.

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

4.7.3.2 Battery Energy Storge System (BESS) technology alternatives

The general purpose and utilisation of a Battery Energy Storage System (BESS) is to save and store excess electrical output as it is generated, allowing for a timed release when the capacity is required. BESS systems therefore provide flexibility in the efficient operation of the electric grid through decoupling of the energy supply and demand. **Figures 4.5, 4.6, 4.7** and **4.8** below illustrate a typical utility scale BESS system (a Lithium-Ion BESS) as applied in the context of a Renewable Energy Facility.

Figure 4.5: Li-Ion BESS implementation for a Renewable Energy facility (Source: Enel Green Power).

Figure 4.6: Li-Ion BESS containerised modules located within the BESS enclosure footprint (Source: Enel Green Power).

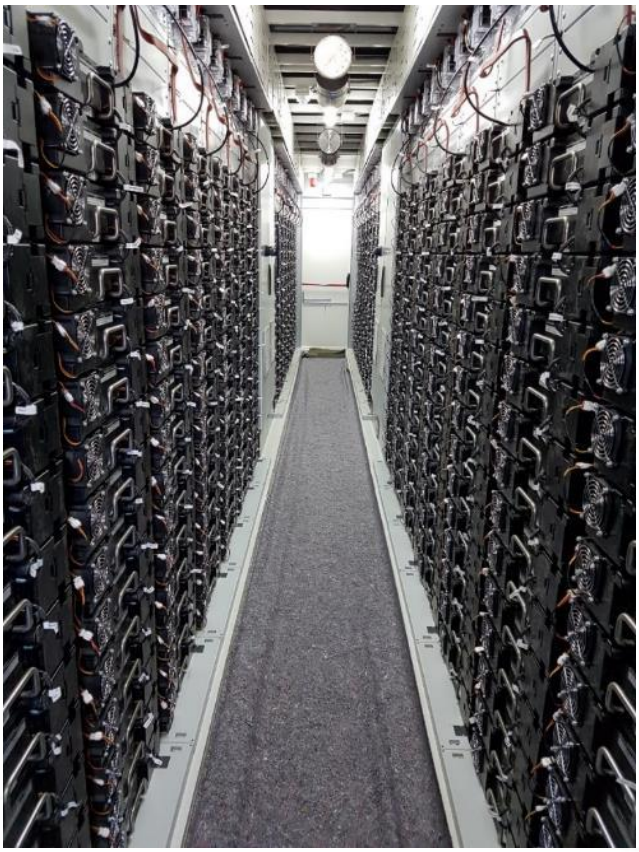


Figure 4.7: Li-Ion BESS internal design and implementation of a container used within a BESS. The image shows a series of sealed battery cell packs within a containerised module (Source: Enel Green Power).

Figure 4.8: Illustration of battery storage units installed by Tesla (Source: fastcompany.com).

As technological advances within battery energy storage systems (BESS) are frequent, no specific technology can be determined for use by the proponent at this stage. Two technology types have been considered. Solid state BESS using Li-Ion technology is preferred and is considered/assessed to ensure all impacts related to all types have been addressed:

» Lithium-Ion technology (e.g. Lithium Ferrophosphate (LFP), Nickel Manganese Cobalt Oxide (NMC) or similar technology and chemistries); and
» Redox-flow technology (e.g. vanadium flow battery, or similar technology and chemistries).

The technology includes batteries housed within containers which are fully enclosed and self-contained. Therefore, the assessment proposes Lithium-Ion technologies for authorisation to allow the proponent to determine the precise technology when the project is implemented.

The solid state BESS technology is described in further detail below.

A lithium-ion (Li-ion) battery is a rechargeable electrochemical battery operating on a wide array of chemistries where lithium ions are transferred between the electrodes during the charge and discharge reactions (Parsons, 2017). A Li-ion cell is comprised of three main components; cathode and anodes electrodes, and an electrolyte that allows lithium ions to move from the negative electrode to the positive electrode during discharge and back when charging (**Figure 4.9**) (Parsons, 2017). While charging, lithium ions flow from the positive metal oxide electrode to the negative graphite electrode which is reversed during discharge (i.e. ion flow is in the opposite direction).

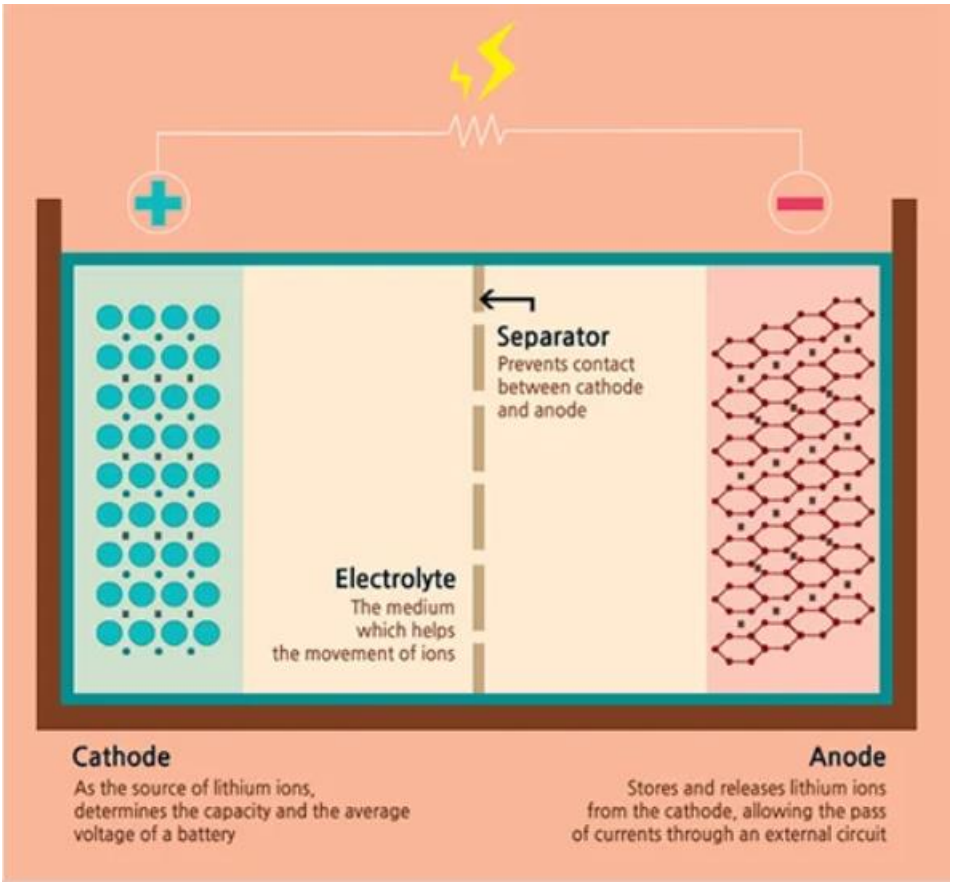


Figure 4.9: An example of a Li-ion cell and its component (Source: https://eepower.com/technical-articles/changing-the-world-with-lithium-ion-batteries/#)

Li-ion battery cells contain two reactive materials which are capable of electron transfer chemical reactions (commonly a lithium source cathode and a graphite anode). Lithium-ion batteries utilise both lithium and a heavy metal (commonly cobalt or manganese) in the reactions required for energy storage. Lithium can however be recycled, adding the future potential use of this battery technology, however the recycling process is difficult and expensive.

This battery type is expected to be a dominant energy storage technology for utility-scale applications, with cycle durations up to 4 hours (Parsons, 2017). Developmental concerns related to the technology included cell monitoring and fire (due to thermal runaway, i.e. a heat positive feedback resulting in runaway heating of the unit) although fire detection, cooling and suppression systems largely address these concerns (Parsons, 2017).

The High round-trip efficiency (the fraction of energy put into the storage that can be retrieved), high power and energy density of this technology provide a significant advantage where a small footprint and available space are an issue. Recent technological advances and large-scale manufacturing have reduced the cost of such installations drastically and increased performance, with the result that Li-ion batteries are expected to be an important BESS through to 2030 in both small- and large-scale applications.

4.7.3.2.1 Compliance to local and international standards and Fire Prevention

The BESS will be compliant with all local laws and regulations and health and safety requirements governing battery facilities. Over and above that they will comply with international standards such as UN 38.3 (Transportation Testing for Lithium Batteries), UL 1642 (Standard for Safety – Lithium-ion Batteries) and IEC 62619 (Secondary cells and batteries containing alkaline or other non-acid electrolytes Safety requirements for secondary lithium cells and batteries, for use in industrial applications). Furthermore, the battery facility will also comply with standards such as UL 1973 (Batteries for Use in Stationary Applications) and IEC 62619-2017 including thermal runaway non-propagation and safety zone region operation limits and a failure mode analysis. The design will be compliant with UL 9540 (Energy Storage Systems and Equipment): this standard defines the safety requirements for battery installation in industrial and grid connected applications.

The design of the BESS in compliance with all the local and international standards ensures that fire risk is minimal. Furthermore, each container has a built-in fire detection and suppression system. This system continually monitors the batteries and in an unlikely event of a fire it supresses the fire using inert gas. Each container is also spaced about 3m apart ensuring the chance of a fire spreading between containers (which are made of metal and therefore not easily flammable) is also minimal.

Figure 4.10 below provides a typical configuration of fire detection and suppression system.

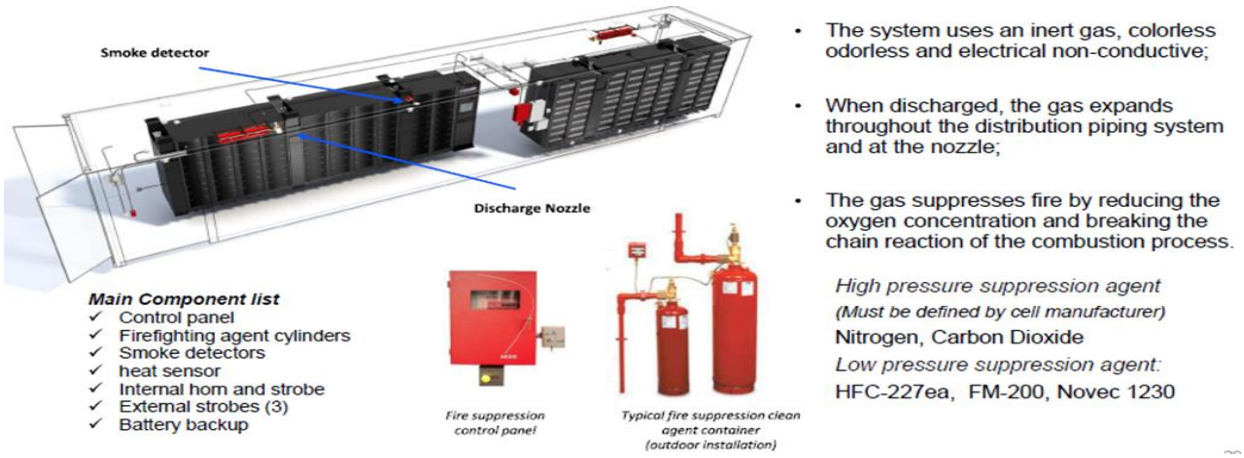


Figure 4.10: Typical configuration of fire detection and suppression system

4.7.4 The 'Do-Nothing' Alternative

The 'Do-Nothing' alternative is the option of not constructing the San Solar PV facility. Should this alternative be selected, there would be no environmental impacts or benefits as a result of construction and operation activities associated with a solar PV facility. The 'do-nothing' alternative will therefore likely result in minimising the cumulative impact on the land, although it is expected that pressure to develop the site for renewable energy purposes will be actively pursued due to the same factors which make the site a viable option for renewable energy development. This alternative will be used as a baseline against which the impacts will be assessed and compared in detail within Chapter 7 of this EIA Report.

CHAPTER 5: APPROACH TO UNDERTAKING THE SCOPING/EIA PROCESS

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

An EIA process refers to the process undertaken in accordance with the requirements of the relevant EIA Regulations (the 2014 EIA Regulations (GNR 326), as amended), which involves the identification and assessment of direct, indirect, and cumulative environmental impacts associated with a proposed project or activity. The EIA process comprises two main phases: i.e. **Scoping** and **EIA Phase**.

A comprehensive consultation process was designed and implemented to cater for the undertaking of a full-scale, innovative public participation process (PPP) which included I&APs, the competent authority, directly impacted landowners/occupiers, adjacent landowners/occupiers, relevant Organs of State departments, ward councillors and other key stakeholders, while remaining within the limits as stipulated by the National Government. This chapter outlines the process that was followed during the Scoping & EIA process.

The EIA process is illustrated in **Figure 5.1**.

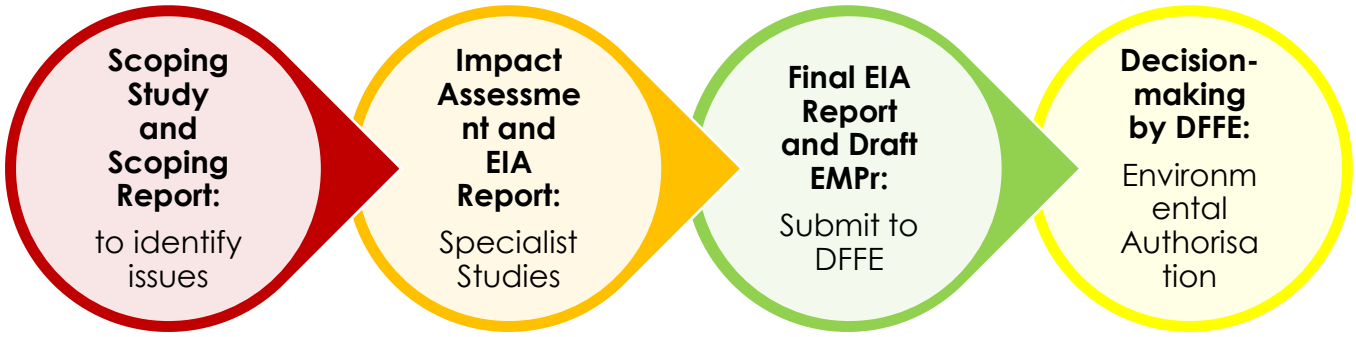


Figure 5.1: The Phases of an Environmental Impact Assessment (EIA) Process

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

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

Requirement	Relevant Section
(d) a description of the scope of the proposed activity, including (i) all listed and specified activities triggered and being applied for and (ii) a description of the associated structures and infrastructure related to the development;	All listed activities triggered and applied for are included in **Section 5.2**.
(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 EIA process for San Solar PV is included in **Section 5.5.2** and copies of the supporting documents and inputs are included in **Appendix C**.
(h)(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them.	Comments raised through the undertaking of the PPP including consultation with I&APs will be included in the Comments and Responses Report in **Appendix C**.
(h)(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives are included in **Section 5.5.3**.

5.2 Relevant legislative permitting requirements

The legislative permitting requirements applicable to San Solar PV facility, as identified at this stage in the process and considered within this EIA process, are described in more detail under the respective sub-headings. Relevant permitting requirements are detailed within **Table 5.5**.

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

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

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

to provide the Competent Authority with sufficient information in order for an informed decision to be taken regarding the Application for EA.

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

Table 5.1 contains all the listed activities identified in terms of NEMA, the 2014 EIA Regulations (GNR 326), and Listing Notice 1 (GNR 327), Listing Notice 2 (GNR 325), and Listing Notice 3 (GNR 324) which may be triggered by the proposed development of the San Solar PV facility and associated infrastructure, and for which an application for EA has been made:

Table 5.1: Listed activities identified in terms of the Listing Notices (GNR 327, 325 and 324)

Notice Number	Activity Number	Description of listed activity
Listing Notice 1 (GNR 327) 08 December 2014 (as amended)	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 275kV or more. ***The San Solar PV facility will include a grid connection solution including a 132kV facility substation, and 132kV switching station to be connected via a 132kV Loop-in-Loop out (LILO) connection to the Fox-Umtu 132kV overhead power line located south of the site. The facility is located outside of an urban area.***
Listing Notice 1 (GNR 327) 08 December 2014 (as amended)	14	The development and related operation of facilities and infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres. ***The development of the PV facility will require the construction and operation of facilities and infrastructure for the storage and handling of a dangerous good (combustible and flammable liquids, such as oils, lubricants, solvents) associated with the facility and substations where such storage will occur inside containers with a combined capacity exceeding 80 cubic meters but not exceeding 500 cubic meters***.
Listing Notice 1 (GNR 327) 08 December 2014 (as amended)	24 (ii)	The development of a road – (ii) with a reserve wider than 13.5m, or where no reserve exists where the road is wider than 8m. ***Access roads will be developed during the construction phase of the project and will exceed 8m in width.***

Listing Notice 1 (GNR 327) 08 December 2014 (as amended)	28 (ii)	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1ha. ***The total area to be developed for the PV facility and associated infrastructure is greater than 1ha and occurs outside an urban area in an area currently zoned for agriculture.***
Listing Notice 2 (GNR 325) 08 December 2014 (as amended)	1	The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20MW or more. ***San Solar PV will generate electricity from a renewable source. and have a capacity that exceeds 20MW. The San Solar PV facility will have a contracted capacity of 100MW.***
Listing Notice 2 (GNR 325) 08 December 2014 (as amended)	15	The clearance of 20ha or more of indigenous vegetation[12]. ***The development of the San Solar PV facility will require the clearance of indigenous vegetation in excess of 20ha for the development of infrastructure.***
Listing Notice 3 (GNR 324) 08 December 2014 (as amended)	4(g)(ii)(ee)	The development of a road wider than 4 metres with a reserve less than 13,5 metres. **g. Northern Cape** ii. Outside urban area. (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; ***The development of the PV facility and associated infrastructure will require the development of roads wider than 4m outside of an urban area, within an ESA area, as identified in the bioregional plan.***
Listing Notice 3 (GNR 324) 08 December 2014 (as amended)	10 (g)(iii)(ee)	The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres **g. Northern Cape** iii. Outside urban areas:

[12] "Indigenous vegetation" as defined by the 2014 EIA Regulations (GNR 326) refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.

		(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans. ***The development of the PV facilities and associated infrastructures will require the storage and handling of a dangerous good with a capacity of 80 cubic meters outside of an urban area, within an ESA area, as identified in the bioregional plan. .***
Listing Notice 3 (GNR 324) 08 December 2014 (as amended)	12(g)(ii)	The clearance of an area of 300 square metres or more of indigenous vegetation **g. Northern Cape** ii. Within critical biodiversity areas identified in bioregional plans. ***The San Solar PV facility and associated infrastructure will require the clearance of >203ha of indigenous vegetation within an area classified as an ESA as identified in the bioregional plan.***
Listing Notice 3 (GNR 324) 08 December 2014 (as amended)	18(g)(ii) (ee)	The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre. **g. Northern Cape** (ii) outside urban areas (ee) Within critical biodiversity areas identified in systematic biodiversity plan adopted by the competent authority or in bioregional plans ***The development of the San Solar PV facility and associated infrastructure will require the widening of a road by more than 4 metres, outside urban areas and within an area classified as an ESA as identified in the bioregional plan.***

5.2.2 National Water Act (No. 36 of 1998) (NWA)

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

There is no natural permanent water or artificial earth dams within the development area. There are scattered ephemeral pans on the project site. The development area/footprint will be able to completely avoid infringement on the ephemeral pans, and as such no further assessment of impacts to the freshwater ecology is considered necessary.

5.2.3 National Heritage Resources Act (No. 25 of 1999) (NHRA)

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

Section 38: Heritage Resources Management

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

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

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

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

i). exceeding 5 000m² in extent; or

ii). Involving three or more existing erven or subdivisions thereof; or

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

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

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

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

5.3 Overview of the Scoping and EIA (S&EIA) Process being undertaken for the San Solar PV facility

In terms of NEMA, the 2014 EIA Regulations (GNR 326), and Listing Notices (Listing Notice 1 (GNR 327), Listing Notice 2 (GNR 325) and Listing Notice 3 (GNR 324) the development of the San Solar PV facility requires Environmental Authorisation from DFFE, subject to the completion of a full Scoping and Environmental Impact Assessment (S&EIA), as prescribed in Regulations 21 to 24 of the 2014 EIA Regulations (GNR 326). The need for a full S&EIA process to be conducted in support of the application for EA is based on listed activities triggered which are contained within Listing Notice 2 (GNR 325).

The S&EIA process is to be undertaken in two phases as follows:

» The **Scoping Phase** includes the identification and description of potential issues associated with the project through desktop studies, field surveys, as well as consultation with I&APs and key stakeholders through a PPP. The entire project site is considered, and areas of sensitivity are identified and delineated

in order to identify any environmental fatal flaws, and environmentally sensitive, or no-go areas which need to be considered. In accordance with Regulation 21(1) of the 2014 EIA Regulations (GNR 326) this Scoping Report prepared for the project will be subject to a 30-day review and comment period during which any Interested and Affected Party (I&AP) or Authority are invited to review and provide comment on the findings (refer to **Figure 5.2**). Following the completion of this review period, a Final Scoping Report (FSR) which incorporates all comments received during the 30-day public review and comment period, will be prepared and submitted to DFFE for consideration. Following receipt of the FSR, DFFE has 43 days within which to either accept the Scoping Report, and advise the applicant to proceed or continue with the tasks contemplated in the Plan of Study for EIA, or refuse the Application for EA in the event that the proposed activity is in conflict with a prohibition contained in legislation, or the Scoping Report does not substantially comply with Appendix 2 of the 2014 EIA Regulations (GNR 326).

» The **EIA Phase** involves a detailed assessment of potentially significant positive and negative direct, indirect, and cumulative impacts identified during the Scoping Phase. This phase includes detailed specialist investigations and a PPP, and results in the compilation of an EIA Report and Environmental Management Programme (EMPr). In accordance with Regulation 23(1)(a) of the 2014 EIA Regulations (GNR 326) the EIA Report and EMPr prepared for the project will also be subject to a 30-day public review and comment period during which members of the public, I&APs, and authorities will be invited to review and provide comment on the EIA Report and EMPr. Following the conclusion of this review period a Final EIA Report and EMPr which incorporates all comments received during the 30-day review and comments period, will be prepared and submitted to DFFE for its consideration. Following its receipt of the Final EIA Report and EMPr, DFFE has 107 days within which to either grant or refuse the EA.

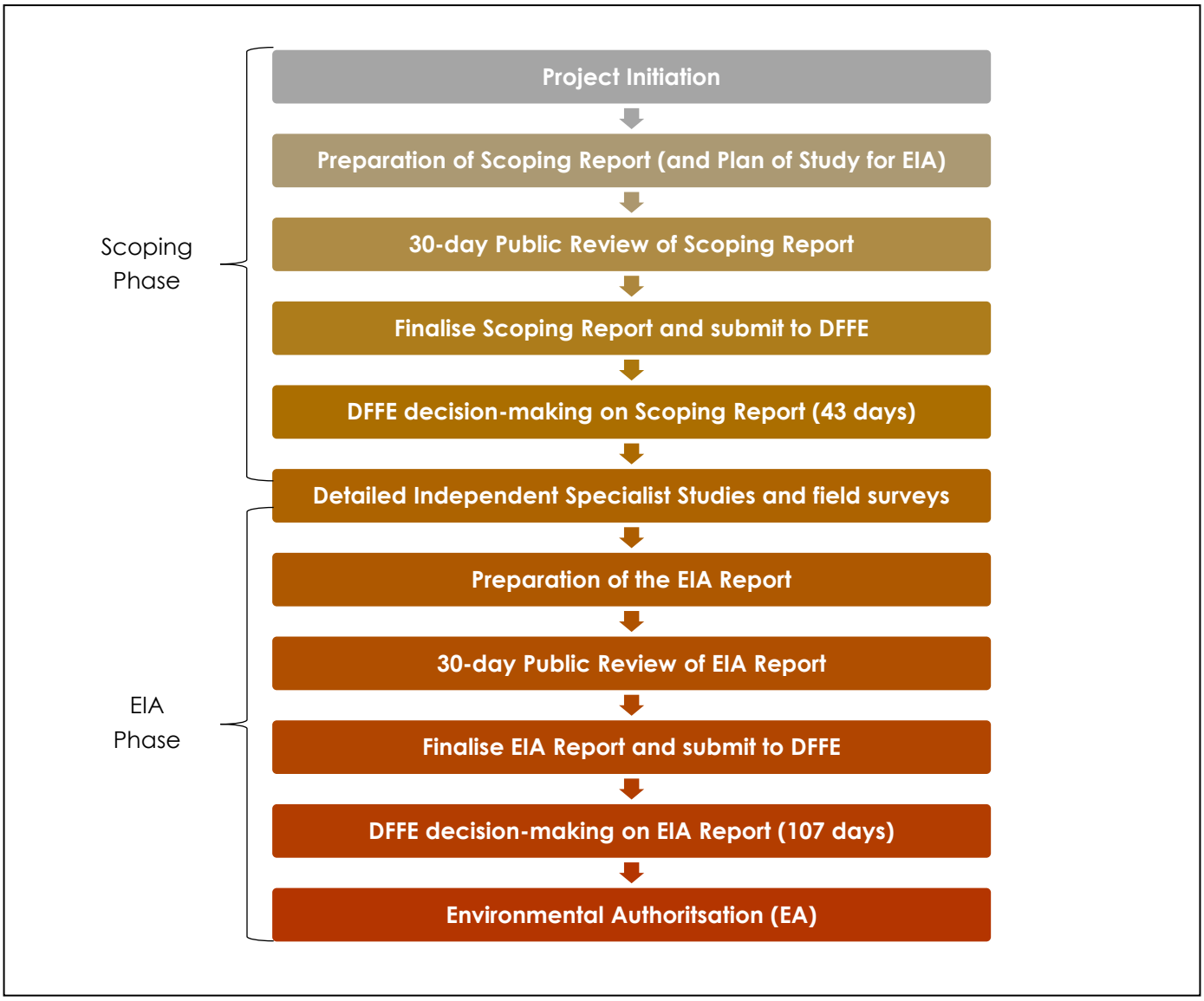


Figure 5.2: Regulated timeframe of an Environmental Impact Assessment (EIA) Process

5.4 Overview of the EIA Phase

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

- Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context.
- Describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the development footprint on the approved site as contemplated in the accepted Scoping Report.
- Identify the location of the development footprint within the approved site as contemplated in the accepted Scoping Report based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment.
- Determine the:

- Nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
- Degree to which these impacts:
  - Can be reversed
  - May cause irreplaceable loss of resources
  - Can be avoided, managed or mitigated

» Identify the most ideal development footprint for the activity within the development envelope of the approved site as contemplated in the accepted Scoping Report based on the lowest level of environmental sensitivity identified during the assessment.
» Identify, assess, and rank the impacts the activity will impose on the development footprint on the approved site as contemplated in the accepted Scoping Report through the life of the activity;
» Identify suitable measures to avoid, manage or mitigate identified impacts.
» Identify residual risks that need to be managed and monitored.

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

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

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

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

» Submission of a Pre-Application Meeting request to DFFE on 01 March 2022 and the proposed Public Participation Plan (PP Plan). The DFFE provided approval of the submitted PP Plan via email on Friday, 04 March 2022, and no pre-application meeting was considered necessary.
» Submission of the Application for Environmental Authorisation to the DFFE via the use of the DFFE Novell Filr System.
» Submission of the Scoping Report for review and comment from 08 March 2022 to 08 April 2022, and submission of the Final Scoping report on 14 April 2022.
» Receipt of the Acceptance of the Acceptance of Scoping on 05 May 2022.

The following steps are to be undertaken as part of this EIA phase of the process:

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

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

A record of all authority correspondence undertaken during the Scoping/EIA process is included in **Appendix B** and **Appendix C5**.

5.4.2 Public Participation Process

Public participation is an essential and regulatory requirement for an environmental authorisation process and is guided by Regulations 41 to 44 of the EIA Regulations 2014 (GN R326) (as amended). The purpose of public participation is clearly outlined in Regulation 40 of the EIA Regulations 2014 (GN R326) (as amended) and is being followed for this project. The benefit to the stakeholder is that all information relevant to the application has been made available for review, and not only for comments to be raised, but also to provide a complete picture of the potential impacts and/or benefits related to the PV project.

The PPP undertaken for San Solar PV facility considers the restrictions and limitations imposed by Government through section 27 (2) of the Disaster Management Act (Act No. 57 of 2002) of 2002 and the Directions issued by the Minister of Forestry and Fisheries (DFFE) in terms of consultations with I&APs. A Public Participation Plan was prepared and submitted to DFFE for approval. Approval of the Plan was provided by the DFFE Case Officer via email on Friday, 04 March 2022 (refer to **Appendix B**).

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

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

- During the **Scoping Phase**:
  - provide an opportunity to submit comments regarding the project;
  - assist in identifying reasonable and feasible alternatives, where required;
  - identify potential issues of concern and suggestions for mitigation measures;
  - contribute relevant local information and knowledge to the environmental assessment;
  - allow registered I&APs to verify that their comments have been recorded, considered and addressed, where applicable, in the environmental investigations;
  - foster trust and co-operation;
  - generate a sense of joint responsibility and ownership of the environment;
  - comment on the findings of the Scoping Phase results; and
  - Identify issues of concern and suggestions for enhanced benefits.

- During the **EIA Phase**:
  - contribute relevant local information and knowledge to the environmental assessment;
  - verify that issues have been considered in the environmental investigations as far as possible as identified within the Scoping Phase;
  - comment on the findings of the environmental assessments; and
  - attend a Focus Group Meeting and an advertised open meeting to be conducted for the project.

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

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

In terms of the requirement of Chapter 6 of the EIA Regulations of December 2014, as amended, the following key public participation tasks are required to be undertaken:
- Fix 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.
- Give 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.
- Place an advertisement in a local newspaper.
- Open and maintain a register of I&APs and Organs of State.
- Release of a Scoping Report for a 30-day review and comment period.
- Prepare the C&RR which documents the comments received through the EIA process together with responses provided to the comments raised.

In compliance with the requirements of Chapter 6: Public Participation of the EIA Regulations, 2014 (as amended), and the approved Public Participation Plan, the following summarises the key public

participation activities implemented. The schematic below provides an overview of the tools that are available to I&APs and stakeholders to access project information and interact with the public participation team to obtain project information and resolve any queries that may arise, and to meet the requirements for public participation.

i. Stakeholder identification and register of I&APs	•Register as an I&AP on the online platfrom, via completion of a form and provison of contact information, by responding to an advert, or sending a 'please call me' which will be responded to •State interest in the project •Receive all project related information via email or other appropriate means.
ii. Notifications	•Advertisements, site notices, and written notifications provide information and details on where to access project information. •Notification regarding the EIA process and availability of project reports for public review to be sent via email, post or SMS notification.
iii. Public Involvement and consultation	•Availability of project information will be via the Savannah website which is accessible and user friendly. •An opportunity for I&APs and stakeholders to request virtual meetings with the project team. •Where limited connectively is encountered, in-person meeting/s will be arranged with strict COVID protocols followed.
iv. Comment on the Scoping/EIA reports	•Availability of the project reports via the online platform for a 30-day comment period. • Where applicable, other electronic platforms (WeTransfer or DropBox), and upon written request CD, USB and/or hard copies will be made available. •Submission of comments faciliated through email, WhatsApp/SMS, direct on-site engagement and where required via post to the PP team. •Comments recorded and responded to, as part of the process.
v. Identification and recording of comments	•Comments and Responses Report, including all comments received throughout the process to be included in the reporting.

i. Stakeholder identification and Register of Interested and Affected Parties

42. A proponent or applicant must ensure the opening and maintenance of a register of I&APs and submit such a register to the competent authority, which register must contain the names, contact details and addresses of –
    (a) All persons who, as a consequence of the PPP conducted in respect of that application, have submitted written comments or attended meetings with the proponent, applicant or EAP;
    (b) All persons who have requested the proponent or applicant, in writing, for their names to be placed on the register; and

I&APs have been identified through a process of networking and referral, obtaining information from Savannah Environmental's existing stakeholder database, specifically for relevant Organs of State, liaison with potentially affected parties and stakeholders in the greater surrounding 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 and a landowner map was developed showing the different land parcels found within the area in order to ensure the landowners are included. Other stakeholders are required to formally register their interest in the project through either directly contacting the Savannah Environmental Public Participation team via phone, text message (SMS and WhatsApp), email or fax, or registering their interest via the online stakeholder engagement platform. An initial list of key stakeholders identified and registered is listed in **Table 5.2**.

Table 5.2: Initial list of Stakeholders identified for the inclusion in the project database during the PPP for San Solar PV facility

Organs of State
National Government Departments
Department of Forestry, Fisheries and the Environment (DFFE)
Department of Mineral Resources and Energy (DMRE)
Department of Agriculture, Land Reform, and Rural Development (DALRRD)
Department of Human Settlements, Water and Sanitation
Department of Communications
Government Bodies and State-Owned Companies
Eskom Holdings SOC Limited
National Energy Regulator of South Africa (NERSA)
Air Traffic Navigation Services (ATNS)
South African Civil Aviation Authority (CAA)
South African Heritage Resources Agency (SAHRA)
South African National Roads Agency Limited (SANRAL)
South African Radio Astronomy Observation (SARAO)
Telkom SA SOC Ltd
Transnet SA SOC Limited
Provincial Government Departments
Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAEARD&LR)
Northern Cape Department of Economic Development and Tourism
Northern Cape Department of Roads and Public Works
Ngwao Boswa Kapa Bokone (NBKB) – provincial Heritage Authority
Local Government Departments
John Taolo Gaetsewe District Municipality
Gamagara Local Municipality – including the Ward Councillor, ward committee members, community representative or local community forum members

Landowners
Affected landowners, tenants and occupiers
Neighbouring landowners, tenants and occupiers
Commenting Stakeholders
BirdLife South Africa
Endangered Wildlife Trust (EWT)
Wildlife and Environment Society of South Africa (WESSA)
Surrounding renewable energy developments
Small, medium and micro enterprises (SMMEs)
Formal local organisations

As per Regulation 42 of the EIA Regulations, 2014 (as amended), 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). In addition to the above-mentioned EIA Regulations, point 4.1 of the Public Participation Guidelines has also been followed. The register of I&APs contains the names[13] of:

- all persons who requested to be registered on the database through the use of the online stakeholder engagement platform or 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 virtual meetings (or in-person consultation where sanitary conditions can be maintained) and viewed the narrated presentations on the Savannah Environmental online platform during the PPP.

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

[13] Contact details and addresses have not been included in the I&AP database as this information is protected by the Protection of Personal Information Act (No 4 of 2013).

ii. Advertisements and Notifications

40.(2)(a)	Fixing a notice board at a place conspicuous to and accessible by the public at the boundary, on the fence or along the corridor of – (i) The site where the activity to which the application or proposed application relates is or is to be undertaken; and (ii) Any alternative site.
40.(2)(b)	Giving written notice, in any of the manners provided for in section 47Dof the Act, to – (i) The occupiers of the site and, if the proponent or applicant is not the owner or person in control of the site on which the activity is to be undertaken, the owner or person in control of the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken; (ii) Owners, persons in control of, and occupiers of land adjacent to the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken; (iii) The municipal councillor of the ward in which the site and alternative site is situated and any organisation of ratepayers that represent the community in the area; (iv) The municipality which has jurisdiction in the area; (v) Any organ of state having jurisdiction in respect of any aspect of the activity; and (vi) Any other party as required by the competent authority.
40.(2)(c)	Placing an advertisement in – (i) One local newspaper; or (ii) Any official Gazette that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations;
40.(2)(d)	Placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or district municipality in which it is or will be undertaken: Provided that this paragraph need not be complied with if an advertisement has been placed in an official Gazette referred to in paragraph (c)(ii); and
40.(2)(e)	Using reasonable alternative methods, as agreed to by the competent authority, in those instances where a person is desirous of but unable to participate in the process due to – (i) Illiteracy; (ii) Disability; or (iii) Any other disadvantage.

The EIA process 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 technical and environmental details on the project and how to become involved in the Scoping & EIA process. This was distributed together with a notification letter via email on **07 March 2022.** The evidence of the distribution is contained in **Appendix C4 and C5** of the EIA Report. The BID is also available electronically on the Savannah Environmental website (http://www.savannahsa.com/public-documents/energy-generation -solar-development/).
  - The BID and the process notification letter announced the EIA process, notifying Organs of State, potentially affected and neighbouring landowners, as well as registered stakeholders/I&APs of the EIA process for the San Solar PV facility,
  - provided background information on the project
  - invited I&APs to register on the project database
  - announced the availability of the Scoping report, the review period, and where it is accessible for review
- Placement of site notices announcing the Scoping and EIA process at visible points along the boundary of the development area (i.e. the boundaries of the affected property), in accordance with the

requirements of the EIA Regulations on **07 March 2022**. Photographs and the GPS co-ordinates of the site notices are contained in **Appendix C2** of the EIA Report.

- Placement of an advertisement in the Kathu Gazette Newspaper on **04 March 2022** announcing the 30-day review and comment period (**Appendix C2**). This advert:
  - announced the project and the associated EIA process,
  - announced the availability of the Scoping & EIA report, the review period, and where it is accessible for review,
  - invited comment on the Scoping Report, and
  - provided all relevant details to access the Savannah Environmental online stakeholder engagement platform.
- The Scoping Report was made available for review by I&APs for a 30-day review and comment period from **Tuesday, 08 March 2022** to **Friday, 08 April 2022**. The full Scoping Report was available on the Savannah Environmental website. The evidence of distribution of the Scoping Report has been included in **Appendix C3**.
- Placement of an advertisement in the Kathu Gazette Newspaper on **24 June 2022** announcing the 30-day review and comment period (**Appendix C2**). This advert:
  - announced the project and the associated EIA process,
  - announced the availability of the Scoping & EIA report, the review period, and where it is accessible for review,
  - invited comment on the EIA Report, and
  - provided all relevant details to access the Savannah Environmental online stakeholder engagement platform.
- A copy of the newspaper adverts as sent to the newspaper is included in **Appendix C2.** The EIA Report was made available for review by I&APs for a 30-day review and comment period from **28 June 2022** to **28 July 2022**. The EIA Report was also made available on the Savannah Environmental website. The evidence of distribution of the EIA Report has been included in **Appendix C6**.
- Focus group meetings were held with key stakeholders on Wednesday, 12 July 2022 at 09h00, 11h00, 13h00, 15h00 and 17h30 via a virtual platform.

iii. Public Involvement and Consultation

In order to accommodate the varying needs of stakeholders and I&APs within the surrounding area, as well as capture their views, comments, issues and concerns regarding the project, various opportunities have been and will continue to be provided to I&APs to note their comments and issues. I&APs are being consulted through the following means:

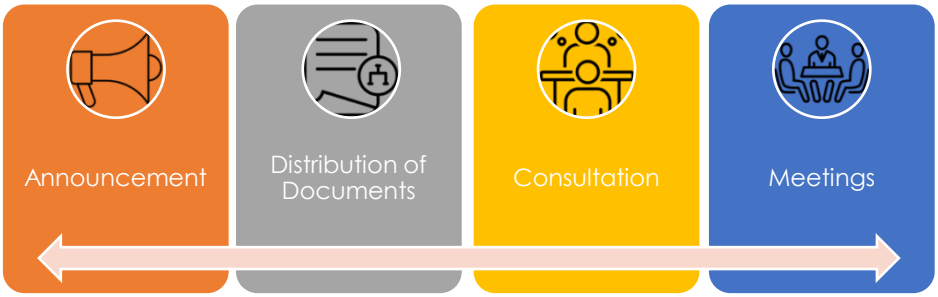


Table 5.3: Summary of public involvement process for San Solar PV – Scoping & EIA phase

Activity	Date
Distribution of the BID, process notification letters and stakeholder reply form announcing the EIA process and inviting I&APs to register on the project database. Letters distributed to landowners, in terms of the EIA regulations, 2014, as amended, regulation 41 (2)(b)(i). The BID and electronic reply form was also made available on Savannah Environmental's website.	07 March 2022
Placement of site notices.	07 March 2022
Advertising of the availability of the Scoping Report for a 30-day review and comment period in Kathu Gazette Newspaper, including details on how to access the Scoping Report via Savannah Environmental's website	04 March 2022
Distribution of notification letters announcing the availability of the Scoping Report for a 30-day review and comment period. These letters were distributed to Organs of State, Government Departments, Ward Councillors, landowners within the surrounding area (including neighbouring landowners) and key stakeholder groups.	08 March 2022
30-day review and comment period of the Scoping Report.	08 March – 11 April 2022
Virtual meetings through the use of virtual platforms as determined through discussions with the relevant stakeholder group: 1. Landowners 2. Authorities and key stakeholders (including Organs of State, local municipality and official representatives of community-based organisations). 3. Interested & Affected Parties (I&APs).	14 March – 25 March 2022
Advertising of the availability of the EIA Report for a 30-day review and comment period in Kathu Gazette Newspaper, including details on how to access the EIA Report via Savannah Environmental's website	24 June 2022
Distribution of notification letters announcing the availability of the EIA Report for a 30-day review and comment period. These letters were distributed to Organs of State, Government Departments, Ward Councillors, landowners within the surrounding area (including neighbouring landowners) and key stakeholder groups.	28 June 2022
Focus group meeting with Key Commenting Authorities, meeting notes will be appended as **Appendix C7 for the FEIAr**.	TBD
30-day review and comment period of the EIA Report.	28 June – 28 July 2022
Virtual meetings through the use of virtual platforms as determined through discussions with the relevant stakeholder group: » Landowners » Authorities and key stakeholders (including Organs of State, local municipality and official representatives of community-based organisations). » Interested & Affected Parties (I&APs)	Focus group meetings were held with key stakeholders on Wednesday, 12 July 2022 at 09h00, 11h00, 13h00, 15h00 and 17h30 via a virtual platform.
Open meeting through the use of virtual platform, this meeting has been included in the advertised in Kathu Gazzete Newspaper.	12 July 2022 at **17:30**.
On-going consultation (i.e. telephone liaison; e-mail communication) with all I&APs.	Throughout the EIA process

The broader project site was considered during the Scoping Study for the 100MW for the San Solar PV facility to identify and delineate any environmental fatal flaws, The preparation and release of the Scoping Report for a 30-day public review period provided stakeholders and I&APs with an opportunity to verify that the comments they had raised during the Scoping process had been captured and adequately considered and provided a further opportunity for additional key comments to be raised for consideration. The Final Scoping Report and Plan of Study for EIA was submitted to DFFE, and acceptance was received on May 2022 (refer to **Appendix B**). Additional information requested by the DFFE in the Acceptance of the Scoping Report and the location of the requested information in this EIA Report is detailed in this EIA Report in **Table 5.4.**

Table 5.4: DFFE requirements and response/ reference to section in the EIA Report

DFFE Requirement for EIA	Response/ Location in this EIA Report
Listed Activities The Department has noted on page 68 of the draft scoping report that, in the description of the portion of the project that relates to activity 18 of Listing Notice 3 you have used the word "may" even though you were requested to refrain from using such a word as reflected in the Departmental comments dated 25 March 2022. Please refrain from using words such as "may" in relation to the applicable listed activities Ensure that only listed activities that are triggered by this development are applied for in the EIAr.	All relevant activities applied for in the application for Environmental Authorisation (EA) and included in this EIA Report are relevant to the San Solar PV and its associated infrastructure as described in the project description (refer to **Section 5.2.1, Table 5.1**).
Additionally, on the Departmental comments dated 25 March 2022, you were requested to confirm the applicability of activity 10, 14 and 18 of Listing Notice 3 to this development as the sub activity cited in these activities refer to a Critical Biodiversity Area while the description of the portion of the project that relates to the sub activity refers to an Ecological Support Area. You are requested confirm in the EIAr whether the development area is within a Critical Biodiversity Area or Ecological Support Area or both and confirm the applicability of the above-mentioned activities as the sub activity cited in the application form and scoping report refers to Critical Biodiversity Areas not Ecological Support Areas.	We have taken guidance in confirming the applicability of activity 10, 14 and 18 from the definitions as provided in the Bioregional plans and Northern Cape Critical Biodiversity Area (CBA) Map published in 2016 and classifies the natural vegetation of the province according to the following conservation value: 1. Protected 2. Critical Biodiversity Area One (Irreplaceable Areas) 3. Critical Biodiversity Area Two (Important Areas) 4. Ecological Support Area 5. Other Natural Area It has been clearly indicated and confirmed that the project area falls within the ESA areas as per the Northern Cape CBA map. As such, all relevant listed activities and sub-activities applied for are considered to be applicable to the San Solar PV development (refer to **Section 5.2.1, Table 5.1**).
It has been noted that the activity numbers and sub-activities in column 2 in the scoping report are not the same with what is in the description of the activities. Therefore, you are advised to ensure applicable listed activities and sub-activities are correctly included in the amended application form and EIAr.	All relevant listed activities and sub-activities applied for are correct and applicable to the San Solar PV development (refer to **Section 5.2.1, Table 5.1**) and an amended application form.
The EIAr must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for.	An assessment of impacts and recommended mitigation measures are included in this EIA Report (refer to **Chapter 7 and Chapter 8**).

DFFE Requirement for EIA	Response/ Location in this EIA Report
Alternatives Please provide a description of each of the preferred alternative type and provide detailed motivation on why it is preferred.	An overview of the various alternatives (i.e., property/location alternatives, design and layout alternatives, activity alternatives, technology alternatives and the 'do-nothing' alternative) considered for the San Solar PV facility is included in Chapter 4 of the EIA Report.
Ensure that you provide details of the BESS alternatives considered and indicate the preferred alternative if any. If no alternatives have been investigated, provide a motivation for not investigating other alternatives in the EIAr.	As technological advances within battery energy storage systems (BESS) are frequent, no specific technology can be determined for use by the proponent at this stage. The proponent will determine the specific technology when designing the detailed final layout for approval by the competent authority.
Specialist studies In terms of GNR 320, you are required to submit a Civil Aviation Compliance Statement for this application as the development area is rated medium sensitivity for the civil aviation theme.	A glint and glare assessment was undertaken for the proposed PV facility. Refer to **Appendix J**.
A desktop Palaeontological Impact Assessment must be undertaken as requested by SAHRA.	A Heritage Impact Assessment including Palaeontology has been undertaken (refer to **Appendix G** of the EIA report.
Other information Ensure that the confirmation of the availability of water for this development from the Gamagara Local Municipality is appended to the final EIAr.	Confirmation of the availability of water for the development will be appended to the final EIAr.
Environmental Management Programme Ensure that the generic EMPrs are used for the management of impacts of the substation and power line that will be constructed for this development.	The EMPr for the substation and the EMPr for the overhead powerline have been compiled using the generic EMPr template.
The EMPr for the facility must comply with the requirements of Appendix 4 in the EIA Regulation, as amended.	The facility EMPr complies with Appendix 4 of the EIA Regulations, 2014, as amended.
(b) Public Participation Please ensure that comments from all relevant stakeholders are submitted to the Department with the EIAr. This includes but not limited to the Department of Forestry, Fisheries and the Environment (DFFE): Biodiversity Planning and Conservation; Department of Water And Sanitation; Department of Mineral Resources & Energy, Northern Cape Department of Agriculture, Environmental Affairs, Rural Development & Land Reform; Ngwao-Boswa Ya Kapa Bokone (NCPHRA); SAHRA; Northern Cape	All comments received to date have been included within the Comments and Responses Report (**Appendix C7**). Where comments have not been obtained, proof that attempts were made to obtain comments have been included in **Appendix C7**. The database detailing registered I&APs is included as **Appendix C1** in the EIA Report.

DFFE Requirement for EIA	Response/ Location in this EIA Report
Department of Forestry, Fisheries and the Environment; Air Traffic and Navigation Services (ATNS); SA Civil Aviation Authority (SA CAA); AgriSA; Agri Northern Cape; Eskom Holdings SOC Ltd; John Taolo Gaetsewe District Municipality; Gamagara Local Municipality; Endangered Wildlife Trust; Birdlife South Africa and adjacent landowners.	
Ensure that all issues raised, and comments received during the circulation of the draft SR and draft EIAr from registered I&APs and organs of state which have jurisdiction in respect of the proposed activity are adequately addressed in the final EIAr. Proof of correspondence with the various stakeholders must be included in the final EIAr. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments.	All comments received during the Scoping phase (included in **Appendix C7** and **Appendix C9**) have been addressed throughout this EIA report. Comments received during the 30-day review and comment period of the draft EIA Report will be captured and addressed in the Comments and Reponses Report (**Appendix C9**) to be submitted with the final EIA Report to the DFFE for decision-making.
A Comments and Response trail report (C&R) must be submitted with the final EIAr. The C&R report must incorporate all comments for this development. The C&R report must be a separate document from the main report. Please refrain from summarising comments made by I&APs. All comments from I&APs must be copied verbatim and responded to clearly. Please note that a response such as "noted" is not regarded as an adequate response to I&AP's comments.	All comments received during the Scoping Phase, and the 30-day review and comment period of the draft EIA Report, including those of the DFFE, will be included within the Comments and Responses Report (to be included as **Appendix C9** to the final EIA Report).
The Public Participation Process must be conducted in terms of Regulations 39, 40, 41, 42, 43 & 44 of the EIA Regulations, 2014, as amended.	The Public Participation Process has been conducted in terms of Regulation 39, 40, 41, 42, 43 & 44 of the EIA Regulations 2014, as amended (GNR 326), as well as in accordance with the approved Public Participation Plan (refer to **Appendix C1**). The details of the steps undertaken for the public participation process for this Application is included in **Chapter 5** During the EIA Phase, I&APs and Organs of State were notified of the availability of the EIA Report for a 30-day review and comment period from **Tuesday, 28 June 2022** until **Thursday, 28 July 2022** as follows: » An advertisement was placed in the Kathu Gazette Newspaper

DFFE Requirement for EIA	Response/ Location in this EIA Report
	» A notification letter was distributed to all registered I&APs on the project database, including the Organs of State Officials on **28 June 2022**. Proof of notification is included in **Appendices C5** and **C6** of the EIA Report. All registered I&APs and Organs of State Officials will receive reminder notifications regarding the nearing of the end of the review and comment period of the EIA Report (proof to be included in **Appendices C6** of the final EIA Report).
(d) Layout and Sensitivity Maps The EIAr must provide the four corner coordinate points for the proposed development site (note that if the site has numerous bend points, at each bend point coordinates must be provided) as well as the start, middle and end point of all linear activities.	The EIA Report includes coordinate points of the proposed development site (centre and corner points) (refer to **Table 1.1., Chapter 1**).
The EIAr must provide the following: » Clear indication of the envisioned area for the proposed solar energy facility i.e., location of solar panels, Battery Energy Storage System (BESS); cabling, site roads, facility substation, switching station, operation and maintenance buildings, grid connection and all associated infrastructure should be mapped at an appropriate scale. » Clear description of all infrastructure. This description must include, but is not limited to the following: o All infrastructure. o All supporting onsite infrastructure.	A facility layout map indicating the infrastructure listed in this comment is included as **Figure 9.1, under Chapter 9, and Appendix O**).
A copy of the final preferred layout map. All available biodiversity information must be used in the finalisation of the layout map. Existing infrastructure must be used as far as possible e.g. roads. The layout map must indicate the following: o All infrastructure o All existing infrastructure on the site; o Location of access and internal roads o Internal roads indicating width;	A facility layout map indicating the infrastructure listed in this comment is included as **Figure 9.1, under Chapter 9, and Appendix O**).

DFFE Requirement for EIA	Response/ Location in this EIA Report
o Wetlands, drainage lines, rivers, stream and water crossing of roads and cables indicating the type of bridging structures that will be used; o The location of sensitive environmental features on site e.g. CBAs, heritage sites, wetlands, drainage lines etc. that will be affected by the facility and its associated infrastructure; o Buffer areas. o Legend that is clear and communicate with the content of the map. o All "no-go" areas.	
An environmental sensitivity map indicating environmental sensitive areas and features identified during the assessment process.	An Environmental Sensitivity Map indicating all environmentally sensitive features is included as **Figure 9.2 under Chapter 9, and Appendix O**).
A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	A map combining the final layout map superimposed (overlain) on the environmental sensitivity map is included as **Figure 9.2.**
Specialist Assessments The EAP must ensure that the terms of reference for all the identified specialist studies must include the following:	
o A detailed description of the study's methodology; indication of the locations and descriptions of the development footprint, and all other associated infrastructures that they have assessed and are recommending for authorisations. o Provide a detailed description of all limitations to the studies. All specialist studies must be conducted in the right season and providing that as a limitation will not be allowed. o Please note that the Department considers a 'no-go' area, as an area where no development of any infrastructure is allowed; therefore, no development of associated infrastructure including access roads is allowed in the 'no-go' areas. o Should the specialist definition of 'no-go' area differ from the Departments definition; this must be clearly indicated. The specialist must also indicate the 'no-go' area's buffer if applicable. o All specialist studies must be final, and provide detailed/practical mitigation measures for the preferred alternative and	The identified specialist studies include a detailed description of the methodology followed as well as an indication of the location and description of the development and all other associated infrastructure. Furthermore, the specialist studies provide a detailed description of the limitations to the studies. The specialist's definition of 'no-go' area is the same as that of the Department and various 'no-go' areas, including their associated buffer areas, have been recommended by the specialists and have been by the developer when designing the facility layout.

DFFE Requirement for EIA	Response/ Location in this EIA Report
recommendations, and must not recommend further studies to be completed post EA. o Should a specialist recommend specific mitigation measures, these must be clearly indicated.	The attached specialist studies include an assessment of the identified potential impacts, as well as practical mitigation measures, and where relevant, enhancement measures. The mitigation and enhancement measures proposed by the specialists are included in Chapters 7 and 8 of the EIA Report, as well as the project EMPr which is attached as Appendix K & M to the EIA Report.
Regarding cumulative impacts: o Clearly defined cumulative impacts and where possible the size of the identified impact must be quantified and indicated, i.e. hectares of cumulatively transformed land. o A detailed process flow to indicate how the specialist's recommendations, mitigation measures and conclusions from the various similar developments in the area were taken into consideration in the assessment of cumulative impacts and when the conclusion and mitigation measures were drafted for this project. o Identified cumulative impacts associated with the proposed development must be rated with the significance rating methodology used in the process. o The significance rating must also inform the need and desirability of the proposed development. o A cumulative impact environmental statement on whether the proposed development must proceed.	Renewable energy facilities within a 30km radius of the proposed development have been identified as detailed in **Chapter 8** of the EIA Report. An evaluation of potential cumulative impacts is included in **Chapter 8** of the EIA Report. A cumulative map showing the location of the San Solar PV facility in relation to other proposed facilities within a 30km radius of the development area as included as **Figure 8.1 under Chapter 8, and Appendix O**).
Should the appointed specialists specify contradicting recommendations, the EAP must clearly indicate the most reasonable recommendation and substantiate this with defendable reasons; and were necessary, include further expert advice.	There are no contradicting recommendations from the specialists regarding significance rating or sensitivities.
Additionally ensure that specialist studies, comply with GN320 and GN1150 notice of 20 March 2020 and 30 October 2020, respectively.	Specialist studies have been undertaken in accordance with the required protocols (**refer to Section 5.6**).

DFFE Requirement for EIA	Response/ Location in this EIA Report
The following Specialist Assessments will form part of the EIAr: **Specialist Study** / **Company** Ecology — Simon Todd (3Foxes Biodiversity Solutions) Avifauna — Lukas Niemand (Pachnoda Consulting) Soils, Land Use, Land Capability and Agricultural Potential — Marine Pienaar (TerraAfrica) Visual impact — Lourens du Plessis (LOGIS) Social — Nondumiso Bulunga (Savannah Environmental) And Tony Barbour Heritage Impact Assessment — Not specified A Glint and Glare assessment — Not specified.	All specified specialist assessments have been undertaken and used to inform the EIAr. No additional studies have been included.
General The applicant is hereby reminded to comply with the requirements of Regulation 45 of GN R982 of 04 December 2014, as amended, with regard to the time period allowed for complying with the requirements of the Regulations.	The submission of the EIA report complies with the prescribed timeframes of the EIA Regulations.
You are hereby reminded of Section 24F of the National Environmental Management Act, Act No. 107 of 1998, as amended, that no activity may commence prior to an environmental authorisation being granted by the Department.	The Applicant acknowledges that no activity may commence prior to receipt of the Environmental Authorisation.

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

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

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

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

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

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

Reasonable alternative methods of recording comments must be provided for.

I&APs registered on the database have been notified by means of a notification letter of the release of the EIA Report for a 30-day review and comment period, invited to provide comment on the EIA Report, and informed of the manner in which, and timeframe within which such comment must be made. The report has been made available in soft copies.

The EIA Report has also been made available on the Savannah Environmental website (i.e. online stakeholder engagement platform) (https://www.savannahsa.com/public-documents/). The notification was distributed prior to commencement of the 30-day review and comment period, on **28 June 2022**. Where I&APs are not able to provide written comments (including SMS and WhatsApp), other means of consultation, such as telephonic discussions are used to provide the I&APs with a platform to verbally raise their concerns and comments on the proposed development.

All comments raised as part of the discussions and written comments submitted during the 30-day review and comment period will be recorded and included in **Appendix C** of the FDEIR.

v. Identification and Recording of Comments

Comments raised by I&APs to date have been collated into a Comments and Responses (C&R) Report which is included in **Appendix C9** of the EIA Report. The C&R Report includes detailed responses from members of the EIA project team and/or the project proponent to the issues and comments raised. The C&R Report will consist of written comments received.

Meeting notes of all virtual meetings and discussions undertaken during the 30-day review and comment period will be included in **Appendix C8** of the final EIA Report.

The C&R Report will be updated with all comments received during the 30-day review and comment period and will be included as **Appendix C9** in the final EIA Report that will be submitted to the DFFE for decision-making.

5.5 Evaluation of Issues Identified through the Scoping & EIA Process

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

The requirement for the submission of a Screening Report (included as **Appendix N** of the EIA Report) for the San Solar PV facility is applicable as it triggers Regulation 19 of the EIA Regulations, 2014 (as amended). **Table 5.5** provides a summary of the specialist assessments identified in terms of the screening tool and responses to each assessment from the project team considering the project site under consideration.

Table 5.5: Sensitivity ratings from the DFFE web-based online Screening Tool associated with the development of the San Solar PV facility

Specialist Assessment	Sensitivity Rating as per the Screening Tool (relating to the need for the study)	Project Team Response
Agricultural Impact Assessment	Medium	The Soils and Agricultural Impact assessment is included in this EIA Report as **Appendix F**.
Landscape/Visual Impact Assessment	The screening report does not indicate a rating for this theme.	A Visual Impact Assessment has been undertaken for the proposed project and is included in this EIA Report as **Appendix H**.
Archaeological and Cultural Heritage Impact Assessment	Very High	A Heritage Impact Assessment which covers archaeological aspects of the project site has been undertaken for the proposed project and is included in this Report as **Appendix G**.
Palaeontology Impact Assessment	High	A Heritage Impact Assessment (which covers palaeontological aspects of the project site) is included in this EIA Report as **Appendix G.**
Terrestrial Biodiversity Impact Assessment	Very high	An Ecological Impact Assessment (including flora and fauna) has been undertaken for the PV facility and is included as **Appendix D** of the EIA Report.
Aquatic Biodiversity Impact Assessment	Very high	An Ecological scoping study which considered freshwater features and aquatic biodiversity was undertaken in the Scoping Phase for the project. The findings indicated that there are no natural permanent water or artificial earth dams within the project site. There are ephemeral pans in the north of the project site. However, as these were identified at Scoping, the development area/footprint was able to completely avoid the ephemeral pans to avoid any impact on these features, and as such ***no further assessment of impacts to the freshwater ecology was recommended or considered necessary (refer to Appendix R)***.
Avian Impact Assessment	High	An Avifauna Impact Assessment (including seasonal monitoring as per the BirdLife SA Best Practice Guidelines) has been undertaken for the PV facility and included as **Appendix E** of the EIA Report.
Civil Aviation Assessment	Medium	The Civil Aviation Authority has been consulted throughout the Scoping phase and will also be consulted during the EIA phase process to obtain input due to the proximity of the Sishen airport.

Defence Assessment	Low	A defence or military base is not located within close proximity to the PV facility.
RFI Assessment	Low	The project site under consideration for is located within an area that as classified as having low sensitivity for telecommunication. The South African Radio Astronomy Observatory (SARAO) have been consulted to provide written comment on the proposed development.
Geotechnical Assessment	The screening report does not indicate a rating for this theme.	Prior to initiating construction, a geotechnical survey will be conducted to acquire information regarding the physical characteristics of soil and rocks underlying a proposed project site and informs the design of earthworks and foundations for structures.
Socio-Economic Assessment	The screening report does not indicate a rating for this theme.	A Social Impact Assessment has been undertaken for the PV facility and is included as **Appendix I** of the EIA Report.
Plant Species Assessment	Low	An Ecological Impact Assessment (including flora and fauna) has been undertaken for the PV facility and is included as **Appendix D** of the EIA Report. Species specific assessments were not required.
Animal Species Assessment	Medium	

Issues (both direct and indirect environmental impacts) associated with the San Solar PV facility identified within the scoping & EIA process have been evaluated through specialist studies by specialist consultants. These specialists include:

Specialist	Area of Expertise	Refer Appendix
Simon Todd - 3Foxes Biodiversity Solutions	Terrestrial Ecology	Appendix D
Lukas Niemand – Pachnoda Consulting	Avifauna	Appendix E
Marine Pienaar – TerraAfrica	Soils and Agricultural Potential	Appendix F
Jenna Lavin – CTS Heritage	Heritage (including archaeology, cultural landscape and palaeontology)	Appendix G
Lourens du Plessis - LOGIS	Visual	Appendix H
Nondumiso Bulunga – Savannah Environmental and Dr. Neville Bews - Dr. Neville Bews & Associates	Social	Appendix I

In order to evaluate issues and assign an order of priority, the following methodology was used to identify the characteristics of each potential issue/impact for each of the proposed project components:

- Identify the **nature** of the potential impact, which includes a description of what causes the effect, what will be affected and how it will be affected.
- Identify the **extent** of the potential impact, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development) or regional.
- Identify **sensitive receptors** that may be impacted on by the San Solar PV and the **types of impacts** that are most likely to occur.
- Evaluate the **significance** of potential impacts in terms of the requirements of the EIA Regulations including nature, significance, consequence, extent, duration and probability of the impacts, the degree to which these impacts a) can be reversed; (b) may cause irreplaceable loss of resources; and (c) can be avoided, managed or mitigated.

» Identify the potential impacts that will be **considered further** in the EIA Phase through detailed investigations.

5.6 Assumptions and Limitations of the EIA Process

The following assumptions and limitations are applicable to the EIA process of San Solar PV:

» 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 area for the solar PV facility identified by the developer represents a technically suitable site for the establishment of San Solar PV which is based on the design undertaken by technical consultants for the project.
» The development footprint (the area that will be affected during the operation phase) will include the footprint for the PV facility and associated infrastructure (i.e. internal access roads, BESS and grid connection infrastructure).
» The EIA Phase evaluation of impacts has been largely based on site surveys. This information has been used to inform this EIA report for San Solar PV.

5. 7 Legislation and Guidelines that have informed the preparation of this EIA Report

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

» National Environmental Management Act (Act No. 107 of 1998);
» EIA Regulations of December 2014, published under Chapter 5 of NEMA (as amended);
» Department of Environmental Affairs (2017), Public Participation guidelines in terms of NEMA EIA Regulations;
» Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for environmental authorisation; and
» International guidelines – the Equator Principles, the IFC Performance Standards, the Sustainable Development Goals, World Bank Environmental and Social Framework, and the and World Bank Group Environmental, Health, and Safety Guidelines (EHS Guidelines).

Several other Acts, standards or guidelines have also informed the project process and the scope of issues addressed and assessed in this EIA Report. A review of legislative requirements applicable to the proposed project is provided in **Table 5.6**.

Table 5.6 Relevant legislative permitting requirements applicable to San Solar PV

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Legislation			
Constitution of the Republic of South Africa (No. 108 of 1996)	In terms of Section 24, the State has an obligation to give effect to the environmental right. The environmental right states that: "*Everyone has the right –* » *To an environment that is not harmful to their health or well-being, and* » *To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:* * *Prevent pollution and ecological degradation,* * *Promote conservation, and* * *Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*."	Applicable to all authorities	There are no permitting requirements associated with this Act. The application of the Environmental Right however implies that environmental impacts associated with proposed developments are considered separately and cumulatively. It is also important to note that the "right to an environment clause" includes the notion that justifiable economic and social development should be promoted, through the use of natural resources and ecologically sustainable development.
National Environmental Management Act (No 107 of 1998) (NEMA)	The 2014 EIA Regulations have been promulgated in terms of Chapter 5 of NEMA. Listed activities which may not commence without EA are identified within the Listing Notices (GNR 327, GNR 325 and GNR 324) which form part of these Regulations (GNR 326). In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation.	DFFE – Competent Authority Northern Cape DAEARD&LR – Commenting Authority	The listed activities triggered by the proposed project have been identified and are being assessed as part of the EIA process currently underway for the project. The EIA process will culminate in the submission of a FSR and a Plan of Study for EIA to DFFE for approval. Considering the capacity of the proposed San Solar PV facility project (i.e. contracted capacity of 100MW) and the triggering of Activity 1 of Listing Notice 2 (GNR 325) a full Scoping and EIA process is required in support of the Application for EA.
National Environmental Management Act (No 107 of 1998) (NEMA)	In terms of the "Duty of Care and Remediation of Environmental Damage" provision in Section 28(1) of NEMA every person who causes, has caused or may cause	DFFE	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section finds application through the

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment. In terms of NEMA, it is the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	Northern Cape DAEARD&LR – Commenting Authority	consideration of potential cumulative, direct, and indirect impacts. It will continue to apply throughout the life cycle of the project.
Environment Conservation Act (No. 73 of 1989) (ECA)	The Noise Control Regulations in terms of Section 25 of the ECA contain regulations applicable for the control of noise in the Provinces of Limpopo, Northern Cape, Mpumalanga, Northern Cape, Eastern Cape, and KwaZulu-Natal Provinces. The Noise Control Regulations cover the powers of a local authority, general prohibitions, prohibitions of disturbing noise, prohibitions of noise nuisance, use of measuring instruments, exemptions, attachments, and penalties. In terms of the Noise Control Regulations, no person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof (Regulation 04).	DFFE Northern Cape DAEARD&LR – Commenting Authority Gamagara Local Municipality	Noise impacts are expected to be associated with the construction phase of the project. Considering the location of the development area in relation to residential areas and provided that appropriate mitigation measures are implemented, construction noise is unlikely to present a significant intrusion to the local community. There is therefore no requirement for a noise permit in terms of the legislation.
National Water Act (No. 36 of 1998) (NWA)	A water use listed under Section 21 of the NWA must be licensed with the Regional DWS, unless it is listed in Schedule 1 of the NWA (i.e. is an existing lawful use), is permissible under a GA, or if a responsible authority waives the need for a licence. Water use is defined broadly, and includes consumptive and non-consumptive water uses, taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact	Regional Department of Water and Sanitation	There is no natural permanent water or any artificial earth dams within the project site. There are three ephemeral pans located in the northern section of the site. The development footprint completely avoids the ephemeral pans. No water uses are triggered by the project.

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

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	standard set out in Regulation 03 must, upon receipt of a notice from the air quality officer, implement a dustfall monitoring programme. Any person who has exceeded the dustfall standard set out in Regulation 03 must, within three months after submission of the dustfall monitoring report, develop and submit a dust management plan to the air quality officer for approval.		
National Heritage Resources Act (No. 25 of 1999) (NHRA)	Section 07 of the NHRA stipulates assessment criteria and categories of heritage resources according to their significance. Section 35 of the NHRA provides for the protection of all archaeological and palaeontological sites, and meteorites. Section 36 of the NHRA provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority. Section 38 of the NHRA lists activities which require developers or any person who intends to undertake a listed activity to notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of the proposed development. Section 44 of the NHRA requires the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction.	South African Heritage Resources Agency (SAHRA) Ngwao Boswa Kapa Bokone (NBKB) – provincial heritage authority	Based on the findings of the heritage Impact Assessment report and the palaeontological impact assessment (refer to **Appendix G**), it is unlikely that the proposed development will impact significant archaeological or palaeontological heritage. However, it is possible that the excavations associated with the development may impact significant archaeological heritage located below the ground surface and as such, it has been recommended by the specialist that: » Should any sink holes or ESA archaeological artefacts be uncovered during the course of excavation activities, work must cease in that area and SAHRA must be contacted regarding a way forward » The Chance Fossil Finds Procedure be implemented for the duration of excavation activities.
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)	Section 53 of NEM:BA provides for the MEC / Minister to identify any process or activity in such a listed ecosystem as a threatening process.	DFFE Northern Cape DAEARD&LR	Under NEM:BA, a permit would be required for any activity that is of a nature that may negatively impact on the survival of a listed protected species.

Legislation	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).		Two NFA-protected tree species occur at the site, *Boscia albitrunca* and *Vachelia erioloba*. No red-listed plant species were observed at the site and the density of protected tree species was low with only *Vachelia erioloba* and *Boscia albitrunca* being present at low density. Refer to the Ecological Impact Assessment (**Appendix D**).
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)	Chapter 5 of NEM:BA pertains to alien and invasive species, and states that a person may not carry out a restricted activity involving a specimen of an alien species without a permit issued in terms of Chapter 7 of NEM:BA, and that a permit may only be issued after a prescribed assessment of risks and potential impacts on biodiversity is carried out. Applicable, and exempted alien and invasive species are contained within the Alien and Invasive Species List (GNR 864).	DFFE Northern Cape DAEARD&LR	An Ecological Impact Assessment has been undertaken for the PV facility and is included as **Appendix D** of the EIA Report.
Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA)	Section 05 of CARA provides for the prohibition of the spreading of weeds.	Department of Agriculture, Rural Development, and Land Reform (DARDLR)	CARA will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies need to be developed and implemented. In

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	Regulation 15 of GN R1048 published under CARA provides for the classification of categories of weeds and invader plants, and restrictions in terms of where these species may occur. Regulation 15E of GN R1048 published under CARA provides requirement and methods to implement control measures for different categories of alien and invasive plant species.		addition, a weed control and management plan must be implemented. In terms of Regulation 15E (GN R1048) where Category 1, 2 or 3 plants occur a land user is required to control such plants by means of one or more of the following methods: » Uprooting, felling, cutting or burning. » Treatment with a weed killer that is registered for use in connection with such plants in accordance with the directions for the use of such a weed killer. » Biological control carried out in accordance with the stipulations of the Agricultural Pests Act (No. 36 of 1983), the ECA and any other applicable legislation. » Any other method of treatment recognised by the executive officer that has as its object the control of plants concerned, subject to the provisions of sub-regulation 4. » A combination of one or more of the methods prescribed, save that biological control reserves and areas where biological control agents are effective shall not be disturbed by other control methods to the extent that the agents are destroyed or become ineffective.
National Forests Act (No. 84 of 1998) (NFA)	According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. Notice of the List of Protected Tree Species under the National Forests Act (No. 84 of 1998) was published in GNR 734.	Department of Forestry, Fisheries and the Environment - DFFE	An Ecological Impact Assessment has been undertaken as part of the EIA Phase to identify the presence of any protected trees present on site which will require a permit.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	The prohibitions provide that "no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister".		Two NFA-protected tree species occur at the site, *Boscia albitrunca* and *Vachelia erioloba*. No red-listed plant species were observed at the site and the density of protected tree species was low with only *Vachelia erioloba* and *Boscia albitrunca* being present at low density. Refer to the Ecological Impact Assessment (**Appendix D**). A licence is required for the removal of protected trees. It is therefore necessary to conduct a walk-through survey that will determine the number and relevant details pertaining to protected tree species present in the development footprint for the submission of relevant permits to authorities prior to the disturbance of these individuals. This survey will be undertaken prior to construction commencing only.
National Veld and Forest Fire Act (No. 101 of 1998) (NVFFA)	Chapter 4 of the NVFFA places a duty on owners to prepare and maintain firebreaks, the procedure in this regard, and the role of adjoining owners and the fire protection association. Provision is also made for the making of firebreaks on the international boundary of the Republic of South Africa. The applicant must ensure that firebreaks are wide and long enough to have a reasonable chance of preventing a veldfire from spreading to or from neighbouring land, it does not cause soil erosion, and it is reasonably free of inflammable material capable of carrying a veldfire across it. Chapter 5 of the Act places a duty on all owners to acquire equipment and have available personnel to fight fires. Every	DFFE	While no permitting or licensing requirements arise from this legislation, this Act will be applicable during the construction and operation of San Solar PV, in terms of the preparation and maintenance of firebreaks, and the need to provide appropriate equipment and trained personnel for firefighting purposes.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	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.		
Hazardous Substances Act (No. 15 of 1973) (HAS)	This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger, to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared as Group I or Group II substance » Group IV: any electronic product, and » 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.	Department of Health (DoH)	It is necessary to identify and list all Group I, II, III, and IV hazardous substances that may be on site and in what operational context they are used, stored or handled. If applicable, a license would be required to be obtained from the DoH.
National Environmental Management: Waste Act (No. 59 of 2008) (NEM:WA)	The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. The Minister may amend the list by –	DFFE – Hazardous Waste Northern Cape DAEARD&LR – General Waste	No waste listed activities are triggered by San Solar PV, therefore, no Waste Management License is required to be obtained. General and hazardous waste handling, storage and disposal will be required during construction

Legislation	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 NEM:WA (GNR 912), a BA or EIA is required to be undertaken for identified listed activities. 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.		and operation. The National Norms and Standards for the Storage of Waste (GNR 926) published under Section 7(1)(c) of NEM:WA will need to be considered in this regard.
National Road Traffic Act (No. 93 of 1996) (NRTA)	The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts.	South African National Roads Agency (SANRAL) – national roads Northern Cape Department of Transport, Safety and Liaison	An abnormal load / vehicle permit may be required to transport the various components to site for construction. These include route clearances and permits required for vehicles carrying abnormally heavy or abnormally dimensioned loads and transport vehicles exceeding the dimensional limitations (length) of 22m. Depending on the trailer configuration and height when loaded, some of the on-site substation and BESS components may not meet specified dimensional

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	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.		limitations (height and width) which will require a permit.
Provincial Policies / Legislation			
Northern Cape Nature Conservation Act (Act No. 9 of 2009)	This Act provides for the sustainable utilisation of wild animals, aquatic biota and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations, the following may apply to the current project: » Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property; » Aquatic habitats may not be destroyed or damaged; » The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species; The Act provides lists of protected species for the Province.	Northern Cape DAEARD&LR	A collection/destruction permit must be obtained from Northern Cape DAEARD&LR for the removal of any Provincially protected species found on site. Should these species be confirmed within the development footprint during any phase of the project, permits will be required. Two NFA-protected tree species occur at the site, *Boscia albitrunca* and *Vachelia erioloba*. No red-listed plant species were observed at the site and the density of protected tree species was low with only *Vachelia erioloba* and *Boscia albitrunca* being present at low density. Refer to the Ecological Impact Assessment (**Appendix D**).

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 5.7** 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 5.7: 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

Type of technology*	Size**	Avifaunal Sensitivity***		
		Low	Medium	High
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.

Bird distribution patterns fluctuate widely in response to environmental conditions (e.g., local rainfall patterns, nomadism, migration patterns, seasonality), meaning that a composition noted at a particular moment in time will differ during another time period at the same locality. For this reason, a dry season and wet season bird monitoring survey was conducted in line with Regime 2 for the San Solar PV. The dry season survey was conducted in February 2022 and the wet season survey was conducted in May 2022, and the findings were used to inform the avifauna EIA report completed for the Scoping & EIA phase.

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. consulting 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 the project 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 San Solar PV facility 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 EIA process is being conducted.

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

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

Requirement	Relevant Section
(g)(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.	The environmental attributes associated with the development of San Solar PV is included within this chapter. The environmental attributes that are assessed within this chapter includes the following:
	» The regional setting of the broader development area and indicates the geographical aspects associated with San Solar PV. This is included in **Section 6.2**.
	» The climatic conditions for the Kathu area have been included in **Section 6.3**.
	» The biophysical characteristics of the development area and the surrounding areas are included in **Section 6.4**. The characteristics considered are topography and terrain, geology, soils and agricultural potential and the ecological profile which includes the vegetation patterns, listed plant species, critical biodiversity areas and broad-scale processes, , terrestrial fauna and avifauna.
	» The heritage and cultural aspects (including archaeology and palaeontology) have been included in **Section 6.5**.
	» The social and socio-economic characteristics associated with the development area (~400ha) have been included in **Section 6.6.**

A more detailed description of each aspect of the affected environment will be included in the specialist reports to be included in the EIA report.

6.2. Regional Setting

The San Solar PV facility development area is located approximately 16km Northern Cape of the Kathu in the Northern Cape Province. The Northern Cape Province is in the north-western extent of South Africa and constitutes South Africa's largest province, occupying an area of 372 889km² in extent, equivalent to nearly a third (30.5%) of the country's total land mass. The development area falls within the Gamagara Local Municipality within the John Taolo Gaetsewe District Municipality.

The closest towns to the proposed development include Kathu, located approximately 16km south east. Other towns in proximity of the development area include Dibeng located west of the project site. Built infrastructure in the form of farm homesteads and workers quarters occur within and around the project site.

The region is sparsely populated (less than 5 people per km^2), with the highest concentrations occurring in the towns of Kathu and Dibeng, and at the Sishen Mine. A number of isolated homesteads occur throughout the project site. This includes but not limited to the Bosaar, Flatlands, Halliford, Selsden, Haakbosskerm homestead and restaurant, Limebank, Klein Landbank, Curtis and Dundrum. The Stokkiesdraai guesthouse is located adjacent south west of the proposed San Solar PV facility site.

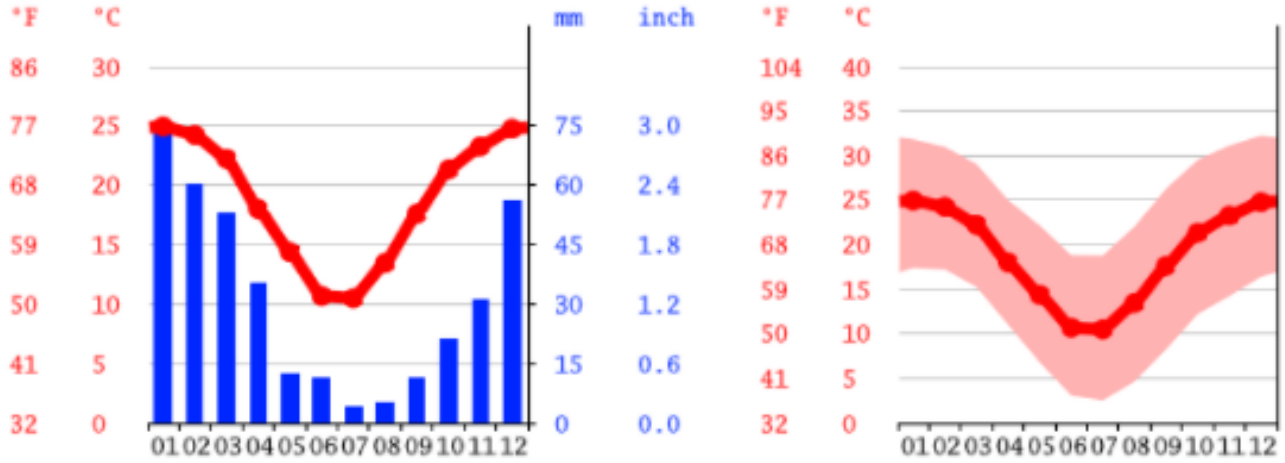
Road systems within the area include the N14 located approximately 3km south of the project site, the R380 located south east of the project site. Access to the development area is obtained via the R380 provincial route which branches off the N14 located south of the development area.

In spite of the predominantly rural and natural character of the project site, there are a large number of overhead power lines in the project site, associated mainly with the Ferrum Substation located at the mine. These include:

- Ferrum-Wincanton 1 132kV
- Ferrum-Fox 1 132kV
- Adams-Ferrum 1 132kV
- Fox-Umtu 1 132kV
- Impala-Mamatwane 1 132kV

6.3. Climatic Conditions

The Kathu area is typically characterised as having a local steppe climate (BSh) with little rainfall. Precipitation is highest in January with an average of 75mm and lowest in July with an average of 4mm. January is the hottest month of the year with an average temperature of 10.5 °C, while July is the coldest month of the year with an average temperature of 10.5°C (refer to **Figure 6.1**). Frost is frequent to very frequent during winter, with up to 37 mean frost days per year. Droughts and floods are a regular occurrence at both provincial and local scales and play a significant role in almost every aspect of the social, economic, and ecological environment within the province.



	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	25 °C (76.9) °F	24.2 °C (75.6) °F	22.2 °C (72) °F	18 °C (64.4) °F	14.4 °C (57.9) °F	10.7 °C (51.2) °F	10.5 °C (50.9) °F	13.5 °C (56.2) °F	17.6 °C (63.7) °F	21.3 °C (70.4) °F	23.3 °C (73.9) °F	24.8 °C (76.6) °F
Min. Temperature °C (°F)	17.4 °C (63.3) °F	17.2 °C (63) °F	15.3 °C (59.5) °F	11 °C (51.8) °F	6.8 °C (44.2) °F	3.1 °C (37.5) °F	2.5 °C (36.5) °F	4.6 °C (40.3) °F	8.2 °C (46.8) °F	12.2 °C (54) °F	14.2 °C (57.6) °F	16.4 °C (61.5) °F
Max. Temperature °C (°F)	31.8 °C (89.3) °F	31 °C (87.8) °F	29.1 °C (84.3) °F	25 °C (77) °F	22.2 °C (71.9) °F	18.8 °C (65.9) °F	18.8 °C (65.8) °F	22 °C (71.7) °F	26.3 °C (79.3) °F	29.5 °C (85.1) °F	31.1 °C (88) °F	32.2 °C (90) °F
Precipitation / Rainfall mm (in)	75 (3)	60 (2.4)	53 (2.1)	35 (1.4)	12 (0.5)	11 (0.4)	4 (0.2)	5 (0.2)	11 (0.4)	21 (0.8)	31 (1.2)	56 (2.2)

Figure 6.1: Climate and Temperature graphs for Kathu, Northern Cape Province (Source: en.climate-data.org).

The suitability of the site for the development of a solar facility is dependent on the prevailing climatic condition of the area. The viability of the solar farm is directly affected by the amount of solar irradiation received in the area. The Northern Cape Province has the Global Horizon Irradiation (GHI) of approximately 2240 kWh/m^2/annum, which relates to the higher end of the spectrum (refer to **Figure 6.2**).

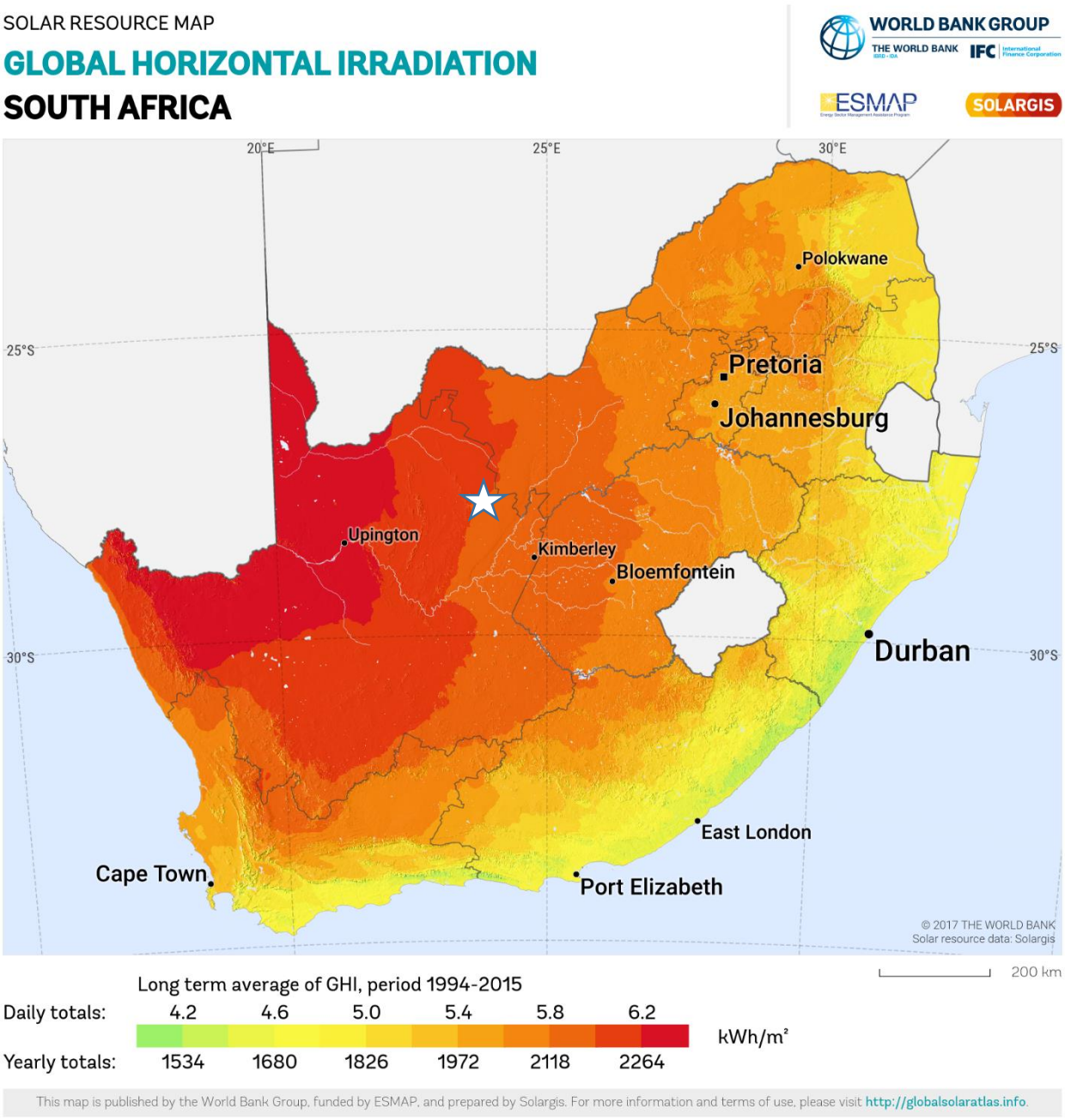


Figure 6.2: GHI map for South Africa (Source: World Bank Group Solar Map). The location of San Solar PV is shown by the white star on the map

6.4. Biophysical Characteristics of the Development area

The following section provides an overview of the biophysical characteristics of the development area.

6.4.1. Topographical profile

The topography of the development area is described as plains and elevations range from 1105m in the north-west to 1195m. The entire development area has a very even (flat) slope from the south-east to the north-west. The site itself is located at an average elevation of 1143m above sea level.

6.4.2. Geology, Soils and Agricultural Potential

i. Geological profile

The site lies on the northern margin of the Transvaal Basin on the Kaapvaal Craton. The Quaternary Kalahari sands form an extensive cover of much younger deposits over much of the Northern Cape Province and Botswana. Haddon and McCarthy (2005) proposed that the Kalahari basin formed as a response to down-warp of the interior of the southern Africa, probably in the Late Cretaceous period. This, along with possible uplift along epeirogenic axes, back-tilted rivers into the newly formed Kalahari basin and deposition of the Kalahari Group sediments began. Sediments included basal gravels in river channels, sand and finer sediments. A period of relative tectonic stability during the mid-Miocene saw the silcretisation and calcretisation of older Kalahari Group lithologies, and this was followed in the Late Miocene by relatively minor uplift of the eastern side of southern Africa and along certain epeirogenic axes in the interior. More uplift during the Pliocene caused erosion of the sand that was then reworked and redeposited by aeolian processes during drier periods, resulting in the extensive dune fields that are preserved today.

The loose sands and sand dunes are of the Gordonia Formation, Kalahari Group of Neogene Age. The Gordonia Formation is the youngest of six formations and is the most extensive, stretching from the northern Karoo, Botswana, Namibia to the Congo River (Partridge et al., 2006). It is considered to be the biggest palaeo-erg in the world. The sands have been derived from local sources with some additional material into the basin (Partridge et al., 2006). Much of the Gordonia Formation comprises linear dunes that were reworked a number of times before being stabilised by vegetation transported.

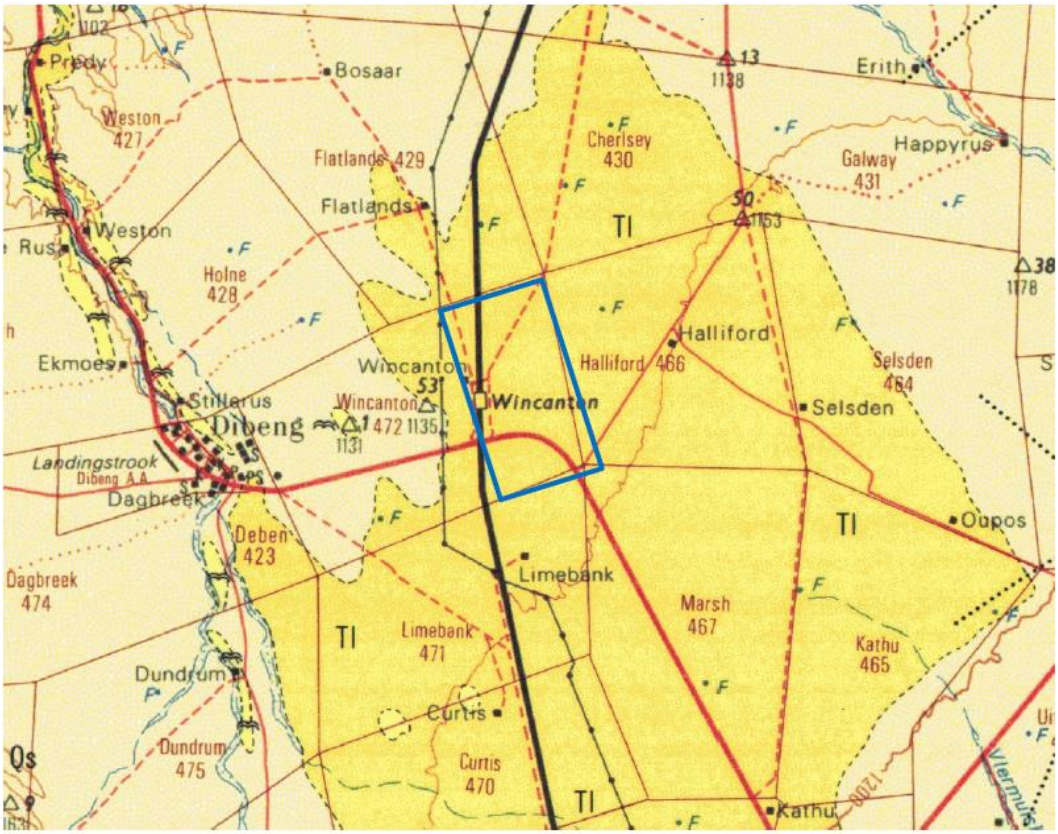


Figure 6.3: Geological map of the area around the Farm Wincanton 472 and the San Solar Facility site as indicated within the blue rectangle (source: Map enlarged from the Geological Survey 1: 250 000 map 2722 Kuruman)

ii. Soils, Land use, carrying capacity and agricultural capability

The entire development area as well as the area bordering on it, falls within Land Type Ag110 (refer to **Figure 6.4 and Figure 6.5**). *Land Type Ag110 consists of only two terrain units, i.e. Terrain units 4 and 5, both with slope ranging between 0 and 2%. This land type represents shallow, rocky soil profiles of the Mispah and Hutton forms that range in depth between 0.02m and 0.3m. Approximately 20% of the toe-slopes and 5% of the valley bottoms consist of deeper Hutton soils that range in depth between 0.45 and 0.90m. Depth limiting materials consist of rock and hardpan carbonate horizons.*

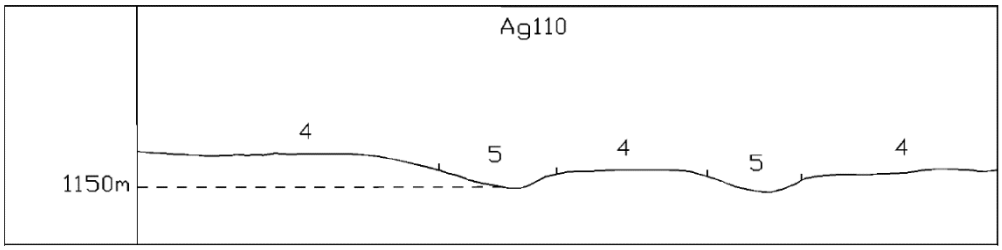


***Figure 6.4**: Terrain form sketch of Land* Type Ag110

Approximately 90% of the area covered by Land Type Ag110 consists of toe-slope (Terrain unit 4) while valley bottoms (Terrain unit 5) make up the remaining 10%. The valley bottoms may consist of approximately 3% stream beds.

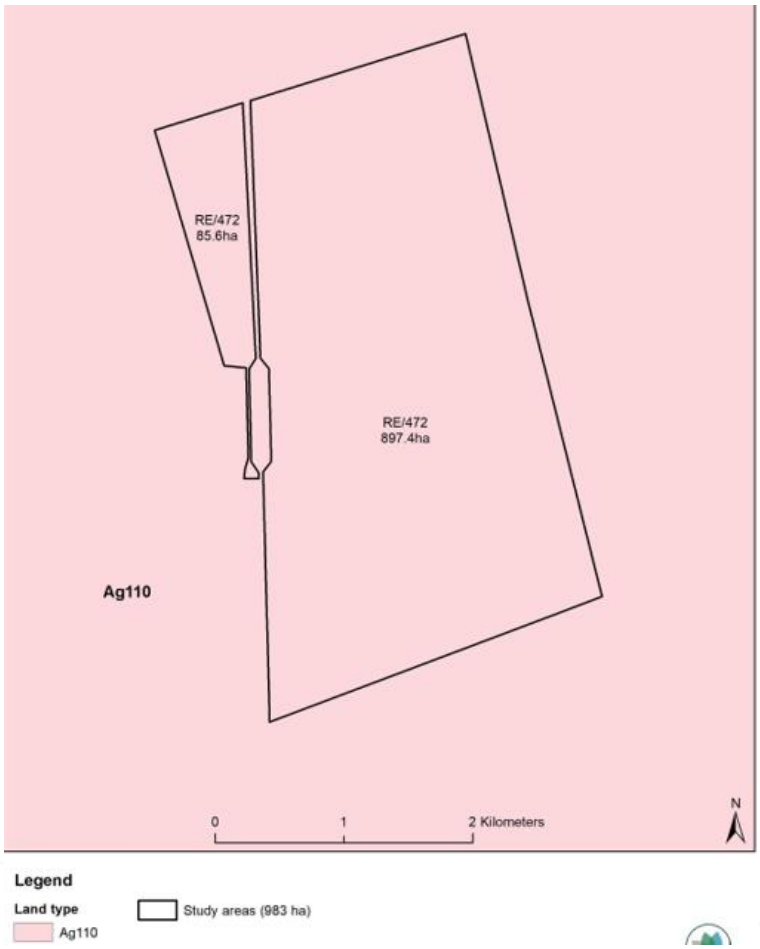


Figure 6.5: Land type classification of the San Solar PV facility project site and development area

The soil profiles classified within the project site consist of the Glenrosa, Coega and Technosol forms as described below and illustrated in **Figure 6.6**.

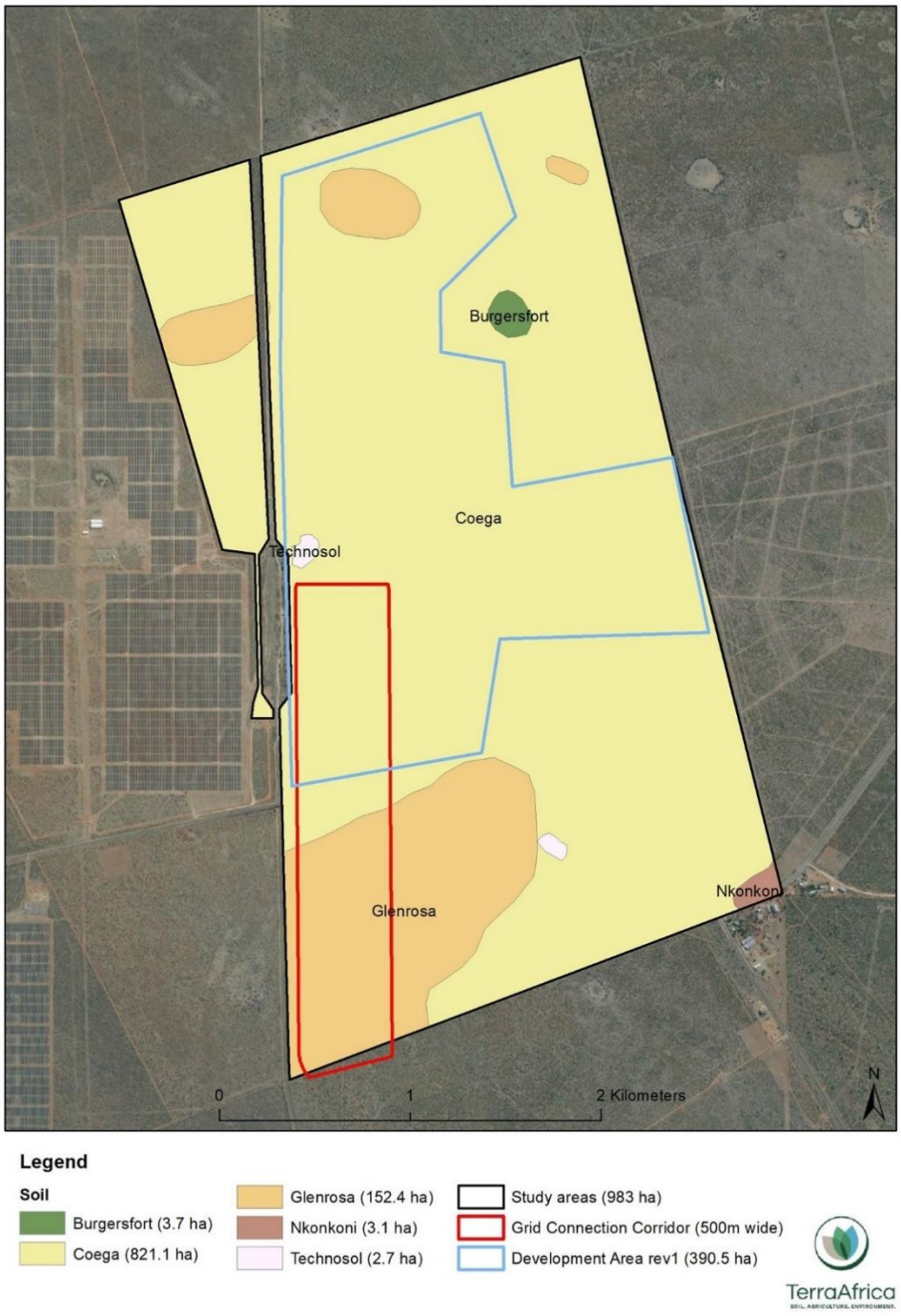


Figure 6.6: Soil classification map of the San Solar PV development area and grid connection corridor

Coega soils

The Coega soil form is the dominant soil form within the study area and covers about 821.1ha of the area. Within the PV facility development area, the Coega form is about 90% of the total development area. Within the grid connection corridor, it is about 50% of the area considered. The Coega soils consist of orthic topsoil between 0.05 and 0.35 m deep that covers a hard carbonate horizon (refer to **Figure 6.7**). The hard

carbonate horizon limits the effective depth of the soils and therefore plant root depth and the water-storage capacity of these soils. The Coega soils are not considered suitable for rainfed crop production.

Figure 6.7: Coega soils within the study area where hard carbonate chunks can be seen on the surface

Glenrosa soils

Glenrosa is the second most prevalent soil form within the study area, with a total area of 152.4ha consisting of Glenrosa soils. It comprises approximately 50% of the grid connection corridor and about 4% of the PV facility's development area. The Glenrosa soils range in depth between 0.05 and 0.30m and consist of orthic topsoil horizons that are either bleached or chromic (light red in colour) with lithic material underneath (refer to **Figure 6.8**). The lithic horizon of the Glenrosa soils within the San Solar PV development area belongs to the geolithic family and consists of soil material as illuvial infillings between partly weathered and fractured rock (Soil Classification Working Group, 2018).

Figure 6.8: Glenrosa soil profile within the grid connection corridor

Technosols

Technosols can be defined as materials from mining, industrial and construction activities that resulted from mechanical working, water diversion, pollution and/or the addition of harmful solids or liquids (contaminants). It also includes areas where previous soil excavation has resulted in open quarries where no backfill has taken place.

Within the San Solar PV Facility development area, one small area of Technosols have been identified directly east of the middle section of the western boundary. This area is characterised by previous topsoil removal and small excavation pits within the larger area (refer to **Figure 6.9**). It is uncertain what the purpose of the excavation was, and the area was not rehabilitated afterwards.

Figure 6.9: Area with Technosols within the PV facility development area

Land use and carrying capacity

The San Solar PV development area consists mainly of land Low (Class 05) land capability with small areas of Low-Moderate (Class 06) land capability present over the entire area. Two very small areas of land with Low-Very low (Class 04) land capability are present west of the western boundary of the development area. Both the land capability classes within the development area, are indicative that the area is suitable for livestock grazing and is considered not suitable for arable agriculture under rainfed conditions.

There are no field crop boundaries within the development area. The nearest crop field boundaries are approximately 15km away to the northwest of the development area and, consist of fields with rainfed annual crops or planted pastures. Other crop fields with either rainfed crops or planted pastures are located 20km south-east and 25km north-east of the development area. Following this data, there is no risk that rainfed or irrigated crop production will be affected by the proposed development.

As per the metadata layer obtained from DALRRD, the grazing capacity of the entire development area, is 13 ha/LSU (large stock unit). This is considered as low-moderate grazing capacity that requires herd and pasture management to avoid land degradation.

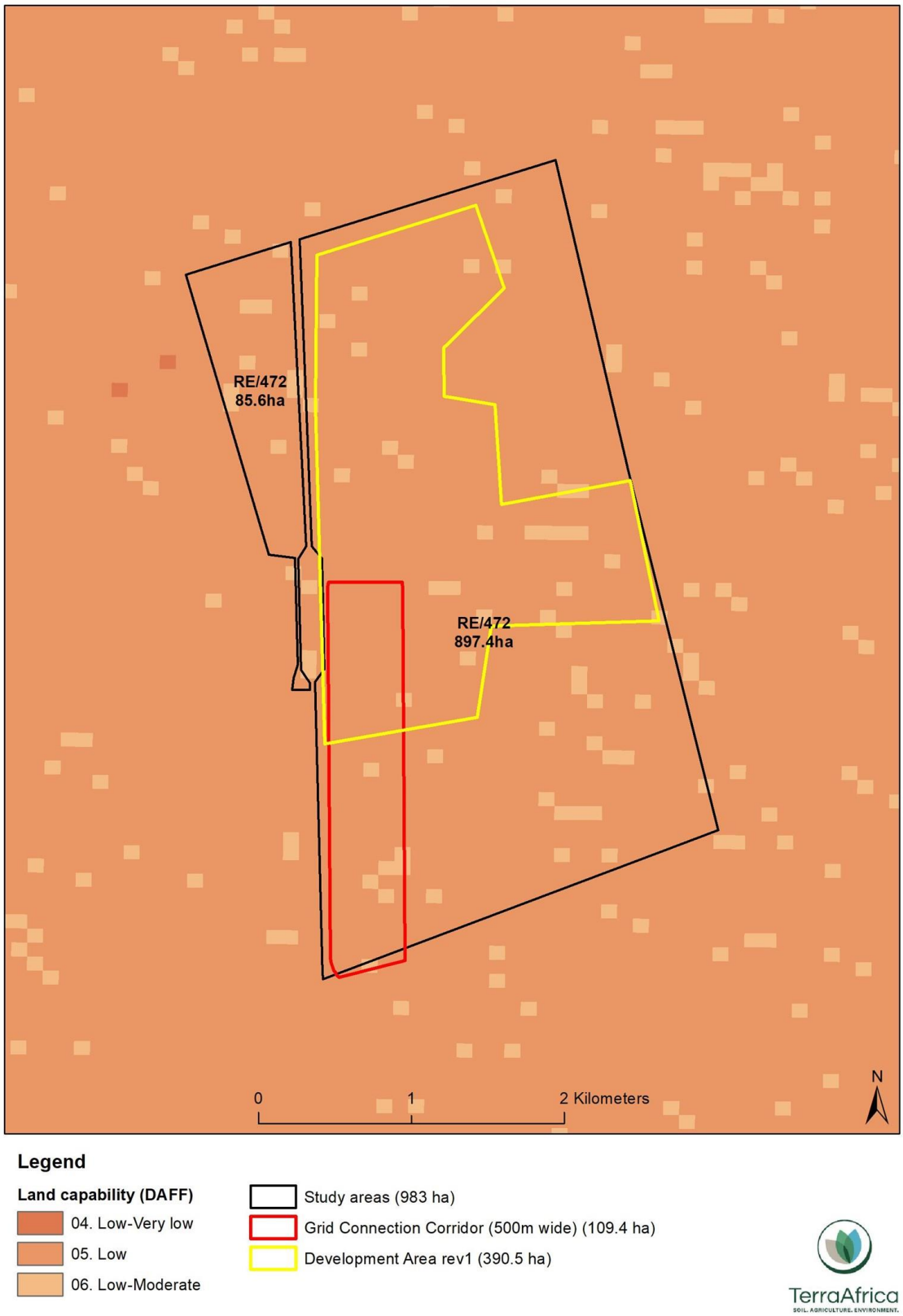


Figure 6.10: Land capability classification of the San Solar PV development area and grid connection corridor (data source: DALRRD, 2016)

Agricultural potential

The largest part of the total study area assessed has Low agricultural potential, except the small area of Nkonkoni soils (3.1ha) that has Low-Moderate agricultural potential. Within the delineated San Solar PV Facility development area (390.5ha), the entire area has Low agricultural potential. Similarly, the entire grid connection corridor (109.4ha) has Low agricultural potential. Low agricultural potential has been assigned to soils of the Coega and Glenrosa forms as a result of the shallow soil depth that limits root growth and water storage capacity within these profiles. Similarly, the area of Technosols, that are largely void of topsoil, has no suitability for rainfed crop production. Therefore, both the PV facility development area and grid connection corridor, are considered better suited to extensive livestock production, which is also the current land use on site.

The ideal grazing capacity is an indication of the long-term production potential of the vegetation layer growing in an area. More specifically, it relates to its ability to maintain an animal with an average weight of 450 kg (defined as 1 Large Stock Unit (LSU)), with an average feed intake of 10 kg dry mass per day over the period of approximately a year. This definition includes the condition that this feed consumption should also prevent the degradation of the soil and the vegetation. The grazing capacity is therefore expressed in number of hectares per LSU (ha/LSU) (DALRRD, 2018).

Following the metadata layer obtained from DALRRD, the long-term grazing capacity of the entire project area is 13 ha/LSU. This is considered as low-moderate grazing capacity that requires herd and pasture management to avoid land degradation. Using the long-term grazing capacity of 13ha/LSU, the PV development area of 390.5ha can provide forage to 30 head of cattle. The grid connection corridor of 109.4ha can provide forage to 8 head of cattle. However, it is anticipated that only the PV facility will be fenced off during the construction phase and livestock grazing around the grid connection corridor will still be possible.

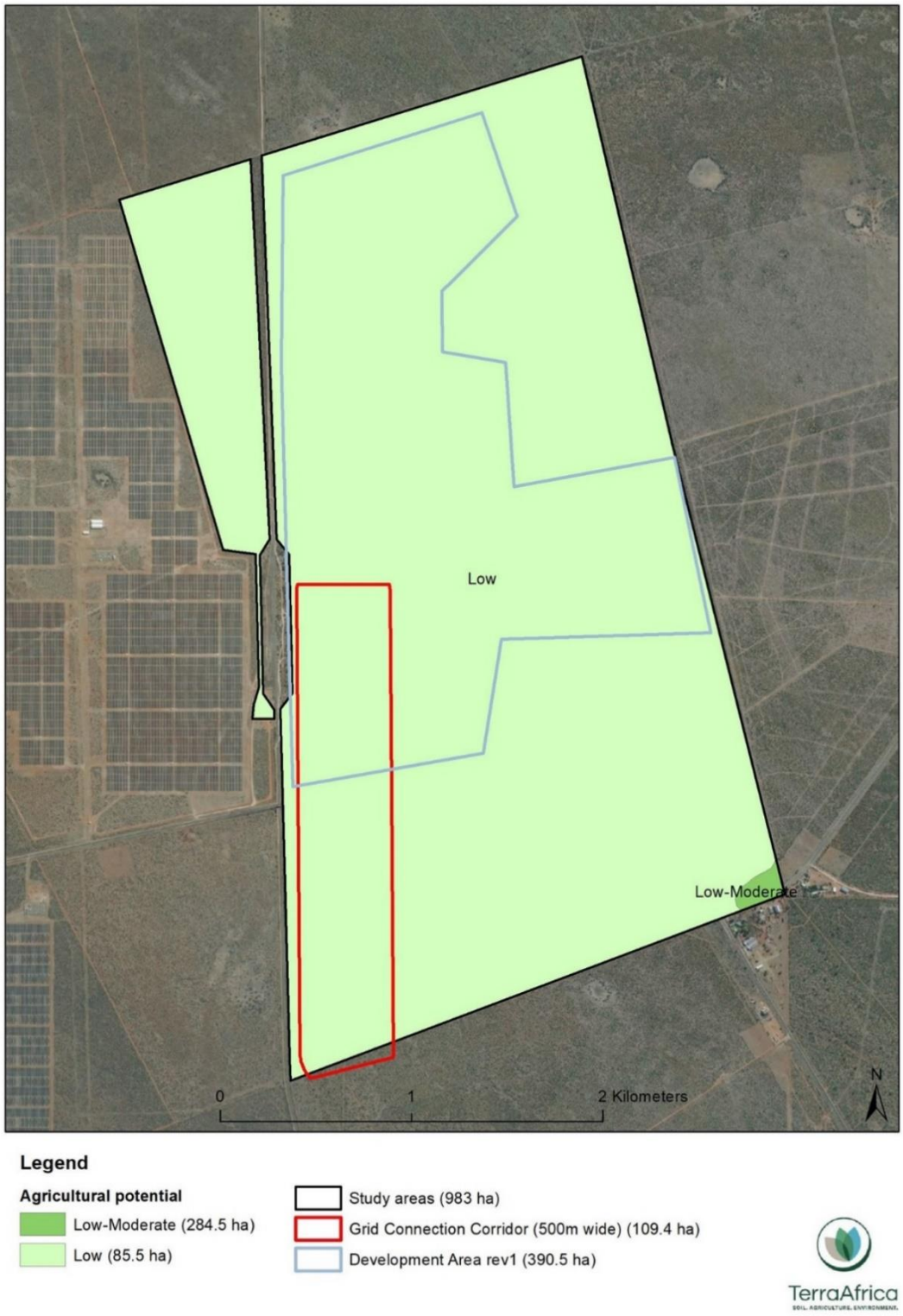


Figure 6.11: Agricultural potential of the San Solar PV development area and grid connection corridor

6.4.3. Ecological profile of the development area

i. Broad-Scale Vegetation Patterns

According to the national vegetation map (Mucina & Rutherford 2006), the development area is restricted to the Kathu Bushveld vegetation type (refer to **Figure 6.12**). This vegetation unit occupies an area of 7 443km^2 and extends from around Kathu and Dibeng in the south through Hotazel and to the Botswana border between Van Zylsrus and McCarthysrus. In terms of soils the vegetation type is associated with aeolian red sand and surface calcrete and deep sandy soils of the Hutton and Clovelly soil forms. The main land types are Ah and Ae with some Ag. The Kathu Bushveld vegetation type is still considered largely intact and less than 2% has been transformed by mining activity and other development, and it is classified as Least Threatened. However, there has been a recent increase in mining as well as solar development within this vegetation type with the result that it has experienced significant recent habitat loss as well as become increasingly fragmented. It is also poorly conserved and does not currently fall within any formal conservation areas apart from the recently declared Kumba Iron Ore offset areas west of Kathu. Although no endemic species are restricted to this vegetation type, a number of Kalahari endemics are known to occur in this vegetation type such as *Vachellia luederitzii var luederitzii, Anthephora argentea, Megaloprotachne albescens, Panicum kalaharense* and *Neuradopsis bechuanensis*. Other vegetation types that occur in the wider area include Kuruman Thornveld to the east and Kuruman Mountain Bushveld to the south and east, neither of which is of conservation concern or occurs within the development area.

Based on the results of a previous assessment for the site (Strobach, 2012), dominant tree species present *Vachelia erioloba, Senegalia mellifera, Boscia albitrunca, Diospyros lycioides, Grewia flava, Tarchonanthus camphoratus and Zizyphus mucronata*. Shrubs presents include *Asparagus retrofractus, Asparagus suaveolens, San Solar rigida, Chrysocoma cilliata, Pentzia calcarea, Penzia incana and Melhania virescens*. Common and dominant grasses include *Aristida adscensionis, Aristida congesta, Cenchrus ciliaris, Enneapogon cenchroides, Enneapogon desvauxii, Eragrostis nindensis, Schmidtia pappophoroides* and *Stipagrostis uniplumis.*

According to the DFFE Screening Tool, the site is considered low sensitivity for the plant species theme. Based on the information available for the site, this is agreeing with the previous assessments that found no species of conservation concern at the site, only the protected tree species, which are not rare species and occur widely.

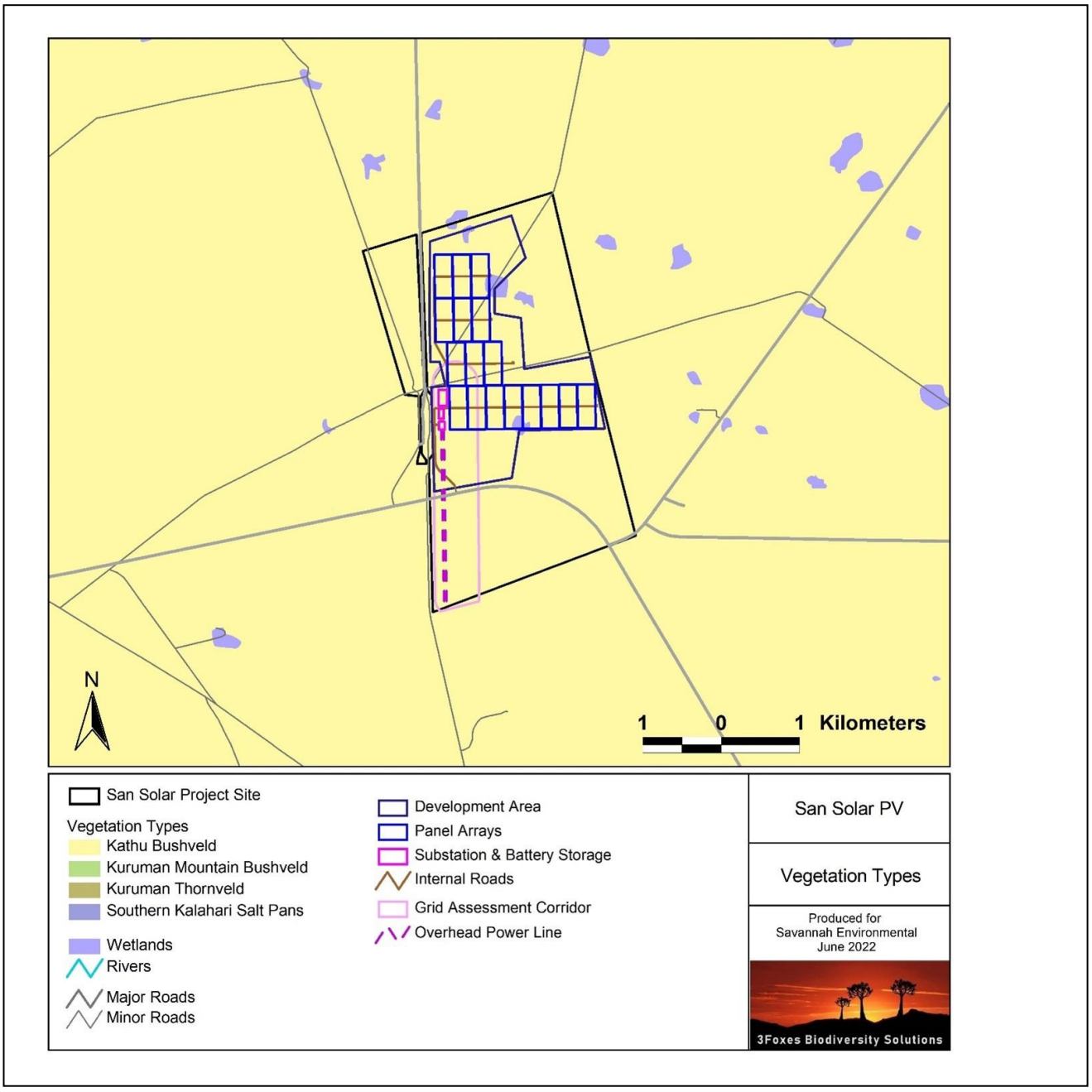


Figure 6.12: Broad-scale overview of the vegetation in and around the San Solar PV site. The site is restricted to the Kathu Bushveld vegetation type with several pans

ii. Listed and protected plant species

Two NFA-protected tree species occur at the site, *Boscia albitrunca and Vachelia erioloba*. Based on the results of the field assessment and the previous walk-through study that was conducted on the site, it is estimated that less than 100 *Vachelia erioloba* trees would be lost to the development, while up to 150 Boscia albitrunca trees would be lost. The Boscia albitrunca present at the site are mostly shrubby and flat versions, with few actual upright trees present. The *Vachelia erioloba* present are moderately tall with larger individuals present in the southwest of the site, outside of the development footprint

iii. Faunal communities

a) Amphibians

The development area lies within or near the range of 10 amphibian species, indicating that the development area potentially has a moderately diverse frog community for an arid area. There is no natural permanent water or artificial earth dams within the development area that would represent suitable breeding habitat for most of these species. The pans which are present at the site would occasionally contain sufficient water for breeding purposes for those species which do not require permanent water. Given the paucity of permanent water at the site, only those species which are relatively independent of water are likely to occur in the area. Species previously observed in the vicinity of the site include Eastern Olive Toad *Amietophrynus garmani* and Bushveld Rain Frog *Breviceps adspersus*, both of which are likely to occur at the development area.

b) Reptiles

The development area lies in or near the distribution range of more than 50 reptile species, although many of these are unlikely to occur at the development area as it is restricted largely to sandy substrate and does not include rocky habitat or other habitats that are important for reptiles. No species of conservation concern are known to occur in the area. The habitat diversity within the development area is relatively low with the result that the number of reptile species present within the development area is likely to be relatively low and only a proportion of the species known from the area are likely to be present on the development area itself.

Species observed on the site of in the immediate area in the past include Serrated Tent Tortoise *Psammobates oculifer*, Cape Cobra *Naja nivea*, Ground Agama *Agama aculeata*, Spotted Sand Lizard *Pedioplanis lineoocellata*, Variable Skink *Trachylepis varia*, Bibron's Blind Snake *Afrotyphlops bibronii*, Western Rock Skink Mabuya sulcata sulcata, Kalahari Tree Skink *Trachylepis spilogaster*, Cape Gecko *Lygodactylus capensis*, Speckled Rock Skink *Trachylepis punctatissima*, *Striped Skaapsteker Psammophylax tritaeniatus* and Boomslang Dispholidus *typus typus*. Impacts on reptiles are likely to be restricted largely to habitat loss within the development footprint. This is likely to be of local significance only as there are no very rare species or specialised habitats present within the footprint area.

c) Mammals

The mammals community at the development area is likely to be of moderate diversity, although more than 50 species 50 species of terrestrial mammals are known from the wider area, the extent and habitat diversity of the development area is too low to support a very wide range of mammals. Species observed or otherwise confirmed present in the area include Aardvark, Cape Porcupine, Springhare, South African Ground Squirrel, Scrub hare, Vervet Monkey, Small-spotted Genet, Yellow Mongoose, Slender Mongoose, Black-Backed Jackal, Steenbok, Duiker and Kudu. Small mammals trapped in the area include Desert Pygmy Mouse *Mus indutus*, Multimammate Mouse *Mastomys coucha*, Bushveld Gerbil *Tatera leucogaster*, Hairy footed Gerbil *Gerbillurus paeba*, Pouched Mouse *Saccostomus campestris* and Grey Climbing Mouse *Dendromus melanotis*.

Five listed terrestrial mammal species potentially occur in the area; these are the Brown Hyaena *Hyaena brunnea* (Near Threatened), Black-footed Cat *Felis nigripes* (Vulnerable), Leopard *Panthera pardus* (VU), Ground Pangolin *Smutsia temminckii* (Vulnerable) and South African Hedgehog *Atelerix frontalis* (Vulnerable). The Leopard and Brown Hyaena are not likely to occur in the area on account of the

agricultural land-use in the area which is not usually conducive to the persistence of large carnivores. The Black-footed Cat is a secretive species which would be likely to occur in the wider area and possibly at the development area given that it occurs within arid, open country. The Hedgehog and Ground Pangolin may also occur in the area at typically low density. Given the extensive national ranges of these species, the impact of the proposed development on habitat loss for these species would be minimal and a long-term impact on these species would be unlikely.

iv. Critical Biodiversity Areas and Broad Scale Processes

The project area is a mix of ESA and "Other natural areas", with no CBAs in close proximity to the site. As per the Northern Cape CBA map, the ESAs are based on the presence of the following features: Kathu Bushveld, Conservation Areas, Wetlands and Landscape Structural Elements. It is not clear what the Conservation Areas being referred to are, as the only formal conservation area in the vicinity is the Kathu Forest Nature Reserve which is some distance from the site. Also, it is not clear why parts of the site are ESA and other parts are not classified, as there is no real difference between these areas in the field. Some of the Other Natural areas have been cleared/transformed in the past. This classification appears to be based on satellite imagery, which is being used to delineate different habitats, with areas of shallow soils falling within the ESAs and deeper sandy soils falling within the other natural areas. In terms of habitat sensitivity, this is difficult to understand as the deeper sands are generally considered to be more sensitive than the shallow soils due to the high density of the protected tree species *Vachelia erioloba* and *Vachelia haematoxylon* that usually characterise these deeper soils. The ESA areas may, therefore, be suggested to be reconsidered based on the field work for this project.

The only protected tree species that tends to be more common on the shallow soils than the deeper sandy soils is *Boscia albitrunca*. In terms of broad-scale ecological processes, there are two large drainage systems in the area, the Ga-Mogara River west of the site and the Vlermuisleegte River east of the site, that would represent broad-scale ecological corridors running through the area. The development would not have an impact on either of these two systems. There would also in principle be some movement of fauna through the site, but as there are no particular features present which would make the site more desirable than adjacent areas, the site is considered typical for the area and is not considered to be of above average significance for faunal movement or other ecological processes. The location of the proposed facility immediately adjacent to an existing PV facility and nearby another is seen as a positive aspect of the current development as concentrating development to within a node may increase local impacts but reduces habitat loss and fragmentation of habitat overall and is seen as being preferred to more dispersed development, especially when the affected habitat is considered relatively low sensitivity.

The ESAs present at the site are reflected as high sensitivity under the Terrestrial Biodiversity Theme of the DFFE Screening Tool. As these are anthropogenic features not closely related to actual features on the ground, it is difficult to verify these features, but based on the available information, there is little ecological basis to support the ESAs at the site as compared to those areas within the site that are not classified as ESA.

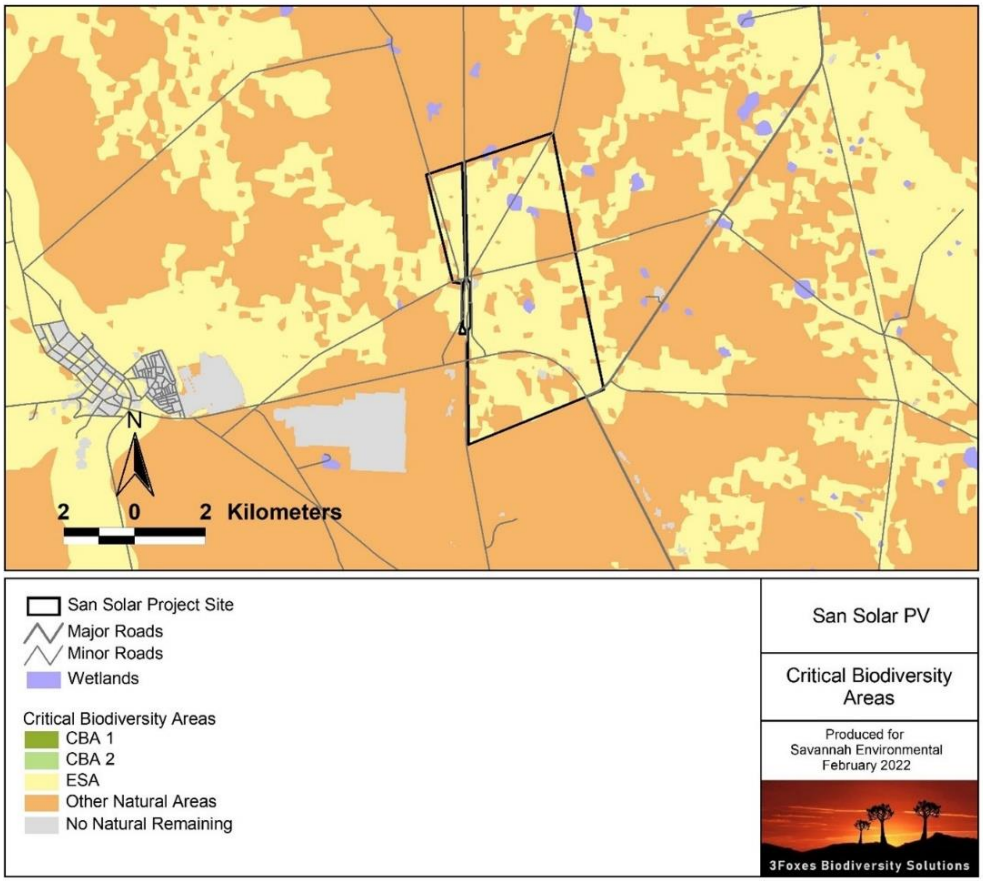


Figure 6.13: Extract of the Northern Cape Critical Biodiversity Areas map for the development area

6.4.4. Avifauna profile for the area

There are no formal protected areas or any Important Bird and Biodiversity Areas in close proximity to the development area. Apart from the regional vegetation type, the local composition and distribution of the vegetation associations on the development area are a consequence of a combination of factors simulated by soil texture, geology and historical disturbance regimes which have culminated in a number of habitat types (refer to **Figure 6.14 & Figure 6.15**).

» Kathu Bushveld

This unit is prominent on the study site and covers a significant extent in surface area of the development area. It is represented by two discrete floristic variations which also provide habitat for two discrete avifaunal associations. The first floristic variation consists of open short shrubland dominated by open short *Senegalia mellifera - Tarchonanthus camphoratus* shrubland with a fairly well developed graminoid layer. It is expected to provide habitat for small passerine granivores and leaf-gleaning insectivores, most notably that of Scaly-feathered Weaver (*Sporopipes squamifrons*), Black-chested Prinia (*Prinia flavicans*) and Chestnut-vented Warbler (*Curruca subcoerulea*). Birds of prey are expected to be rare and mainly occurs overhead during hunting bouts. Large-terrestrial species are expected to occur at low densities and will consist of the Red-crested Korhaan (*Lophotis ruficrista*) and Northern Black Korhaan (*Afrotis afraoides*). The average bird density on this habitat type is expected to approximate 10.51 birds/ha with a richness of approximately 20 - 25 species.

The second variation is compositionally similar to the aforementioned habitat types, but it also includes a tree layer consisting of scattered *Vachellia erioloba* trees. The increase in vertical heterogeneity is expected to be positively correlated with species richness. Expected typical species will include Tinkling Cisticola (*Cisticola rufilatus*), Spotted Flycatcher (*Muscicapa striata*) and Southern Masked Weavers (*Ploceus velatus*) which are normally uncommon from the adjacent shrubland. The *V. erioloba* trees also provide perching and potential nesting sites for small to medium-sized birds of prey. The expected average bird density on this variation approximates 12.53 birds/ha and the expected richness is 30 - 40 species.

» Kathu Bushveld on deep red sands

This unit is prominent on the eastern part of the development area. It is represented by dense *Senegalia mellifera - Tarchonanthus camphoratus* shrubland on deep red sands. The floristic variation is compositionally similar to the aforementioned habitat type, although the shrub layer is marginally taller and denser. The expected bird density is higher, although richness remained constant when compared to the open Kathu Bushveld. The expected average bird density on this habitat type approximates 13.69 birds/ha and the expected richness is 20 - 30 species.

» Ephemeral pans

These are represented by a number of small basins which tend to hold surface water for a short duration after precipitation events. Surface water is a scarce commodity in arid environments and expected to attract many bird species, both passerines and non-passerines. Therefore, when inundated, the pans may provide ephemeral foraging habitat for a number of nomadic waterbirds and shorebirds which under normal environmental conditions, are absent from the development area (e.g. South African Shelduck *Tadorna cana* and Hadeda Ibis *Bostrychia hagedash*). In most instances the pans are expected to be bordered by dense woody vegetation dominated by *Ziziphus mucronata* and *Vachellia karroo*, thereby providing refuge and perching opportunities for a variety of bird species. The expected average bird density on this habitat type approximates 8.67 birds/ha and the expected richness is 25-35 species.

» Open Kathu Bushveld

These are represented by areas that were historically cleared or were intensively grazed or may represent open bushveld on deep sand (the status of this unit will be evaluated during the detailed surveys). The open woody cover provides foraging opportunities for a variety of large terrestrial bird species, many being threatened of near threatened such as the Secretarybird (*Sagittarius serpentarius*) and Kori Bustard (*Ardeotis kori*).

» Artificial livestock watering points

These are represented by artificial water troughs and reservoirs with the purpose to provide drinking water to livestock. However, they act as focal congregation areas for many granivore passerine species. This habitat feature often sustains high bird richness and also provides foraging habitat for bird of prey.

» Transformed areas (including quarries)

These areas are represented by roads, old homesteads and quarries. These often provide habitat for generalist/unspecialised bird species. However, the exposed rocky habitat and vertical banks left by past quarrying activities often attract rupicolous (rock-loving) bird species to the area that were invariably absent

or rare in the area, such as Short-toed Rock Thrush (*Monticola brevipes*). The latter species is a winter visitor to the region.

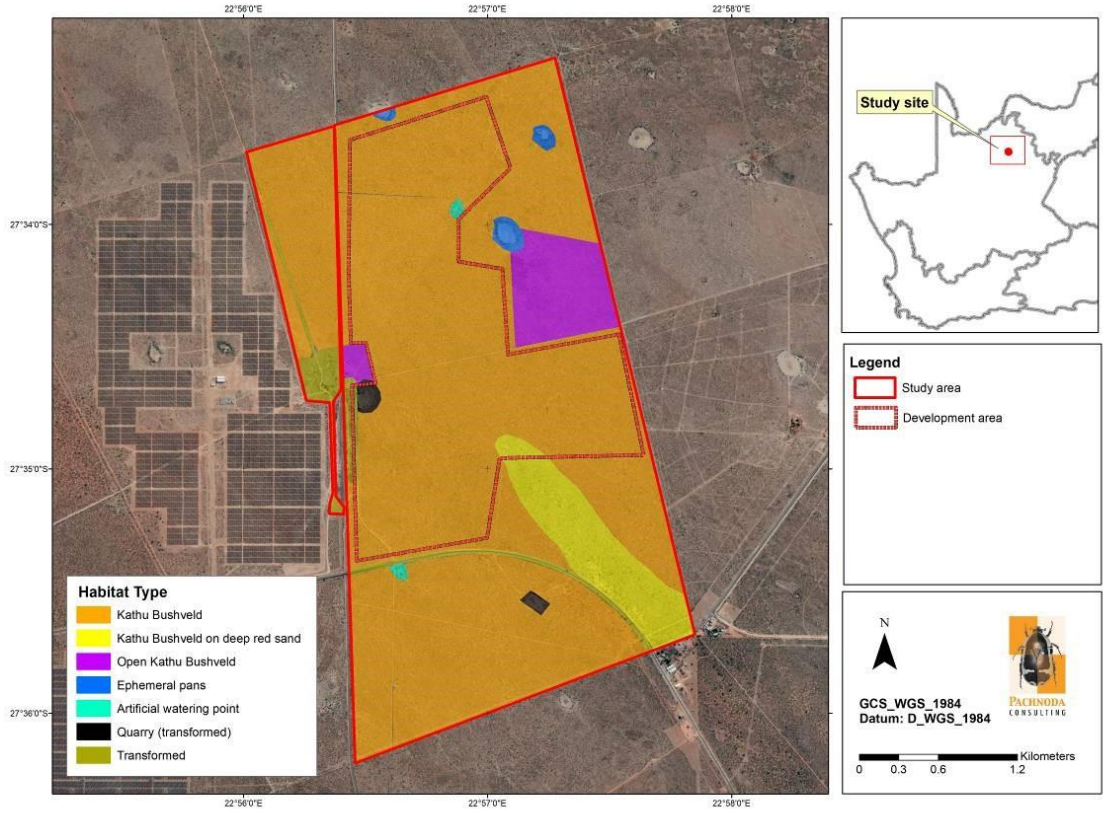


Figure 6.14: Habitat map illustrating the avifaunal habitat types in the study area and development area

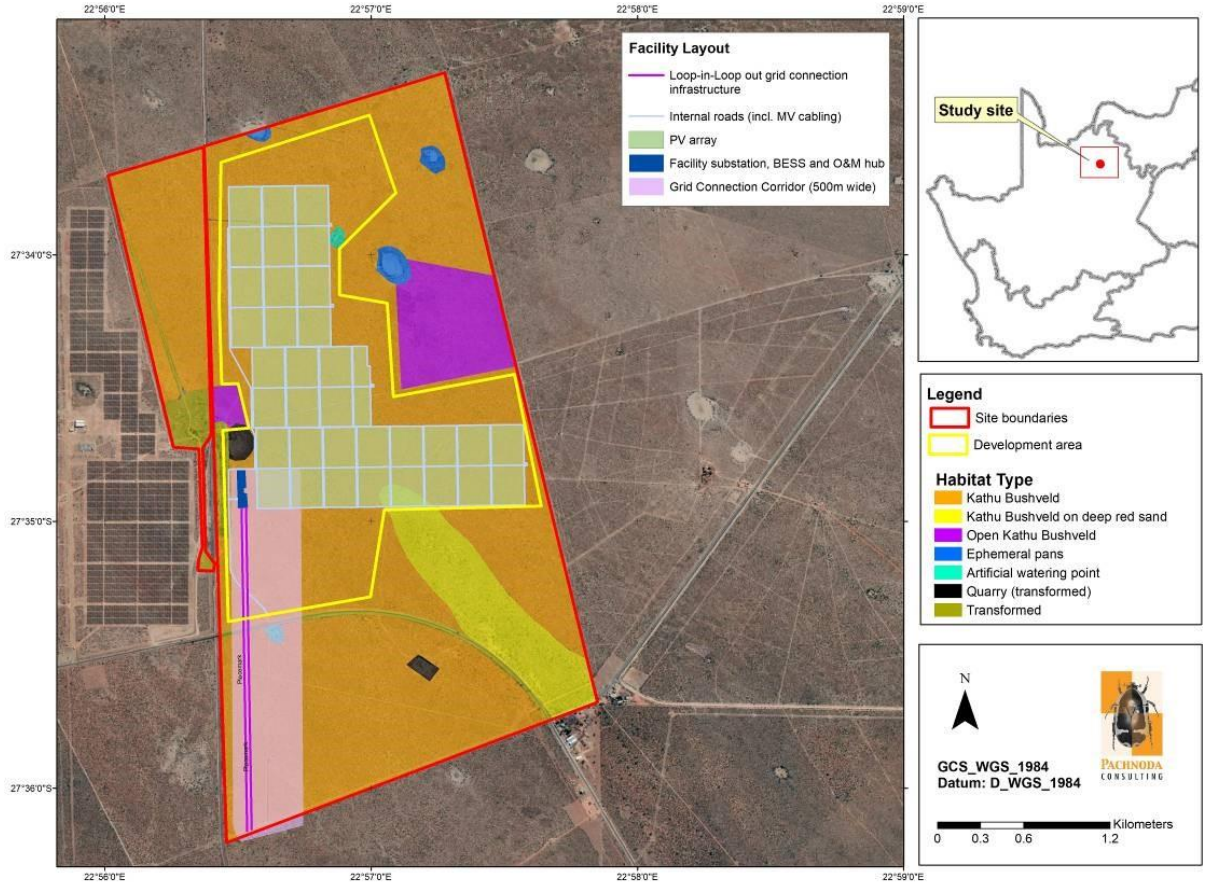


Figure 6.15: A habitat map illustrating the avifaunal habitat types relative to the facility infrastructure

i. Avian species richness and predicted summary statistics

Approximately 152 bird species[14] are expected to occur on the study site and immediate surroundings (refer to **Table 6.1**). The expected richness was inferred from the South African Bird Atlas Project (SABAP1 & SABAP2) and the presence of suitable habitat in the development area. The expected richness is also strongly correlated with favourable environmental conditions (e.g. during good rains when the pans are filled with surface water) and seasonality (e.g. when migratory species are present during the austral summer). This equates to 15% of the approximate 985[15] species listed for the southern African subregion[16] (and approximately 17% of the 871 species recorded within South Africa[17]). However, the species richness obtained from the pentad grids 2730_2255 and 2735_2255 corresponding to the development area is lower than the expected number of species for the project site with an average of 82.5 species recorded. The average number of species for each full protocol card submitted (for observation of two hours or more) is 38.2 species (range = 20 - 58 species).

[14] According to pentad grid 2730_2255 and eight surrounding pentad grids (50 submitted cards, 35 being full protocol cards and 15 being ad hoc cards).
15 *sensu* www.zestforbirds.co.za (Hardaker, 2020)
16 A geographical area south of the Cunene and Zambezi Rivers (includes Namibia, Botswana, Zimbabwe, southern Mozambique, South Africa, Swaziland and Lesotho).
17 With reference to South Africa (including Lesotho and Swaziland (BirdLife South Africa, 2018).

According to field observations, the total number of species observed on the study area is ca. 91 species. This indicates that the surveys on the study area produced a higher tally when compared to the average richness recorded for the corresponding pentad grids and were regarded as sufficient. On a national scale, the species richness per pentad on the study area is considered to be moderate to high.

As indicated in **Table 6.1**, the study area is poorly represented by biome- restricted[18] (refer to **Table 6.2**) and local endemic bird species. However, the expected number of regional near-endemic species is high with ca. 50% of the regional near-endemic species being present on the study area. Of the 152 bird species expected to occur in the study area, only four are threatened or near threatened species, four are local near-endemic species, while it was evident that local endemic species is absent from the area. In addition, one threatened species (White-backed Vulture *Gyps africanus*) was observed on habitat adjacent to the study area (refer to **Table 6.3**). Furthermore, eight southern African endemics and 24 near-endemic species were confirmed on the study site and the immediate surroundings. Waterbird species were highly irregular with only three species observed (all of them fly-overs) during the surveys (e.g. South African *Shelduck Tadorna cana*, African Sacred Ibis *Threskiornis aethiopicus* and White-faced Whistling Duck (*Dendrocygna viduata*).

Table 6.1: A summary table of the total number of species, Red listed species (according to Taylor et al., 2015 and the IUCN, 2021), endemics and biome-restricted species (Marnewick et al., 2015) expected (*sensu* SABAP1 and SABAP2) to occur in the development area.

Description	Expected Richness Value (Study area and surroundings)	Observed Richness Value (study area)
Total number of species	152 (17 %)	91 (60 %)
Number of Red Listed species*	4 (3 %)	1 (25 %)
Number of biome-restricted species – Zambezian and Kalahari-Highveld Biomes)	5 (15 %)	3 (60 %)
Number of local endemics (BirdLife SA, 2018)	0 (0 %)	0 (100 %)
Number of local near endemics (BirdLife SA, 2018)	4 (13 %)	3 (75 %)
Number of regional endemics (Hockey *et al.,* 2005)	12 (11 %)	8 (67 %)
Number of regional near endemics (Hockey *et al.,* 2005)	31 (51 %)	24 (77 %)

* Only species in the geographic boundaries of South Africa (including Lesotho and Swaziland) were considered.

Table 6.2: Expected biome-restricted species (Marnewick *et al*, 2015) likely to occur on the study site.

Species	Kalahari-Highveld	Namib-Karoo	Zambezian	Expected Frequency of occurrence
Kalahari Scrub-robin (*Cercotrichas paena)*	X			Common
Barred Wren-Warbler (*Calamonastes fasciolatus*)	X			Uncommon to rare
Burchell's Sandgrouse (*Pterocles burchelli*)	X			Common
Layard's Warbler (*Curruca layardi*)		X		Uncommon to Rare
White-bellied Sunbird (*Cinnyris talatala*)			X	Rare

Table 6.3: Important bird species occurring in the broader study area which could collide and/ or become displaced by PV infrastructure

[18] A species with a breeding distribution confined to one biome. Many biome-restricted species are also endemic to southern Africa.

Common Name	Scientific name	Regional Status	Global Status	Observed (Feb. & May 2022)	Collision with power lines	Collision with PV panels	Displacement (disturbance & loss of habitat)
White-backed Vulture	*Gyps africanus*	CR	CR	1	1		
Martial Eagle	*Polemaetus bellicosus*	EN	EN		1		
Kori Bustard	*Ardeotis kori*	NT			1		1
South African Shelduck	*Tadorna cana*	End		1	1	1	
Jackal Buzzard	*Buteo rufofuscus*	End			1		
Northern Black Korhaan	*Afrotis afraoides*	End		1	1		1
White-backed Mousebird	*Colius colius*	End		1			1
Southern Pied Babbler	*Turdoides bicolor*	End		1			1
Karoo Thrush	*Turdus smithi*	End					1
Ant-eating Chat	*Myrmecocichla formicivora*	End					1
Karoo Scrub Robin	*Cercotrichas coryphoeus*	End					1
Layard's Tit-Babbler	*Curruca layardi*	End		1			1
Rufous-eared Warbler	*Malcorus pectoralis*	End		1			1
Fiscal Flycatcher	*Sigelus silens*	End		1			1
Orange River White-eye	*Zosterops pallidus*	End		1			1
Red-billed Spurfowl	*Pternistis adspersus*	N-end			1		1
Red-crested Korhaan	*Lophotis ruficrista*	N-end		1	1		1
Pale Chanting Goshawk	*Melierax canorus*	N-end		1	1		
Orange River Francolin	*Scleroptila gutturalis*	N-end		1	1		1
Namaqua Sandgrouse	*Pterocles namaqua*	N-end		1	1	1	1
Burchell's Sandgrouse	*Pterocles burchelli*	N-end		1	1	1	1
Acacia Pied Barbet	*Tricholaema leucomelas*	N-end		1			1
Eastern Clapper Lark	*Mirafra fasciolata*	N-end		1			1
Fawn-coloured Lark	*Calendulauda africanoides*	N-end		1			1
Grey-backed Sparrow-lark	*Eremopterix verticalis*	N-end					1
Ashy Tit	*Parus cinerascens*	N-end		1			1
Cape Penduline-tit	*Anthoscopus minutus*	N-end		1			1

African, Red-eyed Bulbul	*Pycnonotus nigricans*	N-end		1			1
Kalahari Scrub Robin	*Cercotrichas paena*	N-end		1			1
Short-toed Rock Thrush	*Monticola brevipes*	N-end		1			1
Chestnut-vented Warbler	*Curruca subcoerulea*	N-end		1			1
Barred Wren-Warbler	*Calamonastes fasciolatus*	N-end					1
Marico flycatcher	*Bradornis mariquensis*	N-end		1			1
Chat Flycatcher	*Bradornis infuscatus*	N-end					1
Pririt Batis	*Batis pririt*	N-end		1			1
Dusky Sunbird	*Cinnyris fuscus*	N-end		1			1
Crimson-breasted Shrike	*Laniarius atrococcineus*	N-end		1			1
Bokmakierie	*Telophorus zeylonus*	N-end					1
Cape Sparrow	*Passer melanurus*	N-end		1			1
Scaly-feathered Weaver	*Sporopipes squamifrons*	N-end		1			1
Red-headed Finch	*Amadina erythrocephala*	N-end		1			1
Shaft-tailed Whydah	*Vidua regia*	N-end		1			1
Yellow Canary	*Crithagra flaviventris*	N-end		1			1
White-throated Canary	*Crithagra albogularis*	N-end					1
Lark-like Bunting	*Emberiza impetuani*	N-end					1
Lanner Falcon	*Falco biarmicus*	VU			1		
	Totals:	**46**	**2**	**32**	**13**	**3**	**40**

ii. Collision-prone bird species

A total of 34 collision-prone bird species have been recorded in the wider study area, of which 13 species are birds of prey and eight are waterbirds/shorebird taxa (refer to **Table 6.4**). Collision-prone species with the highest probability to occur along the power-line servitude includes the Helmeted Guineafowl (*Numida meleagris*), Pale-chanting Goshawk (*Melierax canorus*), Speckled Pigeon (*Columba guinea*), Pied Crow (*Corvus albus*), Namagua Sandgrouse (*Pterocles namaqua*), Burchell's Sandgrouse (*P. burchellii*), Red-crested Korhaan (*Lophotis ruficrista*), Gabar Goshawk (*Micronisus gabar*) and Northern Black Korhaan (*Afrotis afraoides*). Four of the 34 species are regionally threatened and include the endangered Martial Eagle (*Polemaetus bellicosus*), vulnerable Lanner Falcon (*Falco biarmicus*), critically endangered White-backed Vulture (*Gyps africanus*) and near threatened Kori Bustard (*Ardeotis kori*) (sensu Taylor et al., 2015).

Table 6.4: Collision-prone bird species expected to be present on the study area and inferred from the South African Atlas Project (SABAP2)

Common Name	Scientific Name	SABAP2 Reporting Rate
African Sacred Ibis	*Threskiornis aethiopicus*	2.22
Black-chested Snake Eagle	*Circaetus pectoralis*	11.11
Black-winged Kite	*Elanus caeruleus*	2.22
Black-winged Stilt	*Himantopus himantopus*	4.44
Burchell's Sandgrouse	*Pterocles burchelli*	8.89
Cape Teal	*Anas capensis*	6.67
Common (=Steppe) Buzzard	*Buteo buteo vulpinus*	2.22
Egyptian Goose	*Alopochen aegyptiaca*	4.44
Gabar Goshawk	*Micronisus gabar*	15.56
Greater Kestrel	*Falco rupicoloides*	4.44
Hadada Ibis	*Bostrychia hagedash*	24.44
Helmeted Guineafowl	*Numida meleagris*	68.89
Jackal Buzzard	*Buteo rufofuscus*	2.22
Kori Bustard	*Ardeotis kori*	2.22
Lanner Falcon	*Falco biarmicus*	2.22
Little Grebe	*Tachybaptus ruficollis*	4.44
Martial Eagle	*Polemaetus bellicosus*	2.22
Namaqua Sandgrouse	*Pterocles namaqua*	17.78
Northern Black Korhaan	*Afrotis afraoides*	22.22
Orange River Francolin	*Scleroptila gutturalis*	4.44
Pale Chanting Goshawk	*Melierax canorus*	35.56
Pied Crow	*Corvus albus*	26.67
Red-billed Spurfowl	*Pternistis adspersus*	13.33
Red-billed Teal	*Anas erythrorhyncha*	2.22
Red-crested Korhaan	*Lophotis ruficrista*	24.44
Rock Dove	*Columba livia*	2.22
Rock Kestrel	*Falco rupicolus*	4.44
South African Shelduck	*Tadorna cana*	8.89
Speckled Pigeon	*Columba guinea*	33.33
Spotted Eagle-Owl	*Bubo africanus*	2.22
Western Barn Owl	*Tyto alba*	17.78
Western Cattle Egret	*Bubulcus ibis*	8.89
White-backed Vulture	*Gyps africanus*	n/a
White-faced Whistling Duck	*Dendrocygna viduata*	2.22

i. Bird species of conservation concern

Table 6.5 provides an overview of bird species of conservation concern that could occur on the development area based on their historical distribution ranges and the presence of suitable habitat. A total of four species have been recorded in the wider study area (sensu SABAP2) which include two globally threatened species, one globally near threatened species and one regionally threatened species.

It is evident from **Table 6.5** that these species occur at low reporting rates (< 3% for full protocol cards and <10% for ad hoc cards submitted), which suggests that these species are irregular visitors to the development area. However, the Kori Bustard (*Ardeotis kori*) may be under-recorded in the area (due to the low number of citizen scientists) that have visited the area for which suitable habitat is provided by the open Kathu Bushveld units. However, even during the surveys it remained absent from the study area, of which the most plausible explanation is the high cover abundance of the shrub layer consisting of *Senegalia mellifera* and *Tarchonanthus camphoratus* which may impede the movement of this species (including other large terrestrial bird species) during foraging bouts and hence deter this species from utilising the area. the same assumption is also relevant to the apparent absence of Secretarybirds (*Sagittarius serpentarius*) in the area.

Table 6.5: Bird species of conservation concern that could utilise the study site based on their historical distribution range and the presence of suitable habitat. Red list categories according to the IUCN (2022) and Taylor et al. (2015)

Species	Global Conservation Status*	National Conservation Status**	Mean Reporting rate: SABAP2 (n=50)	Preferred Habitat	Potential Likelihood of Occurrence
Falco biarmicus (Lanner Falcon)	-	Vulnerable	2.22 (singe observation)	Varied, but prefers to breed in mountainous areas	An irregular foraging visitor to the development area. Most recent record obtained during June 2009 (sensu SABAP2).
Polemaetus bellicosus (Martial Eagle)	Endangered	Endangered	2.22	Varied, from open karroid shrub to lowland savanna.	An irregular foraging visitor to the study area although a pair is known to occur south of the study area on the Farm Limebank 471 (pers. obs. @ 20 May 2021 -. This pair may occasionally forage over the development area
Ardeotis kori (Kori Bustard)	Near threatened	Near threatened	2.22	Open savannah grassland and open secondary shrubland	An uncommon foraging and breeding resident. It was last recorded during October 2021 from the development area.
Gyps africanus (White-backed Vulture)	Critically Endangered	Critically Endangered	New record for the area	Breed on tall, flat-topped trees. Mainly restricted to large rural or game farming areas.	An irregular foraging/scavenging visitor to the study area pending the presence of food. Four individuals were observed soaring high at approximately 600m northwest of the study area on the Farm Flatlands 429 (08/02/2022).

White-backed Vulture (*Gyps africanus*)

The White-backed Vulture (*Gyps africanus*) is a large-bodied scavenging raptors are that was formerly listed as vulnerable in South Africa (Barnes 1998), although recent evidence based on severe declining trends in the global population in recent years has upgraded its status to critically endangered (BirdLife International, 2021). It remains an uncommon to highly irregular foraging visitor in the study area and was only recently observed during the February 2022 survey where four individuals were observed soaring high over Farm Flatlands 426 (approximately 600m northwest of the study area). This observation was also the first record of this species for the pentad grids surrounding the study area (refer to **Figure 6.16**). It is however present further west and south of the study area (refer to **Figure 6.17**). It appears that the scarcity of large trees (especially *V. erioloba*) may be a limiting factor in the area, since this species prefers to roost and breed in tall trees (pers. obs.). However, the high occurrence of this species to the southeast of the study area (approximately 90km southwest of the study area) is attributed to the presence of high voltage power lines, where the birds tend to roost on the tall pylon structures (pers. obs.) owing to the absence of suitable tall roosting trees.

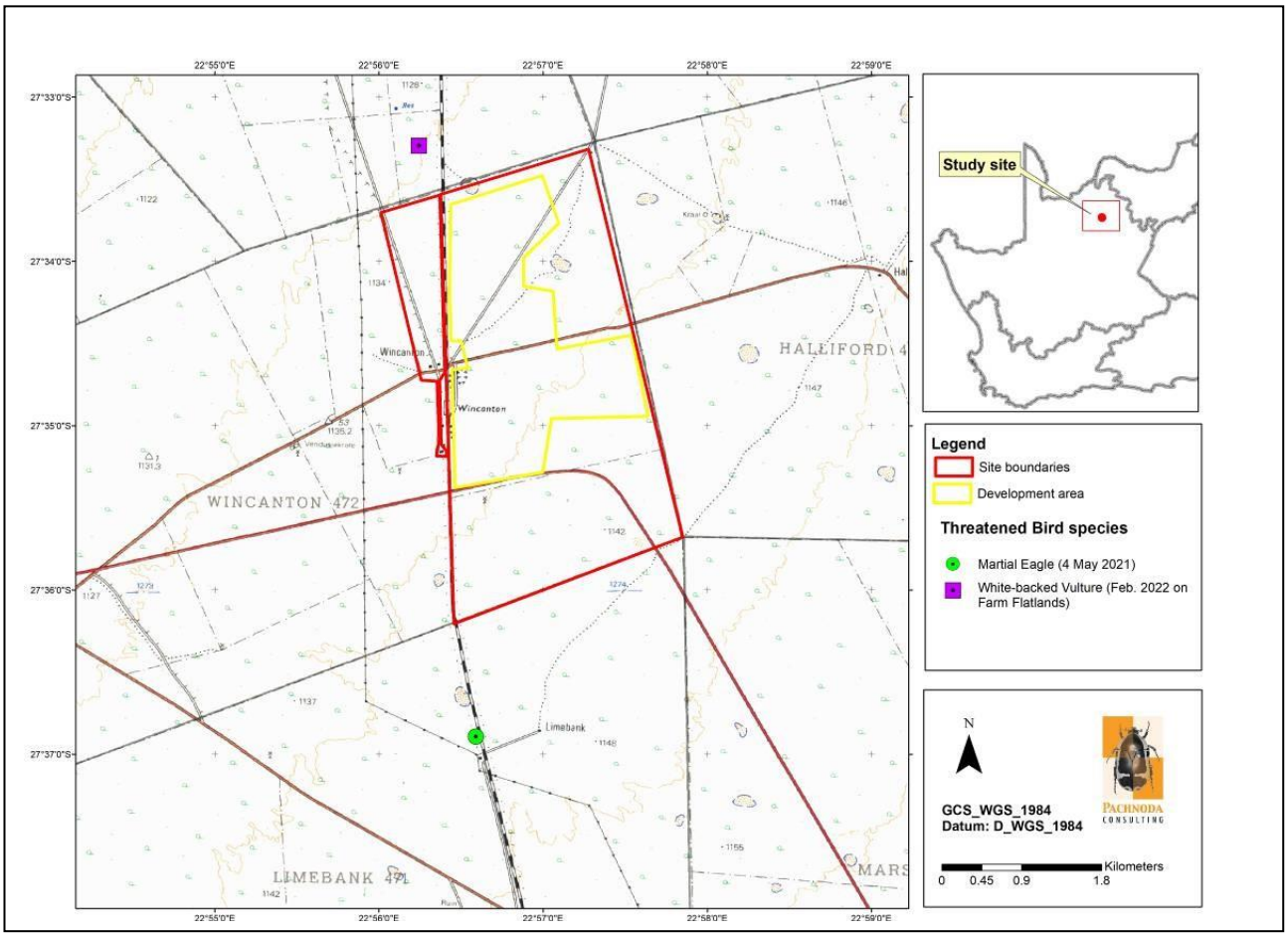


Figure 6.16: A map illustrating the occurrence of the endangered Martial Eagle (*Polemaetus bellicosus*) and critically endangered White-backed Vulture (*Gyps africanus*) in close proximity to the study area.

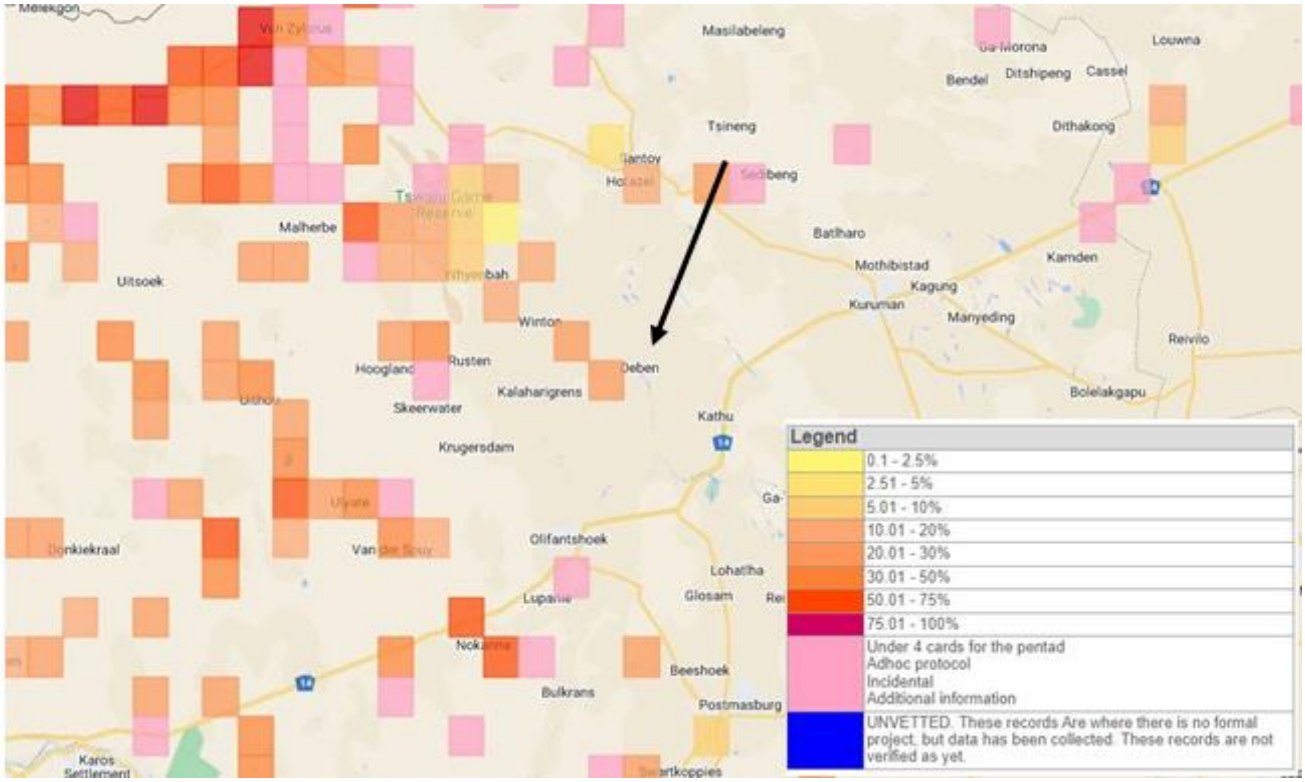


Figure 6.17: The occurrence of White-backed Vulture (*Gyps africanus*) on the study area according to SABAP2 reporting rates (the arrow indicates the position of the study area). Note the presence of vultures to the west and southwest of the study area (map courtesy and copyright of SABAP2 and Animal Demography Unit).

Secretarybird (*Sagittarius serpentarius*)

The conservation status of this species was upgraded from Vulnerable to Endangered since recent evidence suggested that it has experienced rapid declines across its entire range due to habitat loss, anthropogenic disturbances, and intensive grazing (Birdlife International, 2020). Secretarybirds are widespread in Africa south of the Sahara but have declined over most of their geographic distribution range due to the loss of suitable habitat caused by inappropriate grazing regimes (resulting in the expansion of woody vegetation), cultivation and urbinazation. The expansion of woody vegetation often results in a reduction of suitable foraging habitat and foraging efficacy (Birdlife International, 2020). In addition, it is also highly susceptible to collision with electrical cables of powerlines, with over 94 power line fatalities recorded over the past 20 years in South Africa. Based on reporting rates, this species appears to be more largely absent from the study area, with high reporting rates further to the west and north of the study area (refer to **Figure 6.18**), especially in the Tswalu and Witsand areas, and areas west of Postmasburg. The low reporting rates (or absence) of Secretarybirds on the study is probably correlated to the absence of large open areas, in particular open savanna and grassland on the study area since they tend to avoid areas of dense bush or very rocky areas. The high cover abundance of microphyllous shrub (e.g. *Senegalia mellifera*) on the study area probably displaced this species from utilising the area.

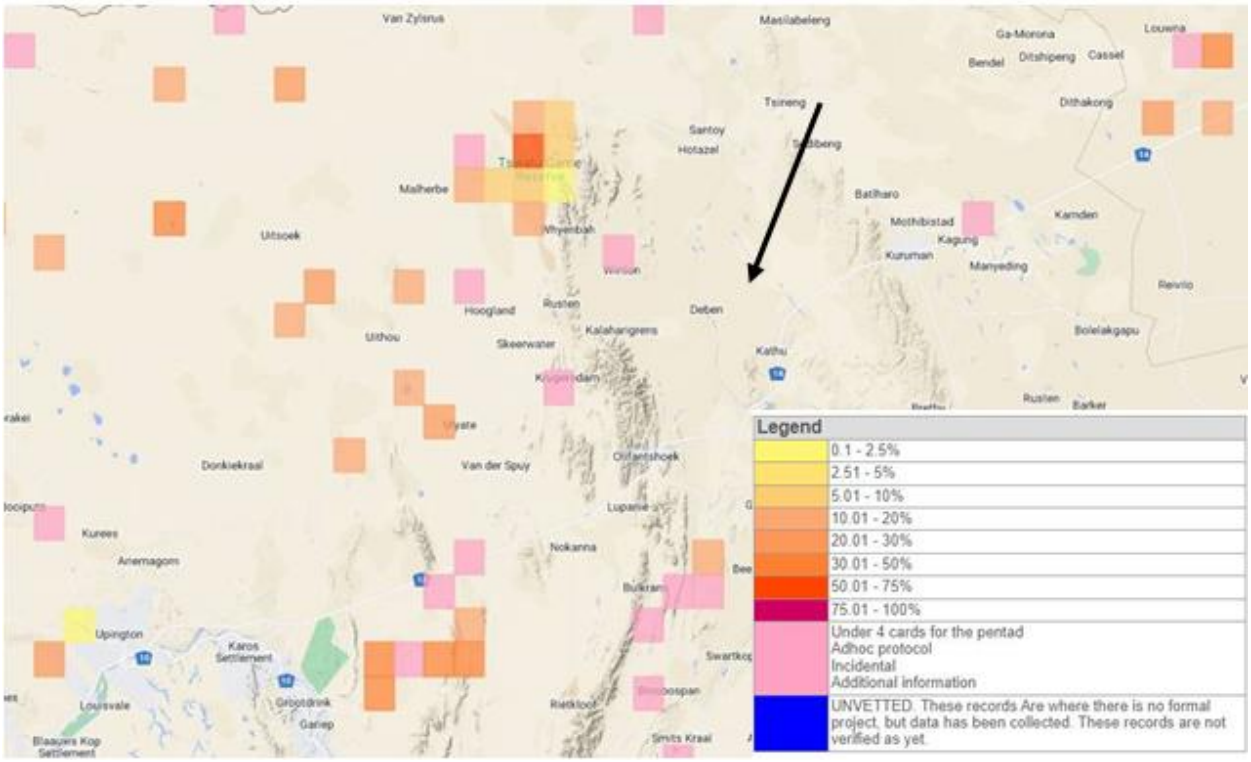


Figure 6.18: The occurrence of Secretarybirds (Sagittarius serpentarius) on the study area according to SABAP2 reporting rates (the arrow indicates the position of the study area). Note the presence of Secretarybirds to the west and southwest of the study area (map courtesy and copyright of SABAP2 and Animal Demography Unit).

ii. Bird Assemblage Structure and Composition

A total of 67 bird species and an average abundance of 631 individuals were recorded from 25 bird points (representing two replicative counts) located on the study area. The data provides an estimate of the bird richness and their numbers on the study site and immediate surroundings obtained during two independent survey sessions. A mean of 17.24 species and 25.24 individuals were recorded per point count. The highest number of species and individuals recorded from a point count was between 28 - 33 species (manly from artificial livestock watering holes and certain pans/depressions) and 66.5 individuals (from artificial watering points). The lowest number of species and individuals was respectively seven species and eight individuals (from dense Kathu Bushveld). The mean frequency of occurrence of a bird species in the study area was 25.73 % and the median was 16.00%, while the most common value (mode) was 4.00%. The latter represents those species that were encountered in only one point count. Three species occurred in all the point counts (c. Black-chested Prinia *Prinia flavicans*, Chestnut-vented Warbler *Curruca subcaerulea* and Kalahari Scrub-robin *Cercotrichas paena*), while 11 species occurred in 50% or more of the counts.

Table 6.6: Bird species with a frequency of occurrence greater than 50% observed on the study area (according to 25 counts).

Species	Frequency (%)	Species	Frequency (%)
Black-chested Prinia (*Prinia flavicans*)	100.00	Chestnut-vented Warbler (*Curruca subcarulea*)	100.00
Kalahari Scrub-robin (*Cercotrichas paena*)	100.00	Violet-eared Waxbill (*Granatina granatina*)	92.00
Yellow-Canary (*Crithagra flaviventris*)	92.00	Scaly-feathered Weaver (*Sporopipes squamifrons*)	88.00
Brown-crowned Tchagra (*Tchagra australis*)	64.00	Desert Cisticola (*Cisticola arudulus*)	60.00
Dusky Sunbird (*Cinnyris fuscus*)	60.00	Sabota Lark (*Calendulauda sabota*)	60.00
Yellow-bellied Eremomela (*Eremomela icteropygialis*	56.00		

iii. Dominance and typical bird species

The dominant (typical) species on the study area are presented in **Table 6.7**. Only those species that cumulatively contributed to more than 90% to the overall similarity between the point counts are presented.

The three most typical bird species on the study area include the Black-chested Prinia (*Prinia flavicans*), Chestnut-vented Warbler (*Curruca subcaerulea*) and Kalahari Scrub-robin (*Cercotrichas paena*). These species are considered widespread species in the broader study area and occur in most of the habitat types that area present. It is also evident from **Table 6.7** that the typical bird assemblage is predominantly represented by insectivores (insect-eating) and by granivores (seed-eating taxa).

Table 6.7: Typical bird species on the study area

Species	Av.Abundance	Consistency (Sim/SD)	Contribution (%)	Primary Trophic Guild
Black-chested Prinia (*Prinia flavicans*)	3.02	2.77	14.41	Insectivore: upper canopy foliage gleaner
Chestnut-vented Warbler (*Curruca subcaerulea*)	2.44	3.07	13.68	Insectivore: upper canopy foliage gleaner
Kalahari Scrub-robin (*Cercotrichas paena*)	1.70	3.26	12.47	Insectivore: upper canopy foliage gleaner
Violet-eared Waxbill (*Granatina granatina*)	1.54	1.89	9.97	Granivore: upper to lower canopy gleaner
Yellow Canary (*Crithagra flaviventris*)	1.60	1.88	9.56	Granivore: upper to lower canopy gleaner
Scaly-feathered Weaver (*Sporopipes squamifrons*)	2.34	1.54	8.73	Granivore: upper to lower canopy gleaner
Desert Cisticola (*Cisticola aridulus*)	0.38	0.69	3.73	Insectivore: upper canopy foliage gleaner
Brown-crowned Tchagra (*Tchagra australis*)	0.52	0.74	3.60	Insectivore: upper canopy foliage gleaner

iv. Composition and diversity

Multidimensional scaling and hierarchical agglomerative clustering ordination of bird abundance values obtained from 25-point counts on the study area differentiate between three discrete bird associations (Global R= 0.56, p=0.001;), with statistically significant differences due to the presence of surface water and canopy height. These include (1) an association on short Kathu Bushveld, (2) an association pertaining to tall Kathu Bushveld on red sands ("parkland") and (3) an association confined pans and the presence of surface water.

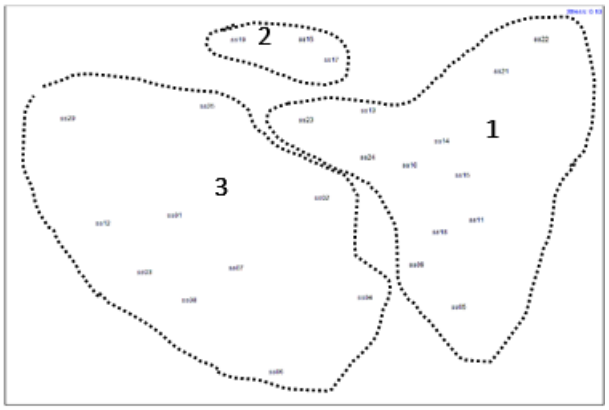


Figure 6.19: A two-dimensional non-metric multidimensional scaling ordination (stress=0.19) of the relative abundances of bird species based on Bray-Curtis similarities obtained from 25-point counts on the project area. It differentiates between three bird associations: (1) an association on short Kathu Bushveld, an (2) association pertaining to tall Kathu Bushveld on red sand and (3) an association confined to pans and the presence of surface water

The following bird associations are relevant to the study site and immediate surroundings:

1. Association on short Kathu Bushveld

Dominant species: The Black-chested Prinia (*Prinia flavicans*), Chestnut-vented Warbler (*Curruca subcaerulea*), Kalahari Scrub-robin (*Cercotrichas paena*), Violet-eared Waxbill (*Granatina granatina*), Green-winged Pytilia (*Pytilia melba*), Shaft-tailed Whydah (*Vidua regia*), Dusky Sunbird (*Cynnyris fuscus*) and African, Red-eyed Bulbul (*Pycnonotus nigricans*).

Indicator species: Mainly African, Red-eyed Bulbul (*P. nigricans*) and Violet-eared Waxbill (*Granatina granatina*), which occur in high numbers.

2. Association on open tall Kathu bushveld on red sand

Dominant species: The Black-chested Prinia (*Prinia flavicans*), Chestnut-vented Warbler (*Curruca subcaerulea*), Kalahari Scrub-robin (*Cercotrichas paena*), Violet-eared Waxbill (*Granatina granatina*), Pririt Batis (*Batis pririt*), Scaly-feathered Weaver (*Sporopipes squamifrons*), Yellow Canary (*Crithagra flaviventris*) and Dusky Sunbird (*Cynnyris fuscus*).

Indicator species: Ashy Tit (*Melaniparus cinerascens*), Marico Sunbird (*Cinnyris mariquensis*), Orange-river White-eye (*Zosterops pallidus*) and Brubru (*Nilaus afer*)

3. Association on pans and at surface water

Dominant species: The Black-chested Prinia (*Prinia flavicans*), Chestnut-vented Warbler (*Curruca subcaerulea*), Kalahari Scrub-robin (*Cercotrichas paena*), Violet-eared Waxbill (*Granatina granatina*), Pririt Batis (*Batis pririt*), Scaly-feathered Weaver (*Sporopipes squamifrons*), Yellow Canary (*Crithagra flaviventris*) and Dusky Sunbird (*Cynnyris fuscus*) - similar to tall Kathu Bushveld.

Indicator species: Black-throated Canary (*Crithagra atrogularis*), Red-billed Quelea (*Quelea quelea*), Burchell's Sandgrouse (*Pterocles burchelli*), Namaqua Sandgrouse (*Pterocles namaqua*), Zitting Cisticola (*Cisticola juncidis*) and Cape Sparrow (*Passer melanurus*).

The highest number of bird species on the study area was observed from pans and areas with surface water, followed by the bird association on tall Kathu Bushveld (refer to **Table 6.8**). The lowest number of bird species was recorded from dense short Kathu Bushveld.

Table 6.8: A summary of the observed species richness and number of bird individuals confined to the bird associations on the study area

Bird Association	Number of species	Number of Individuals	Shannon Wiener Index H'(log_e)
Short Kathu Bushveld	32	11.72	0.96
Tall Kathu Bushveld (on red sand)	34	10.26	0.98
Pans and presence of surface water	52	13.47	0.97

v. Passerine bird densities

Forty-nine passerine bird species were recorded from 25-point counts on the study area. The study area comprises of approximately 19.64 species/ha. The average density per hectare is 28.21 birds/ha and ranges between 10.26 birds/ha to 66.03 birds/ha.

6.5. Integrated Heritage including Archaeology, Palaeontology and the Cultural Landscape

6.5.1. Historical, Archaeological and Built Environment Heritage

The town of Kathu was established in the 1960's and 1970's as a result of the iron ore mining taking place at the neighbouring Sishen mine. The Grade I Kathu Pan Archaeological site lies approximately 10km southeast of the proposed development. At Kathu Pan, evidence of early hominin occupation has been observed at multiple sinkhole sites within the pan, and the results of scientific investigation into these sites has been broadly published. These sites are known for their rich collection of Early Stone Age artefacts, and several Archaeological and Heritage Impact Assessments have recorded the area. These archaeological resources occur in areas associated with outcrops of banded ironstone, and the localised natural pan, with most coming specifically from sinkholes in the pan itself.

The area proposed for the San Solar PV Facility is located immediately adjacent to an existing PV facility to the west. As such, it is not anticipated that the development will have a negative impact on any significant cultural landscape in the area due to the existing similar infrastructure here. Furthermore, it is often preferred to have development such as PV facilities clustered in one area to mitigate the sprawl of this infrastructure across otherwise pristine landscapes.

Gaigher (2013) conducted an assessment for the San Solar Energy Facility located north of Kathu on a Portion of the Farm Wincanton 472 - for this exact development proposal (SAHRIS NID 110765). According to Gaigher (2013), "One site for the placement of Solar Array generation plant was investigated. Due to the topographic requirements of Solar Arrays the areas are by nature flat and featureless with limited possibilities of water intrusion. Traditionally people have congregated in areas where shelter is found in some geographic feature or in areas that are elevated above the surrounding landscape. Accesses to water sources are also a deciding factor in the location of occupational sites. None of these factors were present in the areas investigated. Some dry dongas were located in some of the sites; however, these are not reliable sources of water. The area could still contain the remains of nomadic hunter/gatherer camps and some areas with suitable substrates could have been used as quarries for material to produce Stone Age tools. No such sites were however identified. We should however in this case apply the rule of Absence of Evidence is not Evidence of Absence."

Very few heritage resources of significance were identified during the archaeological field assessment conducted for this project. Three observations of Middle Stone Age scatters of low density noted were all associated with a wetland that is located well-outside of the development footprint. These observations have been graded IIIC for their contextual scientific significance. The field assessment also identified a ruin of a mid-Century (1950's-1970's) structure located in context with other farming infrastructure and an abandoned railway siding on the eastern side of the railway line bordering the old farm settlement. The building material is mostly vernacular (dolomite) with some modern additions. This observation has no intrinsic heritage significance and has been determined to be not conservation worthy.

The field assessment also identified an informal memorial located on the R380 road in remembrance of someone that may have perished in an accident here. Although this memorial may have social significance for specific family members of the deceased, it is hard to argue for broader social significance in terms of the cultural values described in the NHRA. So, while this observation is worth noting, this informal memorial has been determined to be not conservation worthy.

Site No.	Description	Density	Period	Co-ordinates		Grading	Mitigation
002	Ruin of mid-Century structure. In context with farming infrastructure and an abandoned railway siding on the eastern side of the railway line bordering the old farm settlement. Building material mostly vernacular with some modern additions. Karoo cottage style architecture. Building material seems like dolomite blocks.	N/A	Modern	27° 34' 39.10" S	22° 56' 20.40" E	NCW	N/A
004	**Scaper, core and chunk made from CCS and BIF. Located on edge of wetland**	**3/10m²**	**MSA**	**27° 34' 04.6" S**	**22° 57' 04.9" E**	**IIIC**	**200m Buffer**
005	**Scaper, chips and chunks made from CCS and BIF. Located on edge of wetland**	**6/10m²**	**MSA**	**27° 34' 02.3" S**	**22° 57' 08.9" E**	**IIIC**	**200m Buffer**
006	**Unfinished blade, chunk, scraper, chips and a core made from BIF. Located on edge of wetland**	**8/50m²**	**MSA**	**27° 34' 06.3" S**	**22° 57' 06.1" E**	**IIIC**	**200m Buffer**
008	Memorials to those who died in road accidents on the R380 on	N/A	Modern	27° 35' 23.6" S	22° 56' 37.2" E	NCW	N/A

	the eastern edge of the grid connection corridor						


Observation 004

Observation 005

Observation 006


Observation 002

Observation 008

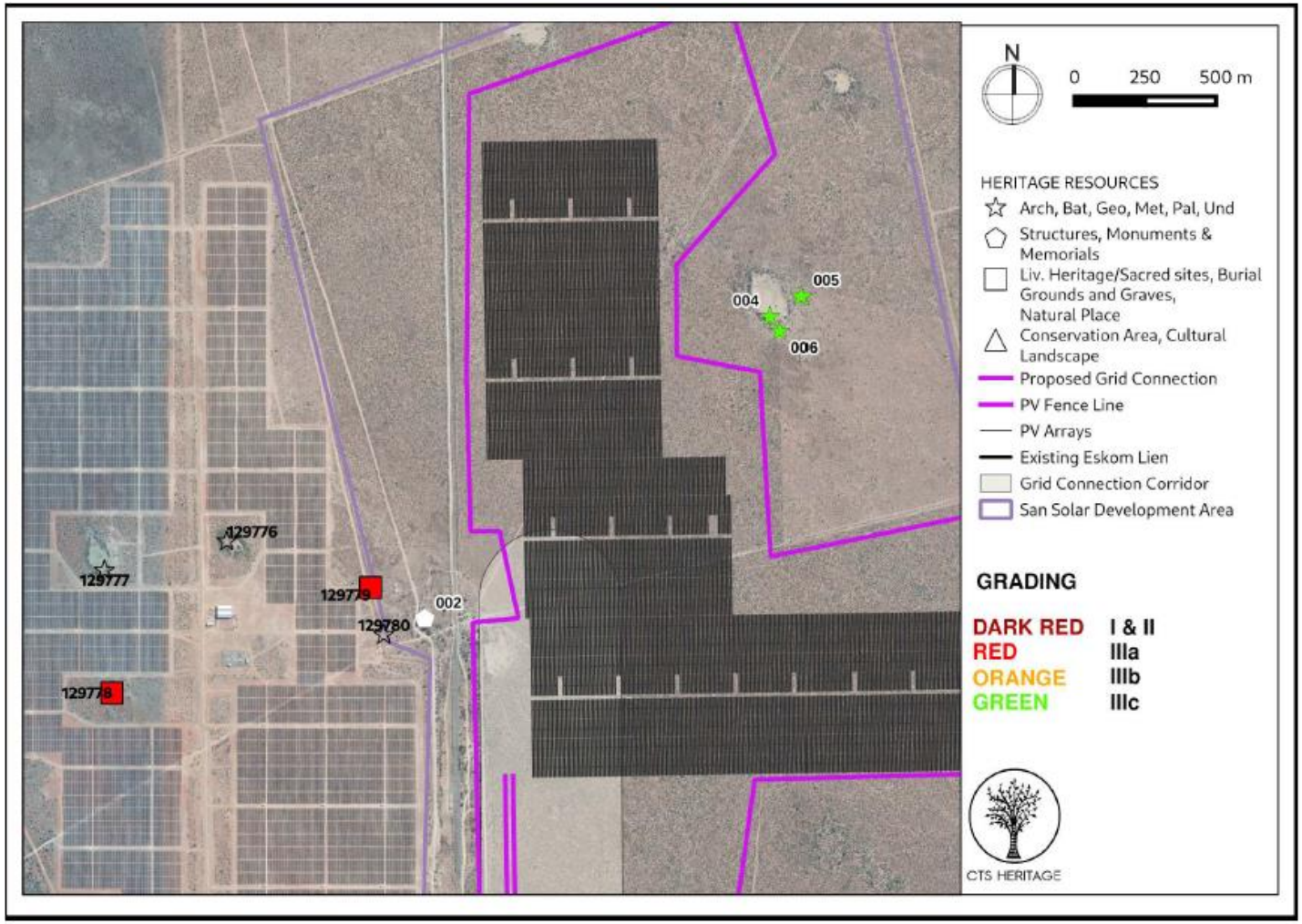


Figure 6.20: Map of all known heritage resources located in proximity to the proposed development of San Solar PV

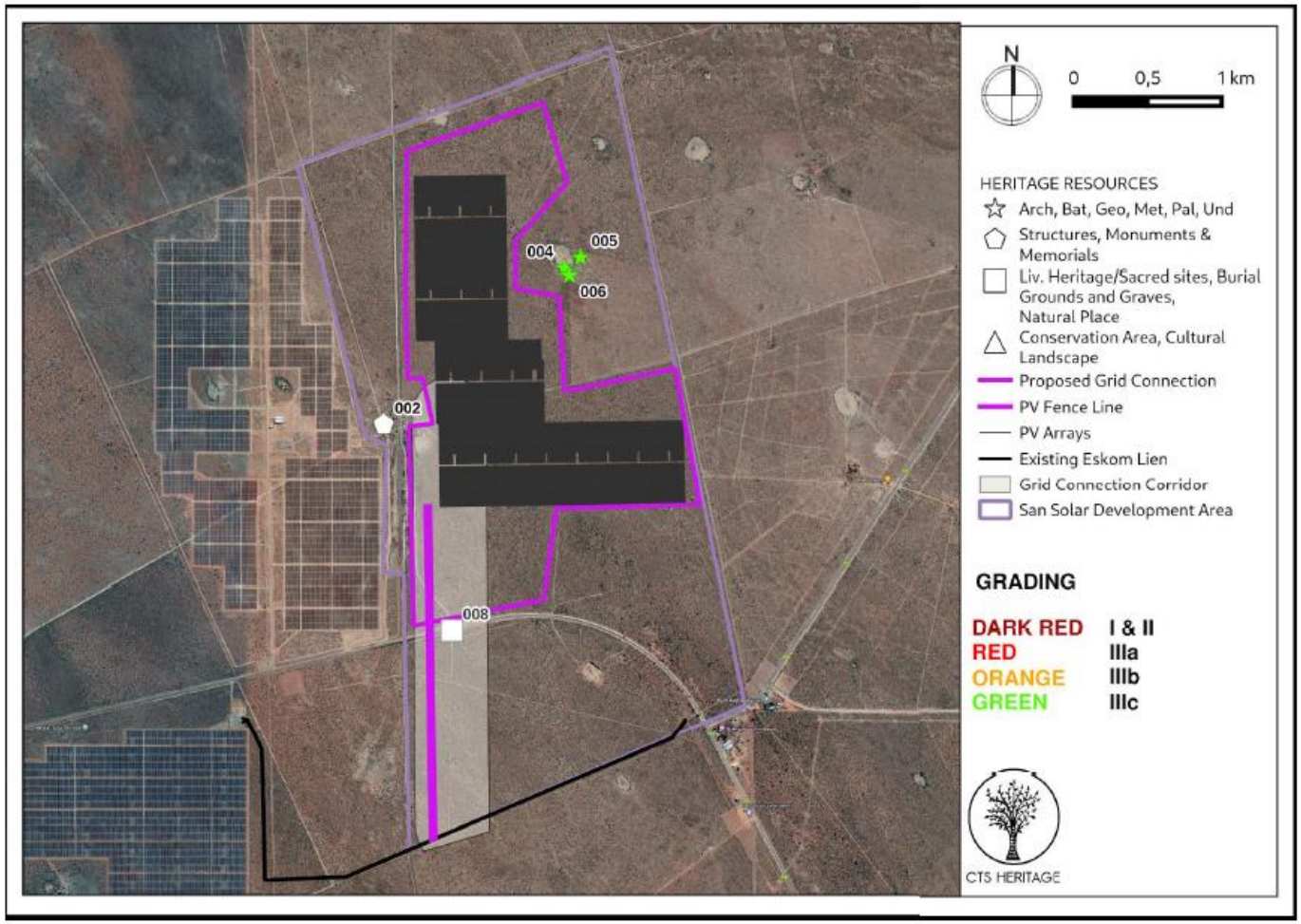


Figure 6.21: Map of heritage resources identified during the field assessment, relative to the proposed development of San Solar PV

6.5.2. Palaeontology

The Tertiary calcretes can trap fossils and artefacts when associated with palaeo-pans or palaeo-springs (Partridge et al., 2006). Where deflation has occurred, for example along the west coast of South Africa, any trapped materials in the different levels can be concentrated in the depo-centre of the pan or dune and therefore it can be challenging to interpret the deposit (Felix-Henningsen et al., 2003). A well-known example of a limestone tufa deposit is at the Buxton-Norlim Limeworks about 15m southwest of Taung, on the margin of the Ghaap Plateau. Fauna and the Taung child cranium were excavated from here, but it should be noted that the topography of this fossiliferous site is very diverse and includes a now roofless cave complex (Hopley et al., 2013). In contrast, the limestones north of Kathu are generally more or less flat.

The Aeolian sands of the Gordonia Formation do not preserve fossils because they have been transported and reworked, but in some regions, these too may have covered pan or spring deposits and these can trap fossils, and more frequently archaeological artefacts. Usually, these geomorphological features can be detected using satellite imagery. No such features are visible.

6.6 Visual Quality

The Ga-Mogara non-perennial river (a dry river-bed for most of the year) is considered to be the main regional drainage feature located within this arid region. The land cover is predominantly grassland and low shrubland with large areas of open woodland in the north-east of the development area, and also scattered throughout the south-west. The vegetation type is Kathu Bushveld of the Eastern Kalahari Bushveld Bioregion, within the Savanna Biome. Bare rock and soil also occur in places such as the dry Ga-Mogara floodplain. Significant tracts of land south of the development area have been transformed by mining and prospecting activities.

Despite the predominantly rural and natural character of the development area, there are a large number of overhead power lines in the development area, associated mainly with the Ferrum Substation located at the mine. These include:

- Ferrum-Wincanton 1 132kV
- Ferrum-Fox 1 132kV
- Adams-Ferrum 1 132kV
- Fox-Umtu 1 132kV
- Impala-Mamatwane 1 132kV

There are no designated protected areas within the region and no major tourist attractions or destinations were identified within the development area (other than the Haakbosskerm restaurant and Stokkiesdraai guesthouse located adjacent (south - west) of the development area).

Figure 6.22 aids in describing the general environment within the development area and the area surrounding the development area.

Figure 6.22: General environment within the development area and the surrounding area

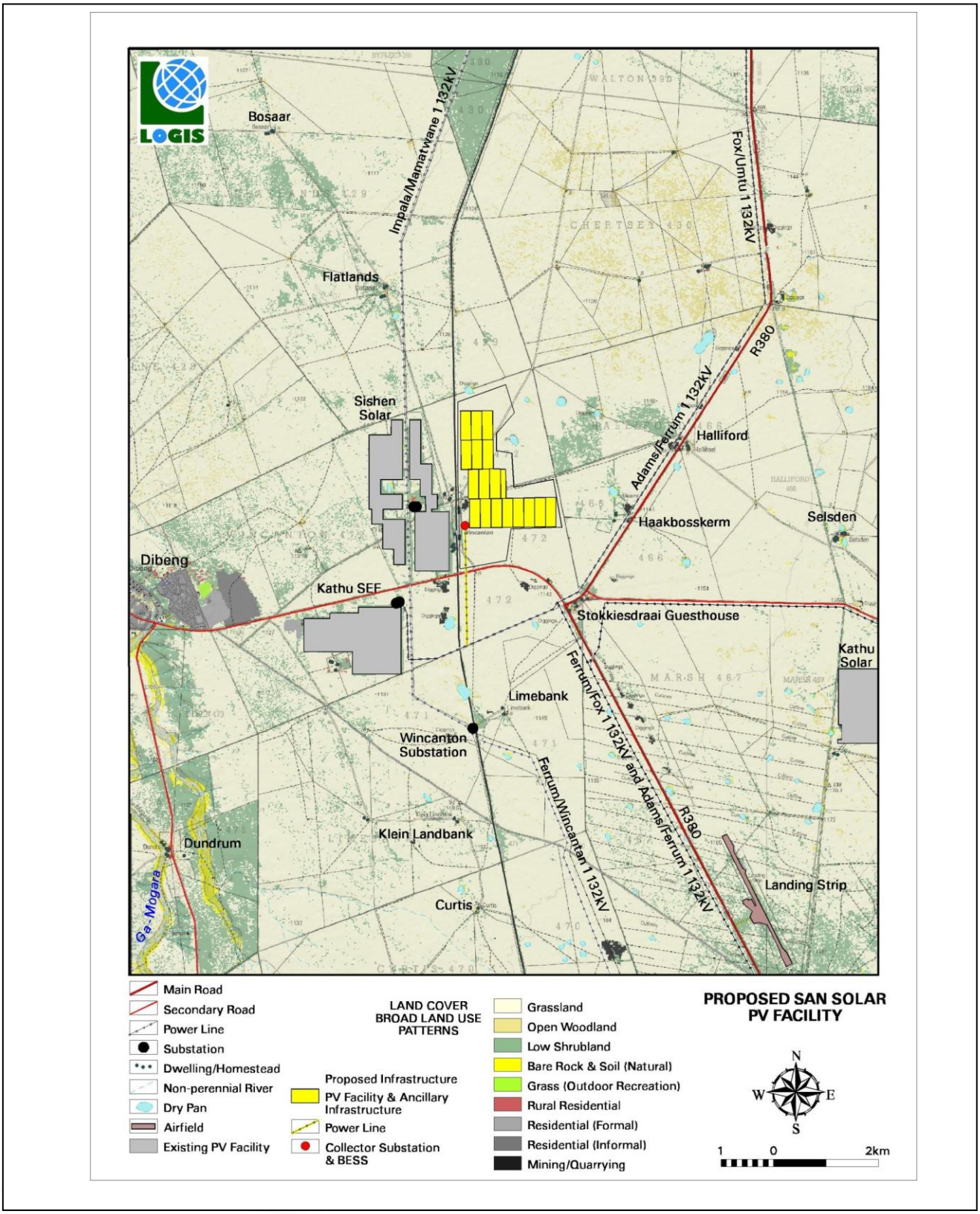


Figure 6.23. Land cover and broad land use patterns of the San Solar PV facility

Potential Visual Exposure

A visibility analysis of the PV facility was undertaken individually from each representative number of vantage points per development footprint at 5m above ground level. This was done in order to determine the general visual exposure (visibility) of the area under investigation, simulating the maximum height of the proposed structures (PV panels, inverters, BESS, etc.) associated with the facility. The result of the visibility analysis is displayed on **Figure 6.24**.

Figure 6.24 also indicates proximity radii from the development footprint in order to show the viewing distance (scale of observation) of the facility in relation to its surrounds. The viewshed analysis includes the effect of vegetation cover and existing structures on the exposure of the proposed infrastructure.

It is clear that the relatively constrained dimensions of the PV facility would amount to a fairly limited area of potential visual exposure. The visual exposure would largely be contained within a 6km radius of the proposed development site, with the predominant exposure to the north-east.

The following is evident from the viewshed analyses:

- 0 – 1km: There are no residences (besides those associated with the Sishen Solar facility) within this zone. There is a section of the Deben secondary road traversing south of the proposed PV facility at distances of under one kilometre.
- 1 – 3km: This zone contains the Stokkiesdraai guesthouse, Haakbosskerm homestead and restaurant, the Flatlands and Halliford homesteads, and sections of the R380 main road. Other than these potential receptor sites, the rest of the visually exposed areas fall within vacant farmland or natural open space. It is expected that the PV facility would be clearly visible from these homesteads.
- 3 - 6km: Within a 3 – 6km radius, the visual exposure is more scattered and interrupted due to the undulating nature of the topography. Most of this zone falls within vacant open space and agricultural land, but does include some farm dwellings and residences (Limebank and Klein Landbank) and the eastern outlying parts of Deben. It appears as if the above homesteads may have been demolished.
- > 6km: At distances exceeding 6km the intensity of visual exposure is expected to be very low and highly unlikely due to the distance between the object (development) and the observer. This zone contains a single potentially exposed receptor site, namely the Bosaar homestead.

Visual Distance/ Observer Proximity to the PV facility

The proximity radii are based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger solar energy facilities/technologies (e.g. more extensive infrastructure associated with power plants exceeding 100MW) and downwards for smaller plants (e.g. smaller infrastructure associated with power plants with less generating capacity such as the proposed 100MW San Solar PV facility).

The proximity radii, based on the dimensions of the proposed development footprint include the following:

- 0 - 1km. Very short distance view where the PV facility would dominate the frame of vision and constitute a very high visual prominence.

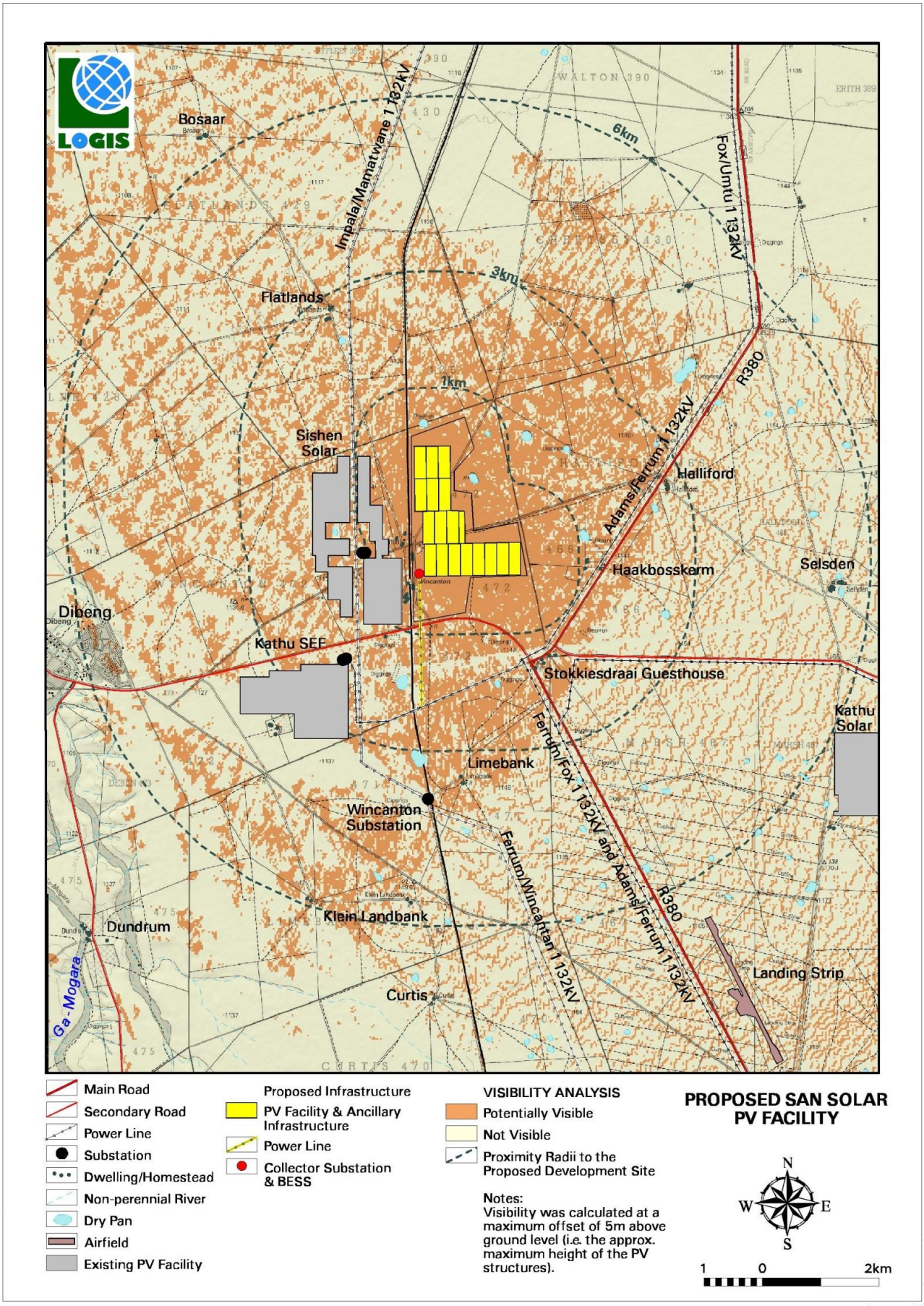


Figure 6.24: Viewshed analysis of the San Solar PV Facility illustrating the potential visual exposure.

- 1 – 3km. Short distance view where the structures would be easily and comfortably visible and constitute a high visual prominence.
- 3 - 6km. Medium to longer distance view where the facility would become part of the visual environment but would still be visible and recognisable. This zone constitutes a moderate visual prominence.
- 6km. Long distance view of the facility where the structures are not expected to be immediately visible and not easily recognisable. This zone constitutes a lower visual prominence for the facility.

6.7 Social Context

Table 6.4 provides a baseline summary of the socio-economic profile of the Gamagara LM within which the San Solar PV Facility is located. In order to provide context against which the LM's socio-economic profile can be compared, the socio-economic profiles of the John Taolo Gaetsewe DM, Northern Cape Province, and South Africa as a whole have also been considered. The data presented in this section have been derived from the 2011 Census, the Local Government Handbook South Africa 2019, the Northern Cape Provincial Spatial Development Framework (PSDF), and the John Taolo Gaetsewe DM and Gamagara LM IDPs.[19]

Table 6.4: Baseline description of the socio-economic characteristics of the area proposed for San Solar PV

Location characteristics
- The project is proposed within the Northern Cape Province, which is South Africa's largest, but least populated Province. - The project is proposed within the Gamagara LM of the John Taolo Gaetsewe DM. - The Gamagara LM is approximately 2619km² in extent, equivalent to approximately 10% of the John Taolo Gaetsewe DM.
Population characteristics
- Between 2011 and 2016 the Gamagara LM experienced a population growth rate of 28.93% over 5 years. - The Gamagara LM has a high urbanisation rate of 97.6%, which is significantly higher than that of the DM (24.9%). The main reason for the high rate is due to the Gamagara LM being a mining hub and individuals are moving in to the area seeking employment opportunities. - The Gamagara LM is male dominated, with males comprising approximately 56.4% of the LM population. The John Taolo Gaetsewe DM is female dominated, with females comprising approximately 50.8% of the DM population. - Black Africans comprise the predominant population group within the Gamagara LM and John Taolo Gaetsewe DM. - The Gamagara LM, John Taolo Gaetsewe DM, and Northern Cape provincial, and South African national population age structures are all youth dominated. A considerable proportion of the respective populations therefore comprise individuals within the economically active population between the ages of 15 and 64 years of age
Economic, education and household characteristics
- The Gamagara LM has a dependency ratio of 34.2, which is lower than the John Taolo Gaetsewe DM (57.9), Northern Cape Province (35.8), and South Africa (34.5). - Education levels within the Gamagara LM are low with approximately 33% of the population aged 20 years and older who have completed Grade 12 / Matric. Only 10.8% of the age group have received higher education. This implies that the majority of the population can be expected to have a relatively low-skill level and would

[19] While information was derived from the Local Government Handbook South Africa 2019, Northern Cape PSDF, John Taolo Gaetsewe DM and Gamagara LM IDPs, these sources largely make use of statistical information derived from the Census 2011. The information presented in this Chapter may therefore be somewhat outdated, but is considered sufficient for the purposes of this assessment (i.e. to provide an overview of the socio-economic characteristics against which impacts can be identified and their significance assessed).

either require employment in low-skill sectors, or skills development opportunities in order to improve the skills level of the area.
- The unemployment rate of the Gamagara LM (17.7%) is lower than that of the John Taolo Gaetsewe DM (29.7%).
- Approximately 32% of people in the Gamagara LM have no monthly income. At least 64% of the population are earning less than R6400 per month. 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 main economic sectors of the Gamagara LM includes mining, game farming and business services.
- 43% of employed people in the Gamagara LM are employed in the formal sector, of which 5% are employed in the informal sector.
- As of 2016 there were a total of 15 723 households within the Gamagara LM. This is equivalent to 21.7% of the total number of households within the John Taolo Gaetsewe DM (72 310), and 5% of the total number of households within Northern Cape Province (313 402).
- The majority of households within the Gamagara LM comprise of houses or brick houses, informal dwellings (i.e. shacks), a flat or house in a backyard, townhouse and flat or apartment in a block of flats.

Services

- The Gamagara LM achieved to provide the following household services:
  - 80.8% have access to flush toilet connected to sewerage;
  - 8.9% have weekly refuse removal;
  - 52% have access to piped water inside a dwelling; and
  - 88.1% have electricity for lighting.

6.7.1 Settlement and infrastructure

The region is sparsely populated (less than 5 people per km^2), with the highest concentrations occurring in the towns of Kathu and Dibeng, and at the Sishen Mine. In addition to the towns and the mine settlements, a number of isolated homesteads occur throughout the development area. Some of these in the development area include[20]:

- Bosaar
- Flatlands
- Halliford
- Selsden
- Haakbosskerm homestead and restaurant
- Limebank
- Klein Landbank
- Curtis
- Dundrum

The Stokkiesdraai guesthouse is located adjacent (south-west) of the proposed San Solar PV facility site. The road (R380) between Dibeng and Kathu cuts crosses the southern portion of the property. This road links Dibeng and Kathu with the N14. The eastern boundary of the southern section of site is formed a railway line which runs in a north-south direction. Significant tracts of land in the south of the study area have been transformed by mining and prospecting activities.

[20] The names listed below are of the homestead or farm dwelling as indicated on the SA 1: 50 000 topographical maps and do not refer to the registered farm name.

Cattle and game farming is undertaken within the development area, with very little agricultural activity due to the scarcity of perennial water (for irrigated agriculture) and the low annual rainfall (for dryland agriculture).

Infrastructure in the region is focussed on the Anglo America Kumba iron ore mine located south-west of Kathu. The expansion of the town of Kathu and most of the larger settlements within the development area are mainly attributed to the mine. Infrastructure closer to the proposed San Solar PV facility includes the Kathu Solar PV, Kathu Solar Energy Facility, and the Sishen Solar PV facility.

CHAPTER 7: ASSESSMENTS OF IMPACTS

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, and indirect) expected to be associated with the development of San Solar PV and its associated infrastructure. This assessment has considered the construction of a PV facility with a contracted capacity of up to 100MW with a development footprint of approximately 205ha. The project will comprise the following key infrastructure and components:

- PV modules and mounting structures
- Inverters and transformers
- Cabling between the panels, to be laid underground where practical
- Battery Energy Storage System (BESS)
- Site and internal access roads (up to 8m wide)
- Laydown area
- Operation and maintenance buildings including a gate and security building, control centre, offices, warehouse, and workshop areas for maintenance and storage.
- Grid connection solution including a 132kV facility substation, 132kV switching station to be connected via a Loop-in-Loop out (LILO) connection to the Fox-Umtu 132kV overhead power line located south of the site.

Grid connection infrastructure for the San Solar PV facility will be located outside the PV development area within a 500m wide corridor. The grid connection point to the grid will be on proposed Fox - Umtu 132kV line. The grid connection will consist of a 132kV facility substation, switching Station and Loop-In Loop-Out Tern line from the 132kV switching Station to Fox - Umtu 132kV line about 5.5km from Eldoret Substation.
a)
The full extent of the project site was considered through the EIA phase by the independent specialists and the EAP. On-site sensitivities were identified through the review of existing information, desk-top evaluations and field surveys. A development footprint for the PV facility within the project site was proposed by the developer through consideration of the sensitive environmental features and areas identified through the EIA process. **Figure 7.1** illustrates the San Solar PV facility development area, including the grid connection corridor.

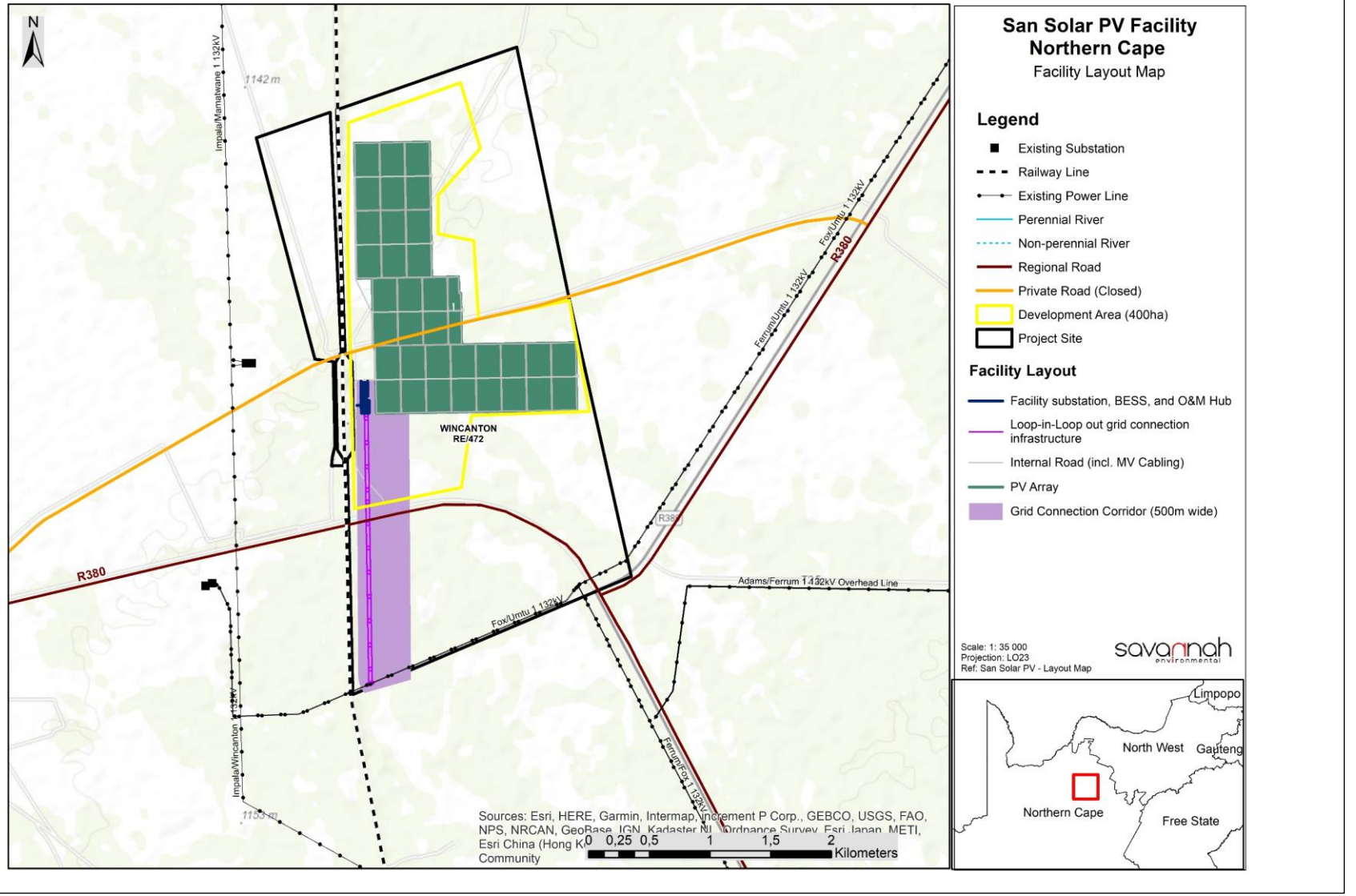


Figure 7.1: Map of the San Solar PV facility development area and grid connection corridor (refer to **Appendix O** for A3 map).

The development of San Solar PV will comprise the following phases:

» *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of access roads, laydown areas, and facility infrastructure (including PV panels and BESS); construction of foundations involving excavations; the transportation of components/construction equipment to site, manoeuvring and operating vehicles for unloading and installation of equipment; laying cabling; and commissioning of new equipment and site rehabilitation. The construction phase is estimated at 12 - 18 months.
» *Operation* – will include the operation of the PV 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 is expected to be approximately 20 years (with maintenance).
» *Decommissioning* – depending on the economic viability of the PV 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 appropriate disposal thereof, 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 impacts associated with construction and decommissioning activities may include, among others, threats to biodiversity and ecological processes, including habitat alteration and impacts to fauna, avifauna and flora, impacts to sites of heritage value, soil contamination, erosion and loss of agricultural land, nuisance from the movement of vehicles transporting equipment and materials, and loss of income from agricultural land .

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

From the specialist studies undertaken (and as identified at Scoping), the following aspects do not require any further assessment:

Freshwater/wetland assessment
An Ecological scoping study which considered freshwater features and aquatic biodiversity was undertaken in the Scoping Phase for the project. The findings indicated that there are no natural permanent water or artificial earth dams within the project site. There are scattered ephemeral pans on the project site. However, as these were identified at Scoping, the development area/footprint was able to completely avoid the ephemeral pans to avoid any impact on these features, and as such ***no further assessment of impacts to the freshwater ecology was recommended by the Plan of Study or considered necessary***[21]. This was accepted through the acceptance of the Final Scoping.

Cultural Landscape
Based on the findings of the heritage report at Scoping, which included the consideration of the cultural landscape, it was not anticipated that the proposed development would have a negative impact on any significant cultural landscape in the area due to the existing similar infrastructure here. As no impact to the

[21] A brief motivation regarding the exclusion of the study is included in Appendix R.

cultural landscape was anticipated, no further assessment of impacts to the cultural landscape was recommended or considered necessary to be assessed through the heritage study.

7.1. Quantification of Areas of Disturbance on the Site

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

- The project development area being assessed for San Solar PV is approximately 400ha in extent, of which the proposed infrastructure will occupy an area of approximately 205ha. This area includes infrastructure such as PV modules and mounting structures, Inverters and transformers, BESS, temporary and permanent laydown area, site offices and maintenance buildings, including workshop areas for maintenance and storage and site and internal access roads.
- The grid connection solution includes additional infrastructure, including a grid line servitude (up to 36m in width, with the towers required to support line up to 24m in height); on-site substation (footprint area up to 1ha in extent) and Eskom switching station (footprint area up to 1ha in extent).

7.2. Potential Impacts on Ecology (Ecology, Flora and Fauna)

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. The significance of the impacts on terrestrial Ecology expected with the development of the San Solar PV project 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 D** for more details).

7.2.1 Results of the Ecological Impact Assessment

A site visit to the site was conducted over two days (21 to 22 April 2022). During the site visit, the different biodiversity features, habitat, and landscape units present at the site were identified and mapped in the field. Two NFA-protected tree species occur at the site, *Boscia albitrunca* and *Vachelia erioloba*. Based on the results of the field assessment and the previous walk-through study that was conducted on the site, it is estimated that less than 100 *Vachelia erioloba* trees would be lost to the development, while up to 150 *Boscia albitrunca* trees would be lost. The *Boscia albitrunca* present at the site are mostly shrubby and flat versions, with few actual upright trees present. The *Vachelia erioloba* present are moderately tall with larger individuals present in the southwest of the site, outside of the development footprint. Given the size and density of *Vachelia erioloba* and *Boscia albitrunca* at the site, an offset to deal with the loss of these individuals from the site is not considered warranted as these are not significant numbers and would not impact the local populations of these species in any way.

The verified plant species theme sensitivity is illustrated (refer to **Figure 7.2**) and show that the PV facility is restricted to the low sensitivity parts of the site. The grid connection runs through areas that are also classified as low sensitivity. Although there are some small pans along the power line corridor, these have been

avoided under the current layout and can also be avoided should there be any changes to the exact routing of the power line.

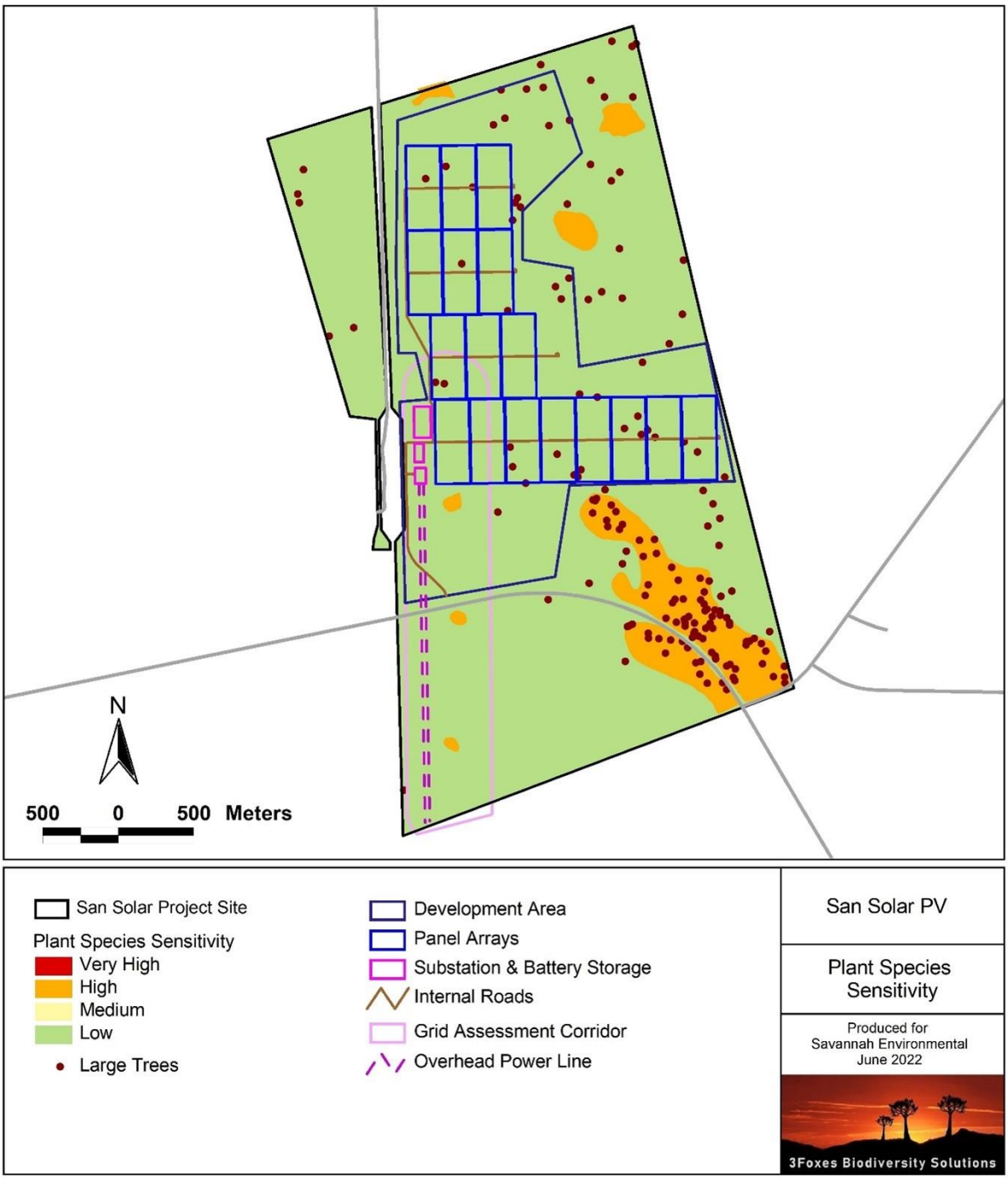


Figure 7.2: Verified plant species theme sensitivity for the San Solar site and grid connection

The animal species sensitivity for the San Solar site is illustrated (refer to **Figure 7.3**). The majority of the site is considered low sensitivity for fauna. The pans and the deeper sands in the south-east of the site are considered to be moderate sensitivity and contribute to the habitat diversity of the site. There are no areas at the site which are considered specifically high sensitivity for terrestrial fauna. As such, the San Solar site is considered acceptable for the development of the PV facility and grid connection from a terrestrial fauna perspective.

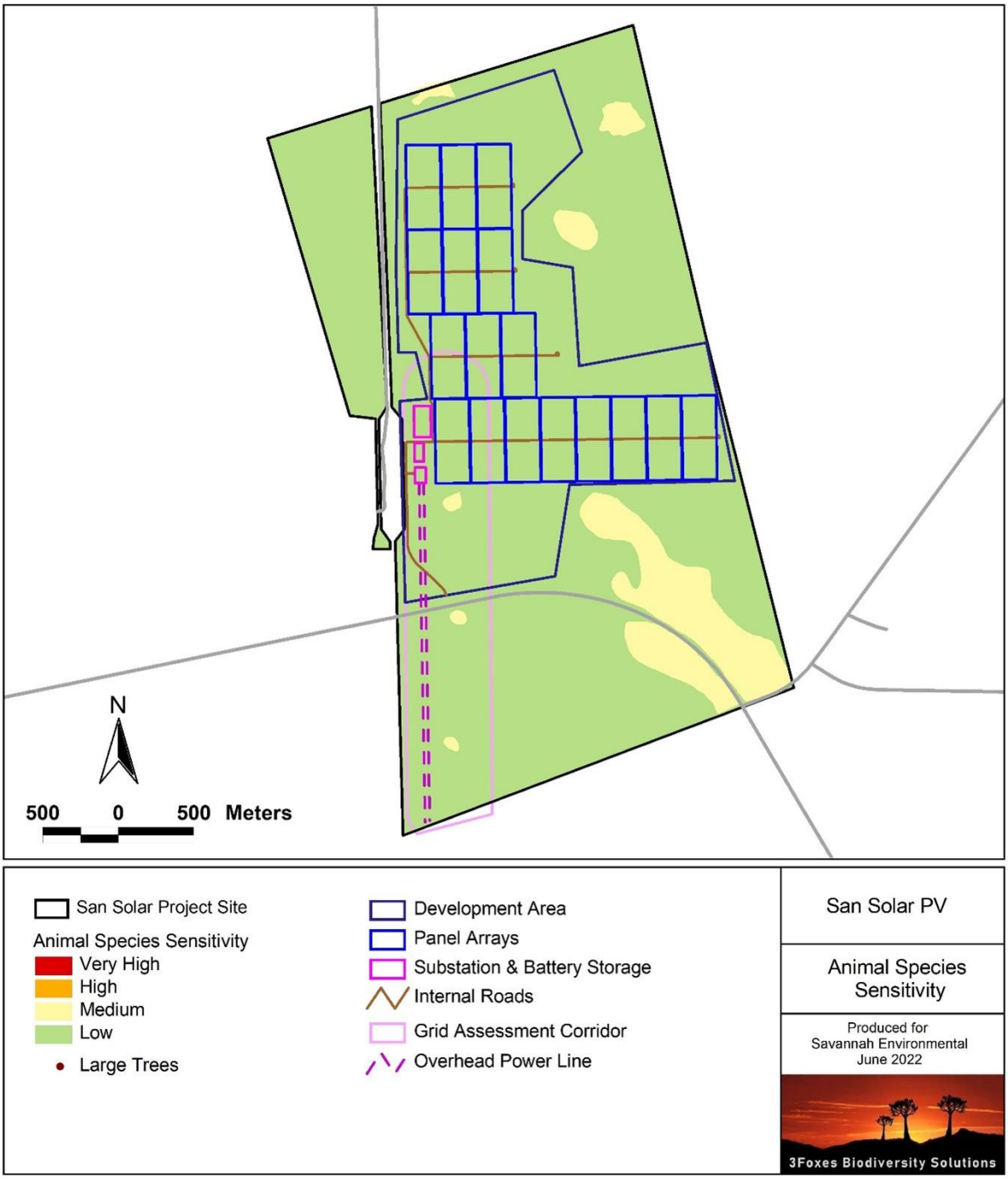


Figure 7.3: Verified animal species theme sensitivity for the San Solar site and grid connection

7.2.2 Description of Ecological Impacts

Although there are no CBAs within the site, a large proportion of the site consists of Ecological Support Areas. Potential ecological impacts resulting from the proposed development of the San Solar PV facility and associated grid connection infrastructure would stem from a variety of different activities and risk factors associated with the preconstruction, construction and operational phases of the project including the following:

7.2.3 Impact tables summarising the significance of impacts on ecology related to the PV facility, substations and the grid line during construction and operation (with and without mitigation)

Impact**: Impacts on vegetation and listed or protected plant species resulting from construction activities* ***Nature: Impacts on vegetation will occur due to disturbance and vegetation clearing associated with the construction of the facility. In addition, there will be loss of individuals of protected tree species.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (5)	Moderate (4)
Probability	Definite (5)	Definite (5)
Significance	**Medium (50)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	This impact cannot be well-mitigated because the loss of vegetation and individuals of protected tree species is unavoidable and is a certain outcome of the development.	
Mitigation: » Pre-construction walk-through of the facility's final layout in order to locate species of conservation concern that can be translocated as well as comply with the Northern Cape Nature Conservation Act and DENC/DEFF permit conditions. » Search and rescue for identified species of concern before construction. » Vegetation clearing to commence only after walk-through and search and rescue has been conducted and necessary permits obtained. » Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimising wildlife interactions, remaining within demarcated construction areas etc. » Contractor's Environmental Officer (EO) to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near the pans. » Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared. » All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area. » Temporary laydown areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use.		
Residual Impacts: As the loss of currently intact vegetation is an unavoidable consequence of the development, the habitat loss associated with the development remains a moderate residual impact even after mitigation and avoidance of more sensitive areas.		

Impact:** Direct faunal impacts due to construction activities* ***Nature: Disturbance, transformation and loss of habitat will have a negative effect on resident fauna during construction. Due to noise and operation of heavy machinery, faunal disturbance will extend well beyond the footprint and extend into adjacent areas. This will however be transient and restricted to the construction phase.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low to Medium (5)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)

Significance	**Medium (32)**	**Low (28)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Although the large amounts of noise and disturbance generated at the site during construction is largely unavoidable, impacts such as those resulting from the presence of construction personnel at the site can be easily mitigated.	

Mitigation:

» All personnel should 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.
» Any fauna threatened by the construction activities should be removed to safety by an appropriately qualified environmental officer.
» All construction vehicles should adhere to a low speed limit (30km/h for heavy vehicles and 40km/h for light vehicles) to avoid collisions with susceptible species such as snakes and tortoises.
» All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
» If trenches need to be dug for electrical cabling or other purpose, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.

Residual Impacts:

It is probable that some individuals of susceptible species will be lost to construction-related activities despite mitigation. However, this is not likely to impact the viability of the local population of any fauna species.

Impact: *Impacts on ESAs and Broad-Scale Ecological Processes*
Nature: Transformation and presence of the facility will contribute to cumulative habitat loss within ESAs and impacts on broad-scale ecological processes such as fragmentation.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (3)	Minor (2)
Probability	Certain (5)	Highly probable (4)
Significance	**Medium (40)**	**Low (28)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	To some degree, but the habitat loss associated with the project is largely unavoidable.	

Mitigation:

» Minimise the development footprint within the high sensitivity areas.
» There should be an integrated management plan for the development area during operation, which is beneficial to fauna and flora.
» All disturbed areas that are not used such as excess road widths, should be rehabilitated with locally occurring shrubs and grasses after construction to reduce the overall footprint of the development.
» Disturbance on the site should be kept to a minimum during operation and maintenance activities.

Residual Impacts:

Habitat loss within the ESAs cannot be fully mitigated or avoided with the result that some residual habitat and local disturbance, for affected fauna and flora will occur during operation of the facility.

Operations Phase Impacts

Impact: *Faunal impacts due to operation* ***Nature:*** The operation and presence of the facility may lead to disturbance or persecution of fauna within or adjacent to the facility.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	To a large extent, but some low-level residual impact due to noise and human disturbance during maintenance is likely.	
Mitigation: » Any potentially dangerous fauna such as snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location. » If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects. » All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. » All vehicles accessing the site should adhere to a low speed limit (30km/h max for heavy vehicles and 40km/h for light vehicles) to avoid collisions with susceptible species such as snakes and tortoises. » If the facility is to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences because they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside as is the case on the majority of already constructed PV plants.		
Residual Impacts: Disturbance from maintenance activities will occur at a low level with the result that disturbance would be largely restricted to the site.		

Impact: *Habitat degradation due to erosion and alien plant invasion* ***Nature:*** Disturbance created during construction will leave the site and its immediate surroundings vulnerable to erosion and alien plant invasion for several years into the operational phase.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (2)	Short-term (1)
Magnitude	Medium (4)	Low (3)
Probability	Likely (4)	Likely (3)
Significance	**Low (28)**	**Low (15)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	High
Irreplaceable loss of resources?	Moderate	Low
Can impacts be mitigated?	Yes, with proper management and avoidance, this impact can be mitigated to a low level.	

Mitigation:

- Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan. This should make provision for annual monitoring and rehabilitation.
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
- There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous perennial shrubs, grasses and trees from the local area.
- Alien management at the site should take place according to the Alien Invasive Management Plan.
- Regular (annual) monitoring for alien plants during operation to ensure that no alien invasive problems have developed as result of the disturbance, as per the Alien Management Plan for the project.
- Woody aliens should be controlled on at least an annual basis using the appropriate alien control techniques as determined by the species present.

Residual Impacts:

Some erosion and alien plant invasion is likely to occur even with the implementation of control measures, but would have a low impact if effectively managed

Decommissioning Phase

Impact: *Habitat degradation due to erosion and alien plant invasion*

Nature: Disturbance created during decommissioning will leave the site vulnerable to erosion and alien plant invasion for several years.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (3)
Magnitude	Medium (4)	Low(3)
Probability	Highly probable (4)	Improbable (3)
Significance	**Medium (32)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	Moderate	Low
Can impacts be mitigated?	Yes, with proper management and avoidance, this impact can be mitigated to a low level.	

Mitigation:

- Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan. This should make provision for monitoring of the site for at least 5 years after decommissioning.
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
- There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous perennial shrubs, grasses and trees from the local area.
- Alien management at the site should take place according to the Alien Invasive Management Plan. This should make provision for alien monitoring and management for at least 5 years after decommissioning.
- Regular (annual) monitoring for alien plants during operation to ensure that no erosion problems have developed as result of the disturbance, as per the Alien Management Plan for the project.
- Woody aliens should be controlled on at least an annual basis using the appropriate alien control techniques as determined by the species present. This might include the use of herbicides where no practical manual means are available.

Residual Impacts:

Some erosion and alien plant invasion is likely to occur even with the implementation of control measures, but would have a low impact if effectively managed.

Impact: *Direct faunal impacts* ***Nature:*** Due to disturbance, noise and the operation of heavy machinery, faunal disturbance due to decommissioning will extend beyond the footprint and impact adjacent areas to some degree. This will however be transient and restricted to the period while machinery is operational. In the long term, decommissioning should restore the ecological functioning and at least some habitat value to the affected areas.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Low (28)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Although the noise and disturbance generated at the site during decommissioning is probably largely unavoidable, this will be transient and ultimately the habitat should be restored to something useable by the local fauna.	
Mitigation: » All personnel should 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. » Any fauna threatened by the decommissioning activities should be removed to safety by an appropriately qualified environmental officer. » All vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises. » All hazardous materials should be stored in the appropriate manner to prevent contamination of the site and ultimately removed from the site as part of decommissioning. 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. » The site should be rehabilitated with locally occurring species to restore ecosystem structure and function.		
Residual Impacts: Although some components of disturbance cannot be avoided, the site itself would have low faunal abundance at decommissioning and no significant residual impacts are likely.		

7.2.5 Implications for Project Implementation

From the outcomes of the studies undertaken, it is concluded that there are no impacts on terrestrial biodiversity associated with the development of the San Solar PV development and Grid Connection that cannot be mitigated to an acceptable level. As such, should all the proposed mitigation be implemented, this development is deemed acceptable from a terrestrial ecological impact perspective.

Based on the above, from an ecological perspective there are no objections with the implementation of mitigation measures . Mitigation and avoidance measures that should be implemented at the San Solar site to limit negative impacts on vegetation and plant species of concern include the following measures:

» Pre-construction walk-through of the facility's final layout in order to locate species of conservation concern that can be translocated as well as comply with the Northern Cape Nature Conservation Act and DENC/DEFF permit conditions.
» Search and rescue for identified species of concern before construction.

- Vegetation clearing to commence only after walk-through and search and rescue has been conducted and necessary permits obtained.
- Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimising wildlife interactions, remaining within demarcated construction areas etc.
- Contractor's Environmental Officer (EO) to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near the pans.
- All construction vehicles should adhere to clearly defined and demarcated roads. No off-
- Temporary laydown areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use.
- Regular (annual) monitoring for alien plants during operation to ensure that no erosion problems have developed as result of the disturbance created at construction.
- Woody aliens should be controlled on at least an annual basis using the appropriate alien control techniques as determined by the species present. This might include the use of herbicides where no practical manual means are available.

Mitigation and avoidance measures that should be implemented at the San Solar site to limit negative impacts on faunal habitats and animal species of concern include the following measures:

- All personnel should 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.
- Any fauna threatened by the construction activities should be removed to safety by an appropriately qualified environmental officer.
- All construction vehicles should adhere to a low speed limit (30km/h for heavy vehicles and 40km/h for light vehicles) to avoid collisions with susceptible species such as snakes and tortoises.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- If trenches need to be dug for electrical cabling or other purpose, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.
- Any potentially dangerous fauna such as snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location.
- If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects.
- If the facility is to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences because they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside as is the case on the majority of already constructed PV plants.

7.3. Potential Impacts on Avifauna

The significance of the impacts on avifauna expected with the development of the San Solar PV project 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).

7.3.1 Results of the Avifauna Impact Assessment

Movement/dispersal of Collison-prone birds

The only deterministic daily flight routes were from two sandgrouse species (c. Burchell's Sandgrouse *Pterocles burchelli* and Namaqua Sandgrouse *Pterocles namaqua*), which arrive in the mornings to drink at one of the artificial livestock watering holes on the study area, especially during the dry season (refer to **Figure 7.4**). This particular artificial watering hole is approximately 50m from the proposed PV arrays, whereby it is recommended that bird flight diverters be applied to the panels nearest to the watering hole in order to minimise the potential interaction (collision trauma) of commuting sandgrouse individuals with the panels and associated infrastructure. The only other regular waterbird that occur in the area is the South African Shelduck (*Tadorna cana*), which could also potentially collide with the PV infrastructure when visiting inundated pans or artificial watering holes which occur in the area.

In addition, the home ranges of approximately 10 pairs of Red-crested Korhaan (*Lophotis ruficrista*) and two pairs of Northern Black Korhaan (*Afrotis afraoides*) correspond to the study area (refer to **Figure 7.5**). The proposed PV arrays coincide with at least three pairs of Red-crested Korhaan and one pair of Northern Black Korhaan, which have a high probability to become displaced due to the loss of habitat. Other collision-prone species that is resident on the study area include a pair of Pale Chanting Goshawks (*Melierax canorus*) and two pairs of Gabar Goshawk (*Micronisus gabar*).

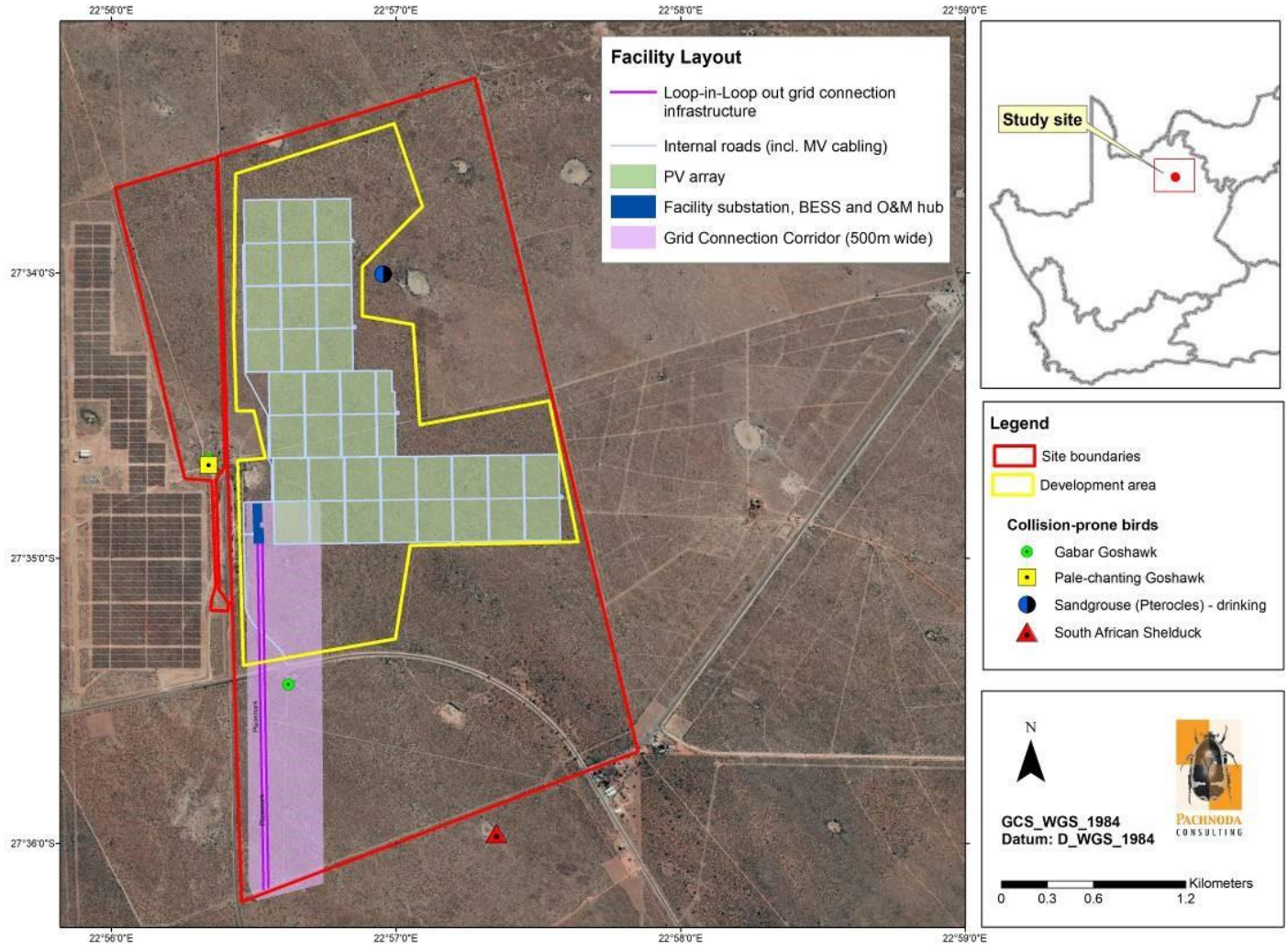


Figure 7.4: A map of the development area illustrating the occurrence of collision-prone birds

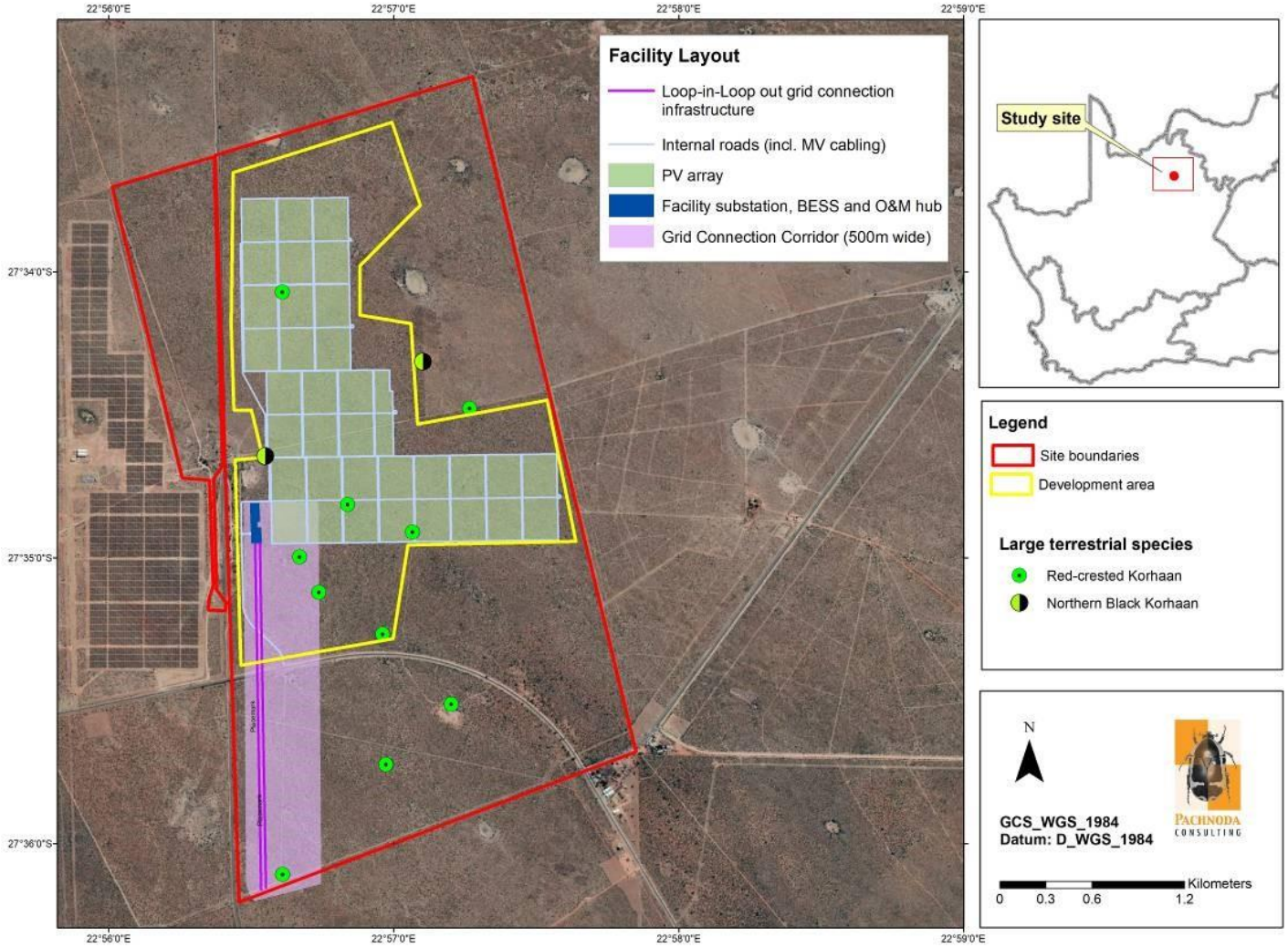


Figure 7.5: A map of the development area illustrating the occurrence of collision prone terrestrial bird species.

Habitat units comprising potential avifauna sensitive elements have been identified within the project site **(refer to Figure 7.6).** These sensitive elements have been classified as being of low sensitivity to high sensitivity and are described below.

» **Areas of high sensitivity**

The high sensitivity habitat units includes the open Kathu Bushveld, ephemeral pans and artificial watering points.

The open Kathu Bushveld, ephemeral pans and artificial watering points are considered to be of high avifaunal sensitivity. The open Kathu Bushveld provides potential foraging habitat for large terrestrial bird species such as the Kori Bustard (*Ardeotis kori*), many which are also prone towards collisions with power lines, although the frequency of occurrence of these species remains low in the area.

The ephemeral pans provide ephemeral foraging opportunities for waterbirds and shorebird taxa, which are rare or absent in the area when these are dry. Many of these species are highly nomadic in the area and may become disorientated by the "lake effect" caused by the PV panels which may result in bird colliding with the panels (and also power lines). The pans are also important from a functional and dynamic perspective at the landscape level since these form part of an "inter-connected" system or "stepping stones" of pans within the regional context, meaning that environmental conditions at these pans (e.g. water levels, salinity, food availability) are constantly changing depending on precipitation and evaporation. Therefore, none of the pans are exactly similar to each, thereby providing a continuous supply of resources for waterbirds when inundated.

The artificial livestock watering points attract large numbers of granivore passerine and non-passerine bird species, of which many need to drink water on a daily basis (e.g. sandgrouse). The placement of electrical and PV infrastructure in close proximity to these areas could increase potential avian collisions with the infrastructure. These areas are therefore of artificial origin, but could be relocated to other areas.

» **Areas of medium sensitivity**

The medium sensitivity habitat units includes the Kathu Bushveld (including Kathu Bushveld on deep red sands).

These are prominent in the region and provides potential suitable foraging habitat for some collision-prone bird species, including the Northern Black Korhaan (*Afrotis afraoides*) and Red-crested Korhaan (*Lophotis ruficrista*) with the potential to interact (e.g. collide) with the proposed electrical infrastructure. In addition, reporting rates for threatened and near threatened bird species are anticipated to be relatively low in this unit, thereby suggesting a medium sensitivity rating instead of a high sensitivity even though the majority of the habitat is natural. In addition, Kathu Bushveld is widespread in the region.

The Kathu Bushveld on deep red sands is expected to sustain a higher number of bird species when compared to the other units.

» **Areas of low sensitivity**

The low sensitivity habitat units are represented by transformed types and roads, homesteads and quarries.

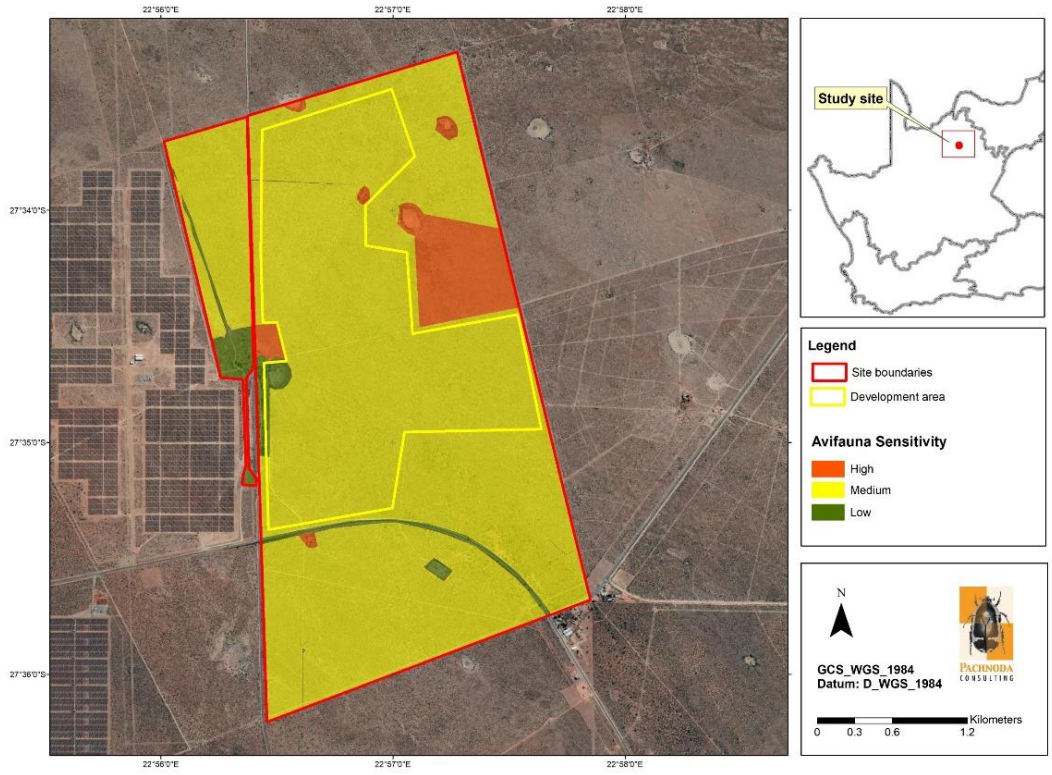


Figure 7.3: A map illustrating the avifaunal sensitivity of the study and development areas based on habitat types supporting bird taxa of conservation concern and important ecological function.

7.3.2 Description of Avifaunal Impacts

Negative avifauna impacts expected to occur with the development of San Solar PV includes a loss of habitat and displacement of birds, the creation of "new" avian habitat and bird pollution, collision trauma caused by PV panels and interaction with the power line, electrocution related to new distribution lines .

» ***Loss of habitat and displacement of birds***
Approximately 197.61 ha will be cleared of vegetation and habitat to accommodate the panel arrays and associated infrastructure. Clearing of vegetation will inevitably result in the loss of habitat and displacement of bird species. From the results, approximately 19.64 species/ha and 28.21 birds/ha will become displaced should the activity occur (as per Jenkins et al., 2017). Displacement will mainly affect regional endemic passerine and smaller non-passerine species inhabiting the Kathu Bushveld habitat of medium avifaunal sensitivity, although at least three pairs of Red-crested Korhaan and one pair of Northern Black Korhaan will become displaced.

The following bird species are most likely to be impacted by the loss of habitat due to their habitat requirements, endemism and conservation status (although not limited to) due to the proposed development:

» Burchell's Sandgrouse (*Pterocles burchelli*);
» Namaqua Sandgrouse (*Pterocles namaquus*)
» Fawn-colored Lark (*Calendulauda africanoides*);
» Kori Bustard (*Ardeotis kori*) - low potential;

- Layard's Warbler (*Curruca layardi*) - rare on study area;
- Pale Chanting Goshawk (*Melierax canorus*);
- Red-crested Korhaan (*Lophotis ruficrista*);
- Northern Black Korhaan (*Afrotis afraoides*);
- Kalahari Scrub Robin (*Cercotrichas paena*);
- White-backed Mousebird (*Colius colius*);
- Southern Pied Babbler (*Turdoides bicolor*) - uncommon on study area;
- Rufous-eared Warber (*Malcorus pectoralis*);
- Orange River Francolin (*Scleroptila gutturalis*).

- ***Creation of "new" avian habitat and bird pollution***

  It is possible that the infrastructure (during operation) could attract bird species which may occupy the site or interact with the local bird assemblages in the wider region. These include alien and cosmopolitan species, as well as aggressive omnivorous passerines which could displace other bird species from the area:

- House Sparrow (*Passer domesticus*);
- Pied Crow (*Corvus albus)*; and
- Speckled Pigeon (*Columba guinea*).

  The infrastructure may attract large numbers of roosting columbid taxa, especially Speckled Pigeons (*Columba guinea*), which may result in avian "pollution" through excreta, thereby fouling the panel surfaces. The impact is manageable and will result in a low significance.

- ***Collision trauma caused by PV panels (the " lake-effect")***

  The presence of surface water in close proximity to the study area consisted of a few small ephemeral pans and artificial livestock watering holes, with an absence of any large impoundments or perennial rivers. This explains the low occurrence of waterbird and shorebird taxa on the study area. The only waterbirds with a high frequency of occurrence which could interact with the PV panels are the Egyptian Goose (*Alopochen aegyptiaca*), South African Shelduck (*Tadorna cana*), African Sacred Ibis (*Threskiornis aethiopicus*) and potentially also White-faced Whistling Duck (*Dendrocygna viduata*). The high ephemeral nature of the pans and irregular rainfall patterns makes predictions regarding the occurrence of waterbird species and their numbers (e.g. density) in the area inconceivable. In addition, two sandgrouse species (*c. Burchell's Sandgrouse Pterocles burchelli and Namaqua Sandgrouse Pterocles namaqua*) could also interact with the PV panels when attempting to drink at these artificial watering holes. Some of the PV panel arrays will be located within 50m from such a watering hole which was regularly visited by sandgrouse (mainly arriving from the east).

  Desktop results and site observations show that the following species could interact with the panel infrastructure:

- Burchell's Sandgrouse (*Pterocles burchelli*)
- Namaqua Sandgrouse (*Pterocles namaqua*)
- South African Shelduck (*Tadorna cana*);
- Egyptian Goose (*Alopochen aegyptiaca*);
- White-faced Duck (*Dendrocygna viduata*);
- African Sacred Ibis (*Threskiornis aethiopicus*) and potentially also

- Little Grebe (*Tachybaptus ruficollis*);
- Black-headed Heron (*Ardea melanocephala*);
- Red-billed Teal (*Anas erythrorhynchus*);
- Cape Teal (*Anas capensis*); and
- Black-winged Stilt (*Himantopus himantopus*).

- ***Interaction with overhead power lines***

The grid connection will consists of an overhead Loop-in-Loop out (LILO) connection to the existing Umtu 132kV power line. The length of the LILO connection is approximately 2.3km and will be positioned parallel to existing Eskom powerlines. Birds are impacted in three ways by means of overhead power lines (described below). It is however a common rule that large and heavy-bodied terrestrial bird species are more at risk of being affected in a negative way when interacting with powerlines in general. These include the following:

- **Electrocution**

Electrocution happens when a bird bridges the gap between the live components or a combination of a live and earth component of a power line, thereby creating a short circuit. This happens when a bird, mainly a species with a fairly large wingspan attempts to perch on a tower or attempts to fly-off a tower. Many of these species include vultures (of the genera *Gyps* and *Torgos*) as well as other large birds of prey such as the Martial Eagle (*Polemaetus bellicosus*) (Ledger & Annegarn, 1981; Kruger, 1999; Van Rooyen, 2000). These species will attempt to roost and even breed on the tower structures if available nesting platforms are a scarce commodity in the area. Other types of electrocutions happen by means of so-called "bird-streamers". This happens when a bird, especially when taking off, excretes and thereby causes a short-circuit through the fluidity excreta (Van Rooyen & Taylor, 1999).

Large transmission lines (from 220kV to 765kV) are seldom a risk of electrocution, although smaller distribution lines (88kV – 132kV) pose a higher risk. However, for this project, the design of the pylon is an important consideration in preventing bird electrocutions.

- **Collision**

Collisions with earth wires have probably accounted for most bird-power line interactions in South Africa. In general, the earth wires are much thinner in diameter when compared to the live components, and therefore less visible to approaching birds. Many of the species likely to be affected include heavy, large-bodied terrestrial species such as bustards, korhaans and a variety of waterbirds that are not very agile or manoeuvrable once airborne. These species, especially those with the habit of flying with outstretched necks (e.g. most species of storks) find it difficult to make a sudden change in direction while flying – resulting in the bird flying into the earth wires.

Areas where bird collisions are likely to be high could be ameliorated by marking the lines with appropriate bird deterrent devices such as "bird diverters" and "flappers" to increase the visibility of the lines.

- **Physical disturbances and habitat destruction caused during construction and maintenance**

It is anticipated that part of the LILO servitude will be cleared of vegetation. In addition, construction activities go hand in hand with high ambient noise levels. Although construction is considered

temporary, many species will vacate the area during the construction phase and will become temporarily displaced.

7.3.3 *Impact tables summarising the significance of impacts on avifauna related to the PV facility and associated infrastructure including the LILO corridor during construction and operation (with and without mitigation)*

Nature: *Loss of habitat* Loss of natural habitat and displacement of birds through physical transformation, modifications, removals and land clearance. This impact is mainly restricted to the construction phase and is permanent.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long term(4)	Long term(4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Definite (5)	Highly Probable (4)
Significance	**Medium (60)**	**Medium (48)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes, to some extent	
Mitigation: It is difficult to mitigate against the loss of habitat since clearing of vegetation (or habitat) will be required for the infrastructure associated with the project. The PV facility and associated infrastructure occur predominantly on habitat types of medium sensitivity. The best practicable mitigation will be to consolidate infrastructure (e.g. proposed power line) to areas where existing impacts occur (e.g. placing the proposed powerline alongside existing power lines).		
Residual Impacts: Decreased bird species richness, low evenness values and subsequent loss of avian diversity on a local scale. The impact will also result in sterilisation of local landscapes and increased fragmentation of habitat.		

Nature: *Creation of "new" avian habitat* The creation of novel or new avian habitat for commensal bird species or superior competitive species. This is expected to occur during the operation phase of the facility.		
	Without mitigation	**With mitigation**
Extent	Footprint (1)	Footprint (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Low (18)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, with experimentation	
Mitigation: » Apply bird deterrent devices within the facility and remove nest structures constructed on infrastructure associated with the PV facility under the guidance of the ECO.		
Residual Impacts: Secondary displacement by completive bird species such as crows and increased fecundity rate for commensal bird species that are adapted to anthropogenic activities. The impact is regarded as low.		

Nature: *Avian collision with PV panels* Avian collision impacts related to the PV facility during the operation phase (i.e. collision with PV panels)		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	Moderate (6)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (56)**	**Low (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes, potential loss of endemic/near-endemic waterfowl and sandgrouse species.	Yes, potential loss of endemic/near-endemic waterfowl and sandgrouse species.
Can impacts be mitigated?	Yes, with experimentation	
Mitigation: » Apply bird deterrent devices such as rotating flashers/reflectors to the panels for birds that may mistake the panels for open water and to prevent them from landing on the panels - these should especially be placed at panels nearest to pans and watering points. » Security/CCTV cameras may be installed to quantify mortalities (cameras are also installed along the perimeter fence for security measures and may also prove effective to quantify mortalities). » Buffer pans by at least 200-300m (arrays should be positioned at least 200-300m away from pans). If post-construction monitoring predicts and/or confirms any bird mortalities, an option is to employ video cameras at selected areas to document bird mortalities and to conduct direct observations and carcass searches on a regular and systematic basis. » If bird mortalities occur at watering points, it is recommended that the watering hole be relocated (at least 300m from the PV arrays - preferred recommendations) or the watering point should be removed.		
Residual Impacts: Direct mortality is possible and may still occur irrespective of applied mitigation measures. Regular and systematic monitoring is proposed to assess the efficacy of applied mitigation and further research and testing is suggested to improve mitigation measures (e.g. bird deterrent devices). The residual impact is regarded as moderate.		

Nature: *Avian collision with power line* Avian collision impacts related to the overhead power lines during the operation phase.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes (to some extent), owing to the potential loss of terrestrial bird and certain bird of prey species.	Yes
Can impacts be mitigated?	Yes	
Mitigation:		

» Apply bird deterrent devices to the power lines and make use of "bird-friendly" pylon structures. Avoid the placement of any watering points in close proximity to any overhead electrical infrastructure in order to avoid attracting birds of prey or scavenger species to the study site. » To aid post-construction monitoring and/or monitoring of bird mortality rates, it is advised to conduct direct observations and carcass searches on a regular and systematic basis. » Collisions will be reduced if the LILO corridor is placed alongside existing powerlines.
Residual Impacts: Direct mortality is possible and may still happen irrespective of applied mitigation measures. The residual impact will be low.

Nature: *Avian electrocution impacts due to power line* Avian electrocution related to the new distribution lines during operation.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (30)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes, owing to the potential loss of terrestrial bird and certain bird of prey species	Yes, owing to the potential loss of terrestrial bird and certain bird of prey species.
Can impacts be mitigated?	Yes, to some extent	
Mitigation: » Avoid the placement of watering points in close proximity to any overhead electrical infrastructure in order to avoid attracting birds of prey or scavenger species such as vultures to the study area. » Make use of bird-friendly pylons and bird guards as recommended by EWT.		
Residual: Direct mortality is possible and may still happen irrespective of applied mitigation measures. The residual impact will be low.		

7.3.5 Implications for Project Implementation

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of avifauna impacts associated with San Solar PV will be medium to low.

From the outcomes of the studies undertaken, it is concluded that the PV facility and associated infrastructure can be developed and impacts on avifauna managed by taking the following into consideration:

» Concentrate all surface infrastructure on habitat of medium to low avifaunal sensitivity. The development footprint of the facility must be kept as small as possible and sensitive habitats must be avoided. Where possible, artificial livestock watering points should be relocated.
» Where possible, existing access roads should be used and the construction of new roads should be kept to a minimum.
» Use indigenous plant species native to the study area during landscaping and rehabilitation.

- Apply bird deterrent devices at selective areas (for example at the corners and middle part of the facility) to the PV panels to discourage birds from colonising the infrastructure or to discourage birds from constructing nests. These could include visual or bio-acoustic deterrents such as highly reflective rotating devices, anti-perching devices such as bird guards, scaring or chasing activities involving the use of trained dogs or raptors and/or netting. Nests should be removed when nest-building attempts are noticed under the guidance of the ECO.
- Buffer pans by at least 200-300m (arrays should be positioned at least 200-300m away from pans).
- Apply systematic reflective/dynamic markers to the boundary fence to increase the visibility of the fence for approaching birds (e.g. korhaan taxa) and to avoid potential bird collisions with the fence structure.
- All internal electrical reticulation should be placed underground, while the alignment of the power line and substation should be placed parallel to existing powerlines lines.
- Reduce or minimise the use of outdoor lighting to avoid attracting birds to the lights or to reduce potential disorientation to migrating birds.
- If bird mortalities occur at watering points (e.g. one of the watering points is within 50m of the proposed PV arrays), it is recommended that the watering hole be relocated (at least 300m from the PV arrays - preferred recommendations) or the watering point should be removed.
- Avoid the placement any livestock watering points in close proximity to overhead electrical infrastructure. A safe distance of at least 100 m from any overhead powerline is recommended.
- A post-construction surveys during operation with a minimum of 2x 3 day surveys during a six month period (including the peak wet season) is recommended.

7.4. Assessment of Impacts on Land Use, Soil and Agricultural Potential

The impact of San Solar PV 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).

7.4.1 Results of the Land Use, Soil and Agricultural Potential Study

Following the consideration of all the desktop and gathered baseline data above, the findings of the report agree with the results of the Environmental Screening Tool. The soil forms present within the proposed San Solar PV Facility development area as well as the grid connection corridor, are shallow soils that range in depth between 0.05 and 0.30m. Rock outcrops are present on the surface in several areas within the San Solar PV development area. The land type data confirms the soil classification data that the development area consists mainly of shallow soils, restricted in depth by lithic material and hard carbonate, in a flat to very slightly undulating landscape.

Even though the area is suitable for livestock farming, the long-term grazing of the entire development area is 13 ha/LSU. This is considered low-moderate grazing potential and livestock numbers must be strictly controlled, especially during periods of drought, to avoid overgrazing and land degradation. Only the PV Facility development area will be fenced off during the construction phase, resulting in the loss of forage that can feed 30 head of cattle.

The low agricultural potential of the site is further confirmed by the absence of any High Potential Agricultural Areas (HPAAs) in the vicinity of the development area. The nearest HPAAs are 170km away in a south-eastern and south-western direction. These HPAAs are associated with irrigation schemes and the availability of water that can be used for irrigation.

Considering the soil properties, land capability and agricultural potential of the development area, the entire PV Facility development area as well as the grid connection corridor have Low Agricultural Sensitivity (refer to **Figure 7.5**). Soil in the project area will have Low to Medium sensitivity, depending on the successful implementation of mitigation measures to prevent soil erosion, compaction and pollution.

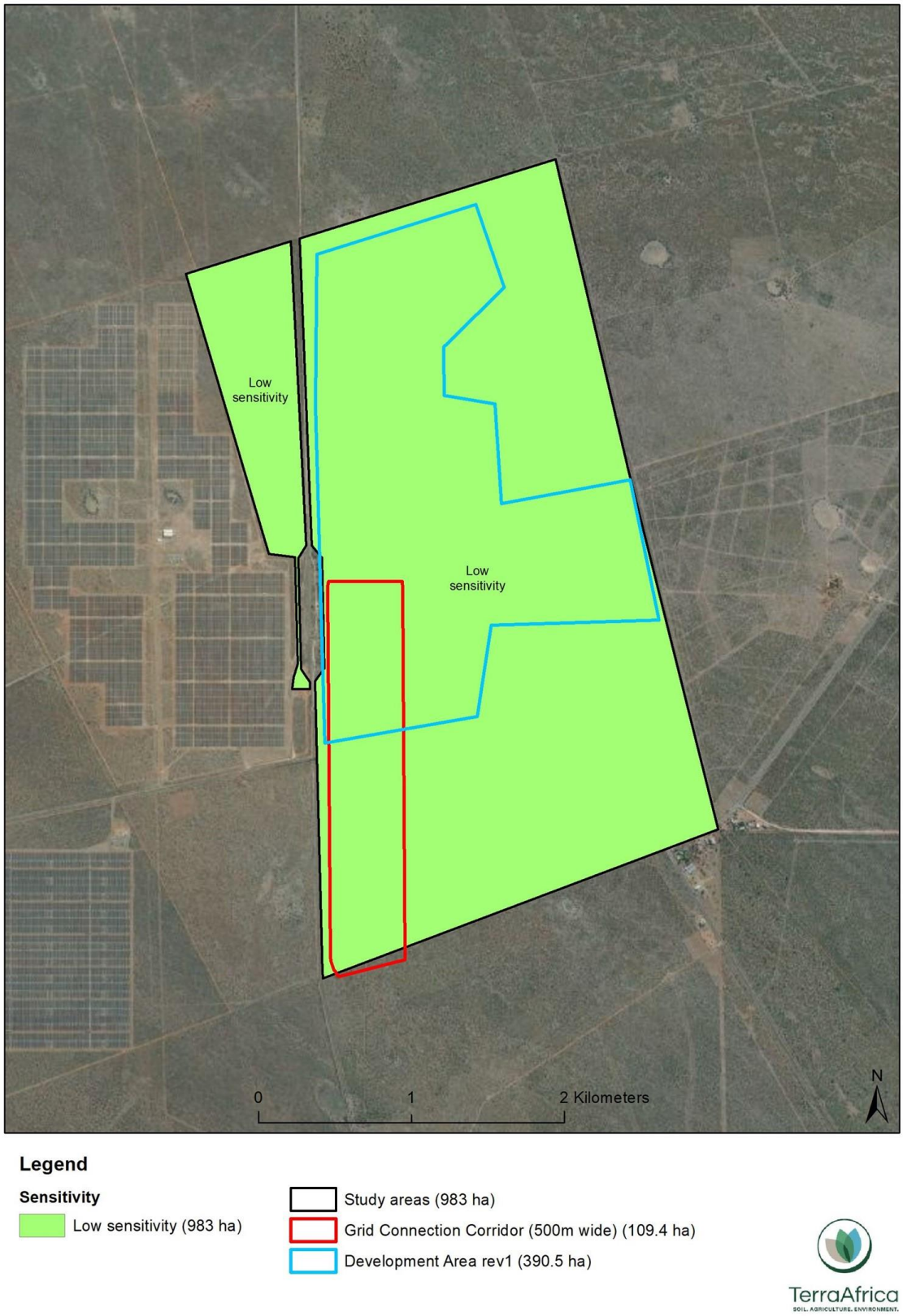


Figure 7.5: Agricultural sensitivity rating of the San Solar PV Facility development area and a grid connection corridor

7.4.2 Description of Land Use, Soil and Agricultural Potential Impacts

The most significant impacts of the proposed project on soil and agricultural productivity will occur during the construction phase when the vegetation is removed and the soil surface is prepared for the delivery of materials and erection of the infrastructure. During the operational phase, the risk remains that soil will be polluted by the waste generated or in the case of a spill incident. During the decommissioning phase, soil will be prone to erosion when the infrastructure is removed from the soil surface.

The impacts rated below are similar for both the PV development area as well as the grid connection corridor. It is assumed that the grid connection will not be fenced off and that the grid connection area will still be available for grazing, except where the pylons are erected. Regular maintenance on the grid connection will be conducted during the operational phase.

7.4.3 Impact tables summarising the significance of impacts on Land Use, Soil and Agricultural Potential during construction and operation (with and without mitigation)

Construction phase

Impact: *Change in land use from livestock farming to energy generation* ***Nature****: Prior to construction of the* project infrastructure, the area will be fenced off and livestock farming will be excluded from 400ha of land. The area where the access road will be constructed will not be fenced off.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (4)	Definite (4)
Significance	**Medium (40)**	**Medium (32)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation: » Vegetation clearance must be restricted to areas where infrastructure is constructed. » No materials removed from development area must be allowed to be dumped in nearby livestock farming areas. » Prior arrangements must be made with the landowners to ensure that livestock and game animals are moved to areas where they cannot be injured by vehicles traversing the area. » No boundary fence must be opened without the landowners' permission. » All left-over construction material must be removed from site once construction on a land portion is completed. » No open fires made by the construction teams are allowable during the construction phase.		
Residual: The residual impact from the construction of the San Solar PV facility and associated infrastructure is considered medium.		

Impact: *Soil Erosion*
Nature: All areas where vegetation is removed from the soil surface in preparation for the infrastructure construction will result in exposed soil surfaces that will be prone to erosion. Both wind and water erosion are a risk, as the area falls within a region that experiences thunderstorms in the summer months and sometimes strong winds during the dry winter months, especially August and September.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:
- Land clearance must only be undertaken immediately prior to construction activities and only within the development footprint;
- Unnecessary land clearance must be avoided;
- Level any remaining soil removed from excavation pits (where the PV modules will be mounted) that remained on the surface, instead of allowing small stockpiles of soil to remain on the surface;
- Where possible, conduct the construction activities outside of the rainy season; and
- Stormwater channels must be designed to minimise soil erosion risk resulting from surface water runoff.

Residual:
The residual impact from the construction and operation of the project on the susceptibility to erosion is considered low.

Impact: *Soil Compaction*
Nature: The clearing and levelling of land for construction of the infrastructure will result in soil compaction. In the area where the access roads and substation will be constructed, topsoil will be removed, and the remaining soil material will be deliberately compacted to ensure a stable surface prior to construction.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:
- Vehicles and equipment must travel within demarcated areas and not outside of the construction footprint;
- Unnecessary land clearance must be avoided;
- Materials must be off-loaded and stored in designated laydown areas;
- Where possible, conduct the construction activities outside of the rainy season; and
- Vehicles and equipment must park in designated parking areas.

Residual:
The residual impact from the construction and operation of the project on soil compaction is considered low.

Impact: *Soil Pollution*
During the construction phase, construction workers will access the land for the preparation of the terrain and the construction of the facility and access road. Potential spills and leaks from construction vehicles and equipment and waste generation on site can result in soil pollution.

Nature: The following construction activities can result in the chemical pollution of the soil:
- Petroleum hydrocarbon (present in oil and diesel) spills by machinery and vehicles during earthworks and the removal of vegetation as part of site preparation;
- Spills from vehicles transporting workers, equipment, and construction material to and from the construction site;
- The accidental spills from temporary chemical toilets used by construction workers;
- The generation of domestic waste by construction workers;
- Spills from fuel storage tanks during construction;
- Pollution from concrete mixing;
- Pollution from road-building materials; and
- Any construction material remaining within the construction area once construction is completed.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Low (4)	Improbable (2)
Significance	**Medium (36)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:
- Maintenance must be undertaken regularly on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills;
- Any waste generated during construction must be stored into designated containers and removed from the site by the construction teams;
- Any left-over construction materials must be removed from site;
- The construction site must be monitored by the Environmental Control Officer (ECO) to detect any early signs of fuel and oil spills and waste dumping;
- Ensure battery transport and installation by accredited staff / contractors; and
- Compile (and adhere to) a procedure for the safe handling of battery cells during transport and installation.

Residual:
The residual impact from the construction and operation of the project will be low and negligible.

Operation phase

Impact: *Soil Erosion*
During the operations phase, staff and maintenance personnel will access the project area daily.

Nature: The areas where vegetation was cleared will remain at risk of soil erosion, especially during a rainfall event when runoff from the cleared surfaces will increase the risk of soil erosion in the areas directly surrounding the project area

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)

Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: » The area around the project, including the internal access roads, must regularly be monitored to detect early signs of soil erosion on-set; and » If soil erosion is detected, the area must be stabilised using geo-textiles and facilitated re-vegetation.		
Residual: The residual impact from the operation of the project on the susceptibility to erosion is considered low.		

Impact: *Soil Pollution*

Nature: During the operation phase, potential spills and leaks from maintenance vehicles and equipment and waste generation on site can result in soil pollution. Also, any spillages around the workshop area or damaged infrastructure, such as inverters and transformers, can be a source of soil pollution.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Low (4)	Improbable (2)
Significance	**Medium (36)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: » Maintenance must be undertaken regularly on all vehicles and maintenance machinery to prevent hydrocarbon spills; » No domestic and other waste must be left at the site and must be transported with the maintenance vehicles to an authorised waste dumping area; and » Regularly monitor areas alongside the roads, parking area and workshop for any signs of oil, grease and fuel spillage or the presence of waste.		
Residual: The residual impact from the operation of the proposed project will be low to negligible.		

Decommissioning phase

The decommissioning phase will have the same impacts as the construction phase i.e. soil erosion, soil compaction and soil pollution. It is anticipated that the risk of soil erosion will especially remain until the vegetation growth has re-established in the area where the project infrastructure was decommissioned.

7.4.5 Implications for Project Implementation

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of impacts of San Solar PV is expected to have a Medium and Low impact on soils and agricultural potential, depending on which impact is being considered. These impacts can be reduced by keeping the footprints 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. From the outcomes of the studies undertaken, it is concluded that the PV facility can be developed and impacts on soils managed by taking the following into consideration:

- Limit vegetation clearance to only the areas where the surface infrastructure will be constructed
- Avoid parking of vehicles and equipment outside of designated parking areas.
- Plan vegetation clearance activities for dry seasons (late autumn, winter and early spring).
- Design and implement a Stormwater Management System where run-off from surfaced areas is expected.
- Re-establish vegetation along the access road to reduce the impact of run-off from the road surface.
- Maintenance must be undertaken regularly on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills.
- Any waste generated during construction must be stored in designated containers and removed from the site by the construction teams.
- Any left-over construction materials must be removed from site.
- Ensure battery transport and installation is by accredited staff / contractors.

7.5. 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 San Solar PV. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix G**).

7.5.1 Results of the Heritage Impact Assessment (including archaeology and palaeontology)

Archaeology

Very few heritage resources of significance were identified during the archaeological field assessment. Three observations of Middle Stone Age scatters of low density noted were all associated with a wetland that is located well-outside of the development footprint, and therefore not impacted. These observations have been graded IIIC for their contextual scientific significance.

The field assessment also identified a ruin of a mid-Century (1950's-1970's) structure located in context with other farming infrastructure and an abandoned railway siding on the eastern side of the railway line bordering the old farm settlement. The building material is mostly vernacular (dolomite) with some modern additions. This observation has no intrinsic heritage significance and has been determined to be not conservation-worthy.

The field assessment also identified an informal remembrance memorial located on the R380 road. Although this memorial may have social significance for specific family members, it is hard to argue for broader social significance in terms of the cultural values described in the NHRA. This informal memorial has been determined to be not conservation-worthy.

Table 7.1: Heritage resources identified within the San Solar PV project site

Site No.	Description	Density	Period	Co-ordinates		Grading	Mitigation
002	Ruin of mid-Century structure. In context with farming infrastructure and an abandoned railway siding on the eastern side of the railway line bordering the old farm settlement. Building material mostly vernacular with some modern additions. Karoo cottage style architecture. Building material seems like dolomite blocks.	N/A	Modern	27° 34' 39.10" S	22° 56' 20.40" E	NCW	N/A
004	**Scaper, core and chunk made from CCS and BIF. Located on edge of wetland**	**3/10m²**	**MSA**	**27° 34' 04.6" S**	**22° 57' 04.9" E**	**IIIC**	**200m Buffer**
005	**Scaper, chips and chunks made from CCS and BIF. Located on edge of wetland**	**6/10m²**	**MSA**	**27° 34' 02.3" S**	**22° 57' 08.9" E**	**IIIC**	**200m Buffer**
006	**Unfinished blade, chunk, scraper, chips and a core made from BIF. Located on edge of wetland**	**8/50m²**	**MSA**	**27° 34' 06.3" S**	**22° 57' 06.1" E**	**IIIC**	**200m Buffer**
008	Memorials to those who died in road accidents on the R380 on the eastern edge of the grid connection corridor	N/A	Modern	27° 35' 23.6" S	22° 56' 37.2" E	NCW	N/A

Palaeontology

The palaeontological sensitivity of the area under consideration is presented in **Figure 7.6**, indicating that the area is underlain by formations of high palaeontological sensitivity. According to the Desktop Palaeontology Assessment completed by Bamford (2021) for this project, "The site lies on the northern margin of the Transvaal Basin on the Kaapvaal Craton. The underlying rocks are not exposed here and only the overlying Tertiary Calcretes are of relevance to this project".

According to Bamford (2021), "Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are either much too old to contain fossils (below ground) or might trap Tertiary fossils in limestones and calcretes. The material to be excavated is flat soils and sands this does not preserve fossil".

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the limestones and calcretes of the Tertiary because they are very rare and there are no visible outcrops in the flat landscape.

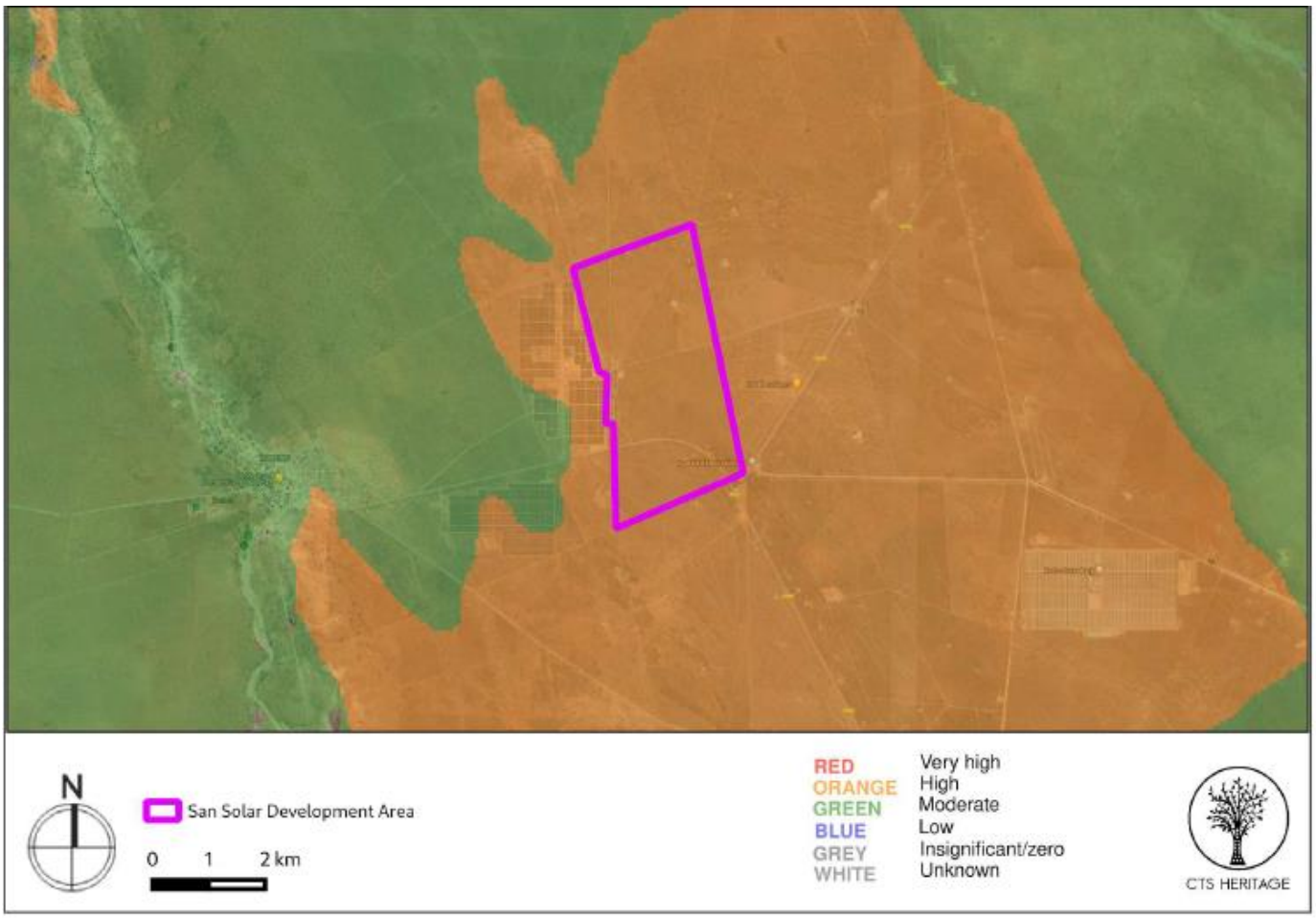


Figure 7.6: Palaeontological sensitivity of the project site and development area

7.5.2 Description of the Heritage Impacts

The archaeological resources identified within the development area are dominated by low density scatters of Middle Stone Age artefacts and flakes located in proximity to a wetland. These resources have been graded IIIC for their contextual significance. Due to its environmental and ecological sensitivity, this wetland is excluded from the development area, and there is more than 200m between the boundaries of the wetland and the proposed PV fence line. As such, no impact to these resources is anticipated.

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the limestones and calcretes of the Tertiary because they are very rare and there are no visible outcrops in the flat landscape. There is a very small chance that fossils may occur in the tertiary limestone, and therefore a Fossil Chance Find Protocol must be implemented.

7.5.3 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)

Nature: *Impacts on archaeology resources* The construction phase of the project will require excavation, which may impact on heritage resources if present		
	Without mitigation	**With mitigation**
Extent	Limited to the development footprint (1)	Limited to the development footprint (1)
Duration	Where manifest, the impact will be permanent (5)	Where manifest, the impact will be permanent (5)
Magnitude	3 archaeological sites of low scientific significance were identified within the area proposed for development (6)	3 archaeological sites of low scientific significance were identified within the area proposed for development (2)
Probability	It is possible that significant archaeological resources will be impacted (3)	It is unlikely that significant archaeological resources will be impacted (1)
Significance	**Medium (60)**	**Low (8)**
Status (positive or negative)	Negative	Neutral
Reversibility	Any impacts to heritage resources that do occur are irreversible	Any impacts to heritage resources that do occur are irreversible
Irreplaceable loss of resources?	Possible	Not likely
Can impacts be mitigated?	Yes	
Mitigation: » A 200m no-go buffer must be implemented around the wetland associated with these archaeological observations » Should any buried archaeological resources or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The South African Heritage Resources Agency (SAHRA) must be contacted immediately in order to determine an appropriate way forward.		
Residual Impacts: None		

Nature: *Impacts on palaeontology resources* It is possible that buried palaeontological resources may be impacted by the proposed development		
	Without mitigation	**With mitigation**
Extent	Limited to the development footprint (1)	Limited to the development footprint (1)
Duration	Where manifest, the impact will be permanent (5)	Where manifest, the impact will be permanent (5)
Magnitude	According to the SAHRIS Palaeosensitivity Map, the area proposed for development is underlain by sediments that have high palaeontological sensitivity (4)	According to the SAHRIS Palaeosensitivity Map, the area proposed for development is underlain by sediments that have high palaeontological sensitivity (2)
Probability	It is unlikely that significant fossils will be impacted (1)	It is unlikely that significant fossils will be impacted (1)
Significance	**Low (10)**	**Low (08)**
Status (positive or negative)	Negative	Negative
Reversibility	Any impacts to heritage resources that do occur are irreversible	Any impacts to heritage resources that do occur are irreversible
Irreplaceable loss of resources?	Possible	Unlikely
Can impacts be mitigated?	Yes	

Mitigation:
» The Chance Fossils Finds Procedure (Appendix 4 of the Heritage Impact Assessment Report) must be implemented
Residual Impacts:
None

7.5.5 Implications for Project Implementation

The results of the archaeological field assessment conducted largely aligns with the findings of previous archaeological assessments completed within and in the vicinity of the proposed development. The archaeological resources identified within the project site are dominated by low density Middle Stone Age flakes and artefacts associated with a wetland. Due to its ecological sensitivity, the wetland has been excluded from the development area and as such, no impact to these resources is anticipated. Based on the information available, the proposed development is unlikely to directly impact on any significant archaeological heritage resources. No heritage finds/resources are required to be avoided by the proposed facility layout.

According to the Desktop PIA (Bamford, 2021), based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the limestones and calcretes of the Tertiary because they are very rare and there are no visible outcrops in the flat landscape. There is a very small chance that fossils may occur in the Tertiary limestones so a Fossil Chance Find Protocol must be implemented.

7.6. Assessment of Visual Impacts

Negative impacts on visual receptors will occur during the undertaking of construction activities and the operation of San Solar PV. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix H**).

7.6.1 Results of the Visual Impact Assessment

Potential Visual Exposure

The viewshed analysis was undertaken from a representative number of vantage points within the development footprint at an offset of 5m above ground level. The result of the visibility analysis is illustrated in **Figure 7.7**.

From the viewshed analysis, it is evident that constrained dimensions of the PV facility would amount to a fairly limited area of potential visual exposure. The visual exposure would largely be contained within a 6km radius of the development site, with the predominant exposure to the north east.

The facility may be highly visible within a 1km radius of the development. There are no residences (besides those associated with the Sishen Solar facility) within this zone, only a section of the Deben secondary road traversing south of the proposed PV facility at distances of under one kilometre.

One 3km zone contains the Stokkiesdraai guesthouse, Haakbosskerm homestead and restaurant, the Flatlands and Halliford homesteads, and sections of the R380 main road. Other than these potential receptor

sites, the rest of the visually exposed areas fall within vacant farmland or natural open space. It is expected that the PV facility would be clearly visible from these homesteads.

Within 3-6km zone radius, the visual exposure is more scattered and interrupted due to the undulating nature of the topography. Most of this zone falls within vacant open space and agricultural land, but does include some farm dwellings and residences (Limebank and Klein Landbank) and the eastern outlying parts of Deben. It appears as if the above homesteads may have been demolished.

At distances exceeding 6km the intensity of visual exposure is expected to be very low and highly unlikely due to the distance between the object (development) and the observer. This zone contains a single potentially exposed receptor site, namely the Bosaar homestead.

Visual Distance/Observer Proximity to the PV facility

The proximity radii are based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for (e.g. more extensive infrastructure associated with power plants exceeding 100MW) and downwards for smaller plants (e.g. smaller infrastructure associated with power plants with less generating capacity such as the proposed 100MW San Solar PV facility).

The proximity radii, based on the dimensions of the proposed development footprint, are indicated in **Figure 7.8**, and include the following:

- 0 - 1km. Very short distance view where the PV facility would dominate the frame of vision and constitute a very high visual prominence.
- 1 – 3km. Short distance view where the structures would be easily and comfortably visible and constitute a high visual prominence.
- 3 - 6km. Medium to longer distance view where the facility would become part of the visual environment but would still be visible and recognisable. This zone constitutes a moderate visual prominence.
- 6km. Long distance view of the facility where the structures are not expected to be immediately visible and not easily recognisable. This zone constitutes a lower visual prominence for the facility.

Visual Impact Index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed PV are shown in **Figure 7.9**. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index.

The index indicates that potentially sensitive visual receptors within a 1km radius of the PV facility may experience a very high visual impact. The magnitude of visual impact on sensitive visual receptors subsequently subsides with distance to; high within a 1 3km radius (where/if sensitive receptors are present) and moderate within a 3 6km radius (where/if sensitive receptors are present). Receptors beyond 6km are expected to have a low potential visual impact.

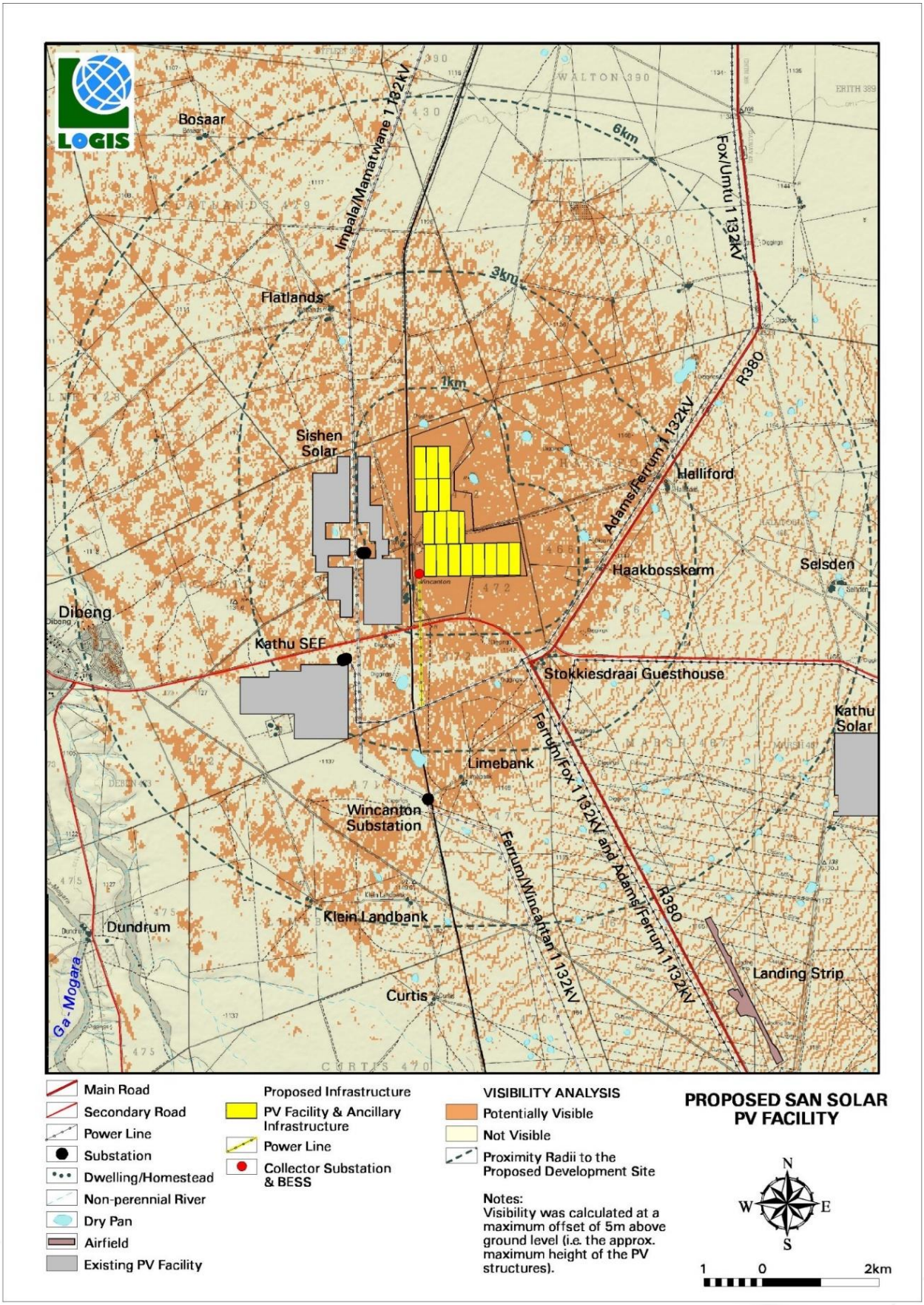


Figure 7.7: Results of the viewshed analysis for the San Solar PV facility indicating that visual exposure would largely be contained within a 6km radius of the development site

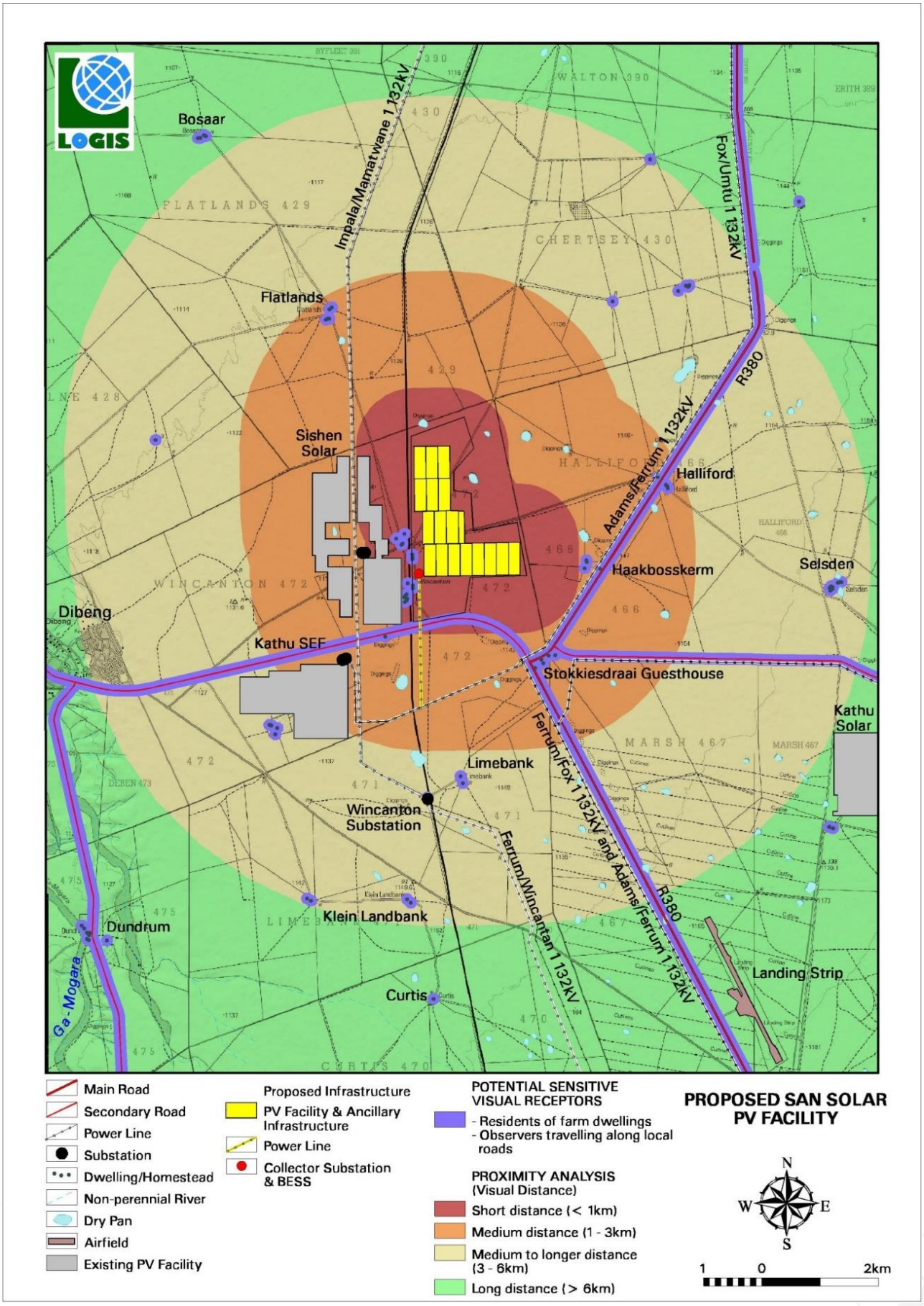


Figure 7.8: Proximity analysis and potential sensitive visual receptors

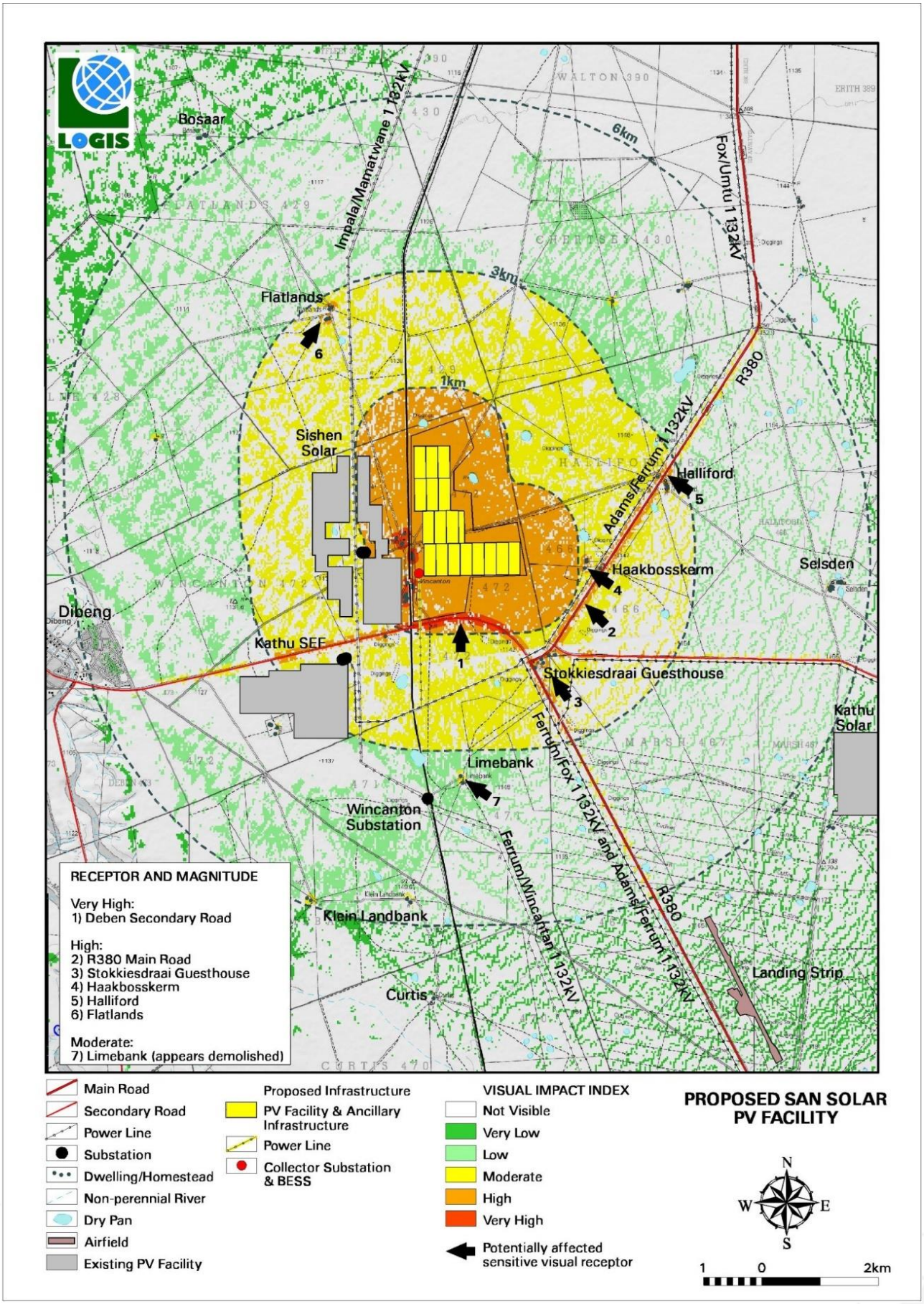


Figure 7.9: Visual impact index and potentially affected sensitive visual receptors for the San Solar PV facility

7.6.2 Description of Visual Impacts

The primary visual impacts associated with the construction and operation of the San Solar PV include:

- During the construction phase, there may be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and landowners in close proximity (<1km) to the construction activities. Construction activities may potentially result in a moderate, temporary visual impact, that may be mitigated to moderate.
- During the operation phase there will be a moderate visual impact on observers travelling along the Deben secondary road, both before and after mitigation. There are no affected residences within a 1km radius of the proposed PV facility. Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended in order to reduce/mitigate the potential visual impact.
- The operational PV facility could have a moderate visual impact on observers (road users and resident/visitors to homesteads) within 1 – 3km radius of the PV facility structures. This impact may be mitigated to low. Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended in order to reduce/mitigate the potential visual impact.
- Visual impacts during the operation phase will also include lighting impacts relating to glare and sky glow The sky glow intensifies with the increase in the amount of light sources. It is possible that San Solar PV may contribute to the effect of sky glow within the environment which is currently undeveloped.
- Secondary visual impacts are also expected with the operation of San Solar PV. These impacts include a visual impact on the sense of place of the region. 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 greater environment has a rural, undeveloped character and a natural appearance. These generally undeveloped landscapes are considered to have a high visual quality, except where urban development represents existing visual disturbances. The anticipated visual impact of San Solar PV on the regional visual quality, and by implication, on the sense of place, is difficult to quantify, but is generally expected to be of low significance.

7.6.3 Glint and Glare

The San Solar PV facility is located 6.7km north-west of the Sishen airfield. A glint and glare study was commissioned by the project proponent (refer to **Appendix J**). According to the study the ocular impact of solar glare is quantified into three categories namely:

- Green - low potential to cause after-image (flash blindness);
- Yellow - potential to cause temporary after-image; and
- Red - potential to cause retinal burn (permanent eye damage).

The findings of the report indicate that the glare analysis found no "yellow" glare (potential for after-image). Although some "green" glare was predicted, this was only for a configuration employing deeply textured glass. For configurations employing module surfaces with smooth or lightly textured glass, which is in line with the proposed configuration, no glint or glare was predicted.

The recommendation from the report stated that the application can be approved for the PV plant configuration as presented in the report. Based on this, the potential visual impact related to solar glint and

glare as an air travel hazard is expected to be of low significance. No mitigation of this impact is considered necessary.

7.6.3 Impact table summarising the significance of visual impacts during construction and operation (with and without mitigation)

Construction Phase Impacts

Nature: *Visual impacts of construction activities on sensitive visual receptors in close proximity to the PV facility* During construction, there may be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and landowners in close proximity (<1km) to the construction activities .		
	Without mitigation	**With mitigation**
Extent	Local/ very short distance (4)	Local/ very short distance (4)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (48)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (3)	Reversible (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning: » Retain and maintain natural vegetation immediately adjacent to the development footprint. Construction: » Ensure that vegetation is not unnecessarily removed during the construction phase. » Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible. » Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. » Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities. » Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent). » Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. » Rehabilitate all disturbed areas immediately after the completion of construction works.		
Residual Impacts: None, provided that rehabilitation work is carried out as specified.		

Operation Phase Impacts

Nature: *Visual impact on observers in close proximity to the proposed PV facility structures* Visual impacts on observers travelling along the Deben secondary road within a 1km radius of the PV facility structures.		
	Without mitigation	**With mitigation**
Extent	Local/ very short distance (4)	Local/ very short distance (4)
Duration	Long term (4)	Long term (4)
Magnitude	Very High (10)	Moderate (6)

Probability	Probable (3)	Probable (3)
Significance	**Medium (54)**	**Medium (42)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Planning:

» Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint.
» Consult adjacent landowners in order to inform them of the development and to identify any (valid) visual impact concerns.
» Investigate the potential to screen affected receptors sites (located within 1km of the facility) with planted vegetation cover.

Operation:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use.
» Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.

Residual Impacts:

The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.

Nature: *Visual impact of the PV facility structure within the region*

Visual impact on observers travelling along the R380 secondary road and residences at homesteads within a 1 – 3km radius of the PV facility structures.

	Without mitigation	**With mitigation**
Extent	Short distance (3)	Short distance (3)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	Improbable (2)	Improbable (2)
Significance	**Medium (30)**	**Low (26)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, however best practice measures are recommended.	

Mitigation:

Planning:

» Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint.

Operation:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use.
» Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.

Residual Impacts:

The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.

Nature: *Lighting impacts*

Visual impact of lighting at night on sensitive visual receptors in close proximity to the PV facility.

	Without mitigation	**With mitigation**
Extent	Local/ very short distance (4))	Local/ very short distance (4))
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (48)**	**Low (28)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning and operation: » Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). » Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. » Make use of minimum lumen or wattage in fixtures. » Make use of down-lighters, or shielded fixtures. » Make use of Low Pressure Sodium lighting or other types of low impact lighting. » Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.		
Residual Impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

Nature: *Solar glint and glare impacts* The visual impact of solar glint and glare as a visual distraction and possible air/road travel hazard.		
	Without mitigation	**With mitigation**
Extent	Local/ very short distance (4))	N/A
Duration	Long-term (4)	N/A
Magnitude	Low (4)	N/A
Probability	Improbable (2)	N/A
Significance	**Low (24)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	Reversible	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated?	N/A	
Mitigation: N/A		
Residual Impacts: N/A		

Nature: *Solar glint and glare impacts* The visual impact of solar glint and glare on residents of homesteads in close proximity to the PV facility.		
	Without mitigation	**With mitigation**
Extent	Local/ very short distance (4)	Local/ very short distance (4)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (24)**	**Low (24)**
Status (positive or negative)	Negative	Negative

Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning and operation: » Use anti-reflective panels and dull polishing on structures. » Adjust tilt angles of the panels if glint and glare issues become evident. » If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site.		
Residual Impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed.		

Nature: *Visual impact of ancillary infrastructure (i.e. internal access roads, buildings, overhead power line)* Visual impact of the ancillary infrastructure during the operation phase on observers in close proximity to the structures.		
	Without mitigation	**With mitigation**
Extent	Local/ very short distance (4)	Local/ very short distance (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (24)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented.	
Mitigation: Planning: » Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/power line servitude. Operation: » Maintain the general appearance of the infrastructure. Decommissioning: » Remove infrastructure not required for the post-decommissioning use. » Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual Impacts: The visual impact will be removed after decommissioning, provided the ancillary infrastructure is removed. Failing this, the visual impact will remain.		

Secondary Impacts

Nature: *Visual impact of the PV facility on the sense of place of the region* The greater environment has a rural, undeveloped character and a natural appearance. These generally undeveloped landscapes are considered to have a high visual quality, except where urban development represents existing visual disturbances. 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.		
	Without mitigation	**With mitigation**
Extent	Regional/ medium to longer distance (2)	Regional/ medium to longer distance (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (20)**	**Low (20)**

Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented.	
Mitigation: Planning: » Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude. Operation: » Maintain the general appearance of the facility as a whole. Decommissioning: » Remove infrastructure not required for the post-decommissioning use. » Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual Impacts: The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.		

7.6.3 Implications for Project Implementation

Overall, the significance of the visual impacts is expected to range from moderate to low, depending on the impact being considered, as a result of the generally undeveloped character of the landscape. The following mitigation is possible:

» Mitigation of lighting impacts includes the pro-active design, planning and specification of lighting for the facility. The correct specification and placement of lighting and light fixtures for the proposed PV facility and ancillary infrastructure will go far to contain rather than spread the light. Mitigation measures include the following:

- Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
- Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
- Making use of minimum lumen or wattage in fixtures;
- Making use of down-lighters, or shielded fixtures;
- Making use of Low Pressure Sodium lighting or other types of low impact lighting.
- Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

» Mitigation of visual impacts associated with the construction phase, albeit temporary, would entail proper planning, management and rehabilitation of the construction site. Recommended mitigation measures include the following:

- Ensure that vegetation adjacent to the development footprint (if present) is not unnecessarily cleared or removed during the construction period.
- Reduce the construction period through careful logistical planning and productive implementation of resources wherever possible.
- Plan the placement of laydown areas and any potential temporary construction camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
- Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.

- Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
- Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
- Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting wherever possible.
- Rehabilitate all disturbed areas (if present/if required) immediately after the completion of construction works.

» Glint and glare impact mitigation measures include the following:

- Use anti-reflective panels and dull polishing on structures, where possible and industry standard.
- Adjust tilt angles of the panels if glint and glare issues become evident, where possible.
- If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site, where possible.

7.7. Assessment of Social Impacts

Positive and negative impacts on the social environment will result from the construction activities and/or the operation of the San Solar PV facility. Potential social impacts and the relative significance of the impacts associated with the development of San Solar PV are summarised below (refer to **Appendix I**).

7.7.1 Results of the Social Impact Assessment

The majority of social impacts associated with the project are anticipated to occur during the construction phase of the development and are typical of the type of social impacts generally associated with construction activities. These impacts will be temporary and short-term (~12 months) but could have long-term effects on the surrounding social environment if not planned or managed appropriately. It is therefore necessary that the detailed design phase be conducted in such a manner so as not to result in permanent social impacts associated with the ill-placement of project components or associated infrastructure or result in the mis-management of the construction phase activities.

7.7.2 Description of Social Impacts

The positive and negative social impacts identified at this stage and will be assessed for the construction phase includes:

» Direct and indirect employment opportunities
» Economic multiplier effects
» Influx of jobseekers and change in population
» Safety and security impacts
» Impacts on daily living and movement patterns
» Nuisance impacts, including noise and dust

7.7.3 Impact tables summarising the significance of social impacts during construction and operation (with and without mitigation measures)

Construction Phase Impacts

Nature: *The creation of direct and indirect employment opportunities during the construction phase of the project*

It is anticipated that development of the PV Facility will result in the creation of approximately 250 temporary employment of which, 50 full -time employment opportunities is anticipated, comprising a mixture of skilled, semi-skilled and unskilled positions during the operational phase. 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. ~18 months). The general labour force will, as far as possible and where skills are available, be sourced from the local labour pool. Where relevant skills are unavailable from the local labour pool, these would need to be sought elsewhere. The injection of income into the area, albeit limited, in the form of wages will represent an opportunity for the local economy and businesses in the area.

Several indirect employment opportunities will also be created. Indirect employment opportunities will predominantly be created in the service industry, through the opportunity for the provision of secondary services to the construction team. Services may include, but are not limited to, accommodation, catering, and laundry services.

	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 (4)
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 enhanced?	Yes	

Enhancement measures:

To enhance the local employment, skills development and business opportunities associated with the construction phase the following measures should be implemented:

- » It is recommended that local employment policy is adopted to maximise the opportunities made available to the local labour force. San Solar Energy (Pty) Ltd should make it a requirement for contractors to implement a 'locals first' policy, especially for semi and low skilled job categories. Enhance employment opportunities for the immediate local area Gamagara Local Municipality, if this is not possible, then the broader focus areas should be considered for sourcing workers.
- » In the recruitment selection process; consideration must be given to women during recruitment process
- » It is recommended to set realistic local recruitment targets for the construction phase
- » Training and skills development programmes should be initiated prior to the commencement of the construction phase

Residual Impacts:

- » Improved pool of skills and experience in the local area
- » Temporary employment during the construction phase will result in job losses and struggles for construction workers to find new employment opportunities following the completion of construction.
- » Economic growth for small-scale entrepreneurs

Nature: *Economic multiplier effects*

Economic multiplier effects from the use of local goods and services opportunities include but are not limited to, the provision of construction materials and equipment, and workforce essentials such as services, safety equipment, ablution, accommodation, transportation and other goods. The increase in demand for goods and services may stimulate local business and local economic development (however locally sourced materials and services may be limited due to

availability). There is likely to be a direct increase in industry and indirect increase in secondary businesses. The impact is likely to be positive, local to regional in extent, short-term, and of medium significance.

	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 enhanced?	Yes	

Enhancement measures:

» A local procurement policy should be adopted to maximise the benefit to the local economy and the existing local SMMEs.
» 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 must be 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*

An influx of people looking for employment or other economic opportunities could result in increased pressure being placed on economic and social infrastructure, and a change in the local population. Population change refers to the size, structure, density as well as demographic profile of the local community.

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. 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	Moderate (6)	Low (4)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (18)**	**Low (14)**
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 recruitment protocol in consultation with the municipality and local community leaders. Ensure that the procedures for applications for employment are clearly communicated.
» 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 local's first procurement policy.
- » Provide transportation for workers to ensure workers can easily access their place of employment and do not need to move closer to the project site.
- » 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 construction 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 construction site.
- » Appoint a security company and implement appropriate security procedures to ensure that workers to not remain on site after working hours.
- » Inform local community organisations and policing forums of construction activities and times and the duration of the construction phase. Inform local community organisations and policing forums of construction times and the duration of the construction phase.

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*

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.

The labour force will not permanently reside within the construction site.

	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 (30)**	**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 must preferably be restricted to daylight hours during the construction phase. Where deviation of working hours is required, it must be approved by the relevant local authorities and surrounding landowners must be notified.
- » All vehicles must be road worthy, and drivers must be licensed, obey traffic rules, follow speed limits and made aware of the potential road safety issues.
- » Construction vehicles should be inspected regularly by the EPC contractor to ensure their road worthiness.
- » Adequate and strategically placed traffic warning signs and control measures must be placed along the 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 and must be maintained throughout the construction phase.
- » Implement penalties for reckless driving as a way to enforce compliance to traffic rules.
- » Avoid heavy vehicle activity through residential areas during "peak" hours (when children are taken to school, people driving to work, etc.).

- The developer and EPC contractor must ensure that all fencing along access roads is maintained in the present condition or repaired if disturbed or damaged 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 damaged (i.e. wear and tear) due to construction activities.
- A protocol for 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.
- Undertake information sessions with the surrounding communities, and affected and adjacent landowners, prior to construction in order to ensure that communities are fully informed of the project to be developed in its final form. This must be undertaken through the appointment of a CLO.
- The placement of the power line route within the grid connection must avoid the sensitive land uses undertaken by the affected landowners as far as possible. Consultation with the affected landowners must be undertaken in this regard.

Residual Impacts:
None anticipated

Nature: *Temporary increase in traffic disruptions and movement patterns*
Project components and equipment will be transported using road transport. Increased traffic due to the movement of 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 and construction activities during the construction phase could also negatively impact local residents and road users.

The labour force will not permanently reside within the construction site.

	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 must preferably be restricted to daylight hours during the construction phase. Where deviation of working hours is required, it must be approved by the relevant local authorities and surrounding landowners must be notified.
- All vehicles must be road worthy, and drivers must be licensed, obey traffic rules, follow speed limits and made aware of the potential road safety issues.
- Construction vehicles should be inspected regularly by the EPC contractor to ensure their road worthiness.
- Adequate and strategically placed traffic warning signs and control measures must be placed along the 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 and must be maintained throughout the construction phase.
- Implement penalties for reckless driving as a way to enforce compliance to traffic rules.
- Avoid heavy vehicle activity through residential areas during "peak" hours (when children are taken to school, people driving to work, etc.).
- The developer and EPC contractor must ensure that all fencing along access roads is maintained in the present condition or repaired if disturbed or damaged 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 damaged (i.e. wear and tear) due to construction activities.

- A protocol for communication must be implemented whereby procedures to lodge complaints are set out for the local community to express any complaints or grievances with the construction process.
- Undertake information sessions with the surrounding communities, and affected and adjacent landowners, prior to construction to ensure that communities are fully informed of the project to be developed in its final form. This must be undertaken through the appointment of a CLO.
- The placement of the power line route within the grid connection corridor must avoid the sensitive land uses undertaken by the affected landowners as far as possible. Consultation with the affected landowners must be undertaken in this regard.

Residual Impacts:
None anticipated

Nature: *Nuisance impacts (dust and noise)*
Nuisance 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, as well as impacts on travellers travelling along the gravel access roads. The primary sources of noise during construction would be from construction equipment, vehicle and truck traffic. Noise levels can be audible over a large distance although are generally short in duration. Dust would be generated from construction activities as well as trucks / vehicles driving on gravel access roads. This impact will negatively impact sensitive receptors. The impact of noise and dust on sensitive receptors can be reduced through the application of appropriate mitigation measures..

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	High (8)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (44)**	**Low (27)**
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 through populated areas 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.
- A speed limit of 40km/hr should be implemented on gravel roads.
- Ensure all vehicles are road worthy, drivers are licensed 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.
- A stakeholder management plan must be implemented by the EPC contractor to address neighbouring farmer concerns regarding safety and security.

Residual Impacts:

- None anticipated

Nature: *Visual impacts*

Intrusion impacts such as aesthetic pollution (i.e. building materials, construction vehicles, etc.), noise and light pollution will impact the "sense of place" for the local community. Construction related activities have the potential to negatively impact a local area's "sense of place". Such an impact is likely to be present during the construction phase. It is envisaged that the structures, where visible from shorter distances (e.g. less than 1km and potentially up to 3km), and where sensitive visual receptors may find themselves within this zone, may constitute a high visual prominence, potentially resulting in a visual impact. This may include residents of the farm dwellings mentioned above, as well as observers travelling along the R380 arterial road in closer proximity to the facility.

Cumulative visual exposure from the formerly mentioned elevated areas occurs at varying distances from the sites, with some sites appearing in the foreground, whilst others further away in the distance. It is also possible that solar panel structures from a Solar Energy Facility closer to the observer may obstruct views facility structures located further away, thereby negating the potential cumulative visual impact.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (40)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

- Retain and maintain natural vegetation immediately adjacent to the development footprint.
- Ensure that vegetation is not unnecessarily removed during the construction phase.
- Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
- Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
- Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
- Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
- Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts.
- Rehabilitate all disturbed areas immediately after the completion of construction works.

Residual Impacts:

None anticipated

Operation Phase Impacts

It is anticipated that the San Solar PV will operate for approximately 20 years which is equivalent to the operational lifespan of the project.

The potential positive and negative social impacts that could arise because of the operation of the proposed project include the following:

- Direct and indirect employment opportunities

» Visual impact and sense of place impacts
» Impacts associated with the loss of agricultural land

Nature: *Direct and indirect employment opportunities and skills development*
Given the location of the proposed facility the majority of permanent staff is likely to reside in Deben. In terms of accommodation options, a percentage of the non-local permanent employees may purchase houses in Deben, while other may decide to rent. Both options would represent a positive economic benefit for the region. In addition, a percentage of the monthly wage bill earned by permanent staff would be spent in the regional and local economy, which will benefit local businesses in these towns. The benefits to the local economy will extend over the operational lifespan of the project.

The local hospitality industry in Deben would also benefit from the operational phase. These benefits are associated with site visits by company staff members and other professionals (engineers, technicians, etc.) who are involved in the company and the project but who are not limited to day-to-day operations.

	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 measures:
» It is recommended that a local employment policy is adopted by the developer to maximise the project opportunities being made available to the local community. Enhance employment opportunities for the immediate local area, if this is not possible, then the broader focus areas should be considered for sourcing employees.
» The recruitment selection process should seek to promote gender equality and the employment of women wherever possible
» The developer should establish vocational training programs for the local employees to promote the development of skills.

Residual Impacts:
» Improved pool of skills and experience in the local area.

Nature: *Visual impacts and sense of place impacts associated with the operation phase of the San Solar PV Facility.*

An area's sense of place is created through the interaction of various characteristics of the environment, including atmosphere, visual resources, aesthetics, climate, lifestyle, culture, and heritage. An area's sense of place is however subjective and largely dependent on the demographics of the population residing within the area and their perceptions regarding trade-offs. For example, while some individuals may prefer not to see any form of infrastructure development, others may be interested in large-scale infrastructure, or engineering projects and consider the impact to be less significant. Such a scenario may be true given that one of the main economic sectors within the area is mining which has altered the landscape from natural to industrial.

Given the location of the corridor within an area characterised as having a low-medium population density, and given the project's location within close proximity to existing operational and visible grid infrastructure and other industrial developments, the visual impact and impact on the area's sense of place associated with the construction of the proposed project, from a social perspective, is anticipated to be of a very limited significance.

	Without enhancement	**With enhancement**
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
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: » Maintain and manage the associated infrastructure to be in a good and neat condition to ensure that no degradation of the area and the associated infrastructure servitude takes place and impacts the visual quality of the area. » Implement the relevant mitigation measures as recommended in the Visual Impact Assessment.		
Residual Impacts: » The visual impact of the PV facility will remain until the infrastructure is completely decommissioned and removed. Thereafter the impact will be removed.		

Nature: Loss of agricultural land and overall productivity because of the operation of the proposed project on an agricultural property.		
	Without enhancement	**With enhancement**
Extent	Local (1)	Local-Regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Medium (20)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	N/A
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Keep the project footprint as small as possible. » Avoid interference with current agricultural activities undertaken within the affected properties		
Residual Impacts: » None expected to occur.		

7.7.5 Implications for Project Implementation

The social impacts identified (including all positive and negative impacts) will be either of a low or medium significance with the implementation of the mitigation measures recommended. These recommendations include:

» The appointment of a CLO to assist with the management of social impacts and to deal with community issues, if feasible.
» Local labour be sourced, wherever possible, to ensure that benefits accrue to the local communities. Efforts should be made to involve local businesses during the construction activities where possible. Local

procurement of labour and services / products would greatly benefit the community during the construction and operation phases of the project.

» Local procurement of services and equipment is required where possible to enhance the multiplier effect.
» Involve the community in the process as far as possible (encourage co-operative decision making and partnerships with local entrepreneurs).
» Employ mitigation measures to minimise the dust and noise pollution and damage to existing roads.
» Safety and security risks should be considered during the planning / construction phase of the proposed project. Access control, security and management should be implemented to limit the risk of crime increasing in the area.

7.9 Risks Associated with Battery Energy Storage (BESS)

An Battery Energy Storage Systems BESS) comprising an solid-state battery system will allow for energy storage for an extended period (of up to 4 hours). The general purpose and utilisation of the BESS will be to save and store excess electrical output from the facility as it is generated, allowing for a timed release to the national grid when the capacity is required. The BESS will be contained within insulated containers and will connect to the on-site facility substation via underground cabling. **Figure 7.10 p**rovides a general illustration of a BESS.

Figure 7.10 Example of battery storage units integrated as part of PV array (Source: nexttracker.com)

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

Possible risks associated with the construction and operation of the BESS from a technical perspective within the development footprint of the San Solar PV facility are limited to health and safety aspects during the project life cycle of the BESS as well as the solar energy facility. The risks identified for the construction and

operation of the BESS are detailed below. Mitigation measures have been included within the project EMPr (**refer to Appendix L**).

Nature of Risk	*Likelihood*	*Impact*	*Mitigation / Management of Risk*
1. <u>Mechanical breakdown/ Exposure to high temperatures</u> » Incidents where the batteries are broken or exposed to temperature above room temperature could lead to overheating as well as fires which can affect infrastructure components of the BESS. » Leakages of substances contained within the battery cells (should they not be assembled off-site).	Low	» Fires, electrocutions and spillage of toxic substances into the surrounding environment. » Spillage of hazardous substances into the surrounding environment. » Soil contamination – leachate from spillages which could lead to an impact of the productivity of soil forms in affected areas. » Water Pollution – spillages into surrounding watercourses as well as groundwater. » Health impacts – on the surrounding communities, particularly those relying on watercourses (i.e. rivers, streams, etc) as a primary source of water.	Operators are trained and competent to operate the BESS. Training should include the discussion of the following: * Potential impact of electrolyte spills on groundwater; * Suitable disposal of waste and effluent; * Key measures in the EMPr relevant to worker's activities; * How incidents and suggestions for improvement can be reported. » Training records should be kept on file and be made available during audits. » Battery supplier user manuals safety specifications and Material Safety Data Sheets (MSDS) are filed on site at all times. » Compile method statements for approval by the Technical/SHEQ Manager for the operation and management and replacement of the battery units / electrolyte for the duration of the project life cycle. Method statements should be kept on site at all times. » Provide signage on site specifying the types of batteries in use and the risk of exposure to hazardous material and electric shock. Signage should also specify how electrical and chemical fires should be dealt with by first responders, and the potential risks to first responders (e.g. the inhalation of toxic fumes, etc.). » Firefighting equipment should readily be available at the BESS area and within the site. » Maintain strict access control to the BESS area. » Ensure all maintenance contractors / staff are familiar with the supplier's specifications. » Undertake daily risk assessment prior to the commencement of daily tasks at the BESS. This should consider any aspects which could result in fire or spillage, and appropriate actions should be taken to prevent these. » Standard Operating Procedures (SOPs) should be made available by the Supplier to ensure that the batteries are handled in accordance with required best practices. » Spill kits must be made available to address any incidents associated with the flow of chemicals from the batteries into the surrounding environment. » The assembly of the batteries on-site should be avoided as far as possible. Activities on-site for the BESS should only be limited to the placement of the container wherein the batteries are placed.

Nature of Risk	*Likelihood*	*Impact*	*Mitigation / Management of Risk*
			» Undertake periodic inspections on the BESS to ensure issues are identified timeously and addressed with the supplier where relevant. » The applicant in consultation with the supplier must compile and implement a Leak and Detection Monitoring Programme during the project life cycle of the BESS. » Batteries must be strictly maintained by the supplier or suitably qualified persons for the duration of the project life cycle. No unauthorised personnel should be allowed to maintain the BESS.
2. <u>Generation of hazardous waste</u> » The incorrect disposal of the batteries and the associated components could have an adverse impact on the environment.	Medium	» Spillage of hazardous substances into the surrounding environment. » Soil contamination – leachate from the disposed batteries into the soil, which could lead to an impact of the productivity of soil forms in affected areas. » Water pollution – leachate from the disposed batteries spilling into surrounding watercourses as well as groundwater. » Health impacts – on the surrounding communities, particularly those relying on watercourses (i.e. rivers, streams, etc) as a primary source of water.	» Damaged and used batteries must be removed from site by the supplier or any other suitably qualified professional for recycling or appropriate disposal. » The applicant should obtain a cradle to grave battery management plan from the supplier during the planning and design phase of the system. The plan must be kept on site and adhered to.

7.9. Assessment of the 'Do Nothing' Alternative

The 'do-nothing' alternative (i.e. no-go alternative) is the option of not constructing San Solar PV. Should this alternative be selected, there would be no environmental impacts on the site due to the construction and operation activities of a PV facility.

b) Land use and agriculture

Cattle farming is a viable long-term land use of the site as long as the field quality is maintained by never exceeding the grazing capacity. Small stock (goats and sheep) as well as game farming may also be viable land use options for the project site

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 the income of the landowner.

The 'do nothing' alternative would result in a lost opportunity for the landowner (in terms of implementing a compatible 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.

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 Kathu 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 Kathu and Deben. 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 PV 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: At the peak of construction, the project is likely to create a maximum of 350 employment opportunities. These employment opportunities will be temporary and will last for a period of approximately 12 to 18 months (i.e. the length of construction). Employment opportunities generated during the construction phase will include low skilled, semi-skilled, and skilled opportunities. Solar PV projects make use of high levels of unskilled and semi-skilled labour so there will be good opportunity to use local labour, where available. Employment opportunities will peak during the construction phase and significantly decline during the operation phase. The injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area. The majority of the labour force is expected to be sourced from the surroundings towns (Kathu and Deben). The employment opportunities for individuals within local communities would be forfeited with the implementation of the 'do nothing' alternative.

Skills development: The establishment of San Solar PV will offer skills development and also use the skills from previous construction of the PVs in the area. This is relevant for both on-site activities and manufacturing activities. The skills development and the use of existing skills would be forfeited with the implementation of the 'do nothing' alternative.

Municipal goals: The implementation of San Solar PV would contribute towards addressing the Gamagara 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 municipal goals within local communities would be forfeited with the implementation of the 'do nothing' alternative.

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.

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 Northern Cape has an ample solar resource. The contribution of a contracted capacity of up to 100MW will assist in meeting the electricity demands 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, with the country's significant renewable energy potential largely untapped to date.

The Integrated Resource Plan (IRP) 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. 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. However, as the project site experiences ample solar resource and optimal grid connection opportunities are available, not developing San Solar PV 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 is not considered significant. 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 San Solar PV. All impacts associated with the project can be mitigated to acceptable levels. If the PV 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 San Solar PV.

CHAPTER 8: ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS

As identified and assessed in Chapter 7, a PV facility and the associated infrastructure may have effects (positive and negative) on the natural and social environments and on the people living in a project area. The preceding impact assessment chapter has reported on the assessment of the impacts associated with San Solar PV largely in isolation (from other similar developments).

The DMRE, 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 11 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 and socio-economic development contributions by the project 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 Northern Cape Provinces), with a number of PV facilities selected as Preferred Bidder projects. It is, therefore, important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts[22] are considered and avoided where possible.

This chapter assesses the potential for the impacts associated with the project to become more significant when considered in combination with the other known or proposed PV facility projects within the area.

8.1 Approach taken to Assess Cumulative Impacts

The cumulative impacts that have the potential to be compounded through the development of the PV facility and its associated infrastructure in proximity to other similar developments include impacts such as those listed below. The role of the cumulative assessment is to test if such impacts are relevant to San Solar PV 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 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;
- Unacceptable impact to socio-economic factors and components; and

[22] 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.

It is important to explore the potential for cumulative impacts as this will lead to a better understanding of these impacts and the potential for mitigation that may be required. The scale at which the cumulative impacts are assessed is important. For example, the significance of the cumulative impact on the regional or national economy will be influenced by PV facility developments throughout South Africa, while the significance of the cumulative impact on visual amenity may only be influenced by PV facility developments that are in closer proximity to each other. For practical purposes a sub-regional scale of 30km has been selected for this cumulative impact evaluation.

Figure 8.1 indicates the location of San Solar PV in relation to all other operational or known PV facilities located within a radius of 30km from the project site. These projects were identified using the Department of Forestry, Fisheries and the Environment Renewable Energy Database and current knowledge of projects being proposed in the area. In the case of San Solar PV, there are eleven (11) PV facilities located within a 30km radius of the project site, eight facilities have been authorised and three facilities are operational (refer to **Figure 8.1** and **Table 8.1**). The potential for cumulative impacts is summarised in the sections that follow and has been considered within the specialist studies (refer to **Appendices D – J**).

Table 8.1: PV facilities located within the broader area (within a 30km radius) of the San Solar PV project site

Project Name	Approximate distance from San Solar PV	Project Status
Kathu Solar PV	Directly west of the San Solar site	Operational
Sishen Solar PV	Directly adjacent farm west of the San Solar site	Operational
Kathu Solar CSP	6km east of the San Solar site	Operational
Boitshoko Solar PV	Directly adjacent farm south west of the San Solar site	Environmental Authorisation issued
AEP Kathu Solar	6km south east of the San Solar site	Environmental Authorisation issued
Mogara Solar PV	6km south east of the San Solar site	Environmental Authorisation issued
Bestwood Solar PV	5km south east of the San Solar site	Environmental Authorisation issued
Hyperion Solar PV	5km north east of the San Solar site	Environmental Authorisation issued
Shirley Solar Park	7km north of the San Solar site	Environmental Authorisation issued
AEP Legoko Solar PV	7km south east of the San Solar site	Environmental Authorisation issued
AEP Mogobe Solar PV	8km south east of the San Solar site	Environmental Authorisation issued

It should be noted that not all the PV 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 (DFFE, DMRE, NERSA and Eskom) due to the following reasons:

» There may be limitations to the capacity of the existing or future Eskom grid;

- Not all applications will receive a positive environmental authorisation;
- There are stringent requirements to be met by applicants in terms of the REIPPP Programme and a highly competitive process that only selects the most competitive projects;
- Not all proposed PV facilities will be able to reduce the associated negative impacts to acceptable levels or be able to mitigate the impacts to acceptable levels (fatally flawed);
- Not all proposed facilities will eventually be granted a generation license by NERSA and sign a Power Purchase Agreement with Eskom; and
- Not all developers will be successful in securing financial support to advance their projects further.

As there is therefore a level of uncertainty as to whether all the above-mentioned PV facilities will be implemented, this results in it being difficult to quantitatively assess the potential cumulative impacts. The cumulative impacts of other known PV facilities in the broader area and San Solar PV are therefore qualitatively assessed in this Chapter. The following potential impacts are considered:

- Cumulative Impacts on Ecological
- 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

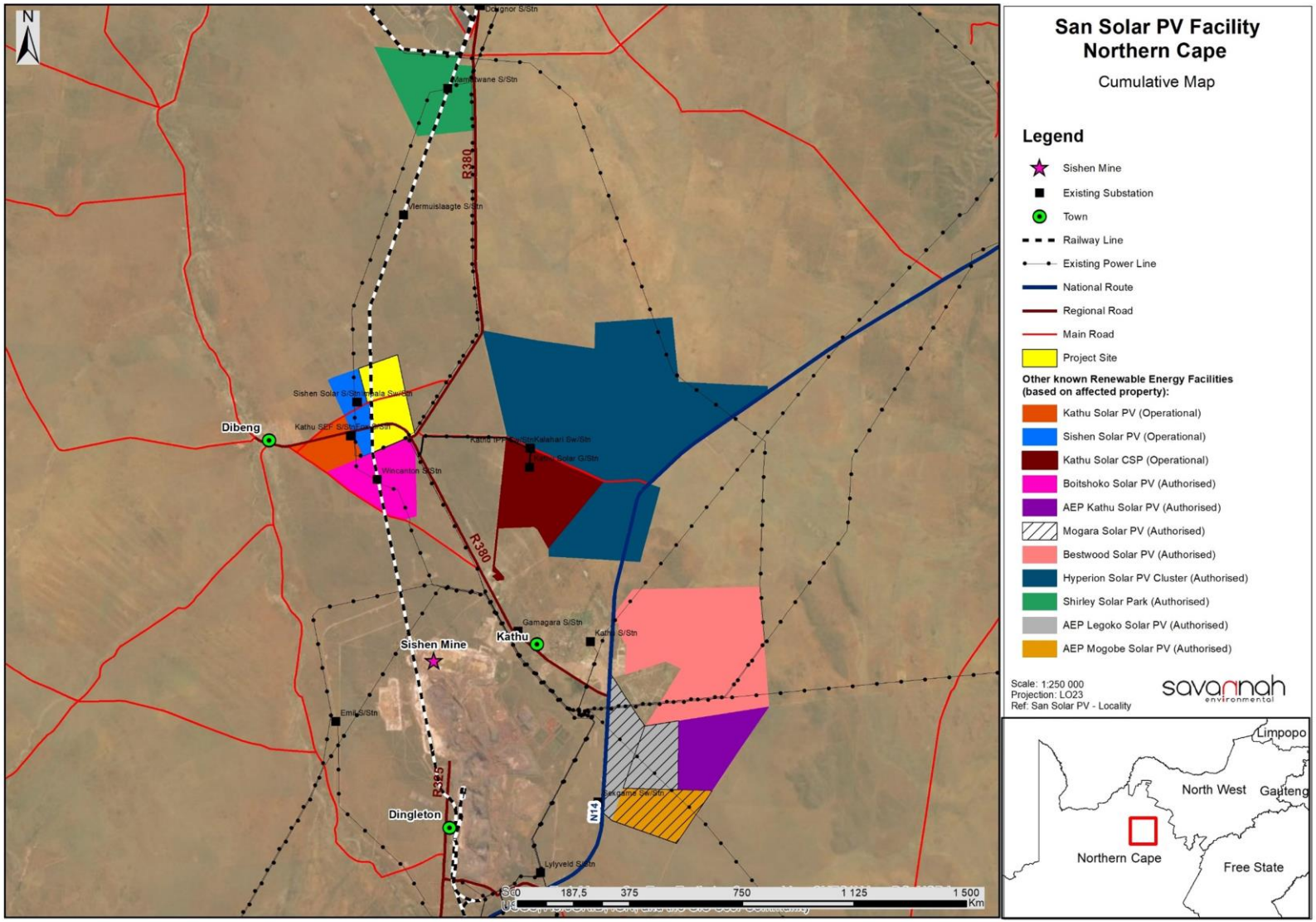


Figure 8.1: Identified PV facility projects located within a 30km radius of the San Solar PV project site that are considered as part of the cumulative impact assessment for the San Solar PV project

8.2 Cumulative Impacts on Ecological

Cumulative impacts associated with San Solar PV and associated infrastructure have been identified by the ecological specialist (refer to **Appendix D**). These impacts are assessed in context of the current site, other developments in the area as well as general habitat loss and transformation resulting from mining, agriculture and other activities in the area.

Impact: *Impacts on terrestrial ecology* ***Nature:*** Development of the San Solar PV plant may impact on broad-scale ecological processes such as the ability of fauna to disperse. The development would potentially contribute to habitat degradation and the loss of landscape connectivity and ecosystem function within the area, but this is likely to be relatively low as most species are likely to be able to avoid the facility as there are still relatively large intact corridors present in 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 (1)
Duration	Long Term (4)	Long-Term (4)
Magnitude	Low (3)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	**Low (16)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Only partly as a significant proportion of the impact results from the presence and operation of the facility which cannot be well mitigated.	
Mitigation: » Avoid impact on the sensitive features of the site such as the larger pans and the deeper sands in the south of the site. » Ensure that the mitigation hierarchy is applied with a particular emphasis on reducing the development footprint, rehabilitating disturbed areas and minimising degradation around the site. » An open space management plan should be developed for the site, which should include management of biodiversity within the affected areas, as well as that in the adjacent bushveld.		

8.3 Cumulative Impacts on Avifauna

Three (3) solar facilities have been constructed in the broader area. These include the Sishen Solar PV and Kathu Solar PV facilities located immediately west of the farm Remaining extent of the Farm Wincanton 472. The Kathu Solar facility is a CSP facility located to the east of the development area.

Cumulative impacts from an avifauna perspective include displacement and loss of habitat. In addition, the grid connection (via overhead power lines) of these facilities could potentially contribute towards bird strikes with power lines and avian mortalities due to collision in the region.

The cumulative avifauna impacts, considering the development of San Solar PV and the PV facilities within the surrounding area will be of a low to high significance, depending on the impact being considered.

Nature: *Habitat loss* Regional losses of natural habitat and subsequent displacement of birds.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (2)	Local and immediate surroundings (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Definite (5)	Definite (5)
Significance	**Medium (60)**	**High (65)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation: » The best practicable mitigation will be to consolidate infrastructure (e.g. proposed power line) to areas where existing impacts occur (e.g. placing the proposed power line alongside existing power lines).		

Nature: *Collision – PV panels* Avian collision impacts related to the PV facility during the operations phase (collision with the PV panels).		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (2)	Local and immediate surroundings (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	High (8)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (56)**	**Medium (60)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes, potential loss of endemic/near-endemic waterfowl and sandgrouse species.	Yes, potential loss of endemic/near-endemic waterfowl and sandgrouse species.
Can impacts be mitigated?	Yes, to some extent	
Mitigation: » Apply bird deterrent devices to the panels for birds that may mistake the panels for open water and to prevent them from landing on the panels. » To aid post-construction monitoring and/or monitoring of bird mortality rates, it is advised to employ video cameras to document any bird mortalities and to conduct direct observations and carcass searches on a regular and systematic basis.		

Nature: *Collision – Grid Infrastructure* Avian collision impacts (i.e. collision impacts with the overhead power lines) are expected during the operation phase.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes, owing to the potential loss of terrestrial bird and certain bird of prey species.	Yes, owing to the potential loss of terrestrial bird and certain bird of prey species.
Can impacts be mitigated?	Yes, to some extent	

Mitigation:

» Apply bird deterrent devices to the power line and make use of "bird-friendly" pylon structures.
» Allow for construction of new power lines parallel to existing lines.
» To aid post-construction monitoring and/or monitoring of bird mortality rates, it is advised to conduct direct observations and carcass searches on a regular and systematic basis.
» All new power lines should be marked with bird diverters.

Nature: *Electrocution*
During the operation phase of San Solar PV and other PV facilities in the area, avian electrocution related to the overhead power lines is 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 (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (30)**	**Low (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes, owing to the potential loss of terrestrial bird and certain bird of prey species.	Yes, owing to the potential loss of terrestrial bird and certain bird of prey species.
Can impacts be mitigated?	Yes, to some extent	

Mitigation:

» Apply bird deterrent devices to the power line and make use of "bird-friendly" pylon structures.
» All new power lines should be marked with bird diverters.
» Make use of bird-friendly pylons and bird guards.
» Position electrical infrastructure in close proximity to existing infrastructure.

8.4 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 and cultivation, as well as an increased risk of erosion. These impacts can be reduced

by keeping the footprints of the PV 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.

Nature: *Decrease in areas with suitable land capability for livestock farming* With the development of the San Solar PV and other PV facilities in the area, the decrease in land capability for livestock is expected to occur, due to construction and operation activities of the PV facility.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (2)
Duration	Short duration (2)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly likely (4)	Highly likely (4)
Significance	**Low (28)**	**Medium (40)**
Status (positive or negative)	Negative	Negative
Reversibility	High	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No
Mitigation: » Keep the footprints of all solar energy facilities as small as possible » Manage the soil quality by avoiding far-reaching soil degradation such as erosion.		

Nature: *Cumulative impact areas susceptible to soil erosion* During construction San Solar PV and other PV facilities in the area will be highly vulnerable to soil erosion due to the disturbances that will be created.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (2)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No
Mitigation: » Projects should adhere to the highest standards for soil erosion prevention and management, as defined in Appendix F attached to this EIA.		

Nature: *Cumulative impact on areas susceptible to soil compaction* During construction San Solar PV and other PV facilities in the area will be highly vulnerable to soil compaction due to heavy machineries on site.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**

Extent	Local (1)	Regional (2)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	**Low (16)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Loss of resources?	No	No
Can impacts be mitigated?	Yes	No
Mitigation:		
» Projects should adhere to the highest standards for soil erosion prevention and management, as defined in Appendix F attached to this EIA.		

Nature: *Cumulative impact on increased risk of soil pollution* During construction San Solar PV and other PV facilities in the area will be vulnerable to soil pollution due to activities such as spills from fuel storage tanks, pollution from concreate mixing and spills from vehicles transporting workers and construction equipment.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No
Mitigation:		
» Projects should adhere to the highest standards for soil erosion prevention and management, as defined in Appendix F attached to this EIA.		

8.5 Cumulative Impacts on Heritage (including archaeology and palaeontology)

From a heritage perspective it is not anticipated that the development will have a negative impact on any significant cultural landscape in the area due to the existing similar infrastructure here. Furthermore, it is often preferred to have development such as PV facilities clustered in one area to mitigate the sprawl of this infrastructure across otherwise pristine landscapes. It is unlikely that the proposed San Solar PV project will result in unacceptable risk, unacceptable loss, whole-scale changes to the sense of place or unacceptable increase in impact due to its location as one of many renewable energy facilities in this area.

The heritage cumulative impacts associated with San Solar PV will be of a low significance.

Nature: *Cumulative heritage impacts* Cumulative impact to the sense of place and known archaeological and palaeontology resources.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Low (1)	Low (1)
Duration	Medium-term (3)	Long-term (4)
Magnitude	Low (4)	Moderate (5)
Probability	Improbable (2)	Probable (3)
Significance	**Low (16)**	**Low (30)**
Status (positive or negative)	Neutral	Neutral
Reversibility	High	Low
Irreplaceable loss of resources?	Unlikely	Unlikely
Can impacts be mitigated?	N/A	
Mitigation: No mitigation required.		

8.6 Cumulative Visual Impacts

There are three operational PV facilities within the study area. These are the Sishen Solar PV, the Kathu Solar CSP and the Kathu Solar PV facility. The two PV facilities are located 382m west and 2km south-west of the proposed San Solar PV facility respectively. The Kathu Solar CSP facility is located 6km east-south-east of the proposed San Solar PV site.

The physical development footprints of the proposed San Solar PV facility and the Sishen Solar PV, and the Kathu PV are contained within an approximately 3km radius of each other (refer to **Figure 8.2**). This map also indicates the potential cumulative visual exposure of the three PV facilities, as well as the Kathu Solar CSP further away. The relative long distance of the Kathu Solar CSP from the formerly mentioned PV facilities is not expected to aggravate the potential cumulative visual exposure significantly.

A visibility analysis of the PV facility was undertaken individually from each of the proposed sites from a representative number of vantage points per development footprint at 5m above ground level. The results of these analyses were merged in order to calculate the combined visual exposure. The result of the combined visual exposure is indicated as a range from yellow to red, where yellow indicates that only one PV facility may be visible and red where all three may be visible (refer to **Figure 8.2**).

The cumulative visual impact of these three PV facilities is ultimately expected to be of moderate to low significance due to their remote location and the general absence of potential sensitive visual receptors. It is further preferred that the proposed San Solar PV facility be placed in as close a proximity to the Sishen and Kathu PV sites as possible, as these two PV facilities represent an existing visual disturbance, i.e. the visual amenity at this location has already been compromised.

Nature: *Potential cumulative visual impact on the visual quality of the landscape* The potential cumulative visual impact of the PV facilities on the visual quality of the landscape.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Very short distance (4)	Medium to longer distance (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium (42)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented.	
Mitigation: Planning: » Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. Operations: » Maintain the general appearance of the facility as a whole. Decommissioning: » Remove infrastructure not required for the post-decommissioning use. » Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		

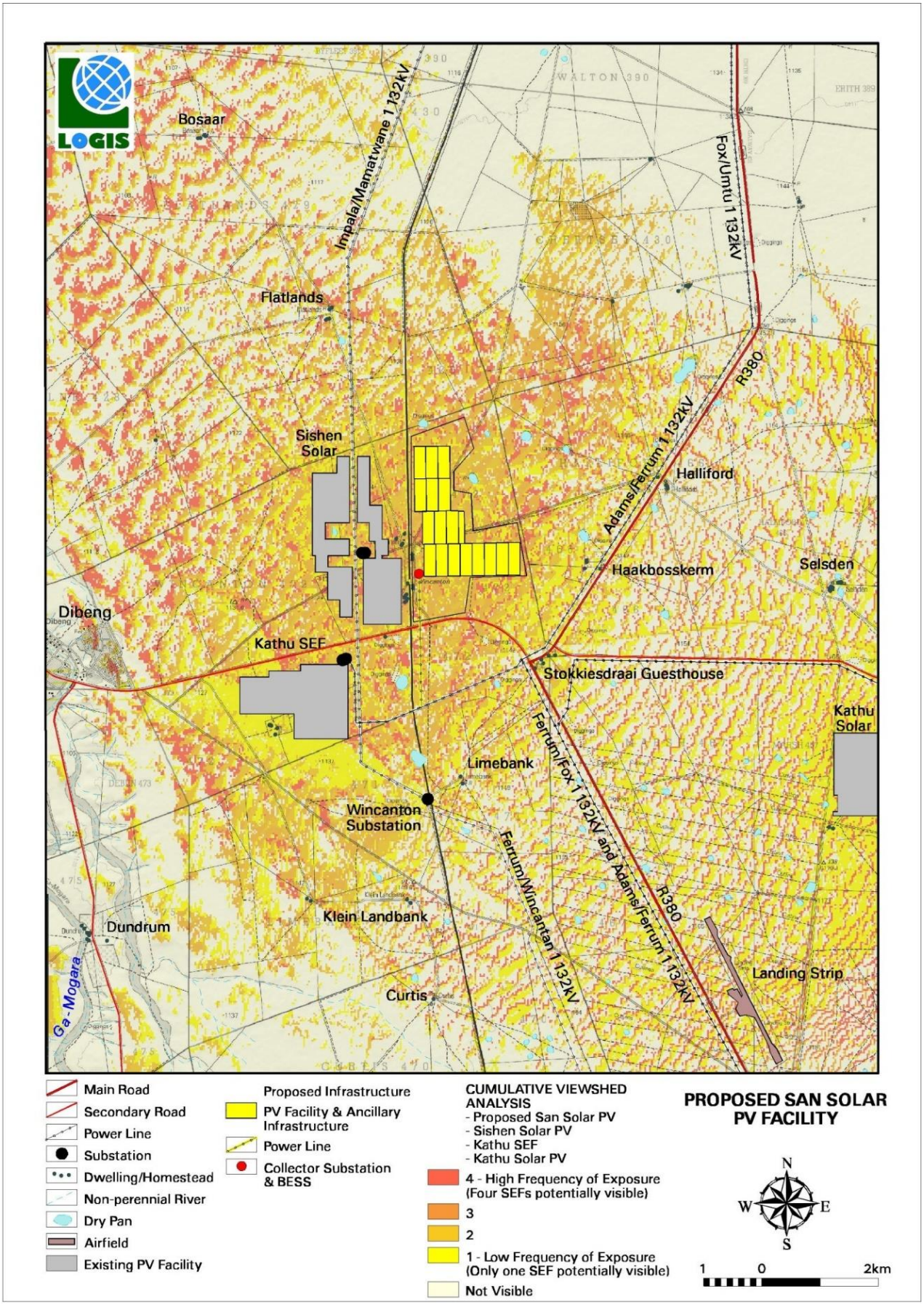


Figure 8.2: Cumulative visual exposure for San Solar PV and surrounding projects

8.7 Cumulative Social Impacts

The potential for cumulative impacts to occur as a result of the projects is likely. Potential cumulative impacts identified for the project include positive impacts on the economy, business development, and employment, as well as negative impacts such as an influx of jobseekers and change in the area's sense of place

Nature: *Cumulative impacts of employment opportunities, business opportunities and skills development*
San 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 San Solar PV Facility alone.

	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	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	**Medium (33)**	**Medium (52)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impacts be enhanced?	Yes	

Mitigation/enhancement:

- The establishment of a number of solar power projects 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

While the development of a single solar power project 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 an area characterised by good levels of solar irradiation suitable for the development of commercial solar energy facilities implies that the surrounding area is likely to be subject to considerable future applications for 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 higher 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.

	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 (2)
Duration	Short-term (2)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Very Improbable (3)	Very Improbable (3)
Significance	**Low (7)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
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.
» 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.

Nature: *Visual impact and impact on the sense of place and landscape character*

The social impacts associated with the impact on sense of place relate to the change in the landscape character and visual impact of San Solar Facility. Given the location of the project on a private property, within an area characterised as a mining area, the visual impact and impact on the area's sense of place associated with the project is anticipated to be of a low significance. The alteration of the sense of place in view of the local residents (specifically adjacent landowners) and road users will start during the construction phase and remain for the project's operational lifetime. The area has been exposed to large scale industrial development.

The anticipated cumulative visual impact of the PV facilities is expected to be of moderate significance, which is acceptable from a visual perspective. This is due to the relatively low viewer incidence within close proximity to the proposed development sites and the presence of the existing electricity infrastructure and mining activities (Sishen Mine) within the broader region.

	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	Moderate (6)	High (8)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practice measures can be implemented	

Mitigation:

» Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint.
» Maintain the general appearance of the facility as a whole.
» Remove infrastructure not required for the post-decommissioning use.
» Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.

8.9 Conclusion regarding Cumulative Impacts

Cumulative impacts are expected to occur with the development of San Solar PV throughout all phases of the project life cycle and within all areas of study considered as part of this EIA Report. The main aim for the assessment of cumulative impacts considering San Solar PV 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 following conclusions can be drawn regarding the cumulative impacts associated with the project:

- There will be no unacceptable loss or impact on ecological aspects (vegetation types, species and ecological processes) due to the development of the San Solar PV Facility and other renewable energy facilities within the surrounding area, provided recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.
- There will be no unacceptable risk to avifauna with the development of the San Solar PV Facility and other renewable energy projects within the surrounding area, provided recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.
- There will be no unacceptable loss of land capability due to the development of the San Solar PV Facility and other renewable energy projects within the surrounding areas, provided recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.
- Change to the sense of place and character of the area is expected, however, the change is not considered to be a fatal flaw.
- There will be no unacceptable loss of heritage resources associated with the development of the San Solar PV Facility within the surrounding areas. The cumulative impact is therefore acceptable.
- No unacceptable social impacts are expected to occur. The cumulative impact is therefore acceptable.

A summary of the cumulative impacts is included in **Table 8.2** below.

Table 8.2: Summary of the cumulative impact significance for San Solar PV

Specialist assessment	Overall significance of impact of the proposed project considered in isolation	Cumulative significance of impact of the project and other projects in the area
Ecology	Low	Low
Avifauna	Low to Medium (depending on the impact being considered)	Low, Medium to High (depending on the impact being considered)
Land use, soil and agricultural potential	Low to Medium (depending on the impact being considered)	Low to Medium (depending on the impact being considered)
Heritage (archaeology and palaeontology)	Low	Low
Visual	Medium	Medium
Socio-Economic	Low to Medium (depending on the impact being considered)	Medium

Based on the specialist cumulative assessment and findings, the development of the San Solar PV Facility and its contribution to the overall impact of all renewable energy facilities to be developed within a 30km radius, it can be concluded that the San Solar PV Facility cumulative impacts will be of a medium to low significance, with impacts of a high significance relating to cumulative avifauna impacts, including the consideration of additional power lines. It was concluded that the development of the San Solar PV Facility will not result in unacceptable, high cumulative impacts (and impacts are able to be mitigated), and will not result in a whole-scale change of the environment.

CHAPTER 9: CONCLUSIONS AND RECOMMENDATIONS

San Solar Energy Facility (Pty) Ltd is proposing the construction of a photovoltaic (PV) solar energy facility (known as San Solar PV) located on a site approximately 16km north-west of the town of Kathu in the Northern Cape Province. The solar energy facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 100MW. The facility will be located within the Remaining extent of the Farm Wincanton 472.

The total extent of the project site property is 991.5ha. The identified development area[23] for the solar PV facility is 400ha in extent and a dedicated development footprint[24] of ~205ha has been demarcated for the placement of the San Solar PV. The development area has been fully considered within this Scoping/EIA process and assessed in terms of its suitability from an environmental and social perspective within this EIA Report. Site-specific studies and assessments have delineated areas of potential sensitivity within the identified project site. The development area is regarded as being of an appropriate extent to provide opportunity for the avoidance of major environmental sensitivities where identified.

The project site was previously authorised for the development of a 75MW PV project, also known as the San Solar PV project. This application for Environmental Authorisation is considered on the same property which contributes to the selection of the project site for the development of a solar PV energy facility.

The Applicant has owned the property since 2015, and the current land use is grazing. The site is also adjacent to other solar PV facilities, collectively forming a renewable energy node in this area north of Kathu. Three (3) solar facilities have been constructed in the broader area. These include the Sishen Solar PV and Kathu Solar PV facilities located immediately west of the farm Remaining extent of the Farm Wincanton 472. The Kathu Solar facility is a CSP facility located to the east of the study area.

San Solar PV will have a contracted capacity of up to 100MW and will include specific infrastructure, namely:

- PV modules and mounting structures
- Inverters and transformers
- Cabling between the panels, to be laid underground where practical
- Battery Energy Storage System (BESS)
- Site and internal access roads (up to 8m wide)
- Laydown area
- Operation and maintenance buildings including a gate and security building, control centre, offices, warehouse, and workshop areas for maintenance and storage.
- Grid connection solution including a 132kV facility substation, 132kV switching station to be connected via a Loop-in-Loop out (LILO) connection to the Fox-Umtu 132kV overhead power line located south of the site.

[23] The development area is that identified area (located within the project site) where the San Solar PV facility is planned to be located. This area is selected as a practicable option for the facility, considering technical preference and environmental constraints. The development area will be ~400ha in extent.

[24] The development footprint is the defined area (located within the development area) where the PV panel array and other associated infrastructure for San Solar PV facility is planned to be constructed. This is the actual footprint of the facility, and the area which would be disturbed.

Grid connection infrastructure for the San Solar PV facility will be located outside the PV development area within a 500m wide corridor ~2.5km in length to enable a LILO with the Fox-Umtu 132kV power line. The grid connection will consist of a 132kV facility substation, switching substation and Loop-In Loop-Out Tern line from the 132kV switching substation to Fox-Umtu 132kV line (at a point approximately 5.5km from Eldoret Substation).

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

As the project has the potential to impact on the environment, an Environmental Impact Assessment process is required to be completed in support of an application for Environmental Authorisation prior to the commencement of construction and operation San Solar PV.

9.1 Legal Requirements as per the EIA Regulations, 2014 (as amended). For the undertaking of an EIA Report

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

Requirement	Relevant Section
3(k) where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report	A summary of the findings of the specialist studies undertaken for San Solar PV Energy 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 development footprint on the approved site as contemplated in the accepted scoping report 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 San Solar PV facility has been included as section 9.5. Sensitive environmental features located within the study area and development area, overlain with the proposed development footprint have been identified and are shown in Figure 9.1.
3(q) 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 San Solar PV facility should be authorised has been included in section 9.6.
3(o) 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 San Solar PV facility have been included in section 9.7.

9.2 Evaluation of San Solar PV facility

The preceding chapters of this report together with the specialist studies contained within **Appendices D-J** provide a detailed assessment of the potential impacts that may result from the development of proposed

San Solar PV facility. This chapter concludes the environmental assessment of San Solar PV facility and associated infrastructure by providing a summary of the results and conclusions of the assessment of the development area. In so doing, it draws on the information gathered as part of the EIA process, the knowledge gained by the environmental specialists and the EAP and presents a combined and informed opinion of the environmental impacts associated with the project.

Through the Scoping and EIA process undertaken, a 400ha development area which was environmentally preferred for the development of a PV facility was selected. The area represents the portion of the farm with the greatest potential for development of a PV facility after taking into consideration the sensitivity identified within the larger site.

A 'funnel-down approach' in the consideration of the project site focused the detailed specialist studies in the EIA Phase to the portion of the site with reduced environmental sensitivities. In order to reduce the potential for on-site environmental impacts, the identified sensitive areas have been avoided. No environmental fatal flaws were identified in the detailed specialist studies conducted.

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

» Impacts on ecology, flora and fauna.
» Impacts on avifauna.
» Impacts to soils and agricultural potential.
» Impacts on heritage resources, including archaeology and palaeontology.
» Visual impacts on the area imposed by the components of the facility.
» Social impacts.

The findings of the environmental assessment are summarised below.

9.2.1 Impacts on Ecology (including flora and fauna)

The Terrestrial Ecology Assessment (**Appendix D**) undertaken determined that there are no impacts associated with the San Solar PV facility and associated grid line corridor that cannot be mitigated to an acceptable level and as such, the assessed layout was considered acceptable. The majority of the site consists of typical Kathu Bushveld dominated by *Senegalia mellifera* and *Tarchonanthus camphoratus*, which is considered low sensitivity on account of the generally low abundance of species of concern. In the south of the site, there is an area of deeper sands with a higher abundance of *Vachellia erioloba* which is considered High sensitivity, and which should be avoided by the PV development. Across the rest of the site there are several pans present, which are considered Very High sensitivity. Given the ecological role that pans play in the landscape, these are considered sensitive features that are not suitable for development. There are no pans within the final development footprint.

The verified plant species theme sensitivity show that the PV facility is restricted to the low sensitivity parts of the site. The grid connection runs through areas that are also classified as low sensitivity. Although there are some small pans along the power line corridor, these have been avoided under the current layout and can also be avoided should there be any changes to the exact routing of the power line.

The majority of the site is considered low sensitivity for fauna. The pans and the deeper sands in the south-east of the site are considered to be moderate sensitivity and contribute to the habitat diversity of the site. There are no areas at the site which are considered specifically high sensitivity for terrestrial fauna. As such, the San Solar site is considered acceptable for the development of the PV facility and grid connection from a terrestrial fauna perspective.

There are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding.

9.2.2 Impacts on Avifauna

The Avifauna Impact Assessment (**Appendix E**), which considered the results of two seasons of pre-construction bird monitoring, determined the significance of potential avifauna impact to be moderate to low after mitigation (depending on the type of impact).

The open Kathu Bushveld, the dense Kathu Bushveld and ephemeral pans habitat units comprising of potential sensitive avifauna features have been observed on the project site. The following avifauna sensitivities have been identified:

» *Areas of high sensitivity*

The high sensitivity habitat units include the open Kathu Bushveld, ephemeral pans and artificial watering points.

The open Kathu Bushveld and ephemeral pans are considered to be of high avifaunal sensitivity. The open Kathu Bushveld is an area which was historically transformed, and now with a less dense vegetation cover provides potential foraging habitat for large terrestrial bird species such as the Kori Bustard (*Ardeotis kori*).

The ephemeral pans provide ephemeral foraging opportunities for waterbirds and shorebird taxa, which are rare or absent in the area when these are dry. Many of these species are highly nomadic in the area may become disorientated by the "lake effect" caused by the PV panels which may result in bird colliding with the panels (and also powerlines).

The artificial livestock watering points often attract large numbers of granivore passerine and non-passerine bird species, of which many need to drink water on a daily basis (e.g. sandgrouse). The placement of electrical and PV infrastructure in close proximity to these areas could increase potential avian collisions with the infrastructure. These areas are therefore of artificial origin but could be relocated to other areas.

» *Areas of medium sensitivity*

The medium sensitivity habitat units include the Kathu Bushveld (including Kathu Bushveld on deep red sands).

These are prominent in the region and provides potential suitable foraging habitat for some collision-prone bird species, including the Northern Black Korhaan (*Afrotis afraoides*) and Red-crested Korhaan (*Lophotis ruficrista*) with the potential to interact (e.g., collide) with the proposed electrical infrastructure. In addition, reporting rates for threatened and near threatened bird species are anticipated to be relatively low in this unit, thereby suggesting a medium sensitivity rating instead of a high sensitivity even though the majority of the habitat is natural. In addition, Kathu Bushveld is widespread in the region.

The Kathu Bushveld on deep red sands is expected to sustain a higher number of bird species when compared to the other units.

No fatal flaws were identified during the assessment of the PV Facility. Impacts related to avian collision and electrocution with the overhead power line were also considered to not be a fatal flaw and can be mitigated. The specialist has recommended mitigation measures and monitoring protocols to be implemented during the construction and operational phase of the project.

9.2.3 Impacts on Soil and Agricultural Potential

There are no crop fields within the development area. Even though the area is suitable for livestock farming, the long-term grazing of the entire development area is 13 ha/LSU, which is a low-moderate grazing potential and livestock numbers must be strictly controlled, especially during periods of drought, to avoid overgrazing and land degradation.

The low agricultural potential of the site is further confirmed by the absence of any High Potential Agricultural Areas (HPAAs) in the vicinity of the development area.

Considering the soil properties, land capability and agricultural potential of the development area, the entire PV Facility development area as well as the grid connection corridor, have Low Agricultural Sensitivity. Soil in the project area will have Low to Medium sensitivity, depending on the successful implementation of mitigation measures to prevent soil erosion, compaction and pollution.

9.2.4 Impacts on Heritage Resources (archaeological and paleontological)

Although the palaeosensitivity was identified as very high in terms of the SAHRIS Palaeontological Sensitivity Map, Almond and Pether (2009) describe these specific formations as having a low sensitivity for fossils. The Palaeosensitivity was identified as high in terms of the SAHRIS Palaeontological Sensitivity Map the geological structures suggest that the rocks are unlikely to contain fossils. Taking account of the defined criteria, the potential impact to fossil heritage resources is likely to be of a low significance. As such, the development is unlikely to negatively impact significant palaeontological heritage resources.

Very few heritage resources of significance were identified during the archaeological field assessment. Three observations of Middle Stone Age scatters of low density noted were all associated with a wetland that is located well-outside of the development footprint, and therefore not impacted. These observations have been graded IIIC for their contextual scientific significance. No other observations were considered to be conservation worthy.

From a heritage and paleontological perspective, both the facility and grid connection are considered acceptable.

9.2.5 Visual Impacts

The anticipated visual impacts associated with the construction and operation phases of the San Solar PV Facility and associated infrastructure range from moderate to low significance. These anticipated visual

impacts on sensitive visual receptors, if and where present, in close proximity to the facility are not considered to be a fatal flaw. Visibility zones of the PV Facility mostly falls within vacant open space and agricultural land but does include some farm dwellings and residences. Potentially sensitive visual receptors include Haakbosskerm homestead and restaurant, the Limebank, Flatlands and Halliford homesteads, and viewers from sections of the R380 main road. Although the proposed infrastructure may be visible does not necessarily imply a high visual impact.

The San Solar PV facility is located 6.7km north-west of the Sishen airfield. The findings of a Glint and Glare assessment indicate that the glare analysis found no "yellow" glare (potential for after-image). For configurations employing module surfaces with smooth or lightly textured glass, which is in line with the proposed configuration, no glint or glare was predicted. Based on this, the potential visual impact related to solar glint and glare as an air travel hazard is expected to be of low significance. No mitigation of this impact is considered were considered necessary.

9.2.6 Social Impacts

The social impacts identified (including all positive and negative impacts) will be either of a low or medium significance. No negative impacts with a high significance rating have been identified to be associated with the development of the San Solar PV Facility and associated infrastructure. All negative social impacts are within acceptable limits with no impacts considered as unacceptable from a social perspective. The recommendations proposed for the project are appropriate and suitable for the mitigation of the negative impacts and the enhancement of the positive impacts. San Solar PV Facility and its associated grid connection is supported at a national, provincial, and local level, and that the proposed project will contribute positively towards a number of targets and policy aims.

Based on the findings of the SIA the proposed establishment of the San Solar PV is supported.

9.2.8 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 and within the surrounding areas of the development area. 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.

Based on the specialist cumulative assessment and findings (**Appendix D** to **Appendix J** and Chapter 8 of the EIA), the development of San Solar PV and its contribution to the overall impact of all existing and proposed solar energy facilities within a 30km radius (which includes the site being adjacent to two solar PV facilities, collectively forming a renewable energy node in this area north of Kathu), it can be concluded that cumulative impacts 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 San Solar PV 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

As part of the specialist investigations undertaken within the project development area, which includes the development footprint, specific environmental features and areas were identified and impacted the placement of San Solar PV facility within the site. The current condition of the features identified (i.e. intact or disturbed) informed the sensitivity of the environmental features and the capacity for disturbance and change.

The environmental features identified within and directly adjacent to the project site and development footprint are illustrated in **Figure 9.1**.

- The areas of high ecological sensitivity include the area of deeper sands with a higher abundance of *Vachellia erioloba* in the south eastern corner.
- Across the rest of the site there are several ephemeral pans present, which are considered Very High ecological sensitivity and high Avifauna sensitivity, and are to be avoided. These features in the arid landscape are required to be treated as an exclusion area. A 200m buffer has been applied to the pans.
- Avifauna habitats of high sensitivity are associated with the open Kathu Bushveld which provides potential foraging habitat for large terrestrial bird species such as the Kori Bustard (*Ardeotis kori*).
- Artificial watering points in the area are high Avifauna sensitivity as these attract large numbers of granivore passerine and non-passerine bird species. These areas of high avifaunal sensitivity are excluded from the from the development footprint, but as these are man-made temporary features, these may be moved.
- Heritage sites with a 200m buffer are located within the pan and considered an exclusion area.

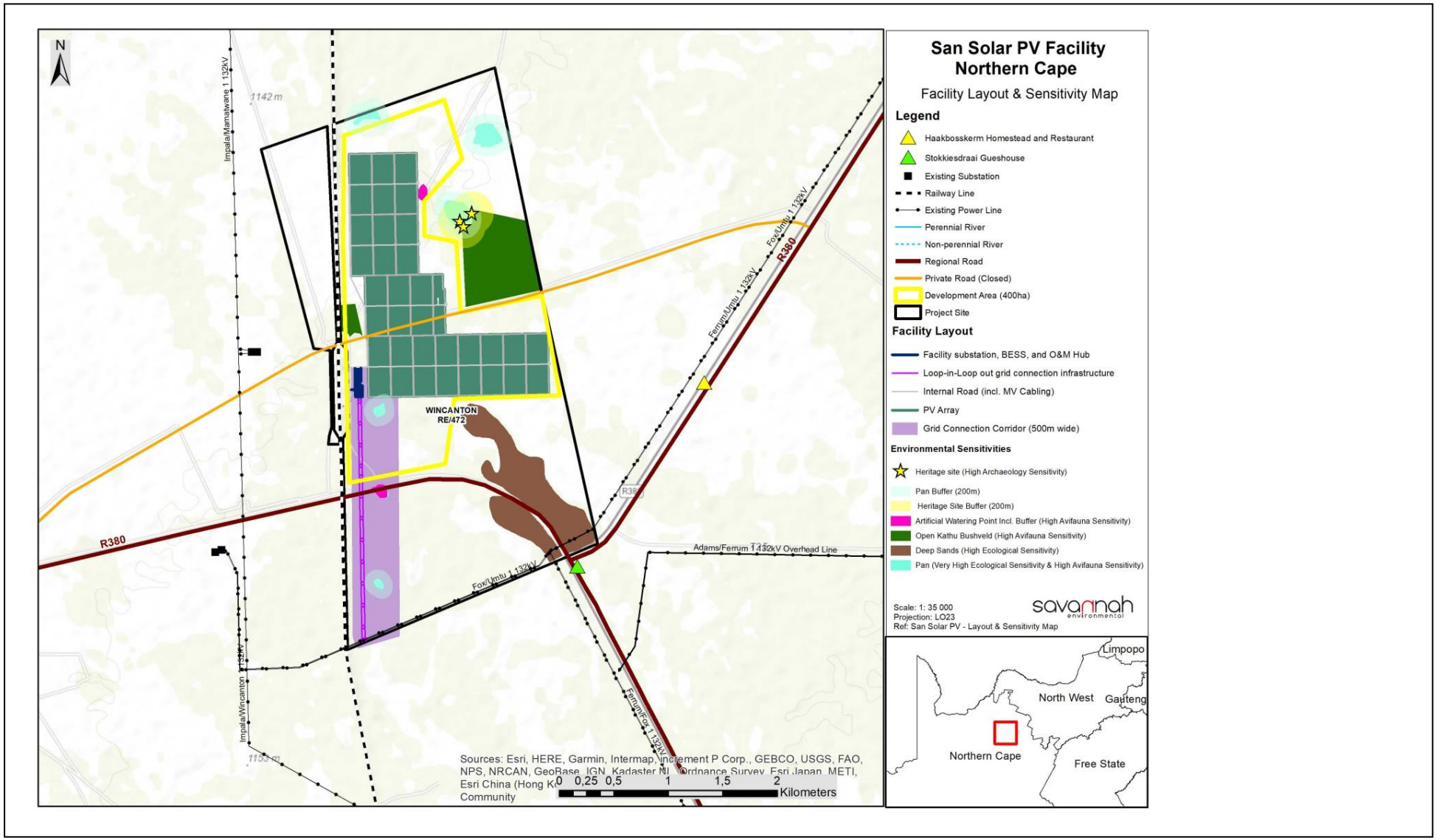


Figure 9.1: Layout and sensitivity map of the development footprint and grid connection corridor for the San Solar PV Facility, as was assessed as part of the EIA process (A3 map is included in Appendix O).

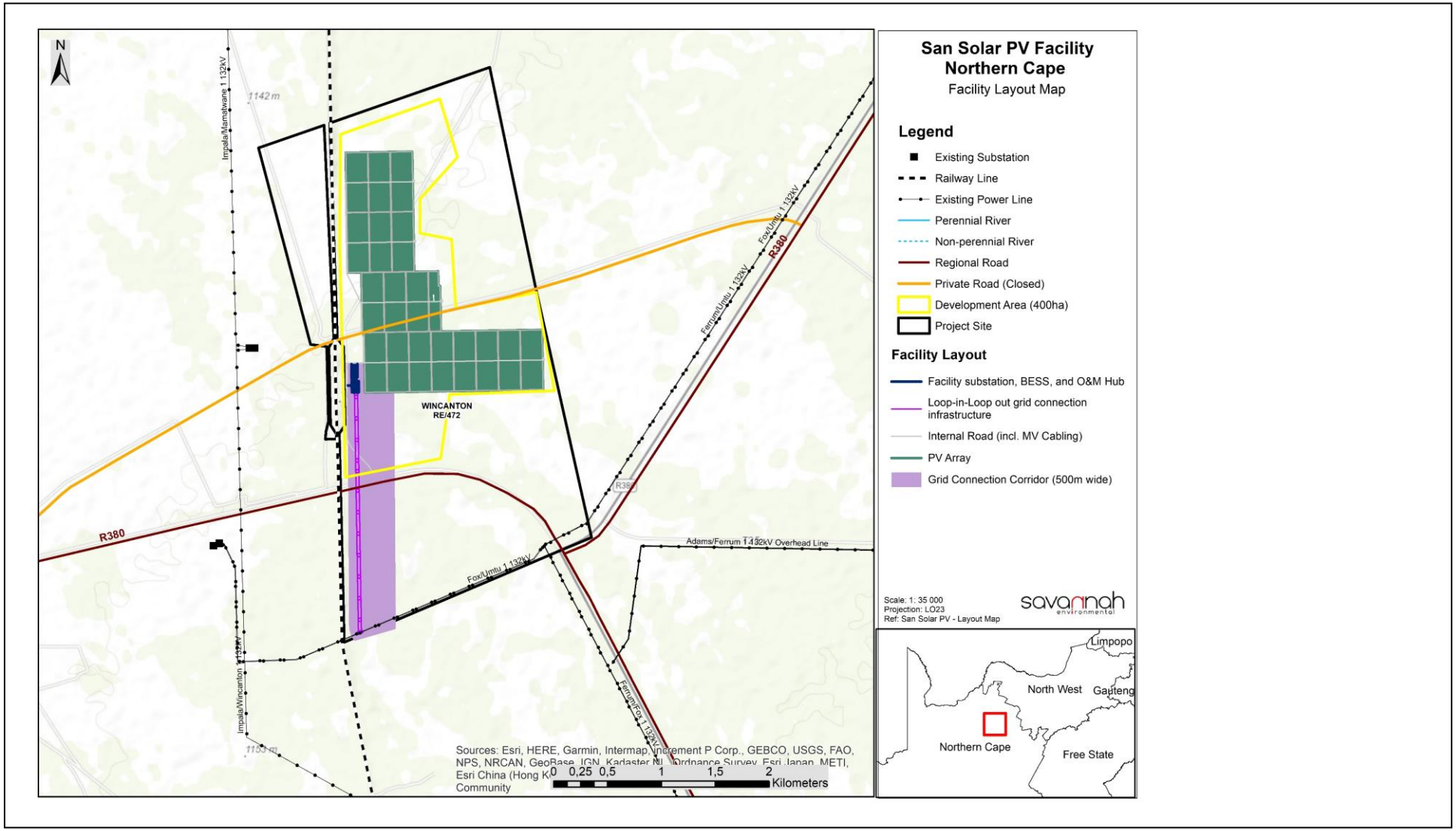


Figure 9.2: Layout map of the development footprint and grid connection corridor for the San Solar PV Facility, as was assessed as part of the EIA process (A3 map is included in Appendix O).

9.5 Environmental Costs of the Solar PV Facility and its associated grid connection versus Benefits of the Solar 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 EIA Report and the EMPr are implemented and adhered to. No fatal flaws have been identified.

These environmental costs could include:

- A direct loss of biodiversity, flora, fauna and avifauna due to the clearing of land for the construction and utilisation of land for the PV facility (which is limited to the development footprint of ~205 hectares). The cost of loss of biodiversity has been minimised/avoided through the location of the development to avoid key areas supporting biodiversity of particularly high conservation importance, and the implementation of recommendations provided by the specialists.
- Loss of land for agriculture. The development will remove areas available for agricultural activities. However, based on the low sensitivity of the soils within the development footprint of the PV Facility, this will not be significant.
- Visual impacts associated with the PV panels and power line. The cost of loss of visual quality to the area is reduced due to the area already been visually impacted by other renewable surrounding project in close proximity to this project.
- Change in land-use and loss of land available for grazing on the development footprint. The cost of loss of grazing potential is reduced due to the best grazing areas on the land parcel being avoided by the development area, with less attractive areas being targeted for the development.
- Impacts on the social environment. Socio-economic impacts include impacts on the sense of place and property and business values that could occur during both construction and operation, the effect on social and economic infrastructure, and crime and social conflicts in the area that could be created during only the construction phase. These impacts though will only affect local communities either temporarily or over the long term. These impacts are not highly significant and can be traded off for the net positive impact created by the project in terms of production, employment, government revenue, community benefits and households' earnings.

Benefits of the San Solar PV Facility include the following:

- The project will result in important economic benefits at the local and regional scale through job creation, income and other associated downstream economic development. These will persist during the preconstruction, construction, operation and decommissioning phases of the project.
- The project provides an opportunity for a new land use on the affected properties which is considered as a more efficient use of the land and provides an opportunity for financial benefits to the current land use.
- The project contributes towards the Provincial and Local goals for the development of renewable energy as outlined in the respective IDPs.
- The project serves to diversify the economy and electricity generation mix of South Africa through the addition of solar energy.

- The water requirement for a solar facility is negligible compared to the levels of water used by coal-based technologies. This generation technology is therefore supported in dry climatic areas.
- South Africa's per capita greenhouse gas emissions are amongst the highest in the world due to the reliance on fossil fuels. The San Solar PV Facility will contribute to achieving goals for implementation of renewable energy and sustaining a 'green' economy within South Africa.
- The establishment of the project will offer numerous opportunities for skills transfer and development. This is relevant for both on-site activities and manufacturing activities. Many PV projects are already being constructed in the Northern Cape, which means that the transfer of skills from foreign experts to the local engineers and construction workers already takes place.

The benefits of the San 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 lower sensitive areas through the avoidance of features and areas considered to be sensitive, the benefits of the project are expected to partially offset the localised environmental costs of the PV facility.

9.6 Overall Conclusion (Impact Statement)

The preferred activity was determined by the developer to be the development of a renewable energy facility on site using solar irradiation as the preferred technology, due to the availability of a suitable solar resource. Independent specialists appointed to undertake the assessment of potential impacts associated with the project assessed a larger area in order to inform the best location for the solar facility infrastructure. The Specialists considered desktop data, results from field work, existing literature and the National Web-based Environmental Screening Tool to inform the identification of sensitivities. A proposed layout was designed after provision of sensitivity data by the specialists with the aim of avoiding the identified sensitive areas.

Based on the specialist investigations of the larger area, a technically viable development footprint was proposed by the developer and assessed as part of the EIA process. The findings of the assessment of the development footprint undertaken by independent specialists have informed the results of this report. The specialist findings have indicated that there are no identified fatal flaws associated with the implementation of the project within the project site.

From a review of the relevant policy and planning framework, it was concluded that the project is well aligned with the policy framework, and a clear need for the project is seen from a policy perspective at a local, provincial and National level. The project development area is located outside of any protected area and outside of any Critical Biodiversity Areas (CBAs) as defined in the Provincial Conservation Plan. When considering biodiversity and socio-economic benefits and impacts on the affected and surrounding areas, the following is concluded from the specialist studies undertaken within this EIA process.

From a biodiversity perspective, the site is not located within a protected area. The site is located within an ESA. However, overall, there are no specific long-term impacts likely to be associated with the development of the San Solar PV facility that cannot be reduced to a low significance. There are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. Where

impacts could not be avoided, appropriate mitigation has been proposed to minimise impacts. It follows therefore that the project does not adversely impact on the ecological integrity of the area.

The Socio-economic Impact Assessment has identified short-term (construction related) impact indicators and operational related socio-economic impact indicators. The assessment of the proposed facility, and its net effect from a socio-economic perspective, indicates that the project would generate greater socio-economic benefits during both the construction and operational phases than the potential losses that could occur as a result of its establishment.

As detailed in the cost-benefit analysis, the benefits of the San 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 lower sensitive areas through the avoidance of features and areas considered to be sensitive, the benefits of the project are expected to partially offset the localised environmental costs of the PV facility. From an economic perspective, both positive and negative impacts are expected.

Based on the conclusions of the specialist studies undertaken, it can be concluded that the development of the San Solar PV facility based on the current layout as provided by the Applicant will not result in unacceptable environmental impacts (subject to the implementation of the recommended mitigation measures). The confidence in the environmental assessment undertaken is regarded as acceptable provided all measures are taken to protect and preserve the surrounding environment.

9.7 Overall Recommendation

Considering the findings of the independent specialist studies, the impacts identified, the development footprint proposed by the developer within the development site, 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 San Solar PV facility is acceptable within the landscape and can reasonably be authorised. The proposed layout as provided by the Applicant (**Figure 9.2**) is considered to be the most appropriate from an environmental perspective as it avoids identified sensitivities and recommended buffer areas.

The following infrastructure would be included within an authorisation issued for the project:

100MW Solar PV facility: San Solar PV facility located within Farm Wincanton 472, including:

- PV modules and mounting structures
- Inverters and transformers
- Cabling between the panels, to be laid underground where practical
- Battery Energy Storage System (BESS)
- Site and internal access roads (up to 8m wide)
- Laydown area
- Operation and maintenance buildings including a gate and security building, control centre, offices, warehouse, and workshop areas for maintenance and storage.

» Grid connection solution including a 132kV facility substation, 132kV switching station to be connected via a Loop-in-Loop out (LILO) connection to the Fox-Umtu 132kV overhead power line located south of the site.

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

» All mitigation measures detailed within this EIA report, as well as the specialist reports contained within **Appendices D to J** are to be implemented.
» The EMPr as contained within **Appendix K** of this EIA report should form part of the contract with the Contractors appointed to construct and maintain the solar facility in order to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the San Solar PV Facility is considered key in achieving the appropriate environmental management standards as detailed for this project.
» Following the final design of the San Solar PV Facility, a revised layout must be submitted to DFFE 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.**
» A pre-construction walk-through of the final layout, including roads and underground cables, should be undertaken before construction commences and adjusted where required to reduce impacts on species of conservation concern and habitats of concern.
» A permit to be obtained for removal of protected trees and provincially protected flora that are affected.
» A walk-through survey be undertaken by an avifauna specialist for the route of the power line only to identify sections of line requiring collision mitigation.
» A post-construction survey during operation with a minimum of 3 x 3–5-day surveys over a six month period (including the peak wet season). The surveys aim to obtain mortality data from birds colliding with the panels to advise on appropriate mitigation measures to be implemented to reduce potential bird mortalities. The surveys should be conducted in a regular and systematic manner by means of direct observations (and the use of installed video cameras) and carcass searches. A management programme must be compiled to assess the efficacy of applied mitigation measures and consult or change measures to reduce on-going mortalities when detected. Additional mitigation measures should be tested or applied, especially if mortalities include birds of prey, sandgrouse and species of conservation concern.
» A detailed site-specific eradication and management programme for alien invasive plants must be developed and implemented.
» Maintain vegetation cover (i.e. either natural or cultivated) immediately adjacent to the actual development footprint, both during construction and operation of the proposed facility.
» Monitor all rehabilitated areas for one year following decommissioning and implement remedial actions as and when required.
» Implement a chance finds procedure for the rescuing of any fossils or heritage resources discovered during construction.
» If any archaeological material or human burials are uncovered during construction activities, work in the immediate area should be halted, the find reported to the heritage authorities and inspected by an archaeologist. Such heritage is the property of the State and may require excavation and curation in an approved institution.

An Environmental Authorisation with a validity period of **10 years** is recommended.

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110652	HIA Phase 1	Stephan Gaigher	01/02/2013	HERITAGE IMPACT ASSESSMENT REPORT ENVIRONMENTAL IMPACT ASSESSMENT PHASE Proposed establishment of the San Solar Energy Facility located south of Kathu on a Portion of the Farm Wincanton 472, Northern Cape Province
110765	HIA Phase 1	Stephan Gaigher	26/02/2013	HERITAGE IMPACT ASSESSMENT REPORT ENVIRONMENTAL IMPACT ASSESSMENT PHASE Proposed establishment of the San Solar Energy Facility located north of Kathu on a Portion of the Farm Wincanton 472, Northern Cape Province
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