# ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

# DRAFT ENVIRONMENTAL IMPACT REPORT

## PROPOSED KHEIS PV SOLAR PARK SOUTH EAST OF UPINGTON, NORTHERN CAPE PROVINCE

**Kheis Solar Park 1 - DEA REF NO.: 14/12/16/3/3/2/569**
**Kheis Solar Park 2 - DEA REF NO.: 14/12/16/3/3/2/570**
**Kheis Solar Park 3 - DEA REF NO.: 14/12/16/3/3/2/571**

DRAFT EIA FOR PUBLIC REVIEW
24 FEBRUARY 2014 – 26 MARCH 2014

**Prepared for:**
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## PROJECT DETAILS

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|---|---|---|
| **DEA Reference No.** | : | Kheis Solar Park 1 - 14/12/16/3/3/2/569<br>Kheis Solar Park 2 - 14/12/16/3/3/2/570<br>Kheis Solar Park 3 - 14/12/16/3/3/2/571 |
| **Title** | : | Environmental Impact Assessment Process<br>Draft Environmental Impact Assessment Report: Proposed Kheis(PV) Solar Park South East of Upington, Northern Cape Province |
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| **Client** | : | PV Africa (Pty) Ltd |
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| **Review Period** | : | 24 February 2014 – 26 March 2014 |

**When used as a reference this report should be cited as:** Savannah Environmental (2014) Draft Environmental Impact Assessment Report: Four Proposed Kheis(PV) Solar Park South East of Upington, Northern Cape Province.

# BACKGROUND TO THE PROJECT AND PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Gestamp Asetym Solar South Africa (Pty) Ltd is proposing to establish three commercial photovoltaic solar energy facilities, as well as associated infrastructure on a site located approximately 60 km south-east of Upington, in the Northern Cape Province. This development is known as the Kheis (PV) Solar Park and will comprise three development phases (to be referred to as "projects" hereafter) (refer to Figure 1.1). Each project will have varying electricity generation capacities and are referred to as follows:
Kheis Solar Park 1 – 75MW
Kheis Solar Park 2 – 55MW
Kheis Solar Park 3 – 20MW

DEA have accepted the three new applications for environmental authorisation and granted permission for a consolidated EIA phase assessment and public participation process to be undertaken for the environmental assessment of the three new projects within the same site (i.e. on Portion 7 and 9 of Portion 4 of the Farm Namakwari 656). The rationale behind the phased approach to the development is based on the Department of Energy (DoE) requirements of restricting the electricity generation capacity per project to 75 MW.

The approach for the EIA phase, as agreed with DEA, includes the compilation of a consolidated Environmental Impact Report (EIR), which considers the Kheis Solar Park 1, 2 and 3 PV projects. The benefit to considering the full extent of the development under one process, is that the impacts are assessed within a consolidated EIA report (although still keeping the assessments for each project/application discrete) – therefore assuring that all stakeholders (including the competent authority) are simultaneously afforded the opportunity to consider all components of the proposed project and understand holistic and cumulative impacts. If authorised, DEA will provide three separate Environmental Authorisations (one for each project). This consolidated EIR assesses the following Kheis Solar Park projects:

» Kheis Solar Park 1 - DEA REF NO.: 14/12/16/3/3/2/569
» Kheis Solar Park 2 - DEA REF NO.: 14/12/16/3/3/2/570
» Kheis Solar Park 3 - DEA REF NO.: 14/12/16/3/3/2/571

Gestamp Asetym Solar South Africa (Pty) Ltd has appointed Savannah Environmental as the independent environmental consultant to undertake the Environmental Impact Assessment (EIA) phase for the above-mentioned three Kheis Solar Park PV Projects. The EIA process is being undertaken in accordance with the requirements of the DEA (EIA Phase study only) and the EIA Regulations of June 2010 (GNR543) promulgated in terms of the National Environmental

Management Act (NEMA; Act No. 107 of 1998). This Draft EIA Report consists of fifteen sections:

**Chapter 1:** Provides background to the proposed facility and the environmental impact assessment.
**Chapter 2:** Provides a description of the proposed project.
**Chapter 3:** Provides an overview of the regulatory and legal context for electricity generation projects and the EIA process.
**Chapter 4:** Outlines the process which was followed during the EIA Phase, including the consultation program that was undertaken and input received from interested parties.
**Chapter 5:** Describes the existing biophysical and socio-economic environment.
**Chapter 6:** Presents the assessment of environmental impacts associated with **Kheis Solar Park 1** of the project.
**Chapter 7:** Presents the conclusions of the EIA, as well as an impact statement for **Kheis Solar Park 1** of the project.
**Chapter 8:** Assesses the potential for cumulative impacts associated with the development of the proposed **Kheis Solar Park 1**
**Chapter 9:** Presents the assessment of environmental impacts associated with **Kheis Solar Park 2** of the project.
**Chapter 10:** Presents the conclusions of the EIA, as well as an impact statement for **Kheis Solar Park 2** of the project.
**Chapter 11:** Assesses the potential for cumulative impacts associated with the development of the proposed **Kheis Solar Park 2**
**Chapter 12:** Presents the assessment of environmental impacts associated with **Kheis Solar Park 3** of the project.
**Chapter 13:** Presents the conclusions of the EIA, as well as an impact statement for **Kheis Solar Park 3** of the project.
**Chapter 15:** Assesses the potential for cumulative impacts associated with the development of the proposed **Kheis Solar Park 3**
**Chapter 15:** Provides a list of references and information sources used in undertaking the studies for this EIA Report.

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. This EIA Phase assessment of Kheis Solar Park 1- 3 project addresses those identified potential environmental impacts and benefits associated with the project and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed the four proposed projects.

The release of this draft EIA Report provides stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final EIA Report will incorporate all issues and responses and will be released for a 21 day public review period prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project.

## INVITATION TO COMMENT ON THE DRAFT EIA REPORT

Members of the public, local communities and stakeholders are invited to comment on the draft EIA Report for Kheis Solar Park 1 - 3 of the Kheis Solar Park PV Projects which has been made available for 30[1]-day public review and comment period at the following locations from **24 February 2014 – 26 March 2014**:

» Grootdrink Library, School Street (next to Community Hall)
» Groblershoop Library

The report is also available for download from www.savannahsa.com.

| ***Please submit your comments to*** |
|---|
| Gabriele Wood of Savannah Environmental (Pty) Ltd<br>PO Box 148, Sunninghill,2157, Gauteng<br>Tel: 011 656 3237<br>Fax: 086 684 0547<br>E-mail: gabriele@savannahsa.com |
| **The due date for comments on the Draft EIA Report is 26 March 2014** |

Comments can be made as written submission via fax, post, or e-mail.

[1] NB: Organs of state have a 40-day review period.

## PUBLIC FEEDBACK MEETING

In order to facilitate comments on the draft EIA report and provide feedback on the findings of the studies undertaken for Kheis Solar Park 1 - 3 of the Kheis Solar Park PV Projects, a public feedback meeting will be as follows:

» Date: Thursday, 13 March 2014
» Time: 17:30
» Venue: Duin-in-die-Weg Guest Farm near Grootdrink

# EXECUTIVE SUMMARY

## Background and Project Overview

Gestamp Asetym Solar South Africa (Pty) Ltd is proposing to establish three commercial photovoltaic solar energy facilities, as well as associated infrastructure on a site located approximately 60 km south-east of Upington, in the Northern Cape Province. This development is known as the Kheis (PV) Solar Park and will comprise three development phases (to be referred to as "projects" hereafter) (refer to Figure 1.1). Each project will have varying electricity generation capacities and are referred to as follows:
Kheis Solar Park 1 – 75MW
Kheis Solar Park 2 – 55MW
Kheis Solar Park 3 – 20MW

The projects falls within the jurisdiction of the Kheis Local Municipality this falls under the jurisdiction of the ZF Mgcawu District Municipality the Northern Cape Province. The site (on Portion 7 and 9 of portion 4 of the Farm Namakwari 656) is located approximately 60 km south-east of Upington. The farm portions cover a total area of 3600 ha. The location of the site and each phase of the project are shown in **Figure 1**.

The scope of this EIA applies to the development footprint and associated infrastructure for Kheis Solar Park 1, 2 and 3, including access roads, power lines, substations, cables, offices, etc. Each of the three proposed project will accommodate several arrays of photovoltaic (PV) panels and associated infrastructure. Each phase is proposed to have stand-alone infrastructure, as each Phase will be bid to the DoE and developed separately. Each phase will comprise of the following typical infrastructure which is included in the scope of this EIA:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings.
» Cabling between the structures, to be lain underground where practical.
» Central invertor/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
» An on-site substation (50m x 50m) and power line (100m-1800m) to evacuate the power from the facility into the Eskom grid via the existing Garona-Gordonia 132kV power line that traverses the site (Portion Farm Namakwari 656)
» Internal access roads (5m wide roads).
» Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity (approximate footprint (±100 m²)

The nature and extent of Kheis Solar Park 1, 2 and 3 of the Kheis Solar Park PV Facility, as well as the potential environmental impacts associated with the construction, operation and decommissioning of each development projects are explored in more detail in this Draft EIA Report.

**Environmental Impact Assessment**

An EIA process, as defined in the NEMA EIA Regulations, is a systematic process of identifying, assessing, and reporting environmental impacts associated with an activity. The EIA process forms part of the planning of a project and informs the final design of a development. In terms of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998), PV Africa requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Northern Cape – Department of Environmental and Nature Conservation (DENC) for the establishment of Kheis Solar Park 1, 2 and 3 of the Kheis Solar Park PV Facility. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543, GNR544, GNR545; and GNR546, a Scoping and an EIA Phase have been undertaken for the proposed project. As part of this EIA process comprehensive, independent environmental studies have been undertaken in accordance with the EIA Regulations.

The conclusions and recommendations of this EIA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area.

**Impact Statement – Kheis Solar Park 1**

From the assessment of potential impacts undertaken within this EIA, it is concluded that there are no environmental fatal flaws associated with the site proposed for Kheis Solar Park 1. Potential environmental impacts and some areas of high sensitivity were however identified. In summary, the most significant environmental impacts associated with Kheis Solar Park 1, as identified through the EIA, include:

» Impacts on ecology on the site.
» Impacts on the local soils, land capability and agricultural potential of the site.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure
» Social and economic impacts.
» Cumulative impacts.

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of Kheis Solar Park 1 and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the impacts of Kheis Solar Park 1 project can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation. Refer to Chapter 8 for conditions to be included in the environmental authorisation.

**Impact Statement - Kheis Solar Park 2**

From the assessment of potential impacts undertaken within this EIA, it is concluded that there are no environmental fatal flaws were identified to be associated with the proposed for Kheis Solar Park 2. Potential environmental impacts and some areas of high sensitivity were however identified. In summary, the most significant environmental impacts associated with Kheis Solar Park 2, as identified through the EIA, include:

» Impacts on ecology on the site.
» Impacts on the local soils, land capability and agricultural potential of the site.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure
» Social and economic impacts.
» Cumulative impacts.

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of Kheis Solar Park 2 and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the impacts of Kheis Solar Park 2 project can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation. Refer to Chapter 10 for conditions to be included in the environmental authorisation.

**Impact Statement - Kheis Solar Park 3**

From the assessment of potential impacts undertaken within this EIA, it is concluded that there are no environmental fatal flaws associated with the site proposed for Kheis Solar Park 3. Potential environmental impacts and some areas of high sensitivity were however identified. In summary, the most significant environmental impacts associated with Kheis Solar Park 3, as identified through the EIA, include:

» Impacts on ecology on the site.
» Impacts on the local soils, land capability and agricultural potential of the site.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure (power line, access road etc.).
» Social and economic impacts.
» Cumulative impacts.

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of Kheis Solar Park 3 and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the impacts of Kheis Solar Park 3 project can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation. Refer to Chapter 14 for conditions to be included in the environmental authorisation.

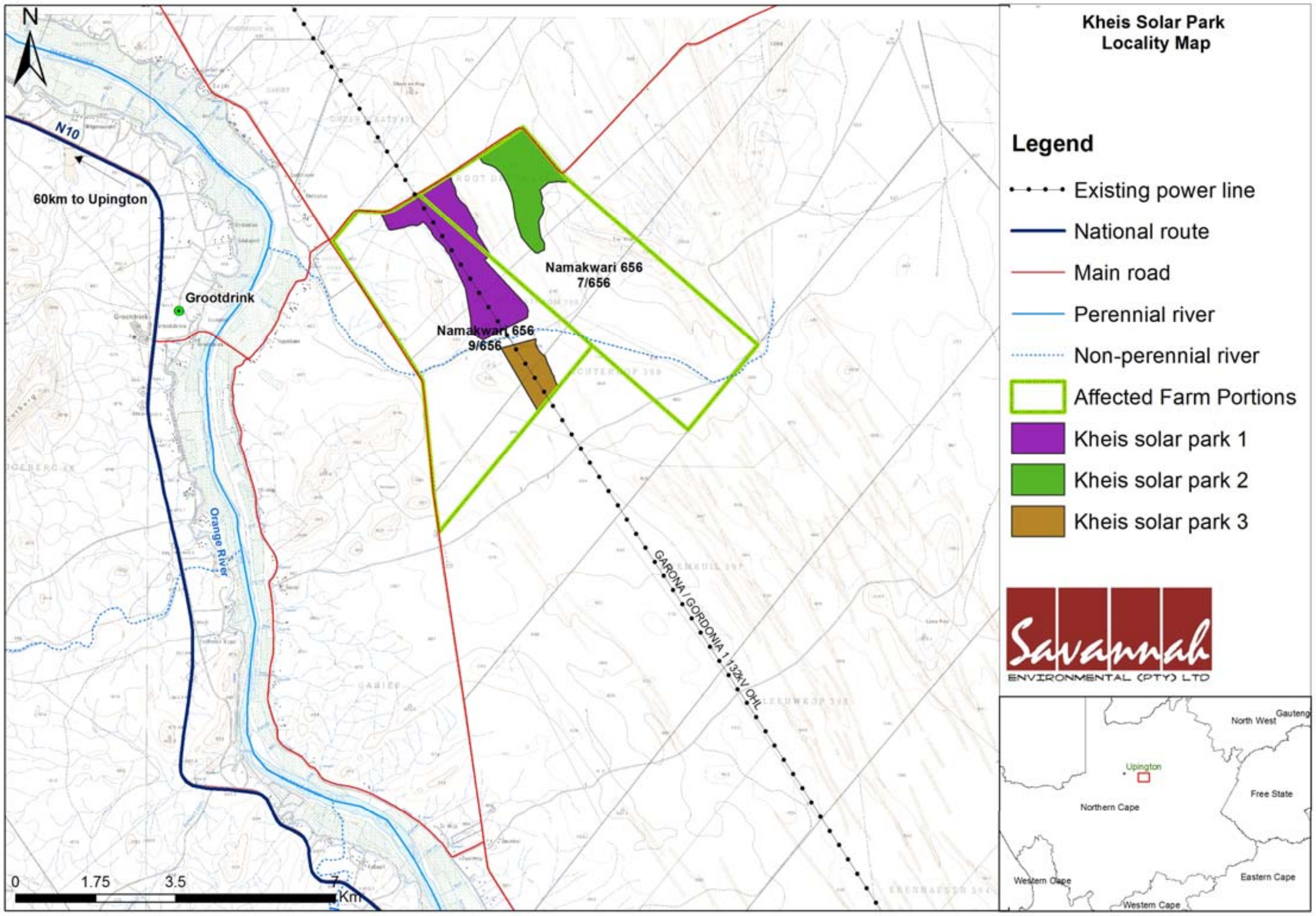


**Figure 1:** Locality Map Locality map illustrating the location of the assessed development site for Kheis Solar Park 1, 2 and 3 of the Kheis Solar Park PV Facility near Grootdrink, Northern Cape Province

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## APPENDICES

# DEFINITIONS AND TERMINOLOGY

# DEFINITIONS AND TERMINOLOGY

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

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

**Cumulative impacts:** The impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

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

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

**Drainage**: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may or may not be present

**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.

**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 (EIA), 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 on-going maintenance after implementation.

**Fossil:** Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

**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 as a result 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 as a result 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 general public.

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

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

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

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

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

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

**Watercourse:** as per the National Water Act means -

(a) a river or spring;

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

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

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

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

## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| BID | Background Information Document |
| $CO_2$ | Carbon dioxide |
| DEA | National Department of Environmental Affairs |
| DoE | Department of Energy |
| DWA | Department of Water Affairs |
| EAP | Environmental Assessment Practitioner |
| EIA | Environmental Impact Assessment |
| EMP | Environmental Management Plan |
| GIS | Geographical Information Systems |
| GG | Government Gazette |
| GN | Government Notice |
| GHG | Green House Gases |
| GWh | Giga Watt Hour |
| I&AP | Interested and Affected Party |
| IDP | Integrated Development Plan |
| IPP | Independent Power Producer |
| $km^2$ | Square kilometres |
| km/hr | Kilometres per hour |
| kV | Kilovolt |
| MAR | Mean Annual Rainfall |
| $m^2$ | Square meters |
| m/s | Meters per second |
| MW | Mega Watt |
| NC DENC | Northern Cape Department of Environment and Nature Conservation |
| NEMA | National Environmental Management Act (Act No. 107 of 1998) |
| NERSA | National Energy Regulator of South Africa |
| NHRA | National Heritage Resources Act (Act No. 25 of 1999) |
| NGOs | Non-Governmental Organisations |
| NWA | National Water Act (Act No. 36 of 1998) |
| SAHRA | South African Heritage Resources Agency |
| SANBI | South African National Biodiversity Institute |
| SANRAL | South African National Roads Agency Limited |
| SDF | Spatial Development Framework |

# INTRODUCTION CHAPTER 1

Gestamp Asetym Solar South Africa (Pty) Ltd is proposing to establish three commercial photovoltaic solar energy facilities, as well as associated infrastructure on a site located approximately 60 km south-east of Upington, in the Northern Cape Province. This development is known as the Kheis (PV) Solar Park and will comprise three development phases (to be referred to as "projects" hereafter) (refer to Figure 1.1). Each project will have varying electricity generation capacities and are referred to as follows:
Kheis Solar Park 1 – 75MW
Kheis Solar Park 2 – 55MW
Kheis Solar Park 3 – 20MW

DEA have accepted the three new applications for environmental authorisation and granted permission for a consolidated EIA phase assessment and public participation process to be undertaken for the environmental assessment of the three new projects within the same site (i.e. on Portion 7 and 9 of Portion 4 of the Farm Namakwari 656). The rationale behind the phased approach to the development is based on the Department of Energy (DoE) requirements of restricting the electricity generation capacity per project to 75 MW.

The approach for the EIA phase, as agreed with DEA, includes the compilation of a consolidated Environmental Impact Report (EIR), which considers the Kheis Solar Park 1, 2 and 3 PV projects. The benefit to considering the full extent of the development under one process, is that the impacts are assessed within a consolidated EIA report (although still keeping the assessments for each project/application discrete) – therefore assuring that all stakeholders (including the competent authority) are simultaneously afforded the opportunity to consider all components of the proposed project and understand holistic and cumulative impacts. If authorised, DEA will provide three separate Environmental Authorisations (one for each project). This consolidated EIR assesses the following projects of the Kheis Solar Park:

**Table 1.1:** DEA Reference numbers for each Phase

| Phase/ Project Name | DEA Reference Number |
|---|---|
| Kheis Solar Park 1 | 14/12/16/3/3/2/569 |
| Kheis Solar Park 2 | 14/12/16/3/3/2/570 |
| Kheis Solar Park 3 | 14/12/16/3/3/2/571 |

The proposed project development site is considered suitable and favourable by the developer for the construction of a solar PV facility from a technical perspective due to the following site characteristics:

» **Climatic conditions:** Climatic conditions determine the economic viability of a solar energy facility as it is directly dependent on the annual direct solar irradiation values for a particular area. Studies of solar irradiation worldwide indicate that the Northern Cape shows great potential for the generation of solar power. The region in the vicinity of the Namibian border has particularly high solar irradiation levels and is considered to be the most efficient location in the country for a solar energy project, as shown by the solar irradiation model.

» **Topographic conditions:** The site conditions are optimum for a development of this nature. For instance the site slope and aspect for the proposed site is predominantly flat. A level surface area (i.e. a gradient of 3% or less) is preferred for the installation of PV panels.

» **Extent of the site:** Significant land area (i.e. 600ha for the Kheis Solar Park projects) is required for the proposed development. The site (ie Portion 7 and 9 of portion 4 of Namakwari farm – 3600ha) is larger than the area required for development which would allow for the avoidance of any identified environmental or technical constraints.

» **Proximity:** This site is located in close proximity to the Eskom Garona-Gordonia 132kV power line that traverses the site, an existing electricity grid connection, which minimises the need for a long connection power line. This is preferred from an environmental and technical perspective.

The nature and extent of the Kheis Solar Park projects, as well as the potential environmental impacts associated with the construction, operation and decommissioning phases are explored in more detail in this Draft EIA Report. The Draft EIA Report consists of fifteen chapters, which include:

**Chapter 1:** Provides background to the proposed facility and the environmental impact assessment.

**Chapter 2:** Provides a description of the proposed project.

**Chapter 3:** Provides an overview of the regulatory and legal context for electricity generation projects and the EIA process.

**Chapter 4:** Outlines the process which was followed during the EIA Phase, including the consultation program that was undertaken and input received from interested parties.

**Chapter 5:** Describes the existing biophysical and socio-economic environment.

**Chapter 6:** Presents the assessment of environmental impacts associated with **Kheis Solar Park 1** of the project.

**Chapter 7:** Presents the conclusions of the EIA, as well as an impact statement for **Kheis Solar Park 1** of the project.

**Chapter 8:** Assesses the potential for cumulative impacts associated with the development of the proposed **Kheis Solar Park 1**

**Chapter 9:** Presents the assessment of environmental impacts associated with **Kheis Solar Park 2** of the project.

**Chapter 10:** Presents the conclusions of the EIA, as well as an impact statement for **Kheis Solar Park 2** of the project.

**Chapter 11:** Assesses the potential for cumulative impacts associated with the development of the proposed **Kheis Solar Park 2**

**Chapter 12:** Presents the assessment of environmental impacts associated with **Kheis Solar Park 3** of the project.

**Chapter 13:** Presents the conclusions of the EIA, as well as an impact statement for **Kheis Solar Park 3** of the project.

**Chapter 14:** Assesses the potential for cumulative impacts associated with the development of the proposed **Kheis Solar Park 3**

**Chapter 15:** Provides a list of references and information sources used in undertaking the studies for this EIA Report.

## 1.1 Summary of the Proposed Development

The project falls within the jurisdiction of the Kheis Local Municipality which, in turn, falls under the jurisdiction of the ZF Mgcawu District Municipality of the Northern Cape Province. The site (Portion 7 and 9 of Portion 4 of the Farm Namakwari 656) is located approximately 60 km south-east of Upington. The farm portions cover an area of 3600 ha. The locations of the proposed Kheis Solar Park projects are shown in **Figure 1.1**.

The scope of the EIA applies to the development footprint for Kheis Solar Park projects and associated infrastructure, including access roads, power lines, substations, cables, offices, etc. Each of the projects will accommodate several arrays of photovoltaic (PV) panels and associated infrastructure. Each project is proposed to have stand-alone infrastructure, as each project will be bid to the DoE and developed separately. Each project will comprise of the following typical infrastructure which is included in the scope of this EIA:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings.
» Cabling between the structures, to be lain underground where practical.
» Central invertor/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
» An on-site substation (50m x 50m) and power line (100m-1800m) to evacuate the power from the facility into the Eskom grid via the existing Garona-Gordonia 132kV power line that traverses the site (Portion 9 of Portion 4 of the Farm Namakwari 656)
» Internal access roads (5m wide roads).

- Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity (approximate footprint (±100 $m^2$)

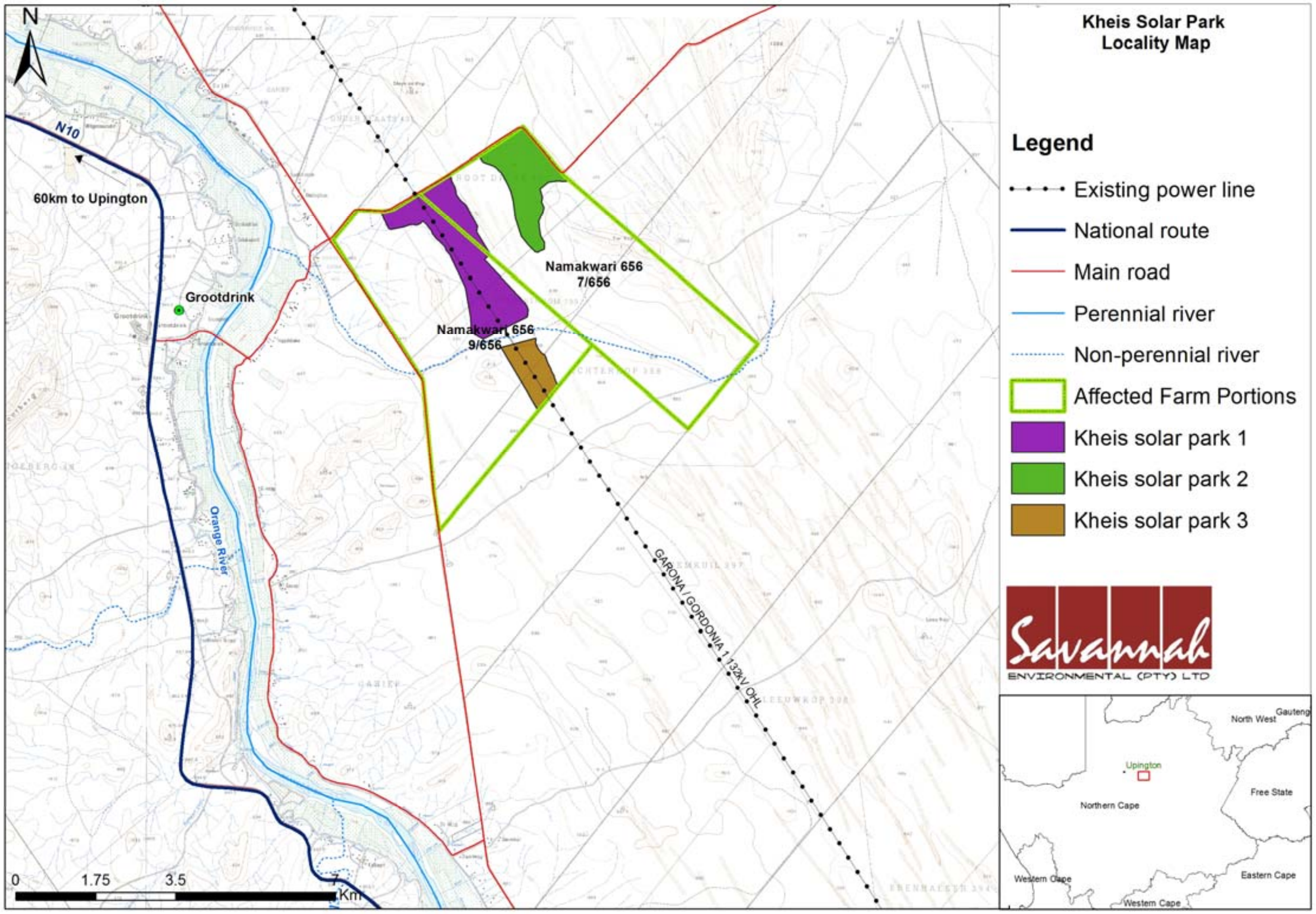


**Figure 1.1:** Locality map illustrating the location of the assessed development site Kheis Solar Park projects near Grootdrink, Northern Cape Province

The scope of the proposed Kheis Solar Park projects, including details of all elements of the projects (for the design/planning, construction, operation and decommissioning Phases) is discussed in more detail in **Chapter 2.**

## 1.2 Conclusions from the Scoping Phase

The full extent of the project development site (i.e. Portion 7 and 9 of Portion 4 of the Farm Namakwari 656) was evaluated within the Scoping phase of the EIA process. The purpose of this was to provide an indication of any potentially high sensitivity or no-go areas from and environmental perspective, thereby informing the location of the development footprint. The following were identified and evaluated (shown in **Figure 1.2**):

» **Ecologically sensitive areas on the site:** Areas identified as potentially having a higher ecological sensitivity were mainly areas with linear dunes, rocky outcrops, exposed calcrete plains and ephemeral drainage lines and possible seasonal pans occurring on the farm portions. These habitats generally have a higher sensitivity because of their ecosystem functions – providing diverse and specialised niches for flora and fauna, creating corridors in the landscape, filtering water, catching sedimentation and concentrating water runoff from catchments.

» **Agricultural Potential:** Due to the aridity constraints and poor soils on the site, agricultural land use is restricted to low intensity grazing only. The natural grazing capacity is low, being 40-60 hectares per large stock unit over most of the site, but slightly higher in other places. From an agricultural impact point of view, no sensitive areas were identified during scoping. Agricultural potential is fairly uniform across the site and there were therefore no preferred locations for the development within the site.

» **Visual / Social Receptors:** The preliminary viewshed analysis indicated that the proposed facility would have a fairly contained area of potential visibility (i.e. within a 5km radius of the site). The area of exposure is generally restricted to vacant natural land, but may contain some potentially sensitive visual receptors. These include *Soekmekaar*, *Onderplaas*, *Donkiedraai* and *Geluksoord*. Visibility between the 2.5 - 5km radii includes a section of the N10 national road, limited sections of secondary roads and a number of residences, namely *Sonderhuis*, Die *Eike* and a number of other unnamed homesteads (primarily to the north-west of the site). This zone also includes the small town of Grootdrink located just less than 5km to the west of the site.

These areas of potential environmental sensitivity identified in the scoping phase relate mostly to the ecological aspects of the site and are illustrated in the preliminary sensitivity map (refer to **Figure 1.2**). It was recommended that infrastructure should be placed so as to consider the identified sensitive areas to minimise impacts. Subsequently, the sensitive environmental features that were identified during the Scoping phase have been refined through the detailed EIA studies and have been taken into consideration through the layout design of the solar energy facility by the developer. The proposed layout of infrastructure is discussed further in Chapter 2.

From the conclusions of the Scoping Phase of the EIA, the potentially significant issues identified as being related to the **construction** of the Kheis Solar Energy Facility include, *inter alia*:

» Loss of or disturbance to protected flora and fauna and associated habitats (local and site specific).
» Loss of soil and impacts on agricultural potential.
» Soil erosion during construction activities.
» Socio-economic impacts, both positive and negative (including job creation and business opportunities, impacts associated with construction workers in the area).

The potentially significant issues related to the **operation** of the Kheis Solar Energy Facility include, *inter alia*:

» Visual impacts and impacts on "sense of place" on nearby residential areas and observers travelling on main roads.
» Positive socio-economic impacts.
» Generation of clean, renewable energy (positive).

The potentially significant issues related to the decommissioning of the Kheis Solar Energy Facility will include, inter alia:

» Loss of or disturbance to protected flora and fauna and associated habitats (local and site specific).
» Soil erosion during decommissioning activities.
» Socio-economic impacts, both positive and negative (including job creation, nuisance).

These issues are assessed within this EIA Report in line with the Plan of Study for EIA approved by the DEA though their acceptance of the Scoping Report.

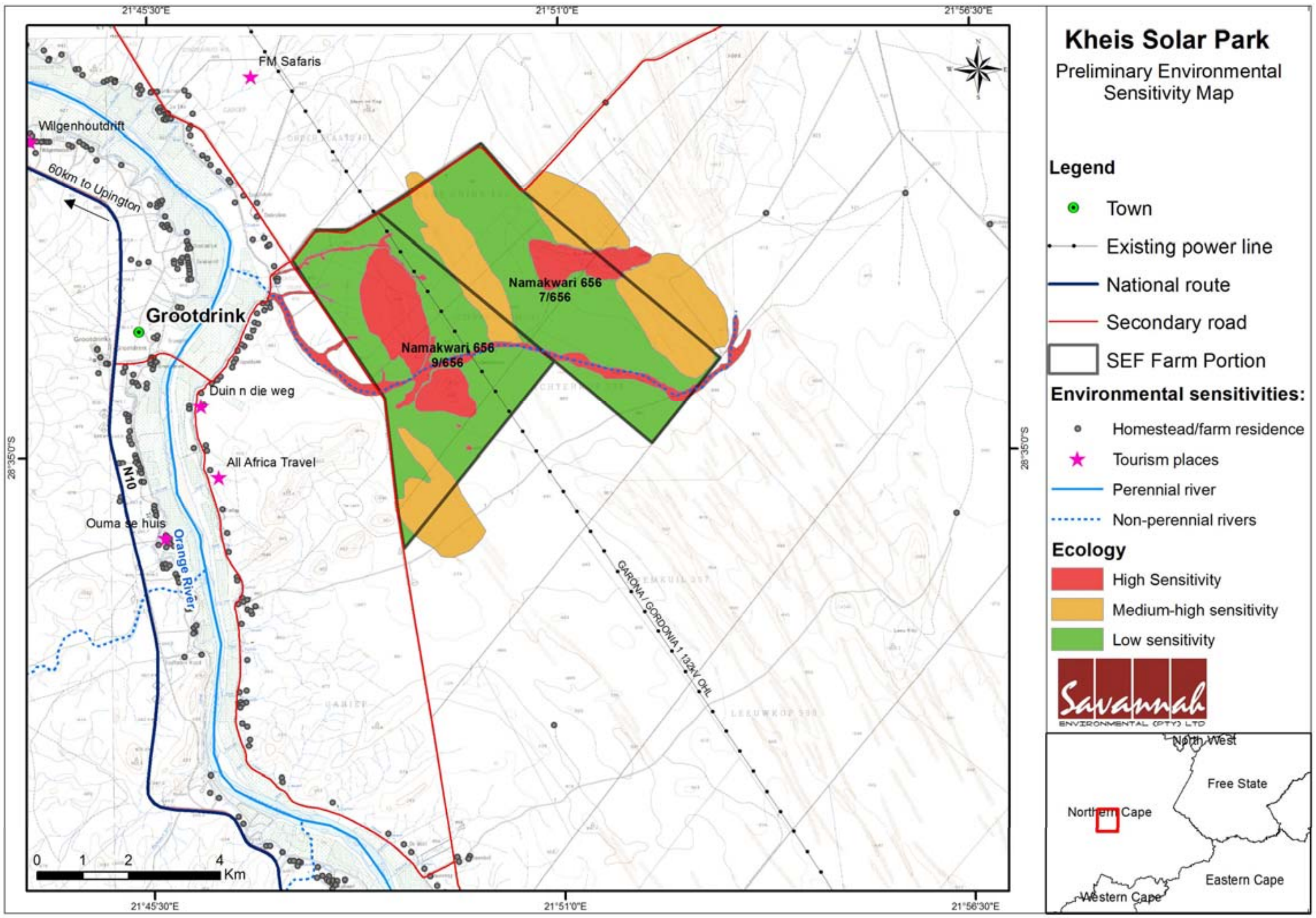


**Figure 1.2**: Desktop Environmental Sensitivity Map of the proposed Kheis Solar Park projects development site illustrating areas of higher sensitivity at the scoping phase level

## 1.3 Requirement for an Environmental Impact Assessment Process

The proposed solar energy facility is subject to the requirements of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998). This section provides a brief overview of the EIA Regulations and their application to this project.

NEMA is the national legislation that provides for the authorisation of "listed activities". In terms of Section 24 (1) of NEMA, the potential impact on the environment associated with these activities must be considered, investigated, assessed and reported on to the competent authority that has been charged by NEMA with the responsibility of granting environmental authorisations. As this is a proposed electricity generation project and thereby considered to be of national importance, the National Department of Environmental Affairs (DEA) is the competent authority[2] and the Northern Cape Department of Environmental and Nature Conservation (DENC) will act as a commenting authority for the application. Separate applications for environmental authorisation have been accepted by DEA under application reference numbers as stated in Table 1.2.

Compliance with the requirements of the EIA Regulations ensures that decision-makers are provided with an opportunity to consider the potential environmental impacts of a project early in the project development process and to assess if potential environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required in accordance with the EIA Regulations to provide the competent authority with sufficient information in order to make an informed decision.

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 developer with the opportunity of being fore-warned of potential environmental issues. Subsequently it may assist with the resolution of issues reported on in the Scoping and EIA Phases as well as promoting dialogue with interested and affected parties (I&APs) and stakeholders. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations R543, an EIA is required to be undertaken for this proposed project as the proposed project includes the following "listed activities" applicable to each of the three projects, in terms of GN R544, R545 and R546 (GG No 33306 of 18 June 2010 as amended).

[2] In terms of the Energy Response Plan, the DEA is the competent authority for all energy related applications.

**Table 1.2:** EIA Listed Activities Applicable to each of the Kheis Solar Park projects applied for to be authorised[3]

| Relevant Notice | Activity No. | Description of Listed Activity | Relevant Component(s) of Facility | Applicability of proposed project to listed activity |
|---|---|---|---|---|
| GN544, 18 June 2010 | 10 | The construction of facilities or infrastructure for the transmission and distribution of electricity-<br>(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts | *Each solar facility will require the construction of an on-site substation and an overhead distribution power line outside an urban area connecting to the existing Eskom Garona-Gordonia 132kV power line that traverses the site* | An on-site substation (500m x 50m) and overhead power lines (100 m to1800m in length) is to be constructed to facilitate the connection between the solar energy facility and the existing Eskom Garona-Gordonia 132kV power line that traverses the site. |
| GN 544, 18 June 2010 | 11 | The construction of:<br>(x) buildings exceeding 50 square metres in size; or<br>(xi) infrastructure or structures covering 50 square metres or more<br>Where such construction occurs within a watercourse or within 32 metres of a watercourse, measures from the edge of a watercourse, excluding where such construction will occur behind the development setback line. | *The construction of the proposed solar facility may impede on watercourse on the site due to infrastructure such as access roads* | There are drainage lines on the proposed site. |
| **Relevant** | **Activity** | **Description of Listed** | **Relevant Component(s) of Facility** | **Applicability of proposed project to** |

[3] An application for each of the Kheis Solar Park projects was amended to include and remove listed activities based on the findings of the scoping study which was conducted. Some listed activities were deemed unnecessary whereas some were crucial in the assessment of the proposed facility; Table 1.2 shows all the relevant applicable activities for each of the Kheis Solar Park projects.

| Notice | No. | Activity | | listed activity |
|---|---|---|---|---|
| GN544, 18 June 2010 | 18 | The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock or more than 5 cubic metres from (i). a water course | *The proposed activity might require the infilling and deposition of materials within watercourses.* | There are drainage lines on the proposed site. |
| GN545, 18 June 2010 | 1 | The construction of facilities or infrastructure, for the generation of electricity where the output is 20 megawatts or more. | *Each PV facility will have a generating capacity of up to 75MW.* | The proposed PV facilities will have an export capacity of 75, 55 and 20 MW for Kheis Solar Park 1, 2 and 3 respectively to be exported to the Eskom national grid. |
| GN545, 18 June 2010 | 15 | Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; | *Each of PV facilities and associated infrastructure will have a developmental footprint of more than 20 ha.* | The establishment of the proposed Kheis Solar Park 1, 2 and 3 will each transform a portion of the farm (exceeding 20ha) from grazing to a PV facility. |
| GN546, 18 June 2010 | 4 | The construction of a road wider than 4 metres with a reserve less than 13.5 metres<br>a) In Northern Cape<br>ii. Outside Urban areas, in:<br>(cc) sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of | *Access roads will be constructed (4-6m) within the site during the development of the proposed facility.* | *Access roads may be constructed during the development of the proposed facilities on sensitive areas as identified by the ZF Mgcawu District Municipality EMF* |

| | | | | |
|---|---|---|---|---|
| | | the Act and as adopted by the competent authority | | |
| GN546, 18 June 2010 | 14 | The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation<br>(a) In the Northern Cape:<br>i. All areas outside urban areas | *The solar energy facility will be located outside urban areas and will require the clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation cover.* | The establishment of each of the proposed Kheis Solar Park projects and access roads will require the clearance of indigenous vegetation within the site over an area of 600ha in total. |
| GN546, 18 June 2010 | 19 | The widening of a road by more than 4 meters or the lengthening of a road by more than 1 kilometres<br>a) In Northern Cape<br>ii. Outside Urban areas, in:<br>(cc). sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority | *Accesse roads may be widen more than 4 meters or lengthen by more than 1 kilometres within the site during the development of the proposed facilities.* | Access roads may be widen more than 4 meters or lengthen by more than 1 kilometres within the site on sensitive areas as identified by the ZF Mgcawu District Municipality EMF |

The EIA process was conducted in accordance with the requirements of the EIA Regulations published in terms of Section 24(5) of NEMA.

## 1.4 Objectives of the EIA Process

The Scoping Phase was completed in **October 2013** with the submission of a Final Scoping Report to the DEA, and the acceptance of scoping was received from DEA on **25 November 2013**. The scoping phase included desk-top studies and served to identify potential impacts associated with the proposed project and to define the extent of studies required within the EIA Phase. The Scoping Phase included input from the project proponent, specialists with experience in the study area and in EIAs for similar projects, as well as a public consultation process with key stakeholders that included both government authorities and interested and affected parties (I&APs).

The EIA Phase (i.e. the current phase) assesses identified environmental impacts (direct, indirect, and cumulative as well as positive and negative) associated with the different project development phases (i.e. design, construction, operation, and decommissioning) for each project. The EIA Phase also recommends appropriate mitigation measures for potentially significant environmental impacts. The release of a draft EIA Report provides stakeholders with an opportunity to verify that issues they have raised through the EIA Process have been captured and adequately considered. The final EIA Report will incorporate all issues and responses raised during the public review phase prior to submission to DEA.

## 1.5 Details of the Environmental Assessment Practitioner and Specialist Team

Savannah Environmental was appointed by Gestamp Asetym Solar South Africa (Pty) Ltd as the independent EAP to undertake the EIA process for the proposed project. Neither Savannah Environmental nor any of its specialist sub-consultants are subsidiaries of or are affiliated to Gestamp Asetym Solar South Africa (Pty) Ltd. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

Savannah Environmental is a specialist environmental consultancy which provides a holistic environmental management service, including environmental assessment and planning to ensure compliance with relevant environmental legislation. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team that has been actively involved in undertaking environmental studies for a wide variety of projects throughout South Africa and neighbouring countries. Strong competencies have been developed in project management of environmental processes, as well as strategic environmental assessment and compliance advice, and the assessment of environmental impacts, the identification of environmental management solutions and mitigation/risk minimising measures.

The EAPs from Savannah Environmental who are responsible for this project are:

» *Sheila Muniongo* - the principle author of this report holds an Honours Bachelor degree in Environmental Management and 3 years experience in the environmental field. Her key focus is on environmental impact assessments, public participation, environmental management programmes, and mapping through ArcGIS for variety of environmental projects. She is currently involved in several EIAs for renewable energy projects across the country.
» Karen Jodas - a registered Professional Natural Scientist and holds a Master of Science degree. She has 16 years experience consulting in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently responsible for the project management of EIAs for several renewable energy projects across the country and the EAP on this project.
» *Gabriele Wood*: the public participation consultant for this project, hold an Honours Bachelor degree in Anthropology and has 6 years experience in Public Participation and Social consulting, including professional execution of public participation processes for a variety of projects as well as managing and co-ordinating public participation processes for Environmental Impact Assessments (EIA).

Savannah Environmental has developed a detailed understanding of impacts associated with the construction and operation of renewable energy facilities through their involvement in numerous EIA processes for these projects. In order to adequately identify and assess potential environmental impacts associated with the proposed project, Savannah Environmental has appointed the following specialists to conduct specialist impact assessments:

» Ecology – Marianne Strohbach (Savannah Environmental)
» Soils and Agricultural Potential – Johann Lanz (Johann Lanz consulting)
» Heritage - David Morris (McGregor Museum)
» Desktop Paleontological Assessment– Barry Millsteed (BM Geological Services)
» Visual – Lourens du Plessis (MetroGIS)
» Social – Anne-Marie Le Roux (Zone Land Solutions)

Curricula vitae for the Savannah Environmental project team and its specialist sub-consultants are included in **Appendix A**

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# DESCRIPTION OF THE PROPOSED PROJECT CHAPTER 2

This chapter provides an overview of Kheis Solar Park 1, 2 and 3 PV projects near Upington, Northern Cape Province. Each project will be a stand-alone project and will have varying generation capacities (, i.e. Kheis 1 - 75MW, Kheis 2 - 55MW and Kheis 3 - 20MW) in line with the DoE requirements under the Renewable Energy Independent Power Producer Programme (REIPPP). The project scope (relevant to each individual project) includes the planning and design, construction, operation and decommissioning phases during which potential impacts will vary in terms of their nature and significance. This chapter also describes the "Do-Nothing" alternative - that is the alternative of not establishing each phase of the solar energy facility on the proposed site.

## 2.1. Need and Desirability of the project

According to the DEA Draft Guideline on Need and Desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 (October 2012) the need and desirability of a development must be measured against the contents of the Integrated Development Plan (IDP), Spatial Development Framework (SDF) and Environmental Management Framework (EMF) for an area, and the sustainable development vision, goals and objectives formulated in, and the desired spatial form and pattern of land use reflected in, the area's IDP and SDF. This section of the report provides a summary of the findings from the review of relevant policies and guidelines at a national, provincial and local scale regarding the need for renewable energy and the Kheis Solar Facilities, in particular.

### *2.1.1 The Need for Renewable Energy Projects at a National Scale*

The need for harnessing renewable energy resources (such as solar energy for electricity generation) is linked to increasing pressure on countries to increase their share of renewable energy generation due to concerns such as exploitation of non-renewable resources and the rising cost of fossil fuels. In order to meet the long-term goal of a sustainable renewable energy industry, a target of 17.8 GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010[4] and incorporated in the Renewable Energy Independent Power Producer Procurement (REIPPP) Programme initiated by the DoE. This programme has been designed so as to contribute towards a target of 3725 MW to be generated from renewable energy sources, required to ensure the continued uninterrupted supply of electricity, towards socio-economic and environmentally sustainable growth, and to start and stimulate the renewable industry in South Africa. The energy procured through

[4] Note that an update of the IRP has been drafted and is currently under review.

this programme will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This 17,8GW of power from renewable energy amounts to ~42% of all new power generation being derived from renewable energy forms by 2030.

### *2.1.2 Strategic Integrated Projects (SIPs)*

In 2010, a National Development Plan was drafted to address socio economic issues affecting development in South Africa. These issues were identified and placed under 18 different Strategic Integrated Projects (SIPs) to address the spatial imbalances of the past by addressing the needs of the poorer provinces and enabling socio-economic development. Amongst these is the green energy in support of South African Economy i.e. SIP 8 and 9. The SIP aims at supporting sustainable green energy initiatives on national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP, 2010).

In fulfilment of SIP 8 (green energy) and to meet the targets set in the Integrated Resource Plan (IRP 2010), the Department of Energy has introduced the REIPPP Programme, which is now in its fourth year. The proposed Kheis Solar Park will contribute towards SIP 8 and SIP 9 due to the addition of clean energy to the grid (increasingly significant if all three PV projects are developed) and the project/s will create significant socio-economic benefits at a local, regional and national scale. The associated power line infrastructure will see the transmission of energy into the national grid and thus contribute towards SIP 10.

### *2.1.3 Renewable Energy Development Zones (REDZ)*

The DEA in discussion with the DoE has been mandated by MinMec to undertake a Strategic Environmental Assessment (SEA). The DEA has subsequently appointed CSIR to manage wind and solar PV SEA processes. The SEAs will be undertaken in order to identify geographical areas most suitable for the rollout of wind and solar PV energy projects and the supporting electricity grid network. The aim of the study is to designate renewable energy development zones (REDZs) within which such development will be incentivised and streamlined.

The CSIR has released a map (Figure 2.1) indicated the initial identification of geographical areas best suited for the roll-out of wind and solar photovoltaic (PV) energy projects in South Africa. The proposed Kheis Solar Park projects falls within one of the identified geographical areas most suitable for the rollout of the development of solar energy projects within the Northern Cape Province as shown on Figure 2.1.

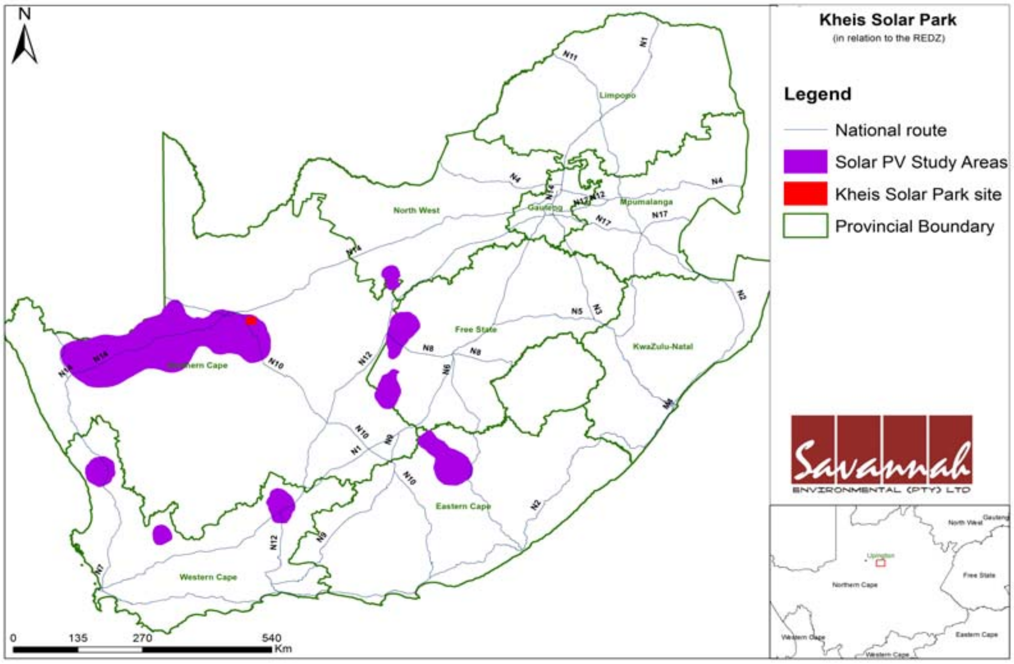


**Figure 2.1**: Renewable Energy Development Zones (REDZ) (CSIR 2013), indicating the location of the proposed Kheis Solar Park (red dot)

### *2.1.4 Rationale for the proposed Kheis Solar Park*

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy as outlined above, Gestamp Asetym Solar South Africa (Pty) Ltd proposes the establishment of the Kheis (PV) Solar Park projects to add new capacity to the national electricity grid. The purpose of the proposed project is to supply renewable energy to the national grid (which is short of generation capacity to meet current and expected demand) and to aid in achieving the goal of a 30% share of all new power generation being derived from Independent Power Producers (IPPs), as targeted by the Department of Energy (DoE).

The development of the project would benefit the local, regional and national community by developing a renewable energy project with a generation capacity of up to 150MW. Surrounding communities would also benefit from the development through job creation and economic spin-offs. In addition, according to the Department of Energy (DoE) bidding requirements, the developer will be required to plan for a percentage of the profit per annum from the solar energy facility operation to go back into the community through a social beneficiation scheme.

#### *2.1.5 Northern Cape Province Spatial Development Framework (NCPSDF)*

The Northern Cape Province Spatial Development Framework (NCPSDF) makes reference to the need to ensure the availability of inexpensive energy. The Framework notes that in order to promote economic growth in the Northern Cape the availability of electricity to key industrial users at critical localities at rates that enhance the competitiveness of their industries must be ensured. At the same time, the development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the province's natural resource endowments must be encouraged.

Of specific relevance to the proposed Kheis Solar Park projects, the the NCPSDF notes that "Renewable energy sources such as wind, solar thermal, biomass and domestic hydroelectricity are to constitute 25% of the province's energy generation capacity by 2020. Promote the development of renewable energy supply schemes. Large-scale renewable energy supply schemes are strategically important for increasing the diversity of domestic energy supplies and avoiding energy imports while minimizing detrimental environmental impacts."

The Upington area has been ear-marked as a hub for the development of solar energy projects due to the solar resource available in the area, and this area is included in the solar corridor which has been identified by the Northern Cape Spatial Development Framework (refer to Figure 2.2). Further detail on the need for renewable energy as included in the NCSDF is provided in Chapter 3.

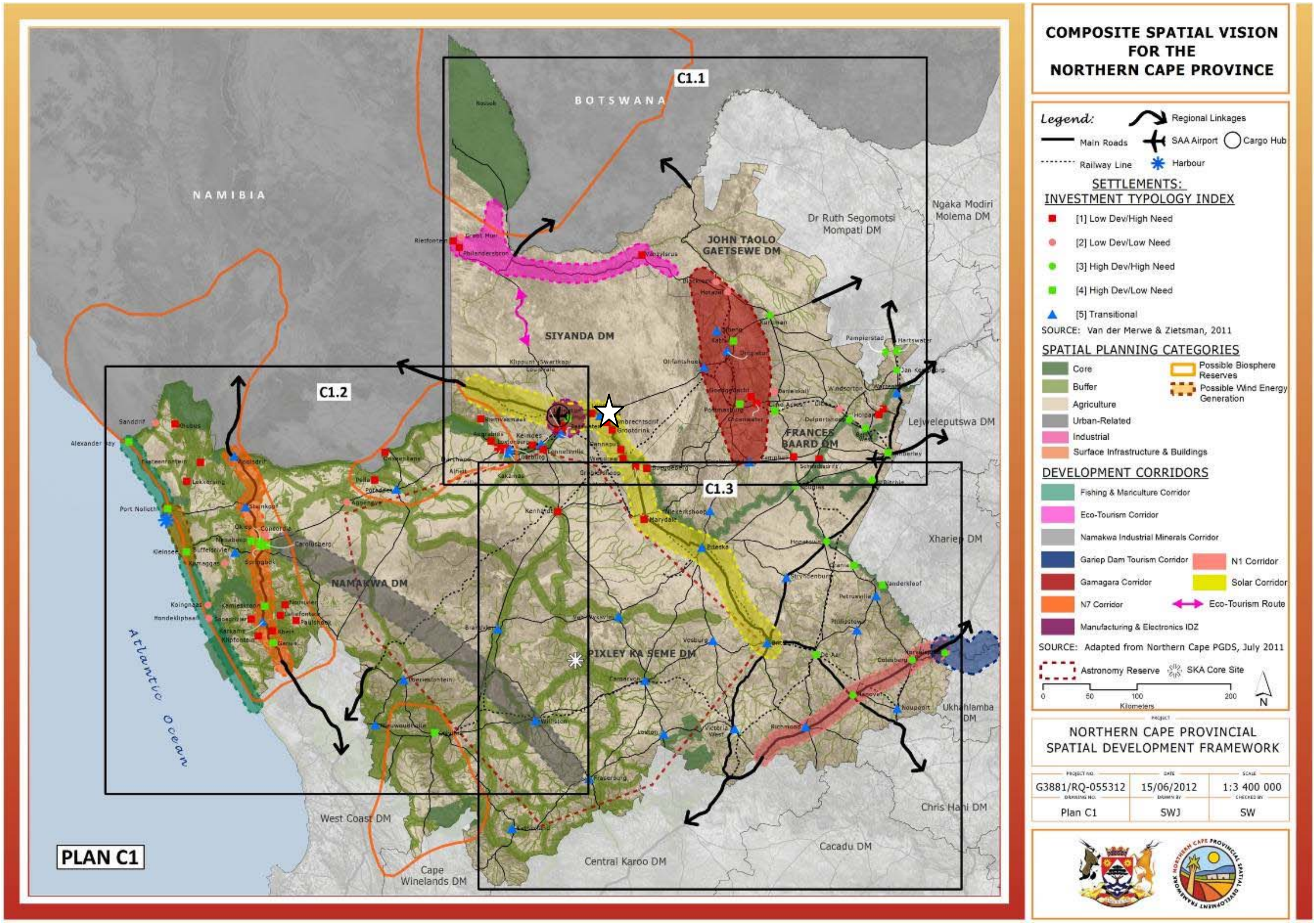


**Figure 2.2:** Composite Spatial Vision for the Northern Cape showing location of the proposed site within the Solar Corridor (white star)

### 2.1.6 ZF Mgcawu District Municipality Environmental Management Framework (EMF)

The ZF Mgcawu District Municipality has compiled an Environmental Management Framework (EMF) in which environmental concerns and conservation priorities for all landscapes within the municipality are listed and mapped. According to the EMF, Bushmanland Arid Grasslands have a medium conservation priority but the proposed project area does not fall within areas earmarked for conservation.

Similarly, the proposed project area has been mapped as Zone 7 in the EMF Environmental Control Zones, indicating the threat that the area has relatively less sensitivity than other zones and no special protection or environmental management parameters or concerns, except those already implemented or required by law. This implies that the proposed project area does have a medium conservation value due to species diversity, but there is no specific restriction on development of the area.

However, the nearby Lower Gariep Alluvial Vegetation on the banks of the Orange River is regarded as a Critical Biodiversity Area, of which remaining sections have been listed as threatened ecosystems. Although these areas fall outside the proposed development area, the intermittent drainage lines on either side of the development site drain directly into the Orange River, and hence contamination or accelerated erosion off the proposed development site could have a negative impact on this important biodiversity area.

### 2.1.7 ZF Mgcawu District Municipality Integrated Development Plan (2012-2017)

The vision of the SDM is:

"To be a model, economically developed district with a high quality of life for all inhabitants"

Linked to this vision the mission statement is: "To promote economic development to the advantage of the community within the boundaries of the SDM" This will be done by the establishment and maintenance of an effective administration and a safe environment in order to attract tourists and investors to the region".

The development goals listed in the IDP that are relevant to the proposed Kheis Solar Park include:

» To deliver a positive contribution to the sustainable growth and development within its boundaries and the rest of the Northern Cape;

» The creation of a healthy and environmentally friendly environment within and outside of the Councils' district boundaries, must be attempted;
» The promotion of a safe and tourism friendly environment should be furthered in order to promote tourism and investor interest in the region;
» The promotion of human resources within and outside the organization through training and the implementation of new technological aids.

Linked to the developmental goals are a number of developmental objectives. The following objectives are relevant to the proposed PV solar facilities:
» Promotion of SMMEs in order to strengthen the Local Economic Sector
» Promote the infrastructure development, including electricity.

The proposed Kheis Solar Park projects will each contribute towards the above-mentioned developmental objectives through local economic upliftment, infrastructural development and job creation.

#### *2.1.8 Kheis Local Municipality Integrated Development Plan (2012-2016)*

The vision for the Kheis Municipality is "The development of an institution, focussing on transparent, loyal and effective service delivery to the residence of the Kheis Municipal Area." and mission of Kheis Municipality is "To promote economic development to the advantage of the communities within the boundaries of the Kheis Municipality; this will be done by the establishment and maintenance of an effective administration and a safe environment in order to attract tourists and investors to the area". The IDP revision lists a number of priority issues that are relevant to the proposed project, including, low level of skills, high level of unemployment and lack of provision of electricity to all residents. The need to protect the natural environment is also identified as a key objective in the IDP. Solar energy is specifically referred to in the following statement: "Due to the climate of the area there is huge potential to utilise solar energy more widely, especially in the remote areas of the district" (Kheis Municipality Integrated Development Plan 2012/16).

Each proposed Kheis Solar Park projects will contribute towards the above-mentioned priority areas through local economic upliftment and job creation, and will promote energy generation through use of the available solar resource.

#### *2.1.9 Desirability for the Kheis Solar Park Projects on the proposed site*

The use of solar irradiation for electricity generation is essentially a non-consumptive use of a natural resource. A solar energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies and other low carbon technologies) as it meets all international requirements in this regard. The proposed site located on Portion 7 and 9 of Portion 4 of the farm Namakwari was selected for the development of a solar energy facility based on its predicted climate (solar resource – refer to Figure 2.8), suitable proximity in relation to the existing and available electricity grid, and minimum technical constraints from a construction and technical perspective. Gestamp Asetym Solar South Africa (Pty) Ltd considers this area, and specifically the demarcated site on Portion 7 and 9 of Portion 4 of the Farm Namakwari was, to be highly preferred for the development of a solar energy facility. The reasons include:

» There are no arable lands in the studied area or directly adjacent to it, which could be impacted upon by the proposed development.
» The current land-use on the site is agriculture (cattle grazing). The development of the Kheis Solar Park projects will allow current livestock grazing to continue on areas of the farm portions which will not be occupied by solar panels and associated infrastructure. Therefore the current land-use will be retained on much of the site (i.e. 83% of the site), while the remainder ill be utilised to generate renewable energy from the sun. As the landowner will benefit from a portion of the revenue from the facility, the development of the project provides an alternative source of income, contributing towards the sustainability of the current farming operations. This presents a win-win situation for the landowner, the economical use of the site, and the developer.
» The power can be readily evacuated to strengthen the local Eskom grid through connection to the Eskom Garona-Gordonia 132kV power line that traverses the site.
» The proposed Solar Corridor identified in the Northern Cape SDF centres on Upington and extends from roughly Kakamas in the north to De Aar in the east (refer to Figure 2.2). The proposed site is located within this Solar Corridor area, which has been ear-marked as a hub for the development of solar energy projects due to the excellent solar resource of the area, as well as the larger centre of Upington acting as a load centre.

## 2.2. Description of the Three Proposed Solar Energy Facilities

Each of the Kheis Solar Park PV projects on Portion 7 and 9 of Portion 4 of the Farm Namakwari 656 are intended to generate electricity by harnessing solar energy (from the sun) by utilising photovoltaic (PV) technology. The main components of each facility include:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings.
» Cabling between the structures, to be lain underground where practical.

» Central invertor/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
» An on-site substation (50m x 50m) and power line (100m-1800m) to evacuate the power from the facility into the Eskom grid via the existing Garona-Gordonia 132kV power line that traverses the site (Portion 9 of Portion 4 of the Farm Namakwari 656).
» Internal access roads (5m wide roads).
» Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity (approximate footprint (±100 m²).

Kheis Solar Park 1, 2, and 3 projects are proposed to have generating capacity of 75, 55 and 20 MW (respectively) and they are to be located on Portion 7 and 9 of Portion 4 of the Farm Namakwari 656 situated approximately 60 km south-east of Upington. The farm portions cover an area of 3600 ha. A combined area of approximately 600 ha (of the 3600 ha) will be occupied by the PV module arrays and associated infrastructure associated for the Kheis Solar Park 1, 2 and 3 projects development. The land area to be occupied by each project is shown in the Table below:

**Table 2.1:** Land Area and Centre Point for each of the Kheis Solar Park PV projects on Portion 7 and Portion 9 of the Farm Namakwari

| **Phase Number** | **Output** | **Area (Ha)** | **Coordinates for Central Point of the Phase** | |
|---|---|---|---|---|
| | | | ***Latitude*** | ***Longitude*** |
| Kheis Solar Park 1 | 75MW | 280ha | 28°32'58.72"S | 21°49'16.81"E |
| Kheis Solar Park 2 | 55MW | 210ha | 28°31'54.42"S | 21°49'59.18"E |
| Kheis Solar Park 3 | 20MW | 110ha | 28°34'14.94"S | 21°50'8.12"E |

A layout of each of the three project of the proposed facility and associated infrastructure (such as access roads, power lines, on-site substation and laydown areas) being considered within this EIA Report has been provided by the project developer, and is indicated in Figure 2.3. This is the layout which has been assessed within this EIA Report.

### *2.2.1 Kheis Solar Park 1*

The Kheis Solar Park 1 PV arrays are proposed to be located to the north of the broader project site located approximately 60km south-east of the town of Upington (straight line distance) (Kheis 1 is indicated in purple in Figure 2.3). The proposed generating capacity for this phase is 75MW, covering an area of 280ha sufficient to accommodate both the tracking and fixed PV technology. An on-site substation is also proposed for this phase, as shown in Figure 2.3. A power line is also required and described in Section 2.6 below.

### *2.2.2 Kheis Solar Park 2*

The Kheis Solar Park 2 PV arrays are proposed to be located to the north-east of the project site located approximately 60km south-east of the town of Upington (straight line distance) (Kheis 2 is indicated in green in Figure 2.3). The proposed generating capacity for this phase is 55MW, covering an area of 210ha sufficient to accommodate both the tracking and fixed PV technology. An on-site substation is also proposed for this phase, as shown in Figure 2.3. A power line is also required and described in Section 2.6 below.

### *2.2.3 Kheis Solar Park 3*

The Kheis Solar Park 3 PV arrays are proposed to be located to the south-east of the project site located approximately 60km south-east of the town of Upington (straight line distance) (Kheis 3 is indicated in brown in Figure 2.3). The proposed generating capacity for this phase is 20MW, covering an area of 110ha sufficient to accommodate both the tracking and fixed PV technology. An on-site substation is also proposed for this phase, as shown in Figure 2.3. A power line is also required and described in Section 2.6 below. .

Table 2.2 summarises the dimensions of the project component.

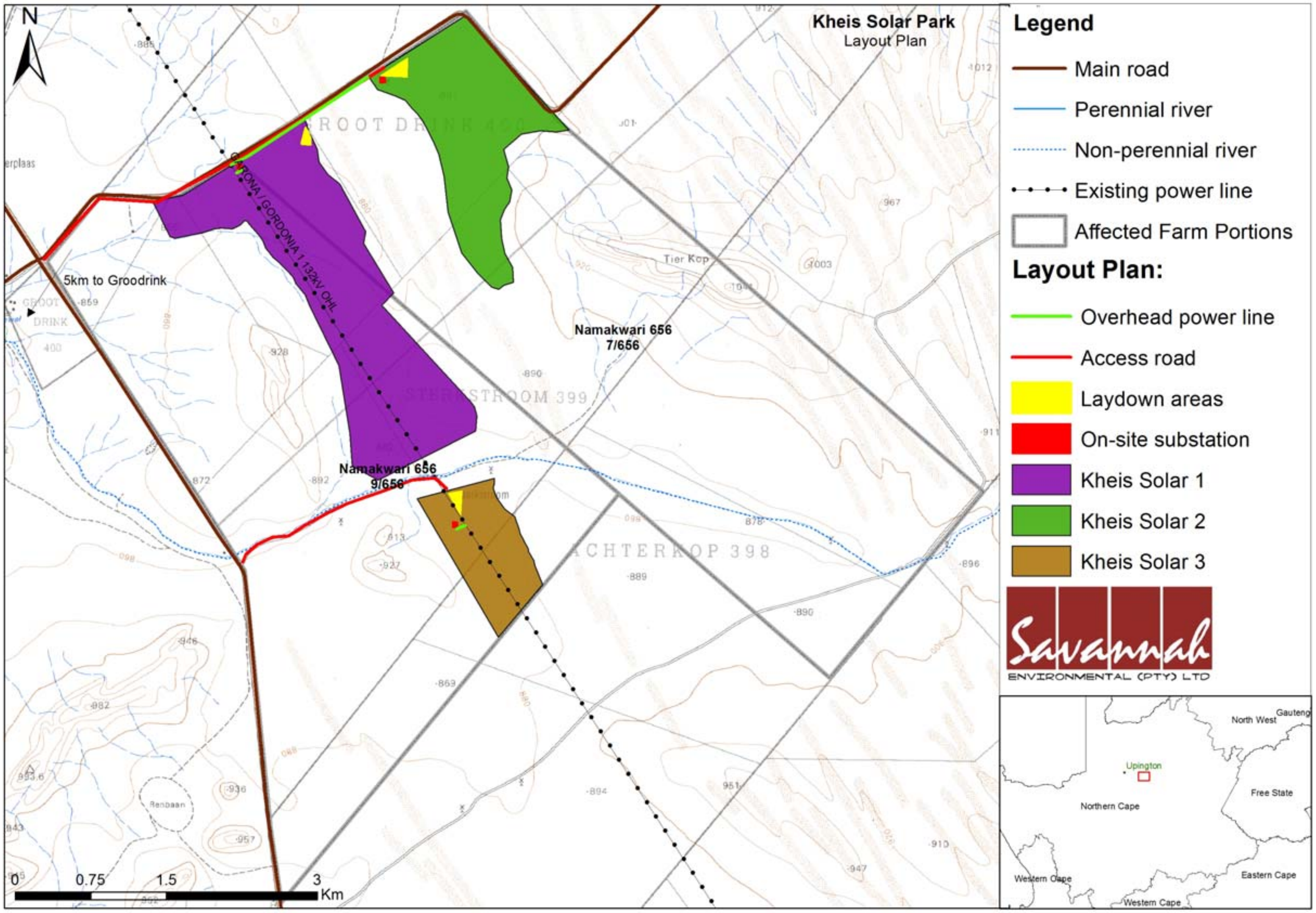


**Figure 2.3:** Layout for the proposed Kheis Solar Park project indicating the location of the three projects on Portion 7 and 9 of portion 4 of the Farm Namakwari 656

**Table 2.2:** Dimensions of the components of Kheis Solar Energy Facilities

| Component | Description / Dimensions |
|---|---|
| Location of the site | Portion 7 and 9 of Portion 4 of the Farm Namakwari 656, located 65km south east of Upington. |
| Municipal Jurisdiction | The property is located within the !Kheis Local Municipality which falls within the ZF Mgcawu District Municipality. |
| Electricity Generating capacity | » Kheis Solar Park 1– 75MW<br>» Kheis Solar Park 2– 55MW<br>» Kheis Solar Park 3– 20MW |
| Extent of the proposed development footprint | » Kheis Solar Park 1– 280 ha<br>» Kheis Solar Park 2– 210 ha<br>» Kheis Solar Park 3– 110ha |
| Extent of broader site | 3600 hectares (Portion 7 and Portion 9 of Portion 4 of the Farm Namakwari 656) |
| Site access | The site can be accessed via the N10 onto a secondary road that runs parallel to the project site; or alternatively via the N14 onto a secondary road heading south to the site. Internal access roads of up to 5m wide will also be required. |
| Proposed technology and Height of installed panels from ground level | Static - up to 4m<br>Tracking – single axis up to 4m |
| Number of Panels | Dependant on module to be used. This will be confirmed before construction. Typically it would be:<br>Kheis 1- 279300<br>Kheis 2- 211470<br>Kheis 3- 79800 |
| Panel Dimensions | 2000 x 990 mm |
| Panel direction | Facing north and tracking east to west (tracking technology) |
| Number of inverters | Dependant on inverter to be used. This will be confirmed before construction. Typically it would be:<br>Kheis 1- 75<br>Kheis 2- 55<br>Kheis 3- 20 |
| Main transformer / on-site substation capacity and size | Kheis 1- 75 MW 33/132kV; 50m x 50m<br>Kheis 2- 55 MW 33/132kV; 50m x 50m<br>Kheis 3- 20 MW 33/132kV; 50m x 50m |
| Office / workshop (size) | ±100 $m^2$ |
| New overhead power line between the site and the Garona - Gordonia 1 132kV OHL power line | Servitude width – 32 m<br>Length: Kheis1 ~100m; Kheis2 ~1800m (1.8km); Kheis3 ~100m<br>Height of towers – maximum height of 25m |
| Services required | » Sewage and Refuse material disposal - all sewage and refuse material generated during the establishment of the proposed site will be collected by a contractor to be disposed of at a licensed waste disposal site |

| Component | Description / Dimensions |
|---|---|
| | » Water and electricity – water will be obtained from the municipality or a licence will be obtained from DWA for abstracting water from local boreholes. Electricity will be generated from generators for any electrical work on site or electricity will be obtained from an Eskom auxiliary supply, depending on the feasibility during construction. |
| Infilling or depositing material | Any infilling material that may be required for project development will be obtained from: <br>» Option 1: Cut and fill material from construction activities on the site (i.e. from Portion 7 and 9 of Portion 4 of the Farm Namakwari 656,) <br>» Option 2: Material from an old 'mining' heap on the adjacent property owned by the same landowner[5] (i.e. from Portion 1 of the Farm Namakwari 656) <br>» Option 3: Contractor to source suitable grade material from an approved/registered borrow pit in the broader Upington region. Any excess/spoil material will be disposed of to a licensed landfill site. |

### Water Requirements

An operational PV plant has no direct water requirement associated with the generation of electricity. Water is required primarily for the construction of the facility and well as for human consumption (sanitation) during operation. In many instances, water is used to clean off dust or dirt that builds up on the panels.

During the construction period, water will be used for site preparation, compaction of building pads, road preparation, and dust control where necessary. A 75MW plant will require approximately 15 000 $m^3$ of water during the construction phase, although a higher volume could be required in the hotter periods of the year when dust suppression would be required on a more frequent basis. A volume of approximately 3000$m^3$ per annum would be required during the operational phase.

There are boreholes located on Portion 7 of Portion 4 of the Farm Namakwari, located near the farmhouse structure. Boreholes on the farm are currently used for stock watering purposes. Abstraction of water from the Orange River and transport to the site via a pipeline of ~4km in length is another option should there not be

[5] Within the study area and on the adjacent land portion (same farm owner), are several sites where old borrow pits and discontinued mines and their overburden heaps have remained. These disturbed areas are mentioned as the old borrow pit and other larger depressions on the study area may have to be filled up and levelled for the development. The overburden material provide an ideal source for such filling material for these and other applications within the development, and this will help lessen these unsightly overburden heaps. Using this material will also prevent additional impacts that would be caused by a new borrow pit.

sufficient water from the boreholes. In the case where water needs are not met by the boreholes, and/or Orange River, water will be transported directly from the Kheis Local Municipality which is the Local Water Services Provider for the area where the project is proposed.

Gestamp Asetym Solar South Africa (Pty) Ltd will be required to obtain confirmation of water availability for the project from the Department of Water Affairs (DWA), Northern Cape Region. DWA is required to provide a non-binding indication of water availability to the project. This non-binding agreement would be required for the purposes of bidding the project to the DoE. Such confirmation is only provided by DWA following selection of the project by the DoE and on final design of the facility.

## 2.3. Solar Energy as a Power Generation Technology

The generation of electricity can be easily explained as the conversion of energy from one form to another. Solar energy facilities operate by harnessing solar energy and converting it into a useful form (i.e. electricity). Solar technologies can be divided into two categories, those that harness solar energy to create thermal energy which in turn can be converted into electricity, and those that use the electromagnetic radiation of the sun and convert it directly into electricity. The latter is known as photovoltaic (PV) technology, which is proposed for this project, and is the direct conversion of sunlight into electricity without the use of water for power generation.

The use of solar energy for electricity generation is a non-consumptive use of a natural resource. Renewable energy is considered a 'clean source of energy' with the potential to contribute greatly to a more ecologically, socially, and economically sustainable future. The challenge now is ensuring solar energy projects are able to meet all economic, social, and environmental sustainability criteria in terms of NEMA.

### *2.3.1 How do Grid Connected Photovoltaic Facilities Function?*

Solar energy facilities, such as those using PV technology use the energy from the sun to generate electricity through a process known as the Photoelectric Effect. A PV cell or solar cell is the semiconductor device that converts sunlight into electricity. These cells are interconnected to form panels which, in turn, are combined with associated structural and electrical equipment to create what are called arrays – the actual solar generation systems which connect to the energy grid. As sunlight hits the solar panel, photons can be reflected, absorbed, or pass through the panel. When photons are absorbed, they have the energy to knock electrons loose, which flow in one direction within the panel and exit through connecting wires as solar electricity.

There are several types of semiconductor technologies currently in use for PV solar panels. Two however, have become the most widely adopted: crystalline silicon and thin film. The former is constructed by first putting a single slice of silicon through a series of processing steps, creating one solar cell. These cells are assembled together in multiples to make a solar panel. The latter is made by placing thin layers, hence the name thin-film, of semiconductor material onto various surfaces, usually glass. This project proposes using a thin-film PV technology which encloses the semiconductor between two sheets of glass.

A solar energy facility typically uses the following components:

The **Photovoltaic Panels**

Solar photovoltaic (PV) panels consist primarily of glass and various semiconductor materials and in a typical solar PV project, will be arranged in rows to form solar arrays, as shown in Figure 2.4 and Figure 2.5. The PV panels are designed to operate continuously for more than 25 years with minimal maintenance required.

**Figure 2.4:** Picture of a PV Panel (Gestamp Asetym Solar South Africa (Pty) Ltd)

**Figure 2.5:** Picture of the installation of a typical PV array (Gestamp Asetym Solar South Africa (Pty) Ltd)

The **Support Structure**

The photovoltaic (PV) modules will be mounted to steel support structures. These can either be mounted at a fixed tilt angle, optimised to receive the maximum amount of solar radiation and dependent on the latitude of the proposed facility, or on a tracking mechanism where at a maximum tilt angle of 4 to 55 degrees the lowest part of the panel can be 30-50cm from the ground (refer to Figure 2.6).

The **Inverter**

The photovoltaic effect produces electricity in direct current (DC). Therefore an inverter (refer to Figure 2.7) must be used to invert it to alternating current (AC) for transmission in the national grid. The inverters convert the DC electric input into AC electric output, and then a transformer steps up the current to 33kV for on-site transmission of the power. The inverter and transformer are housed within the power conversion station (PCS). The PV combining switchgear (PVCS), which are dispersed among the arrays, collects the power from the arrays for transmission to the project's substation.

**Figure 2.6:** The support structures elevate the PV panels and allow for single axis tracking of the sun for increased efficiency (Source: Gestamp Asetym Solar South Africa (Pty) Ltd)

**Figure 2.7:** Image of a typical inverter

## 2.4. Project Alternatives

In accordance with the requirements of the EIA Regulations[6], alternatives are required to be considered within any environmental impact assessment (EIA) process, and may refer to any of the following:

» Site alternatives
» Design or layout alternatives
» Technology alternatives
» The No-go alternative

#### *2.4.1 Site Alternatives*

Only one technically and economically feasible alternative site for the establishment of the proposed project has been identified by the developer for investigation in an EIA process, i.e. Portion 7 and Portion 9 of Portion 4 of the Farm Namakwari 656. This is based on an investigation by the developer of various sites within the area. The following factors have been considered in determining a preferred site for the PV solar development:

***Site location:*** According to the Northern Cape PSDF 2012 the Solar Corridor centres on Upington and extends from roughly Kakamas in the north to De Aar in the east. Grootdrink is located within this Solar Corridor area has which has been ear-marked as a hub for the development of solar energy projects due to the excellent solar resource of the area, as well as the larger centre of Upington acting as load centre. In addition, there are several authorised solar energy projects located near Upington in the ZF Mgcawu District Municipality, making this an attractive node for solar facility development. The authorised facilities in the area surrounding the Kheis Solar Park site include the Khi CSP Tower Plant (west of Upington) which is currently under construction, the approved Karoshoek Solar Thermal Park at Karos Settlement, the SolAfrica Bokpoort CSP facility, and the Kleinbegin PV facility. This makes the area preferred from technical point of view.

The site is situated in close proximity to the town of Grootdrink. This is a town marked with high levels of unemployment and poverty. Other surrounding towns include Groblershoop and the city of Upington which experience similar levels of unemployment and poverty. As a consequence, local labour would be easy to source. This fits in well with the REIPPP Programme economic development criteria for socio-economic upliftment. Currently, a large proportion of local labour is used in the agricultural industry. A few negatives related to agricultural employment are that it is very seasonal and it is not always in close proximity to people’s homes, forcing workers to travel large distances on a daily basis to reach their place of employment.

[6] GNR543 27(e) calls for the applicant to identify feasible and reasonable alternatives for the proposed activity.

***Site extent:*** Space is a constraining factor for a large-scale PV solar facility installation. The three PV facilities will require an area of approximately 600 ha. There is sufficient space within areas of lower environmental sensitivity for the full extent of the proposed project within the area under consideration (Portion 7 and 9 of Portion 4 of the Farm Namakwari 656, which has a total size of ~3600 ha).

***Site availability:*** These specific farm portions are commercially farmed (grazing) by the current owner and the owner has decided to diversify his income stream with the addition of a long-term secure income in the means of leasing out a portion of the property for the construction and operation of the proposed solar energy facility.

***Site access:*** The site can be accessed via a secondary (gravel) road that bridges the Orange River from the N10 national road near Grootdrink; or alternatively via the N14 onto a secondary road heading south next to the site. The site is therefore appropriately located for easy transport of components and equipment as well as labour movement to and from the site. Large volumes of material and components would need to be transported to the project site during the construction phase of the project. The accessibility of the site was therefore a key factor in determining the viability of the solar energy facility at the proposed site, particularly taking transportation costs (direct and indirect), impacts on people in the area and other environmental issues into consideration, as well as the impact of this on project economics and therefore the ability to submit a competitive bid under the DoE's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

***Climatic conditions:*** Due to the nature of the development (i.e. PV solar energy facilities), the location of the facilities are largely dependent on technical and environmental factors such as solar irradiation (i.e. the fuel source), climatic conditions, topography of the site, and access to the grid. Studies of solar irradiation worldwide indicate that the Northern Cape shows great potential for the generation of solar power. The region in the vicinity of Upington has particularly high solar irradiation levels and is considered to be one of the most efficient locations in the country for a solar energy project, as shown by the solar irradiation map below (see Figure 2.8).

***Site slope and aspect:*** A level surface area (i.e. a gradient of 3% or less) is preferred for the installation of PV panels and the most flat areas of the site are proposed for the PV panels.

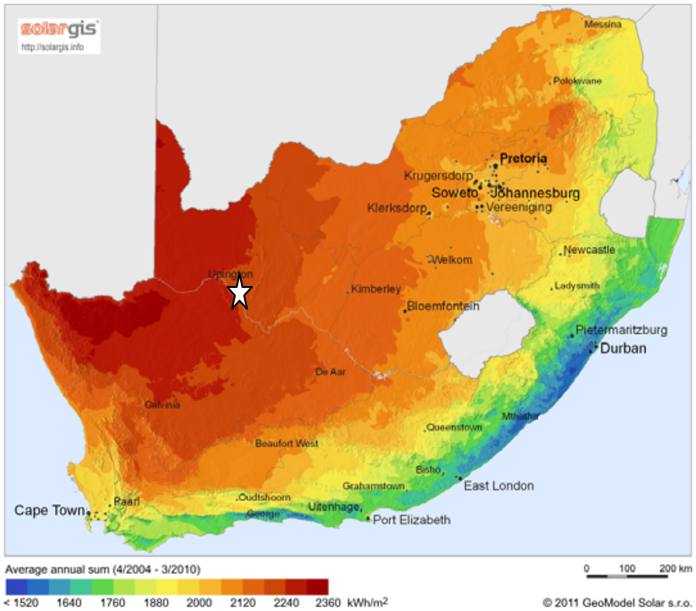


**Figure 2.8:** Solar irradiation map for South Africa (Source: adapted from GeoModel Solar, 2011)

***Grid Connection:*** The proximity of the site to the existing Garona- Gordonia 1 132kV OHL power line traversing the proposed site means that the power generated by each of the three facilities can be fed into the grid via a loop in-loop out configuration from the on-site substation to this line. Due to the short distances required for the power line connection of each facility, the impacts associated with the proposed overhead power lines will be limited to the site. The projects' proximity to the national grid connection also reduces some of the impacts related to building longer power lines to connect to the grid connection.

### *2.4.2 Layout Alternatives*

Alternative sites within the proposed farm portions were considered during the scoping processes (as shown in Figure 2.9), and were excluded based on environmental sensitivity including biodiversity, hydrology and topography. The location of each of the layouts therefore aims to avoid these identified sensitivities and the area available for the layout of the infrastructure is constrained on this basis. Based on the environmental sensitivities identified and the technical constraints of the development, no feasible alternative locations within the broader site or farm portion were identified for investigation.

### *2.4.3 Technology Alternatives*

As it is the intention of the developer to develop renewable energy projects as part of the DoE's REIPPP Programme, only renewable energy technologies are being considered. Solar energy is considered to be the most suitable renewable energy technology for this site, based on the site location, ambient conditions and energy resource availability (i.e. solar irradiation, with the average annual irradiation at the site being up to 2360 $KWh/m^3$ per annum – refer to Figure 2.10). Solar PV technology was determined as the most suitable option for the proposed site as large volumes of water are not needed for power generation purposes compared to concentrated solar power technologies (CSP). PV is also preferred when compared to CSP technology because of the lower visual profile.

Two solar energy technology alternatives are being considered for the proposed project and include:

» Fixed Mounted PV systems (static/fixed-tilt panels);
» Tracking PV systems (with solar panels that rotate around a defined axis to follow the sun's movement);

**Fixed Mounted PV System**

In a fixed mounted PV system (fixed-tilt), PV panels are installed at 45 to 55° angle i.e. facing in the northerly direction from which they will not move during the lifetime of the plant's operation. The limitations imposed on this system due to its static placement are offset by the fact that the PV panels are able to absorb incident radiation reflected from surrounding objects. In addition, the misalignment of the angle of PV panels has been shown to only marginally affect the efficiency of energy collection. There are further advantages which are gained from fixed mounted systems, including:

» The maintenance and installation costs of a fixed mounted PV system are lower than that of a tracking system, which is mechanically more complex given that PV mountings include moving parts.
» Fixed mounted PV systems are an established technology with a proven track record in terms of reliable functioning. In addition, replacement parts are able to be sourced more economically and with greater ease than with alternative systems.
» Fixed mounted systems are robustly designed and able to withstand greater exposure to winds than tracking systems.
» Fixed mounted PV systems occupy less space than the tracking systems, thereby reducing impacts on the environment in this regard.

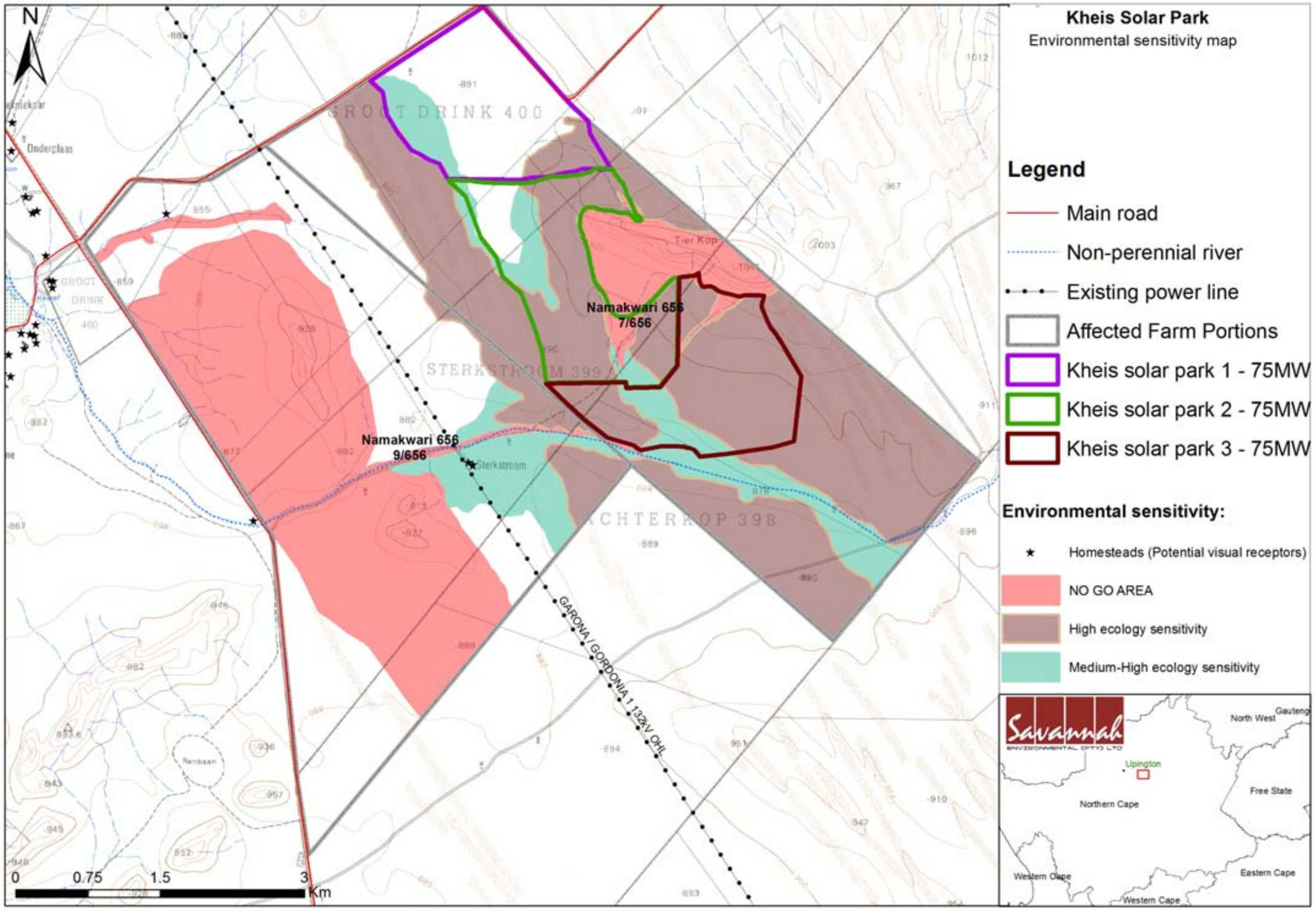


**Figure 2.8**: Alternative sites considered during the scoping processes for the proposed Kheis Solar Park projects.

**Tracking PV System**

Tracking PV Systems (single axis or dual axis trackers) are fixed to mountings which track the sun's movement. There are various tracking systems. A 'single axis tracker' will track the sun from east to west, while a dual axis tracker will in addition be equipped to account for the seasonal waning of the sun. These systems utilise moving parts and more complex technology, which may include solar irradiation sensors to optimise the exposure of PV panels to sunlight. Tracking PV panels follow the suns rotational path all day, every day of the year giving it the best solar panel orientation and thereby enabling it to generate the maximum possible output power.

Regardless of the technology selected, the PV panels are designed to operate continuously for more than 20 years, unattended and with low maintenance. The technology to be used for each of the Kheis Solar Projects will be assessed further in Chapter 6, 9 and 12 of this report.

### *2.4.4. Do Nothing Alternative*

The no-go option would mean that the proposed Kheis Solar Park PV projects including all associated infrastructure would not be developed. Should this alternative be selected, there would be no impacts on the area designated for the construction of Kheis Solar Park PV projects due to the associated construction and operation activities.

It is noteworthy that receipt of an environmental authorisation for the projects may not necessarily result in the projects being implemented due to other external factors, including whether the developers are awarded preferred bidder status by the DoE. The region surrounding Upington and Grootdrink has received a considerable amount of attention with respect to renewable energy facility applications. Five large renewable energy facility applications have been identified within the study area. These are the Kleinbegin Solar Energy Facility (PV; located 25km south west of the site), the Karoshoek solar park with 12 separate PV and CSP projects, of which one (Ilanga CSP) is a Round 3 preferred bidder project (located 20km north west of the site), the proposed Grootdrink Solar Facility (located 15km north) and the Bokpoort CSP project a Round 2 prefer bidder (located 20km south-east).

While the no-go alternative will have socio-economic implications at a local and broader scale, the extent of the impact is minimised by the number of solar energy projects proposed to be developed in the Grootdrink area. The do-nothing alternative will therefore likely result in minimising the cumulative impact associated with cumulative solar energy developments in the Grootdrink area, although it is expected that pressure to develop the site for renewable energy purposes will be actively pursued due to the very factors which make the site a viable option for renewable energy development as discussed previously in this chapter. Other developers will likely seek to develop the site for renewable energy purposes in order to realise targets for renewable energy in the country, the socio-economic and environmental benefits of which include:

» ***Increased energy security:*** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.
» ***Resource saving*:** Conventional coal fired plants are major consumers of water during their requisite cooling processes. 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, when compared with wet cooled conventional power stations. This translates into revenue savings of R26.6 million. 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.
» ***Exploitation of our significant renewable energy resource:*** At present, valuable national resources including biomass by-products, solar radiation and wind power remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio.
» ***Pollution reduction:*** The releases of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation. The use of solar radiation for power generation is considered a non-consumptive use of a natural resource which produces zero greenhouse gas emissions.
» ***Climate friendly development:*** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be responsible for approximately 1% of global GHG emissions and is currently ranked 9$^{th}$ worldwide in terms of per capita carbon dioxide emissions.
» ***Support for international agreements:*** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.

- ***Employment creation:*** The sale, development, installation, maintenance and management of renewable energy facilities have significant potential for job creation in South Africa.
- ***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.

## 2.5. Proposed Activities during the Project Development Stages

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

### *2.5.1. Design and Pre-Construction Phase*

**Conduct Surveys**

Prior to initiating construction, a number of surveys will be required including, but not limited to confirmation of the micro-siting footprint (i.e. the precise location of the PV panels, substation and the plant's associated infrastructure) and a geotechnical survey. Geotechnical surveys are executed by geotechnical engineers and geologists to acquire information regarding the physical characteristics of soil and rocks underlying a proposed site. The purpose is to design earthworks and foundations for structures and to execute earthwork repairs necessitated due to changes in the subsurface environment.

A power line servitude survey will also be conducted. If necessary, a walk through survey will be undertaken for ecological/heritage resources prior to construction.

### *2.5.2. Construction Phase*

As each project will be bid as a separate project under the DoE REIPPP, it is unknown at this stage whether the construction of more than one facility would be undertaken at one time. Should this be the case, there is the opportunity to combine some of the below-mentioned activities.

The construction of each project is expected to extend over a period of approximately 15-18 months and create at least 250-300 employment opportunities at peak. The majority of the employment opportunities, specifically the low and semi-skilled opportunities, are likely to be available to local residents in the area. The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community, representing a significant positive social benefit in an area with limited employment opportunities. The construction phase will entail a series of activities including:

**Undertake Site Preparation**

Site preparation involves construction of new access roads and improvement of existing on-site construction access roads with compacted native soil, installation of drainage crossings, setup of construction staging areas, storm water management work, preparation of land areas for array installation, and other activities needed before installation of the solar arrays can begin. The work would involve trimming of vegetation, selected compacting and grading, and setup of modular offices and other construction facilities.

The PV arrays require a relatively level and stable surface for safe and effective installation. Topographic, geotechnical, and hydrologic studies will be used to determine the necessary grading and compaction.

Trenching would occur within each array to bury the electrical cables. The trenches would be up to ~ 1.8m in width and 2m deep, for a total combined length of approximately 10 km. Minimal ground disturbance may occur within the trenched corridors to restore them after soil has been replaced in the trenches, so that the corridor can conform to the existing surface contours.

**Transport of Components and Construction Equipment to Site**

The components for the proposed facility will be transported to site by road. Some of the substation components may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)[7] by virtue of the dimensional limitations (i.e. size and weight). The typical civil engineering construction equipment will need to be brought to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.), as well as the components required for the establishment of the substation and power line.

**Establishment of Access Roads to the Site**

The site can be accessed via the N10 onto a gravel road that runs parallel to the project site; or alternatively via the N14 onto a secondary road (gravel) heading south parallel to the site Within the site itself, access will be required to the individual facility components for construction purposes (and later limited access

[7] A permit will be required for the transportation of these abnormal loads on public roads.

for maintenance). Upgrade of access roads within the site will be required and new access roads will be required (~5m wide). Access track construction would normally comprise of compacted rock-fill with a layer of higher quality surfacing stone on top. The strength and durability properties of the rock strata at the proposed site are not known at this stage; this will need to be assessed via a geotechnical study to be conducted by the project proponent. Depending on the results of these studies, it may be possible in some areas, to strip off the existing vegetation and ground surface and level the exposed formation to form an access track surface. The final layout of the access roads will be determined following the identification of site related sensitivities.

**Installation of the PV Power Plant**

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

**Establishment of Ancillary Infrastructure**

Ancillary infrastructure for each project will include; a workshop, laydown area and office. The laydown area will be a temporary structure. The establishment of these areas/facilities/buildings will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. A laydown area for building materials and equipment associated with these buildings will also be required.

**Construct on-site Substation and Power line**

Substations are constructed in the following simplified sequence:

**Step 1**: Survey the area

**Step 2**: Final design of the substation and placement of the infrastructure

**Step 3**: Vegetation clearance and construction of access roads (where required)

**Step 4:** Construction of foundations
**Step 5**: Assembly and erection of infrastructure on site, connect conductors
**Step 6**: Rehabilitation of disturbed area and protection of erosion sensitive areas

The expected lifespan of the proposed on-site substation associated with each PV facility is 35 – 50 years. During the life-span of the substation, on-going maintenance is performed. Inspections are undertaken.

Power lines are constructed in the following simplified sequence:
**Step 1:** Survey of the route
**Step 2:** Selection of best-suited conductor, towers, insulators, foundations
**Step 3:** Final design of line and placement of towers
**Step 4:** Vegetation clearance and construction of access roads (where required)
**Step 5:** Tower pegging
**Step 6:** Construction of foundations
**Step 7:** Assembly and erection of towers on site
**Step 8:** Stringing of conductors
**Step 9:** Rehabilitation of disturbed area and protection of erosion sensitive areas

Construction of the power line is required to be undertaken in accordance with the specifications of the Environmental Management Programme (EMPr), as well as in compliance with Eskom's technical requirements.

**Undertake Site Rehabilitation**

As construction is completed in an area, and as all construction equipment is removed from the site, the site must be rehabilitated where practical and reasonable. Upon completion of commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.

### *2.5.3. Operational Phase*

Each solar energy facility is expected to be operational for a minimum of 25 years, with an opportunity for a lifetime of 50 years or more with equipment replacement and repowering. The project will operate continuously, 7 days a week, during daylight hours. While the project will be largely self-sufficient upon completion of construction, monitoring and periodic, as needed maintenance activities will be required. Key elements of the Operation and Maintenance plan include monitoring and reporting the performance of the project, conducting preventative and corrective maintenance, receiving visitors, and maintaining security of the project. The operational phase (for one solar energy facility) will create 7-15 full-time employment positions. No large scale energy storage mechanisms for the facility which would allow for continued generation at night or on cloudy days are proposed.

### *2.5.4. Decommissioning Phase*

Depending on the continued economic viability of the facility following the initial 25-year operational period, each solar energy facility will either be decommissioned or the operational phase will be extended. If it is deemed financially viable to extend the operational phase, existing components would either continue to operate or be dissembled and replaced with new, more efficient technology/infrastructure available at that time. However, if the decision is made to decommission the facility, the following activities will form part of the project scope.

When the project is ultimately decommissioned, the equipment to be removed will depend on the proposed land use for the site at that time. For example, depending on the power needs at the time of decommissioning, the on-site substations could remain for use by the utility or other industrial activity.

Below is a discussion of expected decommissioning activities.

**Site Preparation**

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

**Disassemble and Remove Existing Components**

All above ground facilities that are not intended for future use at the site will be removed. Underground equipment (e.g. foundation, wiring) will either be removed, or cut off 1m below the ground surface, and the surface restored to the original contours. Much of the above ground wire, steel, and PV panels of which the system is comprised are recyclable materials and would be recycled to the extent feasible. The components of the plant would be deconstructed and recycled or disposed of in accordance with regulatory requirements. The site will be rehabilitated and can be returned to the agricultural or other beneficial land-use.

# REGULATORY AND LEGAL CONTEXT CHAPTER 3

## 3.1 National Policy and Planning Context

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 Energy (DoE). The hierarchy of policy and planning documentation that support the development of renewable energy projects such as solar energy facilities is illustrated in **Figure 3.1**. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the development of Kheis Solar Park facilities on Portion 7 and 9 of Portion 4 of the Farm Namakwari, located south-east of Upington.

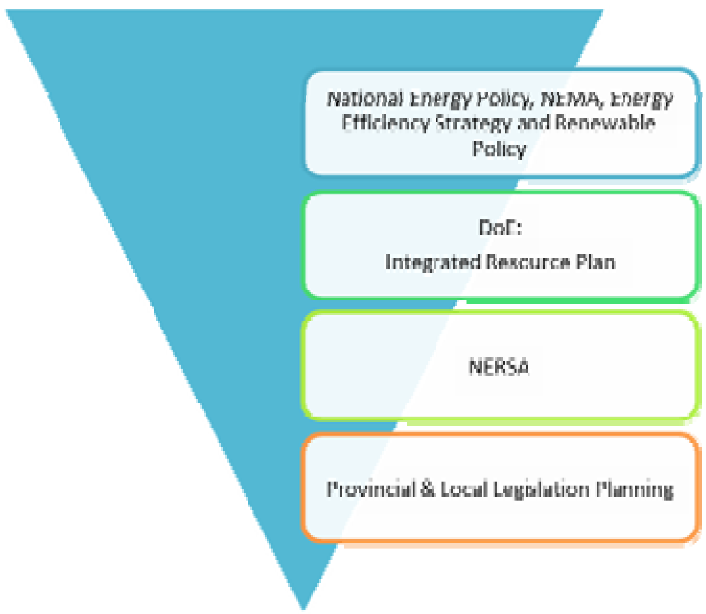


**Figure 3.1:** Hierarchy of electricity policy and planning documents

### *3.1.1 The National Energy Act (2008)*

The National Energy Act was promulgated in 2008 (Act No 34 of 2008). One of the objectives of the Act was to promote diversity of supply of energy and its sources. In this regard, the preamble makes direct reference to renewable resources, including solar:

> *"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, taking into account*

> *environmental management requirements; to provide for increased generation and consumption of renewable energies (Preamble)"*

The National Energy Act aims 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, taking into account environmental management requirements and interactions amongst economic sectors, as well as matters relating to renewable energy. The Act provides the legal framework which supports the development of renewable energy facilities for the greater environmental and social good.

### *3.1.2 White Paper on the Energy Policy of South Africa, 1998*

Development within the South African energy sector is governed by the White Paper on a National Energy Policy (DME, 1998). The White Paper identifies key objectives for energy supply, such as increasing access to affordable energy services, managing energy-related environmental impacts and securing energy supply through diversity.

As such, investment in renewable energy initiatives is supported, based on an understanding that renewable energy sources have significant medium - long-term commercial potential and can increasingly contribute towards a long-term sustainable energy future.

### *3.1.3 White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)*

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

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

This White Paper on Renewable Energy (November, 2003) sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. South Africa relies heavily on coal to meet its energy needs because it is well-endowed with coal resources; in particular. However South Africa is endowed with renewable energy resources that can be sustainable alternatives to fossil fuels, so far these have remained largely untapped. The White Paper on Renewable Energy sets a target of generating 10 000GWh from renewable energy sources. Therefore the policy supports the investment in renewable energy facilities sources at ensuring energy security through the diversification of supply.

The support for the Renewable Energy Policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind, and that renewable applications are, in fact, the least cost energy service in many cases from a fuel resource perspective (i.e. the cost of fuel in generating electricity from such technology) and more so when social and environmental costs are taken into account. In spite of this range of resources, the National Energy Policy acknowledges that the development and implementation of renewable energy applications has been neglected in South Africa.

Government policy on renewable energy is therefore concerned with meeting the following challenges:

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

The White Paper on Renewable Energy states "*It is imperative for South Africa to supplement its existing energy supply with renewable energies to combat Global Climate Change which is having profound impacts on our planet*."

### *3.1.3 Final Integrated Resource Plan, 2010 - 2030*

The current iteration of the Integrated Resource Plan (IRP) for South Africa, initiated by the Department of Energy (DoE) after a first round of public participation in June 2010, led to the Revised Balanced Scenario (RBS) that was published in October 2010. The document outlines the proposed generation new build fleet for South Africa for the period 2010 to 2030. This scenario was derived based on the cost-optimal solution for new build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures such as local job creation. In addition to all existing and committed power plants, the RBS included a nuclear fleet of 9,6 GW; 6,3 GW of coal; 11,4 GW of renewables; and 11,0 GW of other generation sources.

A second round of public participation was conducted in November/December 2010, which led to several changes to the IRP model assumptions. The main changes were the disaggregation of renewable energy technologies to explicitly display solar photovoltaic (PV), concentrated solar power (CSP) and wind options; the inclusion of learning rates, which mainly affected renewables; and the adjustment of investment costs for nuclear units, which until then represented the costs of a traditional technology reactor and were too low for a newer technology reactor (a possible increase of 40%).

Additional cost-optimal scenarios were generated based on the changes. The outcomes of these scenarios, in conjunction with the following policy considerations, led to the Policy-Adjusted IRP:

- The installation of renewables (solar PV, CSP and wind) were brought forward in order to accelerate a local industry;
- To account for the uncertainties associated with the costs of renewables and fuels, a nuclear fleet of 9,6 GW was included in the IRP;
- The emission constraint of the RBS (275 million tons of carbon dioxide per year after 2024) was maintained; and
- Energy efficiency demand-side management (EEDSM) measures were maintained at the level of the RBS.

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

Firm commitment necessary now

Final commitment in IRP 2012

1. Built, owned & operated by IPPs 2. Commitment necessary due to required high-voltage infrastructure, which has long lead time 3. Commitment necessary due to required gas infrastructure, which has long lead time 4. Possibly required grid upgrade has long lead time and thus makes commitment to power capacity necessary

**Figure 3.1** National Energy Development Commitments before the next IRP

**Figure 3.1** above indicates the new capacities of the Policy commitment. The dates shown in **Figure 3.1** indicate the latest that the capacity is required in order to avoid security of supply concerns. The document notes that projects could be concluded earlier than indicated.

The Policy-Adjusted IRP includes the same amount of coal and nuclear new builds as the RBS, while reflecting recent developments with respect to prices for renewables. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9,6 GW of nuclear; 6,3 GW of coal; 17,8 GW of renewables; and 8,9 GW of other generation sources. The Policy-Adjusted IRP has therefore resulted in an increase in the contribution from renewables from 11,4 GW to 17,8 GW. The key recommendations pertaining to PV solar energy contained in the IRP 2010 to 2013 (March 2011) include:

» Solar PV programme 2012-2015: In order to facilitate the connection of the first solar PV units to the grid in 2012 a firm commitment to this capacity is necessary. Furthermore, to provide the security of investment to ramp up a sustainable local industry cluster, the first four years from 2012 to 2015 require firm commitment; and
» Solar PV 2016 to 2019: Grid upgrades might become necessary for the second round of solar PV installations from 2016 to 2019, depending on their location. To trigger the associated tasks in a timely manner, a firm commitment to these capacities is necessary in the next round of the IRP at the latest. By then, the assumed cost decreases for solar PV will be confirmed.

The Integrated Resource Plan (IRP) 2010-30 was promulgated in March 2011. It was indicated at the time that the IRP should be a "living plan" which would be revised by the Department of Energy (DoE) every two years. Since the promulgation of the Integrated Resource Plan (IRP) 2010-30 there have been a number of developments in the energy sector in South and Southern Africa. In addition the electricity demand outlook has changed markedly from that expected in 2010.

The Department of Energy have now completed an IRP 2010 Update (which was available for comments until 7 February 2014). It is expected that the final IRP 2010 Update will be submitted to Cabinet for final approval by March 2014, and subsequently promulgated and published in the Government Gazette.

### *3.1.4 Electricity Regulation Act, 2006*

Under the National Energy Regulator Act, 2004 (Act No 40 of 2004), the Electricity Regulation Act, 2006 (Act No 4 of 2006) and all subsequent relevant Acts of Amendment, NERSA has the mandate to determine the prices at and conditions under which electricity may be supplied by licence to Independent Power Producers (IPPs). NERSA has recently awarded electricity generation licences for new generation capacity projects under the IPP procurement programme.

## 3.2 Provincial Policy and Planning Context

### *3.2.1. Northern Cape Provincial Spatial Development Framework (2012)*

Northern Cape Provincial Spatial Development Framework (NCSDF) lists a number of sectoral strategies and plans to be read and treated as key components of the PSDF. Of these, there are a number that are relevant to the proposed solar energy facility. These include:

» Sectoral Strategy 1: Provincial Growth and Development Strategy of the Provincial Government.
» Sectoral Strategy 2: Comprehensive Growth and Development Programme of the Department of Agriculture, Land Reform and Rural Development.
» Sectoral Strategy 5: Local Economic Development (LED) Strategy of the Department of Economic Development and Tourism.
» Sectoral Strategy 11: Small Micro Medium Enterprises (SMME) Development Strategy of the Department of Economic Development and Tourism.
» Sectoral Strategy 12: Tourism Strategy of the Department of Economic Development and Tourism.
» Sectoral Strategy 19: Provincial renewable energy strategy (to be facilitated by the Department of Economic Development and Tourism).

The NCSDF (2012) notes the total area of high radiation in South Africa amounts to approximately 194 000 $km^2$ of which the majority falls within the Northern Cape. It is estimated that, if the electricity production per $km^2$ of mirror surface in a solar thermal power station were 30.2 MW and only 1% of the area of high radiation were available for solar power generation, then generation potential would equate to approximately 64 GW. A mere 1.25% of the area of high radiation could thus meet projected South African electricity demand in 2025 (80 GW) (NCPSDF, 2012). However the SDF does indicate that this would require large investments in transmission lines from the areas of high radiation to the main electricity consumer centres. The SDF also notes that the implementation of large concentrating solar power (CSP) plants has been proposed as one of the main contributors to greenhouse gas emission reductions in South Africa. In this regard various solar parks and CSP and PV plants have been proposed in the province with Upington being the hub of such developments (NCPSDF, 2012). A solar corridor has been defined for the province. Upington is included within this corridor.

Section C8.2.3 of the NPSDF, sets out the energy objectives for the Northern Cape Province. The section makes specific reference to renewable energy. The objectives are listed below:

» Promote the development of renewable energy supply schemes. Large-scale renewable energy supply schemes are strategically important for increasing the diversity of domestic energy supplies and avoiding energy imports while minimising detrimental environmental impacts.
» Enhance the efficiency of Eskom's power station at the Vanderkloof power station.
» In order to reinforce the existing transmission network and to ensure a reliable electricity supply in the Northern Cape, construct a 400 kV transmission power line from Ferrum Substation (near Kathu/Sishen) to Garona Substation (near Groblershoop). There is a national electricity supply shortage and the country is now in a position where it needs to commission additional plants urgently. Consequently, renewable energy projects are a high priority.
» Develop and institute innovative new energy technologies to improve access to reliable, sustainable and affordable energy services with the objective to realize sustainable economic growth and development. The goals of securing supply, providing energy services, tackling climate change, avoiding air pollution and reaching sustainable development in the province offer both opportunities and synergies which require joint planning between local and provincial government as well as the private sector.
» Develop and institute energy supply schemes with the aim to contribute to the achievement of the targets set by the White Paper on Renewable Energy (2003).

Section C8.3.3, Energy Policy, sets out the policy guidelines for the development of the energy sector, with specific reference to the renewable energy sector.

» The construction of telecommunication infrastructure must be strictly regulated in terms of the spatial plans and guidelines put forward in the PSDF. They must be carefully placed to avoid visual impacts on landscapes of significant symbolic, aesthetic, cultural or historic value and should blend in with the surrounding environment to the extent possible.
» Renewable energy sources such as wind, solar thermal, biomass and domestic hydroelectricity are to constitute 25% of the province's energy generation capacity by 2020.
» The following key policy principles for renewable energy apply:
    * Full cost accounting: Pricing policies will be based on an assessment of the full economic, social and environmental costs and benefits of energy production and utilisation.

- Equity: There should be equitable access to basic services to meet human needs and ensure human well-being. Each generation has a duty to avoid impairing the ability of future generations and their own well-being.
- Global and international cooperation and responsibilities: Government recognises its shared responsibility for global and regional issues and act with due regard to the principles contained in relevant policies and applicable regional and international agreements.
- Allocation of functions: Government will allocate functions within the framework of the Constitution to competent institutions and spheres of government that can most effectively achieve the objectives of the energy policy.
- The implementation of sustainable renewable energy is to be promoted through appropriate financial and fiscal instruments.
- An effective legislative system to promote the implementation of renewable energy is to be developed, implemented, and continuously improved.
- Public awareness of the benefits and opportunities of renewable energy must be promoted.
- The development of renewable energy systems is to be harnessed as a mechanism for economic development throughout the province in accordance with the Sustainable Development Initiative (SDI) approach (refer to Toolkit D10) or any comparable approach.
- Renewable energy must, first, and foremost, be used to address the needs of the province before being exported.

### *3.2.3. 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 wild fire, with heightened requirements for effective disaster management”.

Key points from MEC address include the NCPG’s commitment to develop and implement policy in accord with the National Green Paper for the National Climate Change Response Strategy (2010), and an acknowledgement of the NCP’s extreme vulnerability to climate-change driven desertification. The development and promotion of a provincial green economy, including green jobs, and environmental learnership is indented 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 MEC further indicated that the NCP was involved in the processing 7 wind energy facility and 11 solar energy facility EIA applications (March 2011)[8].

## 3.3 Local Policy and Planning Context

### *3.3.1 ZF Mgcawu District Conservation Planning*

The ZF Mgcawu District Municipality has compiled an Environmental Management Framework (EMF) (www.ZF Mgcawu-dm.co.za), in which environmental concerns and conservation priorities for all landscapes within the municipality are listed and mapped. According to the EMF, Bushmanland Arid Grasslands have a medium conservation priority, but the proposed project area does not fall within areas earmarked for conservation.

Similarly, the proposed project area has been mapped as Zone 2 and 7 in the EMF Environmental Control Zones, indicating the threat that the area has relatively less sensitivity than other zones and no special protection or environmental management parameters or concerns, except those already implemented or required by law. This implies that the proposed project area does have a medium conservation value due to species diversity, but there is no specific restriction on development of the area.

However, the nearby Lower Gariep Alluvial Vegetation on the banks of the Orange River is regarded as a Critical Biodiversity Area, of which remaining sections have been listed as threatened ecosystems. Although these areas fall outside the proposed development, the intermittent drainage lines on either side of the development site drain directly into the Orange River, hence contamination or accelerated erosion off the proposed development site could have a negative impact on this important biodiversity area.

### *3.3.2. ZF Mgcawu District Municipality Integrated Development Plan (2012-2017)*

The key priority issues listed in the ZF Mgcawu District Municipality Integrated Development Plan (ZFMDM IDP) includes:

» Basic Service Delivery;
» Municipal Institutional Development and Transformation;

[8] (www.info.gov.za/speech/DynamicAction?pageid=461&sid=22143&tid=45200).

» Local Economic Development;
» Municipal Financial Viability and Management;
» Good Governance and Public Participation.

The vision of the ZFMDM is: "To be a model, economically developed district with a high quality of life for all inhabitants". Linked to this vision the mission statement is to: "Promote economic development to the advantage of the community within the boundaries of the ZFMDM" This will be done by the establishment and maintenance of an effective administration and a safe environment in order to attract tourists and investors to the region".

The development goals listed in the IDP that are relevant to the proposed solar energy facility include:

» To deliver a positive contribution to the sustainable growth and development within its boundaries and the rest of the Northern Cape;
» The creation of a healthy and environmentally friendly environment within and outside of the Councils" district boundaries, must be attempted;
» The promotion of a safe and tourism friendly environment should be furthered in order to promote tourism and investor interest in the region;
» The promotion of human resources within and outside the organization through training and the implementation of new technological aids.

Linked to the developmental goals are a number of developmental objectives. The following objectives are relevant to the proposed solar energy facility:

» Promotion of SMMEs in order to strengthen the Local Economic Sector
» Promote the development of the tourism sector, with specific emphasis on community based tourism;
» Promote the infrastructure development, including electricity.

### *3.3.3 Kheis Local Municipality IDP 2012-2016*

The vision for the !Kheis Municipality is "The development of an institution, focussing on transparent, loyal and effective service delivery to the residence of the !Kheis Municipal Area." and mission of !Kheis Municipality is "To promote economic development to the advantage of the communities within the boundaries of the !Kheis Municipality this will be done by the establishment and maintenance of an effective administration and a safe environment in order to attract tourists and investors to the area".

The IDP revision lists a number of priority issues that are relevant to the proposed project, including, low level of skills, high level of unemployment and lack of provision of electricity to all residents. The need to protect the natural environment is also identified as a key objective in the IDP. "Due to the climate of the area there is huge potential to utilise solar energy more widely, especially in the remote areas of the district… "(Kheis Municipality Integrated Development Plan 2012/16)

## 3.4. Alignment of Kheis Solar Park with the Policies and Planning

From the above policies it can be said that the proposed Kheis solar energy projects are in line with both the local and the provincial policies. The proposed projects are will contribute towards the promotion of SMMEs in order to strengthen the Local Economic Sector and bring job opportunities to the locals which are some of the top priority in these polices.

## 3.5. Regulatory Hierarchy for Energy Generation Projects

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 development is a multi-sectorial issue (encompassing economic, spatial, biophysical, and cultural dimensions) various statutory bodies are likely to be involved in the approval process for solar energy facility project and the related statutory environmental assessment process.

### *3.3.1. Regulatory Hierarchy*

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

» *Department of Energy (DoE):* This Department is responsible for policy relating to all energy forms, including renewable energy, and is responsible for forming and approving the IRP (Integrated Resource Plan for Electricity).
» *National Energy Regulator of South Africa (NERSA):* This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for solar energy developments to generate electricity.
» *Department of Environmental Affairs (DEA):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. The DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.
» *The South African Heritage Resources Agency (SAHRA):* SAHRA is a statutory organisation established under the National Heritage Resources Act, No 25 of 1999, as the national administrative body responsible for the protection of South Africa's cultural heritage.
» *National Department of Agriculture, Forestry, and Fisheries (DAFF):* This Department is responsible for activities pertaining to subdivision and rezoning

of agricultural land. The forestry section is responsible for the protection of tree species under the National Forests Act (Act No 84 of 1998).

» *South African National Roads Agency (SANRAL):* This Agency is responsible for the regulation and maintenance of all national routes.
» *National Department of Water Affairs:* This Department is responsible for water resource protection, water use licensing and permits. This area of the Northern Cape is not generally authorised, so applications go through the National Department.

At the Provincial Level, the main regulatory agencies are:

» *Provincial Government of the Northern Cape – Department of Environmental and Nature Conservation (NC DENC):* This Department is the commenting authority for these projects.
» *Department of Transport and Public Works:* This Department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
» *Provincial Department of Water Affairs:* This Department is responsible for water resource protection, water use licensing and permits.
» *Ngwao Boswa ya Kapa Bokone (Northern Cape Heritage Authority):* This body is responsible for commenting on heritage related issues in the Northern Cape Province.
» *Northern Cape Department of Agriculture, Land Reform and Rural Development:* This Department is responsible for all matters which affect agricultural land.
» *Northern Cape Department of Mineral Resources (DMR):* Approval from the may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that might occur on site.

At the **Local Level,** the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Northern Cape, both the local and district municipalities play a role. The local municipality is the !Kheis Local Municipality which forms part of the ZF Mgcawu District Municipality. There are also numerous non-statutory bodies such as environmental non-governmental organisations (NGOs) and community based organisations (CBO) working groups that play a role in various aspects of planning and environmental monitoring that will have some influence on proposed solar energy development in the area.

### *3.3.2 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, published under Chapter 5 of the NEMA (GNR R543 in Government Gazette 33306 of 18 June 2010)
- » Guidelines published in terms of the NEMA EIA Regulations, in particular:
  - ∗ Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010)
  - ∗ Public Participation in the EIA Process (DEA, 2010)
  - ∗ Integrated Environmental Management Information Series (published by DEA)
- » Kheis Municipality Integrated Development Plan (2012-2017)
- » ZF Mgcawu District Municipality Integrated Development Plan (2012-2017)
- » International guidelines – the Equator Principles and the International Finance Corporation and World Bank Guidelines.

Several other Acts, standards or guidelines have also informed the project process and the scope of issues assessed in this report. A listing of relevant legislation is provided in **Table 3.1** and **Table 3.2.**

**Table 3.1:** Relevant legislative permitting requirements applicable to the proposed Kheis Solar Park facilities

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| **National Legislation** | | | |
| National Environmental Management Act (Act No 107 of 1998) | The EIA Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorisation are identified within these Regulations.<br><br>In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation.<br><br>In terms of GN R543, R544, R545 and R546 of 18 June 2010, a Scoping and EIA Process is required to be undertaken for the proposed project. | Department of Environmental Affairs – competent authority<br><br>Department of Environmental and Nature Conservation (DENC)- commenting authority | The listed activities triggered by the proposed solar energy facility have been identified and assessed in the EIA process being undertaken (i.e. Scoping and EIA).<br><br>This EIA Report will be submitted to the competent and commenting authority in support of the application for authorisation. |
| National Environmental Management Act (Act No 107 of 1998) | In terms of the Duty of Care Provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised.<br><br>In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts. | Department of Environmental Affairs | While no permitting or licensing requirements arise directly by virtue of the proposed project, this section has found application during the EIA Phase through the consideration of potential impacts (cumulative, direct, and indirect). It will continue to apply throughout the life cycle of the project. |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| Environment Conservation Act (Act No 73 of 1989) | National Noise Control Regulations (GN R154 dated 10 January 1992) | Department of Environmental Affairs<br><br>Department of Environmental and Nature Conservation (DENC)-<br><br>Local Authorities | Noise impacts are expected to be associated with the construction phase of the project and are not likely to present a significant intrusion to the local community. Therefore is no requirement for a noise permit in terms of the legislation.<br><br>On-site activities should be limited to 6:00am - 6:00pm, Monday – Saturday (excluding public holidays).<br><br>Should activities need to be undertaken outside of these times, the surrounding communities will need to be notified and appropriate approval will be obtained from DEA and the Local Municipality. |
| National Water Act (Act No 36 of 1998) | Water uses under S21 of the Act must be licensed, unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation (and then registration of the water use is required). | Department of Water Affairs<br><br>Provincial Department of Water Affairs | A water use license (WUL) is required to be obtained if wetlands or drainage lines are impacted on, or if infrastructure lies within 500m of such features. |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | Consumptive water uses may include the taking of water from a water resource and storage - Sections 21a and b.<br><br>Non-consumptive water uses may include impeding or diverting of flow in a water course - Section 21c; and altering of bed, banks or characteristics of a watercourse - Section 21i. | | Should water be extracted from a borehole on site or from the Orange River for use within the facility, a water use license will be required in terms of Section 21(a) and 21 (b) of the National Water Act. |
| Minerals and Petroleum Resources Development Act (Act No 28 of 2002) | A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act.<br><br>Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act.<br><br>S53 Department of Mineral Resources: Approval from the Department of Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that might occur on site. | Department of Mineral Resources | Within the study area they are old borrow pits and discontinued mines and their overburden heaps have remained. The overburden materials provide an ideal source for such filling material for these and other applications within the development. Using this material will also prevent additional impacts that would be caused by a new borrow pit. Alternatively, the infilling or depositing of material for access roads will be obtained from a registered borrow pit no mining permit or right is required to be obtained.<br><br>A Section 53 application will be |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | | | submitted the Northern Cape DMR office. |
| National Environmental Management: Air Quality Act (Act No 39 of 2004) | Measures in respect of dust control (S32)and National Dust Control Regulations of February 2014.<br>Measures to control noise (S34) - no regulations promulgated yet. | Department of Environmental Affairs | No permitting or licensing requirements arise from this legislation. However, National, provincial and local ambient air quality standards (S9 - 10 & S11) to be considered.<br><br>Measures in respect of dust control (S32) and the National Dust Control Regulations of February 2014.<br><br>The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act. |
| National Heritage Resources Act (Act No 25 of 1999) | » Stipulates assessment criteria and categories of heritage resources according to their significance (S7).<br>» Provides for the protection of all archaeological and palaeontological sites, and meteorites (S35). | South African Heritage Resources Agency | An HIA and PIA has been undertaken as part of the EIA Process to identify heritage sites (refer to Appendix F&G), there are not sensitive heritage object found on site, should a heritage resource |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | » Provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority (S36).<br>» Lists activities which require developers any person who intends to undertake to notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of the proposed development (S38).<br>» 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 (S44). | | be impacted upon, a permit may be required from SAHRA. |
| National Environmental Management: Biodiversity Act (Act No 10 of 2004) | » Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53)<br>» A list of threatened and protected species has been published in terms of S 56(1) - Government Gazette 29657.<br>» Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations).<br>» Provides for listing threatened or protected | Department of Environmental Affairs | Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species.<br><br>An ecological study has been undertaken as part of the EIA Phase. As such the potentially occurrence protected species and the potential for them to be affected has been considered. This report is contained in |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | ecosystems, in one of four categories: critically endangered (CR), endangered (EN), 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 (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011).<br>» This Act also regulates alien and invader species. | | Appendix E |
| Conservation of Agricultural Resources Act (Act No 43 of 1983) | » Prohibition of the spreading of weeds (S5)<br>» Classification of categories of weeds & invader plants (Regulation 15 of GN R1048) & restrictions in terms of where these species may occur.<br>» Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048). | Department of Agriculture | This Act will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented. |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | | | The permission of agricultural authorities will be required if the Project requires the draining of vleis, marshes or water sponges on land outside urban areas. There are none for the projects. |
| National Forests Act (Act No. 84 of 1998) | According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. 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'. | National Department of Forestry | A licence is required for the removal of protected trees. There were protected tree species recorded during the ecological survey within the broader study area. Few *Acacia* species and *Boschia* species are the largest are the most obvious woody plants. Should protected trees need to be removed; a permit will be required to be obtained from DAFF. |
| National Veld and Forest Fire Act (Act 101 of 1998) | In terms of S12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material.<br><br>In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires. | Department of Agriculture, Forestry and Fisheries (DAFF) | While no permitting or licensing requirements arise from this legislation, this Act will find application during the construction and operational phase of the project. |
| Hazardous Substances Act (Act No | This Act regulates the control of substances that | Department of Health | It is necessary to identify and list |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| 15 of 1973) | may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products.<br><br>Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared as Group I or Group II substance<br>• Group IV: any electronic product; and<br>• Group V: any radioactive material.<br><br>The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force. | | all the Group I, II, III, and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health. |
| Development Facilitation Act (Act No 67 of 1995) | Provides for the overall framework and administrative structures for planning throughout the Republic. | Local Municipality | The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | S (2-4) provide general principles for land development and conflict resolution. | | development applicant who wishes to establish a land development area must comply with procedures set out in the Act. |
| National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) | The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment.<br><br>The Minister may amend the list by –<br><br>» Adding other waste management activities to the list.<br>» Removing waste management activities from the list.<br>» Making other changes to the particulars on the list.<br><br>In terms of the Regulations published in terms of this Act (GN 921), A Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities.<br><br>Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: | National Department of Water and Environmental Affairs (hazardous waste)<br><br>Provincial Department of Environmental Affairs (general waste) | As no waste disposal site is to be associated with the proposed project, no permit is required in this regard.<br><br>General waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of the Act, as detailed in the EMPs for each Phase (refer to Appendix K-M). The DWAF (1998) Waste Management Series. Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste will also need to be considered.<br><br>The volumes of solid waste to be generated and stored on the site during construction and operation of the facility will not require a |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | » The containers in which any waste is stored, are intact and not corroded or in<br>» any other way rendered unlit for the safe storage of waste.<br>» Adequate measures are taken to prevent accidental spillage or leaking.<br>» The waste cannot be blown away.<br>» Nuisances such as odour, visual impacts and breeding of vectors do not arise; and<br>» Pollution of the environment and harm to health are prevented. | | waste license (provided these remain below the prescribed thresholds).<br><br>The contractor's camp will result in sewage and grey water handling. Sewage is regarded as hazardous waste in terms of this Act. However the volume of hazardous waste generated from the construction and operation of the facility will not exceed the specified threshold volumes within the Waste Act (i.e. an annual throughout capacity of 2000m$^3$) and therefore a waste license from National DEA will not be required. |
| Subdivision of Agricultural Land Act (Act No 70 of 1970) | Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land in the Province | Department of Agriculture | Subdivision will have to be in place prior to any subdivision approval in terms of S24 and S17 of the Act. |
| National Road Traffic Act (Act No 93 of 1996) | » The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and | » South African National Roads Agency Limited (national roads)<br>» Provincial Department of | An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include route clearances and permits will be required for vehicles carrying |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed.<br>» Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts.<br>» 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. | Transport | abnormally heavy or abnormally dimensioned loads. Transport vehicles exceeding the dimensional limitations (length) of 22m. Depending on the trailer configuration and height when loaded, some of the power station components may not meet specified dimensional limitations (height and width). |
| **Provincial 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. | Northern Cape Department of Environment and Nature Conservation | A collection/destruction permit must be obtained from Northern Cape Nature Conservation for the removal of any protected plant species found on site. Additionally, a permit for the disturbance or destruction of indigenous species must be applied for. |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | Amongst other regulations, the following may apply to the current project:<br>» Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property;<br>» Aquatic habitats may not be destroyed or damaged;<br>» 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.<br>» The Act provides lists of protected species for the Province. | | |
| Astronomy Geographic Advantage Act (Act No. 21 of 2007) | » The Astronomy Geographic Advantage Act (No. 21 of 2007) provides for the preservation and protection of areas within South Africa that are uniquely suited for optical and radio astronomy; for intergovernmental co-operation and public consultation on matters concerning nationally significant astronomy advantage areas and for matters connected thereto.<br>» Chapter 2 of the act allows for the declaration of astronomy advantage areas whilst Chapter 3 pertains to the management and control of astronomy advantage areas. Management and control of astronomy advantage areas include, amongst others, the following: | South Africa Kilometre Array | On 19 February 2010, the Minister of Science and Technology (the Minister) declared the whole of the territory of the Northern Cape province, excluding Sol Plaatje Municipality, as an astronomy advantage area for radio astronomy purposes in terms of Section 5 of the Act and on 20 August 2010 declared the Karoo Core Astronomy Advantage Area for the purposes of radio astronomy. |

| Legislation | Applicable Requirements | Relevant Authority | Compliance Requirements |
|---|---|---|---|
| | » Restrictions on use of radio frequency spectrum in astronomy advantage areas;<br>» Declared activities in core or central astronomy advantage area;<br>» Identified activities in coordinated astronomy advantage area; and<br>» Authorisation to undertake identified activities. | | |

**Table 3.2:** Standards applicable to the Kheis Solar Park

| Theme | Standard | Summary |
|---|---|---|
| Air | South African National Standard (SANS) 69 | Framework for setting and implementing national ambient air quality standards |
| | SANS 1929: Ambient Air Quality | Sets limits for common pollutants |
| Noise | SANS 10328:2003: Methods for Environmental Noise Impact Assessments | General procedure used to determine the noise impact |
| | SANS 10103:2008: The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and Speech Communication | Provides noise impact criteria |
| | National Noise Control Regulations | Provides noise impact criteria |
| | SANS 10210: Calculating and Predicting Road Traffic Noise | Provides guidelines for traffic noise levels |
| Waste | DWAF (1998) Waste Management Series. Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste | DWAF Minimum Requirements |
| | National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) – National norms and standard for the storage of waste. | » Provides uniform national approach relating the management of waste facilities<br>» Ensure best practice in management of waste storage |

| | | |
|---|---|---|
| | | » Provides minimum standards for the design and operation of new and existing waste storage |
| Water | Best Practise Guideline (G1) Storm Water Management DWA 2006 | Provides guidelines to the management of storm water |
| Water | South African Water Quality Guidelines | Provides water quality guidelines |
| Others | » Kheis Local Municipality 2012-2016 IDP<br>» ZF Mgcawu District Municipality Integrated Development Plan (2012-2017) | According to the Municipal Systems Act of 2000, all Municipalities have to undertake an Integrated Development Planning (IDP) process to produce Integrated Development Plans (IDPs). As the IDP is a legislative requirement it has a legal status and it supersedes all other plans that guide development at local government level. |

# APPROACH TO UNDERTAKING THE EIA PHASE CHAPTER 4

The EIA process for the proposed Kheis Solar Park PV facilities is regulated by the EIA Regulations of June 2010 (as amended), which involves the identification of and assessment of direct, indirect, and cumulative environmental impacts (both positive and negative) associated with a proposed project. The EIA process forms part of the feasibility studies for a project, and comprises a Scoping Phase and EIA Phase which culminates in the submission of an EIA Report together with an Environmental Management Programme (EMPr) to the competent authority for decision-making. This EIA Report considers the three phases of the Kheis Solar Park. Three EMPrs have been prepared, one for each facility.

The EIA process for the three proposed PV facilities has been undertaken in accordance with the EIA Regulations in terms of Sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR544; GNR545; and GNR546 of Section 24(5) of the National Environmental Management Act (NEMA Act No. 107 of 1998). In line with the EIA Regulations, an application for authorisation was lodged with the National DEA for each of the Kheis Solar project phases.

## 4.1. Phase 1: Scoping Phase

The Scoping Study, which was completed in November 2013 with the acceptance of Scoping by the DEA, served to identify potential issues associated with the proposed project and define the extent of studies required within the EIA Phase, as detailed in the Plan of Study for EIA compiled as part of the Scoping Report. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs).

I&APs were provided with the opportunity to receive information regarding the proposed project, to participate in the process and to raise issues or concerns. Furthermore, the Draft Scoping Report was made available at Groblershoop and Upington Public Library and on the Savannah Environmental website for I&AP review and comment (for a 30-day period). All the comments, concerns, and suggestions received during the Scoping Phase and the review period were included in the Final Scoping Report.

The Scoping Report was submitted to the National Department of Environmental Affairs in October 2013. The Final Scoping Report and Plan of Study for the EIA were accepted by the DEA, as the competent authority, in November 2013. In terms of this acceptance, an EIA was required to be undertaken for the proposed project.

» **Circulation of the Draft and Final Scoping Report**
During the scoping phase, the following registered I&APs and State Departments were informed in writing of the availability of the Draft Scoping Report or provided with a copy of the report. They were also informed in writing of the availability of the Final Scoping Report and were requested to submit comment directly to DEA, although some have submitted comment directly to Savanah Environmental.

- Northern Cape – Department of Environmental and Nature Conservation (DENC)
- Northern Cape - Agriculture and Rural Development
- Northern Cape - Public Works, Roads and Transport
- Northern Cape - Water Affairs
- South African Heritage Resources Agency
- Department of Agriculture, Forestry and Fisheries
- South African National Roads Agency
- Department of Energy
- Civil Aviation Authority
- Square Kilometre Array (SKA) Project
- !Kheis Local Municipality
- ZF Mgcawu District Municipality
- Landowners, surrounding landowners
- Ngwao Boswa ya Kapa Bokone (Northern Cape Provincial Heritage Authority)
- Eskom Transmission and Distribution
- Wildlife Environment Society of South Africa
- BirdLife South Africa

## 4.2. Phase 2: Environmental Impact Assessment Phase

The EIA Phase for Kheis Solar Park PV Projects aims to achieve the following:

» Provide a comprehensive assessment of the social and biophysical environments affected by the proposed projects put forward as part of the project.
» Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed facilities.
» Comparatively assess any alternatives put forward as part of the projects.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.

» Undertake a fully inclusive public participation process to ensure that I&AP are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA Report addresses potential direct, indirect, and cumulative[9] impacts (both positive and negative) associated with all phases of the project including design, 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.

#### *4.2.1. Tasks completed during the EIA Phase*

The EIA Phase has been undertaken in accordance with the EIA Regulations published in GN 33306 of 18 June 2010, in terms of NEMA. Key tasks undertaken within the EIA phase included:

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
» Undertaking a public participation process throughout the EIA process in accordance with Regulation 54 of GN R543 of 2010 in order to identify any additional issues and concerns associated with the proposed project.
» Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of GN R543 of 2010).
» Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.
» Preparation of a Draft EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.
» Prepare a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of GN R543 of 2010).
» Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.
» Preparation of a Draft EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.

#### *4.2.2 Authority Consultation*

The National DEA is the competent authority for this application. A record of all authority consultation undertaken is included within this EIA report. Consultation

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

with the regulating authorities (i.e. DEA and Northern Cape DENC) has continued throughout the EIA process. On-going consultation included the following:

» Submission of a final Scoping Report with a Plan of Study for the EIA phase, were submitted and accepted by DEA in November 2013.

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

» Submission of a final EIA Report following the 30-day public review period.
» If required, an opportunity for DEA and NC DENC representatives to visit and inspect the proposed site, and the study area.
» Notification and Consultation with Organs of State that may have jurisdiction over the project, including:
  * Provincial and local government departments (including South African Heritage Resources Agency, Department of Water Affairs, Department of Agriculture, etc.).
  * Government Structures (including the Department of Public Works, Roads and Transport, etc.).
  * Parastatals and Non-Governmental Organisations (South African Civil Aviation Authority (SACAA), Eskom SOC Limited, and Square Kilometre Array (SKA)), South African National Roads Agency Limited (SANRAL).

A record of the authority consultation in the EIA process is included within **Appendix B.**

#### *4.3.1 Public Involvement and Consultation*

The aim of the public participation process is primarily to ensure that:

» Information containing all relevant facts in respect of the proposed project was made available to potential stakeholders and I&APs.
» Participation by potential I&APs was facilitated in such a manner that all potential stakeholders and I&APs were provided with a reasonable opportunity to comment on the proposed project.
» Comments received from stakeholders and I&APs were recorded and incorporated into the EIA process.

In order to accommodate the varying needs of stakeholders and I&APs within the study area, as well as capture their inputs regarding the project, various opportunities for stakeholders and I&APs to be involved in the EIA Phase of the process will be provided, as follows:

» Focus group meetings and a public meeting (pre-arranged and stakeholders invited to attend - for example with directly affected and surrounding landowners).
» Telephonic consultation sessions (consultation with various parties from the EIA project team, including the project participation consultant, lead EIA consultant as well as specialist consultants).
» Written, faxed or e-mail correspondence.
» The Draft EIA Report was released for a 30-day public review period from 24 February 2014 – 26 March 2014: The comments received from I&APs will be captured within a Comments and Response Report, which will be included within the Final EIA Report, for submission to the authorities for decision-making.

In terms of the requirement of Chapter 6 of the EIA Regulations of June 2010, the following public participation tasks are required to be undertaken:

» Distribution of Letters of Notification to identified and registered I&APs to inform them on the changes in the project and planned EIA phase.
» Fixing a notice board at a place conspicuous to the public at the boundary or on the fence of—
  - (i) the site where the activity to which the application relates is or is to be undertaken; and
  - (ii) any alternative site mentioned in the application;
» Giving written notice to:
  - (i) the owner or person in control of that land if the applicant is not the owner or person in control of the land;
  - (ii) the occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
  - (iii) Owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
  - (iv) the municipal councillor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;
  - (v) the municipality which has jurisdiction in the area;
  - (vi) any organ of state having jurisdiction in respect of any aspect of the activity; and
  - (vii) any other party as required by the competent authority.
» Placing an advertisement in:
  - (i) one local newspaper; and
  - (ii) in at least one provincial newspaper.
» Open and maintain a register/ database of interested and affected parties and organs of state
» Release of a Draft EIA Report for Public Review for a 30-day period.

» Hosting of a Public Meeting and Focus Group Meetings by the EAP to discuss and share information on the project.
» Preparation of a Comments and Responses Report which document all the comments received and responses from the project team.

Below is a summary of the key public participation activities conducted to date in the process.

» **Placement of Site Notices**
Site notices have been placed on-site and at relevant public places and proof of this is included in Appendix D.

» **Identification of I&APs and establishment of a database**
Identification of I&APs was undertaken by Savannah Environmental) through existing contacts and databases, recording responses to site notices and the newspaper advertisement, as well as through the process of networking. The key stakeholder groups identified include authorities, local and district municipalities, public stakeholders, Parastatals and Non-Governmental Organisations (refer to Table 4.1 below).

**Table 4.1:** Key stakeholder groups identified during the EIA Process

| Stakeholder Group | Department |
|---|---|
| National and Provincial Authorities | » Northern Cape – Department of Environmental and Nature Conservation (DENC)<br>» Northern Cape - Agriculture and Rural Development<br>» Northern Cape - Public Works, Roads and Transport<br>» Northern Cape - Water Affairs<br>» South African Heritage Resources Agency<br>» Department of Agriculture, Forestry and Fisheries<br>» South African National Roads Agency (SANRAL)<br>» Department of Energy<br>» Civil Aviation Authority<br>» |
| Municipalities | » !Kheis Local Municipality<br>» ZF Mgcawu District Municipality |
| Public stakeholders | » Landowners, surrounding landowners, occupiers of land, farmer's unions. |
| Parastatals & service providers | » Square Kilometre Array (SKA) Project<br>» Eskom Transmission and Distribution<br>» Ngwao Boswa ya Kapa Bokone (Northern Cape Provincial Heritage Authority) |
| NGOs/Business forums | » Wildlife Environment Society of South Africa<br>» BirdLife South Africa |

All relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to **Appendix C**). While I&APs were encouraged to register their interest in the project from the onset of the process undertaken by Savannah Environmental, the identification and registration of I&APs has been on-going for the duration of the EIA phase of the process.

» **Newspaper Advertisements**

In order to notify and inform the public of the proposed project and invite members of the public to register as interested and affected parties (I&APs), the project, and EIA process was advertised in the following newspapers

* The Volksblad (22 July 2013)
* Gemsbok (26 July 2013)

During the scoping phase, a second round of newspaper adverts was placed to inform the public of the review date of the report and details of the public meeting. These adverts were placed in the following newspapers:

* Volksblad (26 August 2013)
* Gemsbok (28 August 2013)

During the EIA phase, a fourth round of newspaper adverts has been placed in the following newspapers to inform the public of the availability of the Draft EIA report and the public meeting:

* Volksblad (24 February 2014)
* Gemsbok (26 February 2014)

Refer to **Appendix D** for proof of advertisements which were placed.

» **Consultation**

In order to accommodate the varying needs of stakeholders and I&APs, the following opportunities have been provided for I&AP issues to be recorded and verified through the EIA process as outlined in the table below:

| **Consultations in Scoping phase:** | **Date** |
|---|---|
| Public meeting | 05 September 2013 |
| Focus Group Meeting with Kheis Local Municipality | 05 September 2013 |
| Focus Group Meeting with ZF Mgcawu District Municipality | 06 September 2013 |
| Focus Group Meeting with Water Affairs – Northern Cape | 06 September 2013 |

| | |
|---|---|
| Focus Group Meeting Councillor of Ward 2 | |
| **Consultations in EIA phase:** | **Date** |
| Public meeting | 13 March 2014 |
| Focus Group Meeting with Kheis Local Municipality | To be confirmed |
| Focus Group Meeting with landowners | To be confirmed |

» In order to further facilitate comments on the Draft EIA report and to provide feedback on the findings of the specialist EIA studies, a public feedback meeting will be held on 13 March 2014 and interested and affected parties have been invited to attend the public meeting. Adverts informing the public on the availability of the draft EIA report for public comment and public meeting were advertised in the Volksblad and Gemsbok newspapers are as follows :

* **Date:** Thursday, 13 March 2014
* **Time:** 17:30
* **Venue:** Duin-in-die-Weg Guest Farm near Grootdrink

#### *4.3.2 Identification and Recording of Issues and Concerns*

Issues and comments raised by I&APs over the duration of the EIA process will be synthesised into a Comments and Response Reports. The Comments and Response Report will include responses from members of the EIA project team and/or the project proponent. Where issues are raised that the EIA team considers beyond the scope and purpose of this EIA process, clear reasoning for this view is provided. This is included in **Appendix D**.

#### *4.3.3 Assessment of Issues Identified through the Scoping Process*

Issues which require investigation within the EIA Phase, as well as the specialists involved in the assessment of these impacts are indicated in Table 4.2 below.

**Table 4.2:** Specialist studies undertaken within the EIA Phase

| Specialist | Area of Expertise | Refer Appendix |
|---|---|---|
| Marianne Strohbach (Savannah Environmental) | Ecological impact assessment | Appendix E |
| David Morris (McGregor Museum) | Heritage impact assessment | Appendix F |
| Barry Millsteed (BM Geological Services) | Palaeontology impact assessment | Appendix G |
| Anna-Marie Roux (Zone Land Solutions) | Social impact assessment | Appendix H |

| Specialist | Area of Expertise | Refer Appendix |
|---|---|---|
| Johann Lanz (Johan Lanz Consulting) | Soils and Agricultural Potential | Appendix I |
| Lourens du Plessis (MetroGIS) | Visual impact assessment | Appendix J |

Specialist studies considered direct, indirect, cumulative, and residual environmental impacts associated with the development of the proposed Kheis Solar Park 1, 2 and 3 PV projects. Issues were assessed in terms of the following criteria:

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

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

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

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

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

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

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

As the developer has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. A draft EMPr for each facility is included as **Appendix K** (Kheis Solar Park 1), **Appendix L** (Kheis Solar Park 1) and **Appendix M** (Kheis Solar Park 1).

#### *4.3.4 Assumptions and Limitations*

The following assumptions and limitations are applicable to the studies undertaken within this EIA Phase:

- All information provided by the developer and I&APs to the environmental team was correct and valid at the time it was provided.
- The development site identified by the developer represents a technically suitable site for the establishment of the proposed solar facility.
- The proposed connection to the National Grid is viable.

» Studies assume that any potential impacts on the environment associated with the proposed development will be avoided, mitigated, or offset.
» This report and its investigations are project-specific, and consequently the environmental team did not evaluate any other power generation alternatives
» Refer to the specialist studies in **Appendices E – J** for specialist study specific limitations.

# DESCRIPTION OF THE RECEIVING ENVIRONMENT CHAPTER 5

This section of the Draft EIA Report provides a description of the environment that may be affected by the three Kheis Solar Park PV facilities on Portion 7 and 9 of Portion 4 of the Farm Namakwari 656 (referred to as "the site"). Features of the biophysical, social and economic environment that could directly or indirectly be affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area as well as collected field data, and aims to provide the context within which this EIA is being conducted. A more detailed description of each aspect of the affected environment is included within the specialist reports contained within **Appendices E – J**. The entire project development area is described below. The sites for the three phases are fairly similar and are located within the same site (Portion 7 and 9 of the Portion 4 of farm Namakwari 656). Where there are differences between the environments of the projects, this is highlighted. A summary of the environment of each of the three project development phases is provided at the end of this Chapter in Table 5.16.

## 5.1 Project Location

The project falls within the jurisdiction of the !Kheis Local Municipality, which in turn falls under the jurisdiction of the ZF Mgcawu District Municipality of the Northern Cape Province. Portion 7 and 9 of Portion 4 of the Farm Namakwari 656 is located approximately 60km south-east of Upington. The farm portions cover an area of 3600 ha. The proposed PV facilities form part of a larger development of up to 150MW in generating capacity (comprising 3 phases, and referred to as the "Project"). The co-ordinates for the central point of each project considered in this report is listed in Table 5.1.

**Table 5.1:** Details for each project of the Portion 7and 9 of portion 4 of the Farm Namakwari 656.

| Phase Number | Output | Area (Ha) | Coordinates for Central Point of the Phase | |
|---|---|---|---|---|
| | | | ***Latitude*** | ***Longitude*** |
| Kheis Solar Park 1 | 75MW | 280ha | 28°32'58.72"S | 21°49'16.81"E |
| Kheis Solar Park 2 | 55MW | 210ha | 28°31'54.42"S | 21°49'59.18"E |
| Kheis Solar Park 3 | 20MW | 110ha | 28°34'14.94"S | 21°50'8.12"E |

## 5.2 Topography

The site can be described as slightly undulating to flat with several isolated outcrops, draining south-west and west into small ephemeral drainage lines that drain into the Orange River (Gariep River) approximately 1 km west of the closest edge of the land portions selected for the proposed development. The topography or terrain morphology of the region is broadly described as *Dune Hills and Lowlands* (to the east), *Extremely Irregular Plains* (along the Orange River) and *Hills* (Grootberg, Tierkop, Leeukop, Steyn se Kop, etc.), as shown on Figure 5.1.

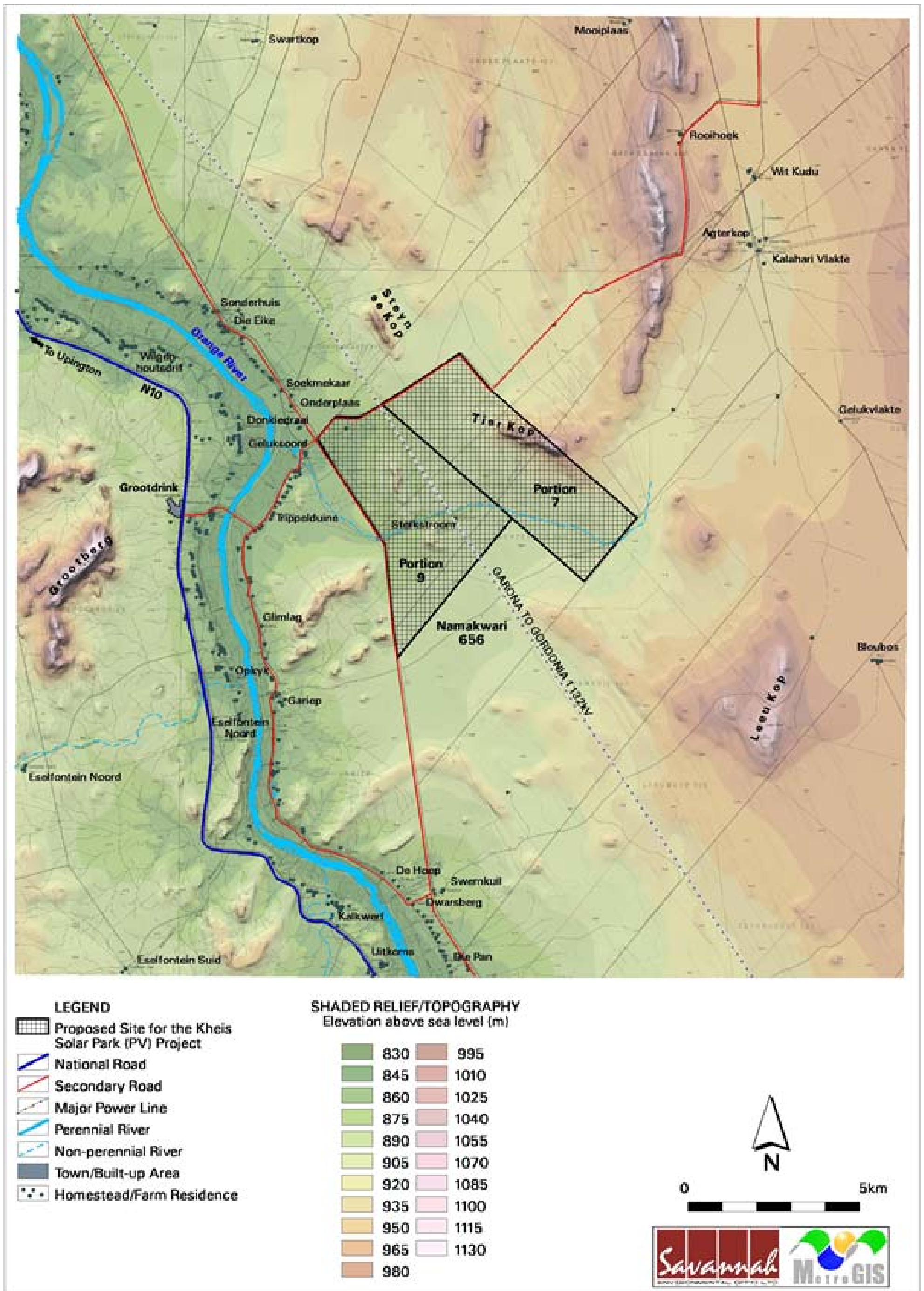


**Figure 5.1:** Map indicating the general topography of the proposed Kheis Solar Park project site and surrounding environment

The elevation above sea level in the broader study area ranges from 1130m on top of the Grootberg hill and the hills located to the north-east, to 830m along the Orange River floodplain (where it leaves the study area in the north-west). The slope elevation of the site itself is generally flat, with the exception of the Tierkop hill along the north-eastern boundary of Portion 7 and the smaller unnamed hills in the centre of Portion 9. Parallel dunes do, however, occur within the proposed site, especially on Portion 7.

### 5.3 Geology

Figure 5.2 shows the geology underlying each of Kheis Solar Park project phases, and can be described as follow:

» **Kheis Solar Park 1**: the majority of the project area is underlain by unconsolidated sands of the Gordonia Formation. The south western quadrant of the site contains extensive exposures of the Zonderhuis Formation. This formation appears to underlie the Gordonia Formation throughout the extent of the Kheis Solar Park 1 area.
» **Kheis Solar Park 2**: The land surface of Solar Park 2 is composed completely of unconsolidated sands of the Gordonia Formation. It is probable that the Zonderhuis Formation forms the bedrock for the Kalahari sands throughout Kheis Solar Park 2.
» **Kheis Solar Park 3**: The land surface of the majority of this Solar Park area is formed by bedrocks of the Groblershoop Formation. The Gordonia Formation sands form the land surface in the south western corner and along the southern margin of the Solar Park site. It is probable that the Groblershoop Formation underlies the Gordonia Formation throughout the Kheis Solar Park 3 site.

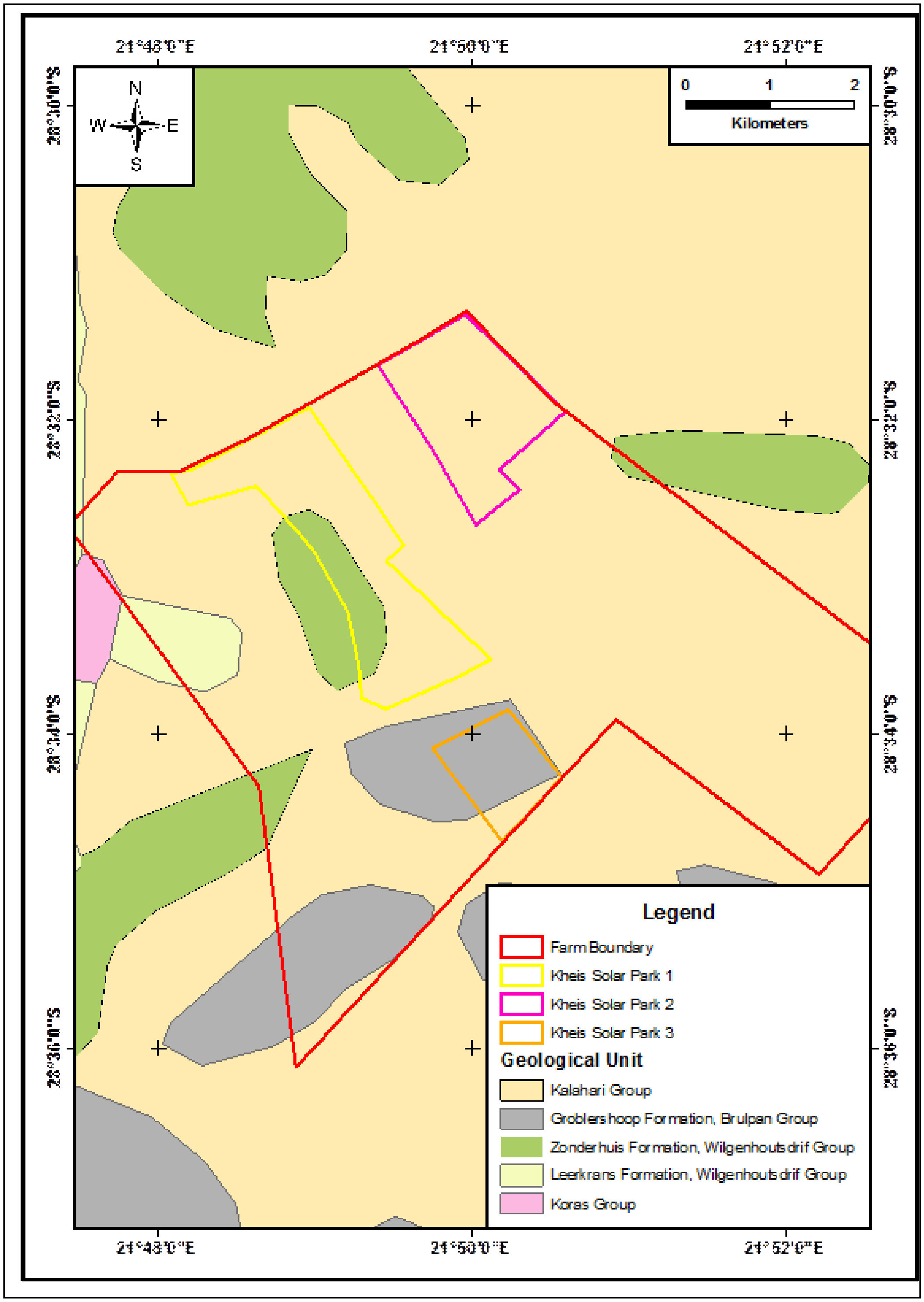


**Figure 5.2:** Map of the geology underlying the project area on farm Portion 7 and 9 of Portion 4 of the Farm Namakwari 656 and its surroundings

## 5.4 Conservation Planning - Critical Biodiversity Areas

The ZF Mgcawu District Municipality (formerly Siyanda District Municipality) has compiled an Environmental Management Framework (EMF), in which environmental concerns and conservation priorities for all landscapes within the municipality are listed and mapped. According to the EMF, the proposed project area does not fall within areas earmarked as being of conservation priority from a vegetation perspective (refer to Figure 5.3). Nevertheless, Bushmanland Arid Grasslands have been allocated a medium conservation priority, and Kalahari Karroid Shrubland a high conservation priority (Figure 5.3). This implies that despite the area not being earmarked for conservation in terms of the EMF, all care should be taken to disturb/break as little ground as possible.

Similarly, the proposed project area has been mapped as Zone 2 and Zone 7 in the EMF Environmental Control Zones (refer to Figure 5.4). These maps already indicate a relatively high biodiversity value of the plains. This implies that the proposed project area does have a medium conservation value due to species diversity over most parts, with portions of high conservation value areas. There is no specific restriction on development of the area, but areas that are more sensitive should be excluded from the development and the footprint area restricted as far as possible. The nearby Lower Gariep Alluvial Vegetation on the banks of the Orange River is regarded as a Critical Biodiversity.

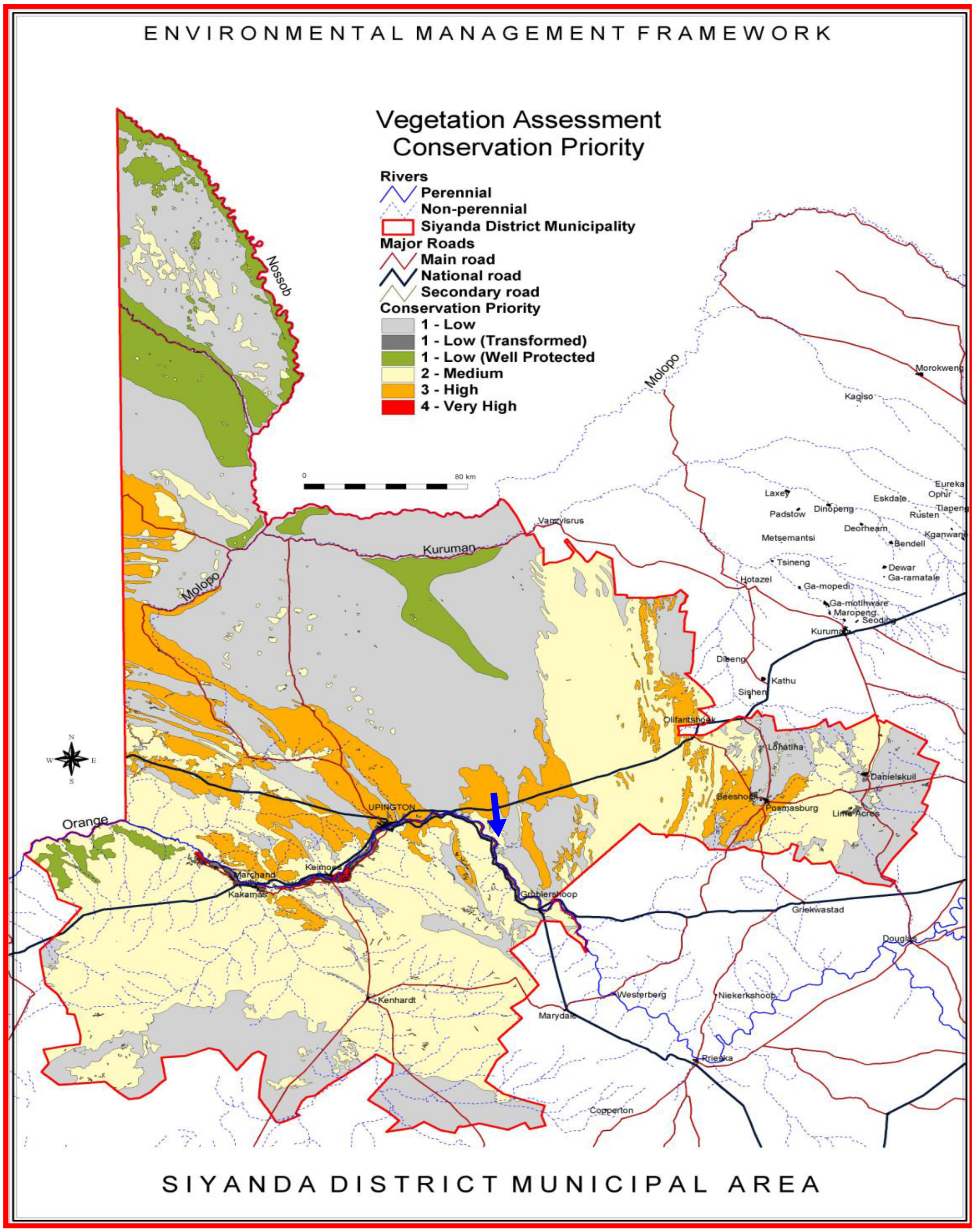


**Figure 5.3:** Map from the ZF Mgcawu EMF showing the conservation priorities for the vegetation types. The proposed development (blue arrow) falls in a low conservation value

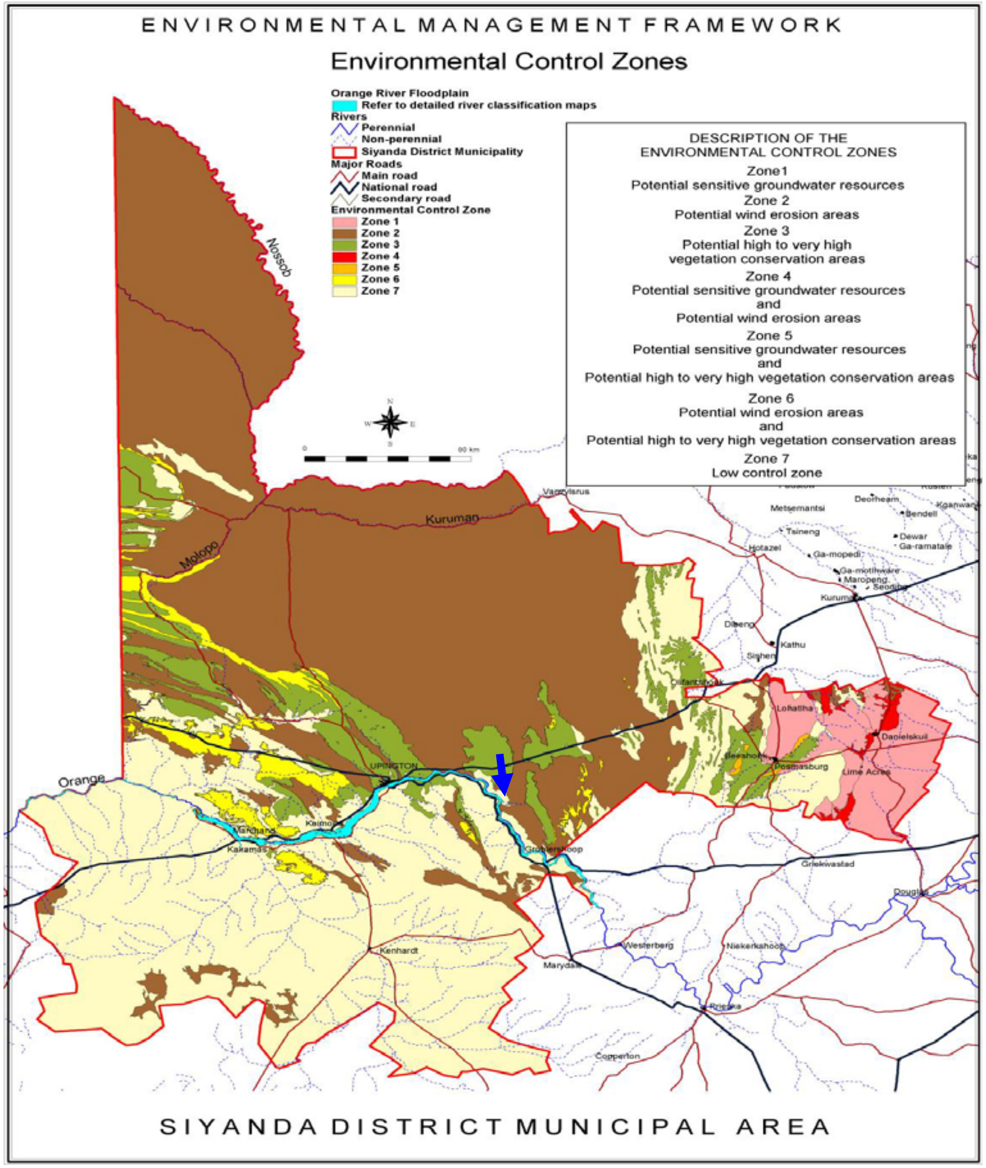


**Figure 5.4**: Map from the ZF Mgcawu EMF showing the environmental control zones. The approximate proposed development location is indicated by the blue arrow.

## 5.5 Land Cover / Land-Use

Land use activities (depicted in Figure 5.5) within the broader region are predominantly concentrated along the Orange River and include vineyards and wine production. This area is home to some of the most awarded wine producers in the country. Further afield from the Orange River, the intensity of land use activities decreases dramatically. Large tracts of natural land, generally described as the southern Kalahari, are mainly utilised for sheep, cattle and game farming. The current land-use for the proposed development site is cattle farming. No formally protected areas or major tourist attractions/destinations were identified within the study area, but the region has a number of smaller guest lodges and tour operators (e.g. Duin-in-die-Weg Lodge and FM Safaris) located within a 5km radius of the proposed PV development site. At the public meeting, some of the locals mentioned that tourism development/ projects are planned in the area of the Kheis Solar Park facilities. The proposed site is located in an area that has a distinct rural and natural character, with very little development in close proximity to the site. Exceptions occur where the Garona-Gordonia No.1 132kV power line traverses the site and some mining/quarrying activity located just north-west of the site. Other than these built structures or activities, most of the developments or activities within the region are concentrated along the Orange River.

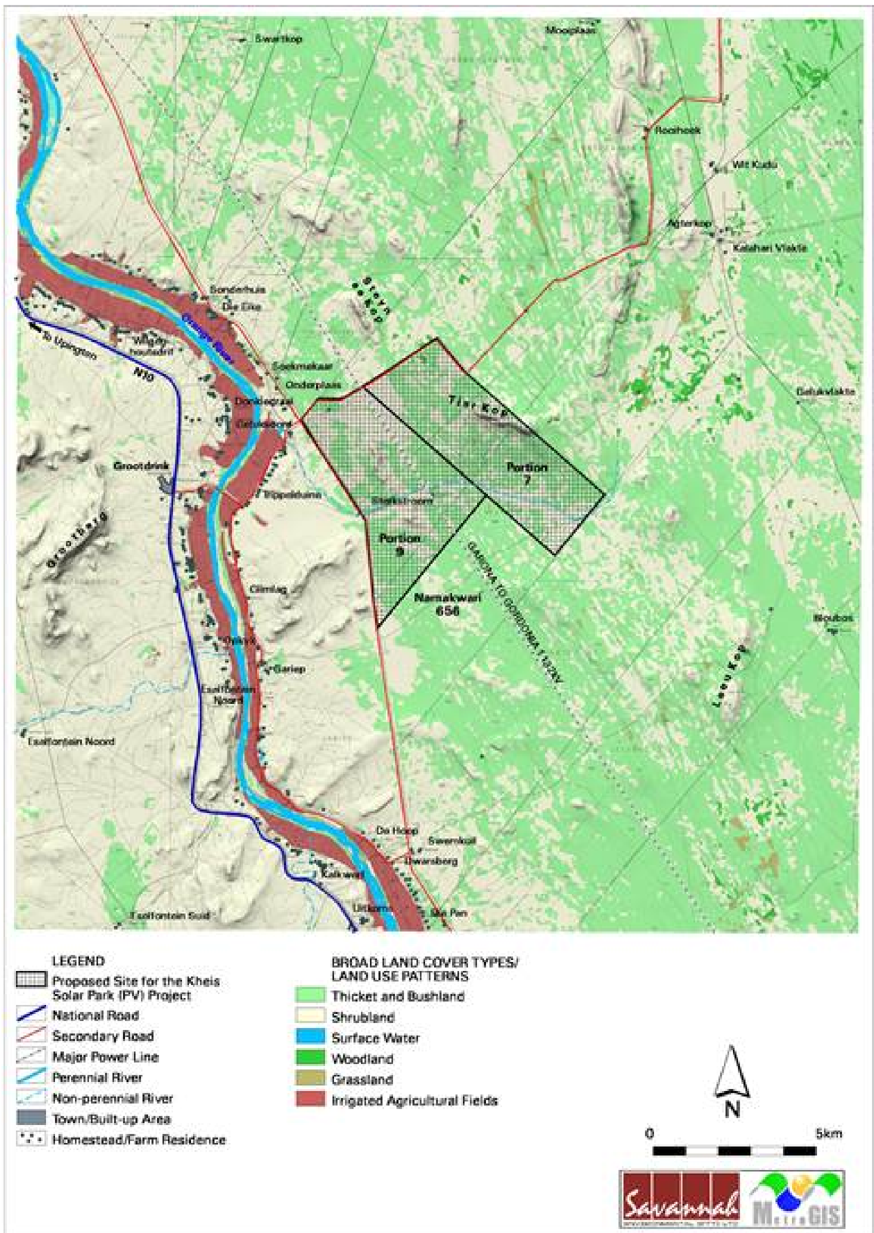


**Figure 5.5:** Land cover & broad land use patterns for the study area.

## 5.6 Access

Access to the proposed development area is afforded by a secondary (gravel) road that bridges the Orange River from the N10 national road near Grootdrink or alternatively from the N14 into the Loop 16 (gravel), from which direct access to the site can be obtained.

## 5.7 Flora

The study area for the Kheis Solar Park is located in an area characterised by Lower Gariep Broken Veld (NKb 1), Bushmanland Arid Grassland (NKb 3), Gordonia Duneveld (SVkd 1) and fractions of the Kalahari Karroid Shrubland (NKb 5). These are shown on Figure 5.6. Riparian vegetation occurs on the banks of small ephemeral water washes that drain into the nearby Orange River west of the study area. Only the vegetation along the Orange River itself is currently regarded as a threatened ecosystem, and may be impacted indirectly if impacts of the proposed development are not adequately mitigated. Three vegetation associations could be identified during site investigation namely:

» Association 1: *Leucosphaera bainesii – Zygophyllum dregeanum* calcareous low shrub plains occupy most of the developable parts of the study area. Species composition is very diverse, with forb and low shrub dominating most areas.
» Association 2: *Acacia erioloba – Centropodia glauca* duneveld occupies most of the eastern land portion. Interdunal plains, dune slopes and dune crests all have a few unique plant species, but generally the vegetation consist of open to slightly closed savanna with a strong perennial grass layer.
» Association 3: *Rhigozum trichotomum – Stipagrostis ciliata* mixed shrub occur as a transition between the calcareous plains and dune fields. More surface sand creates a more favourable environment for perennial grasses, but soil depth is restricted by underlying calcrete, and therefore the density of large trees is considerably lower than on the duneveld.

All the proposed Kheis Solar Projects are located in vegetation unit 1 and 2, which if of a much lower sensitivity than vegetation unit 3

Current levels of alien invasive species are low on the farm portions. The most common alien species observed were *Prosopis glandulosa* and *P. velutina*. Outside the study area, along major transport routes, several *Opuntia* species were observed, as well as *Salsola kali* and *Argemone ochroleuca*. There is a high risk of invasion of these and other alien invasive species onto the property and development area during and after construction, necessitating regular monitoring and eradication of such species as soon as observed.

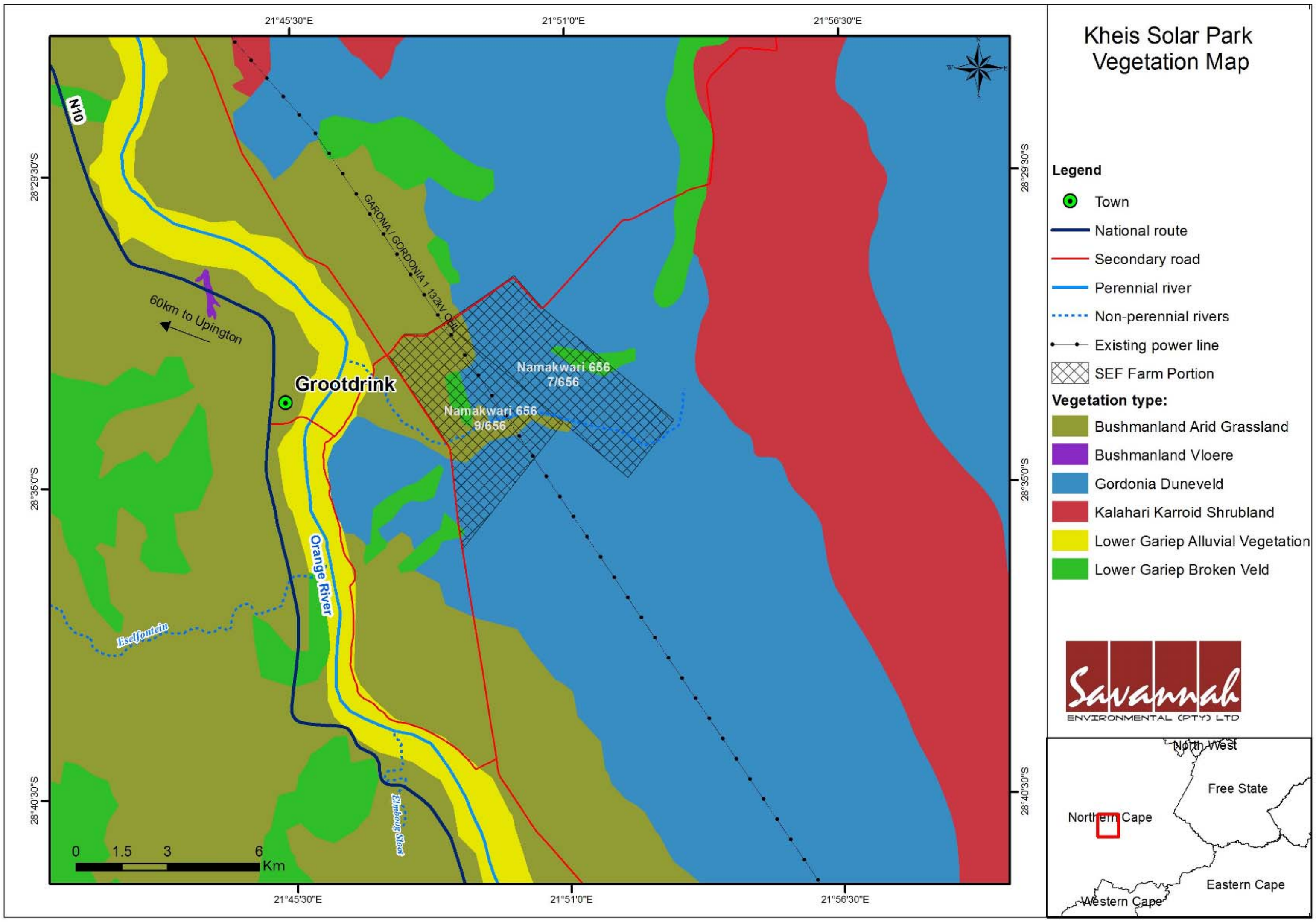


**Figure 5.6:** Map of the vegetation types as defined by Mucina and Rutherford (2006) on and around the proposed project area

#### *5.6.1. Plant species of Conservation Concern*

The following red data species have been recorded from the area (Grid 2821) according to the red data species list of SANBI and the ADU database:

**Table 5.2**: Red data species according to the red data species list of SANBI and the ADU database

| Species | RD Status |
|---|---|
| *Acacia erioloba* | *Declining, P* |
| *Boophone disticha* | *Declining, P* |
| *Crinum bulbispermum* | *Declining, P* |
| *Drimia sanguinea* | *Near Threatened (NT), P* |
| *Dinteranthus wilmotianus* | *Near Threatened (NT), P* |
| *Haworthia venosa subsp. venosa* | *Vulnerable VU, 2, end* |
| *Hoodia gordonii* | *Data Deficient - Insufficient Information, P* |
| *Hoodia officinalis subsp. officinalis* | *Near Threatened, P* |
| *Senecio monticola* | *Data Deficient Taxonomically Problematic* |
| *Senecio trachylaenus* | *Data Deficient Taxonomically Problematic* |

The following plants encountered on the study site are protected (see Figure 5.7):

» **NCNCA: Specially Protected Species – Schedule 1**
  - *Hoodia gordonii*

» **NCNCA: Protected Species – Schedule 2**
  - *Acacia erioloba*
  - *Acacia haematoxylon*
  - *Adenium oleifolium*
  - *Aloe claviflora*
  - *Anacampseros filamentosa*
  - *Avonia albissima*
  - *Boophane disticha*
  - *Boscia albitrunca*
  - *Boscia foetida*
  - *Cynanchum orangeanum*
  - *Euphorbia rudis*
  - *Euphorbia spinea*
  - *Lapeirousia sp*
  - *Moraea sp*
  - *Ruschia spinosa*

» **National Forest Act (Act No. 84 of 1998)**

- *Acacia erioloba*
- *Acacia haematoxylon*
- *Boscia albitrunca*

**Figure 5.7**: Some of the protected plants: *Hoodia gordonii* (top), *Anacampseros filamentosa* (bottom left), and *Euphorbia rudis* (bottom right).

## 5.8 Fauna

The study area was investigated during the vegetation survey for signs or the presence (observations) of amphibians, reptiles, and mammals. Most of the burrowing species recorded occurred on and around the duneveld areas and plains with deeper sandy soils. Species and signs of such sighted during the survey on and in the vicinity of the study area were the following:

» Cape Hare (*Lepus capensis*)
» Springhare (*Pedetes capensis)*
» Gerbils (possibly *Gerbillurus paeba)*
» Signs of Porcupine (*Hystrix africaeaustralis)*
» Cape Ground Squirrel (*Xerus inauris*)
» Suricates (*Suricata suricatta)*
» Common duiker (*Sylvicapra grimmia*)
» Common Barking Gecko (*Ptenopus garrulus* subsp. *garrulus*)
» Skink species (identification not established)
» Sandsnake (*Psammophis* species)

The following animals encountered on the study site are protected:

- **NCNCA: Specially Protected Species – Schedule 1**
  - Social Weavers and their nests
- **NCNCA: Protected Species – Schedule 2**
  - Cape Hare (*Lepus capensis*)
  - Porcupine (*Hystrix africaeaustralis)*
  - Cape Ground Squirrel (*Xerus inauris*)
  - Yellow Mongoose (*Cynictis penicillata*)
  - Steenbok (*Raphicerus campestris*)
  - Common duiker (*Sylvicapra grimmia*)

Additionally, Ostrich (a breeding pair), social weavers, and the Southern Pale Chanting Goshawk were observed. Whilst fauna species are mobile and the impact of new structures does not destroy animals as it does plants, they do depend on specific habitats. One example are the social weavers – although not specifically studied as part of this survey, the presence of large nests was noticed in large *Acacia erioloba* trees in most of the riparian areas. These nests may only be removed with a permit and by a specialist, whilst *Acacia erioloba* is also protected. Another example would be the tree mouse (*Thallomys paedulcus*), which is expected to occur in the area but needs large trees with holes to build its nests, and feeds on fruit and young shoots of tree and shrub species found in the riparian woodlands.

A full list of vertebrate species that could occur in the study area according to the ADU and SANBI databases, as well as Apps (2000) is presented in **Appendix E** – ecology report.

## 5.9 Soils

There are three land types across the extent of the site (refer to Figure 5.8), and can be described as follows for each project:

- Kheis Solar Park 1 development footprint is located on the Af7 and a small portion on Ag4 soil types.
- Kheis Solar Park 2 and 3 development footprints entirely located on the Af7 type.

Soils across the Af7 land type are moderately deep to deep, red, very sandy soils of the Hutton soil form. The Ag4 land type includes very similar soils to Af7, but it also includes over 48% of its surface area, much shallower soils on underlying rock and rock outcrops.The field data confirms that soils are very uniform red sands across the development footprint, with calcrete occurring in places. The underlying geology is metamorphic rocks of the Namaqualand Metamorphic Complex, with unconsolidated, sandy, superficial deposits of Tertiary to Recent age.

Land capability is the combination of soil suitability and climate factors. Most of the site has a land capability classification, on the 8 category scale, of: Class 7 - non-arable, low potential grazing land. The mountain features are classified as Class 8 - non-utilisable wilderness. The limitations to agriculture are aridity and lack of access to water and the very low clay content of the soil, which limits its water and nutrient holding capacity. The land has a low to moderate water erosion hazard (class 5), although the steeper slopes of the mountain features have higher erosion hazard (class 6). The susceptibility to wind erosion of most of the site is high due to the sandy texture of the soil.

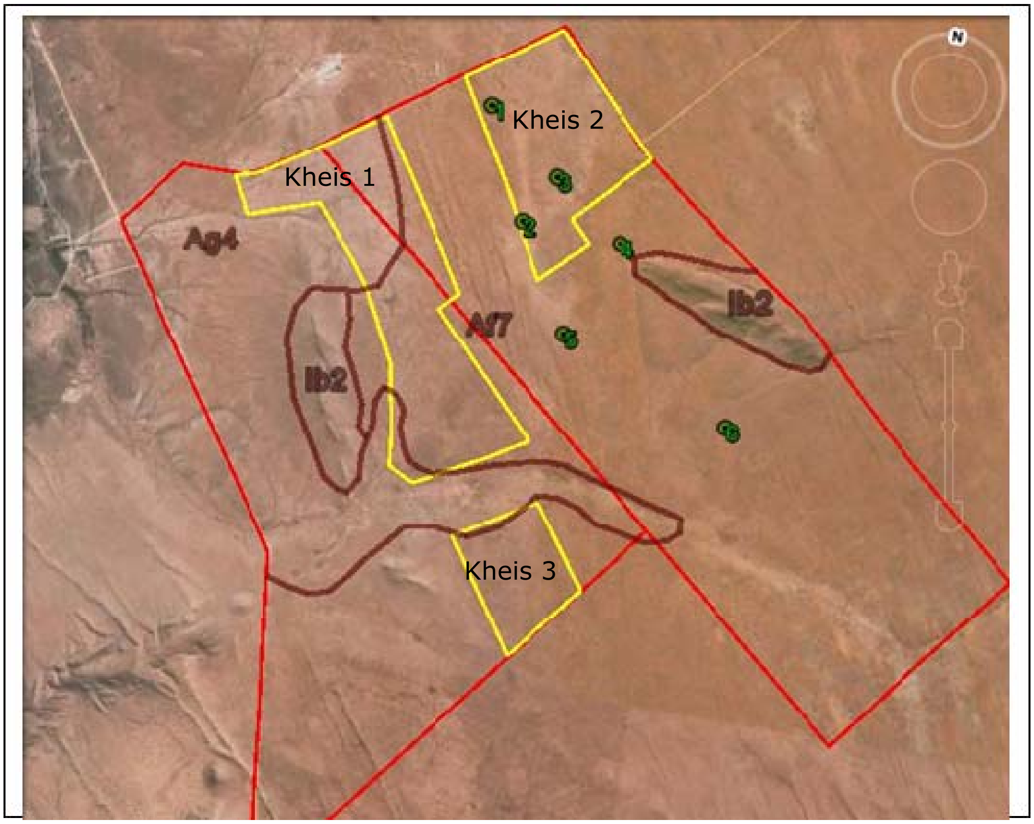


**Figure 5.8:** The distribution of the different land types across the proposed site on farm Portion 7 and 9 of Portion 4 of the Farm Namakwari 656

## 5.10 Agricultural Potential

Predominantly as a result of the aridity constraints in the area, but also because of poor soils, agricultural land use on the site is restricted to low intensity grazing only. The natural grazing capacity is low, being 40-60 hectares per large stock unit over most of the site, but may be slightly higher in places. Agricultural potential is fairly uniform across the farm and the choice of placement of the facility on the farm therefore has minimal influence on the significance of agricultural impacts.

No agriculturally sensitive areas occur within the proposed development footprint. The farm is located within a sheep farming agricultural region, but currently cattle are being grazed on the site. There has never been any cultivation or irrigation on the site. The only agricultural infrastructure at the solar site is fencing into camps and stock watering points.

### 5.11 Water Resources

Ephemeral[10] drainage lines and perennial rivers are of specific importance to a variety of Red Data species in this arid area. The perennial Orange River is situated approximately 3 km south-west at the closest point to the proposed development sites. This perennial river together with its surrounding vegetation are regarded as Critical Biodiversity Areas, which have a high conservation priority.

Several ephemeral drainage lines exist within the study area, of which most are relatively insignificant. The larger drainage channels lack a clear water-deposited (fluvial) sand bed and are rather filled with aeolian sands. This indicates that floods in these drainage lines are extremely rare and limited to events such as cloudbursts only, as rainfall will rapidly seep into the sands of the dunes and sandy plains rather than form a lot of runoff. However, subterrestrial water seepage will occur in these drainage lines, supporting the generally much higher trees or denser shrubs. The larger drainage lines are corridors for seed transfer and fauna movement, In the broader study area, large *Acacia erioloba* trees on the banks of these rivers are preferred nesting sites for sociable weavers.

### 5.12 Heritage Resources

Based on previous experience, it was predicted (Morris 2013) that the terrain was likely not to be rich in archaeological traces of major significance, although significant sites may occur at or near features such as hills and watercourses, as well as on the dunes. The latter features were largely excluded (based on other environmental studies) from the development area which consists of flat plains either side of the power line running north-west to south-east through Groot Drink, Sterkstroom and Achterkop [11]farm (refer to Figure 5.9).

Generally very low densities of essentially isolated stone artefacts were found in all areas, with exceptions occurring in locales where tillite is exposed at the surface (addressed in terms of the following prediction). Similar terrain in the region has minimal Stone Age traces comprising generally widely

10 An ephemeral waterbody is a wetland, spring, stream, river, pond or lake that only exists for a short period following precipitation or snowmelt. They are not the same as intermittent or seasonal waterbodies, which exist for longer periods, but not all year round.

11 Some portions of these farms have and have been compined to Portion 7 and 9 of the Farm Namakwari 656.

scattered/isolated stone artefacts mainly based on jaspilite (banded ironstone) sourced from the banks and terraces of the Orange/Gariep River, these where local sources of Dwyka tillite occur, these may have served as raw materials often drawn upon in Pleistocene times.

This prediction holds for a limited area where relatively plentiful raw material is available in a gravel/tillite on higher ground just to the north west of the Sterkstroom farm yard. In the scoping phase of the study it was further predicted that there appear not to be colonial era built environmental features in the areas of the proposed solar development, except at the farm Sterkstroom, where it might also be expected that there could be farm graves. Nineteenth- and twentieth-century cultural history and intangible heritage values attached to places may be difficult to recover owing to the sparse population. No colonial era built environment features were found except in the vicinity of the Sterkstroom farmstead, which is in a state of ruin. An ash midden was found with indications of last occupancy in at least the late twentieth century. No graves were found in the vicinity.

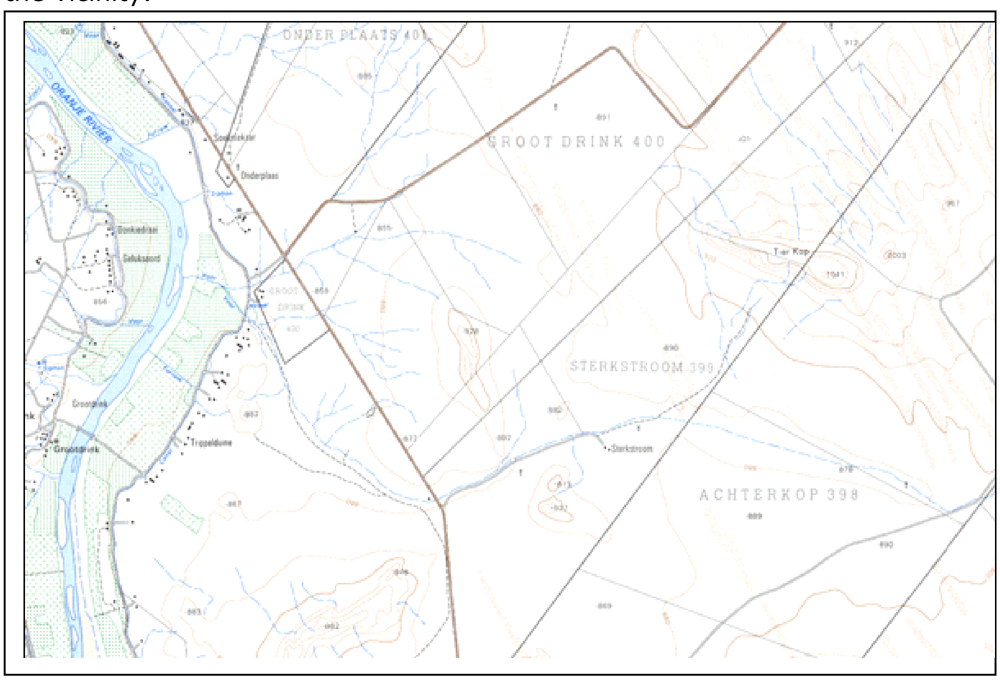


**Figure 5.9**: Extract from 1:50 000 sheet 2821DB indicating the farms Grootdrink, Sterkstroom and Achterkop across which the proposed development spans

## 5.13 Palaeontology

The three projects (Kheis Solar Parks 1, 2 and 3) are variously underlain by metamorphic rocks of the Zonderhuis and Groblershoop Formations (Kaaien Terrane of the Namaqua-Natal Province). The metamorphic bed rocks are capped by unfossiliferous calcrete, which is itself overlain by potentially fossiliferous aeolian sands of the Gordonia Formation. Gordonia Formation as no fossil materials was identified during the site visit. The calcrete as well as the Zonderhuis and Groblershoop Formations are considered to be unfossiliferous.

## 5.14 Visual Quality of the Study Area

The natural vegetation or land cover types of the region are described as *Thicket and Bushland* (mainly east of the Orange River) and *Shrubland* west of the river. Vegetation cover along the Orange River floodplain has largely been replaced by cultivated fields (primarily vineyards) with limited patches of *Lower Gariep Alluvial Vegetation* still remaining (Figure 5.10 and 5.11). The site itself is located within vegetation types identified as *Gordonia Duneveld* and *Bushmanland Arid Grassland*. The higher lying areas (ridges and hills) are indicated as *Lower Gariep Broken Veld.* Farm settlements or residences are predominantly concentrated within the town of Grootdrink and along the Orange River, with a limited number of homesteads located further afield. Some of these, in close proximity to the proposed development site, include: *Soekmekaar*, *Onderplaas*, *Donkiedraai*, *Geluksoord*, *Trippelduine*, *Glimlag*, *Gariep*, etc. The average population density of the region is considered to be very low and is indicated as approximately 2.5 people per km$^2$. The topography or terrain morphology of the region is broadly described as Dune Hills and Lowlands (to the east), Extremely Irregular Plains (along the Orange River) and Hills (Grootberg, Tierkop, Leeukop, Steyn se Kop, etc.), as shown on Figure 5.1 (Shaded Relief/Topography).

**Figure 5.10:** Shrubland vegetation within the study area.

**Figure 5.11**: Vineyards and agricultural activities along the Orange River.

## 5.15 Socio-Economic Environment

The Northern Cape Province is administratively divided into five District Municipalities, namely: Namakwa, Pixley Ka Seme, John TaoloGaetsewe, Frances Baard and ZF Mgcawu District Municipality (formerly Siyanda). The proposed development falls within the ZF Mgcawu District Municipality and specifically the Kheis Local Municipality. The following gives an overview of the population demographics in the ZF Mgcawu District (referred to as Siyanda DM in the tables) as derived from Census 2011 statistics. Local municipal demographics could not be verified at the time of publication.

**Population:** Black African and Coloured population groups constitute the majority in the Province, with disparities across Districts. The Black African population group has increased while the White population declined over time. Afrikaans is the main language spoken, followed by Setswana. There is consistent decline in the proportion of the population aged 0-14 years and an increase in the proportion of the population aged 15-64 and 65+ in the Province over time. In short, the average population for the area is aging. Although all indicators show that the proportion of the population with no schooling has declined across all the Districts, the percentage of people who completed Grade 12 is still relatively low

**Employment and Income distribution:** The Northern Cape has the third highest per capita income of all nine Provinces; however, income distribution is extremely skewed, with a high percentage of the population living in extreme poverty. The 2001 census showed that 55.5 % of the economically active population in the Northern Cape were employed while 26.1 % could not find employment. Approximately 45 % of the potential labour force of the province is younger than 30 years. Unemployment is the highest among the youth, with unemployment rates of 54 % and 47% in the 15-19 and 20-24 year-old age groups respectively. A large number of residents are dependent on government pensions, implying that a large part of the residents of Kheis earn less than R

2000-00 per month and that in itself has a negative influence on the payment of services. In total 81% of Communities are subsidised by the services subsidy scheme. According to the Environomics (2008) the high incomes (above R 50 000 per month) were then also limited to less than 200 people. The Human Development Index (HDI) represents the life expectancy, adult literacy, GDP per capita (adjusted for real income) and education attainment of a specific area. The HDI of the Northern Cape as a whole is 0.58 which is substantially below the South African figure of 0.72. The areas of lowest Human Development Index include the South Eastern region (Noupoort and Richmond). Table 10 shows the unemployment rate in the Northern Cape, and specifically the ZF Mgcawu District was highest in 2001, with a positive trend in 2011.

From 2001 to 2011 there was an increase in average household income across the Districts. Agriculture (skilled) work contributes to 10% of the occupation. A large proportion (87%) of people earns R800 per month or less. Reading these trends in conjunction with the abovementioned unemployment rates provides a better understanding of the actual poverty level within the region. A notable portion of the population who indicated that they are employed, earn a nominal income, with which they often have to support a large number of dependants. The fact that the majority of local population is searching for employment opportunities is relevant to this study and specifically the Kheis Solar Park projects.**Economic context:** Some of the key development priorities of the Province are Agriculture, Mining, Manufacturing and Tourism. Due to its extensive landscape and climate, the economy revolves around extensive animal farming (sheep, game and boerbok), dried-fruit industries and wine-making. The fast diminishing subsistence diamond mining and the resultant growing unemployment have effectively turned some small towns into welfare neighbourhoods; with many people depending on state grants for survival (refer to 5.12 below).

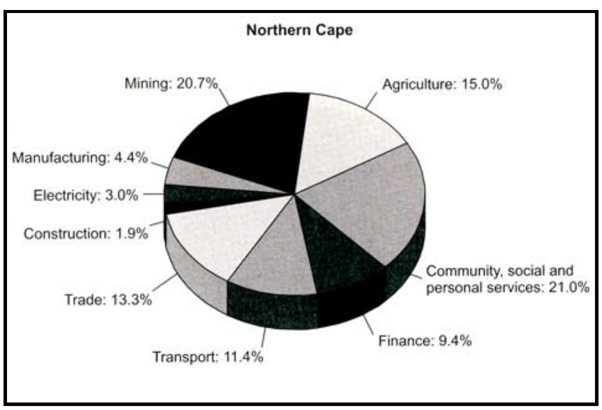


**Figure 5.12:** GGP Northern Cape 2005

**Tourism:** According to the Northern Cape Growth and Development Strategy 2012-2017, the Province is successful in the foreign markets, attracting 7.2 % of

French visitors, 7.9 % of German visitors and 8% of Dutch visitors to in 2009. Travel, leisure and tourism have emerged as drivers to a "new economy" based upon services.

The Northern Cape has set a specific vision for the tourism sector:
"*To be the preferred adventure and ecotourism destination in South Africa that is recognized for its cultural heritage and special interest tourism offering through the responsible development of natural and cultural resources*" as well as key objectives that support the 2015 vision of the Northern Cape. Considering that renewable energy forms part of the educational ambition to develop a sustainable future for the country and the rest of the world, the tourism industry could benefit from the development of solar energy in the area.

Kheis Municipal Area witnesses several native groups, stretching out across the area. Groups like the San, Korannas, Griekwas, Twanas, Coloureds, Whites and Xhosas, migrated across the area and settled within the area, at one or other time in the past. These groups each have their own culture. The opportunity exists to utilise these cultural treasures to draw tourists to the area.

In summary Kheis Municipal Area has the following characteristic:

» Low levels of education and skills (more than 50% having only primary school or no education)
» Low incomes with high dependency on social grants
» High levels of unemployment (relative to national levels)
» Out-migration of youth for employment elsewhere
» Disparity between the rich and the poor
» HIV/AIDS and alcohol abuse are key health concerns
» Petty crime linked to alcohol and substance abuse is prevalent
» Dominant extensive agricultural sector
» Potential for growth in tourism, which is currently struggling
» Good roads network with a lack of public transport in rural areas

Some communities struggle with access to basic services

## 5.16 Description of the Environment - Summary of the Environmental & Social characteristics of the three project development phases

Table 5.3 provides a summary of the environmental and social characteristics of Kheis Solar Park PV facility 1, 2 and 3.

**Table 5.2:** Summary of the Environmental and Social characteristics of the three Kheis projects

| Environmental Characteristics | Kheis Solar Park 1 | Kheis Solar Park 2 | Kheis Solar Park 3 |
|---|---|---|---|
| 1. Land Use | » Grazing land (livestock) | » Grazing land (livestock) | » Grazing land (livestock) |
| 2. Land Capability | » The area is within an arid environment and therefore agricultural potential and capability is low | » The area is within an arid environment and therefore agricultural potential and capability is low | » The area is within an arid environment and therefore agricultural potential and capability is low |
| 3. Climate | » Arid | » Arid | » Arid |
| 4. Topography | » 1130m on top of the Grootberg hill and the hills located to the north-east, to 830m along the Orange River floodplain<br>» The slope elevation of the site itself is generally quite flat, with the exception of the Tierkop hill along the north-eastern boundary of Portion 7 and the smaller unnamed hills in the centre of Portion 9 | » 1130m on top of the Grootberg hill and the hills located to the north-east, to 830m along the Orange River floodplain<br>» The slope elevation of the site itself is generally quite flat, with the exception of the Tierkop hill along the north-eastern boundary of Portion 7 | » 1130m on top of the Grootberg hill and the hills located to the north-east, to 830m along the Orange River floodplain<br>» The slope elevation of the site itself is generally quite flat, with the exception of the small unnamed hills in the centre of Portion 9 |
| 5. Hydrology, Riparian Zones and Watercourses | » Small ephemeral drainage lines that drain into the Orange River (approximately 1 km from the Orange River) | » Small ephemeral drainage lines that drain into the Orange River (approximately 1 km from the Orange River) | » Small ephemeral drainage lines that drain into the Orange River (approximately 1 km from the Orange River) |
| 6. Conservation Planning | » Bushmanland Arid Grasslands have a medium conservation priority, but proposed project area does not fall within areas earmarked for conservation.<br>» The Lower Gariep Alluvial Vegetation which occurs on the banks of the Orange River (~1km from the Kheis 1site) is | » Bushmanland Arid Grasslands have a medium conservation priority, but proposed project area does not fall within areas earmarked for conservation.<br>» The Lower Gariep Alluvial Vegetation which occurs on the banks of the Orange River (~1km from the Kheis 2 site) is | » Bushmanland Arid Grasslands have a medium conservation priority, but proposed project area does not fall within areas earmarked for conservation.<br>» The Lower Gariep Alluvial Vegetation which occurs on the banks of the Orange River (~1km from the Kheis 3 site) is |

| Environmental Characteristics | Kheis Solar Park 1 | Kheis Solar Park 2 | Kheis Solar Park 3 |
|---|---|---|---|
| | regarded as a Critical Biodiversity Area, of which remaining sections have been listed as threatened ecosystems | regarded as a Critical Biodiversity Area, of which remaining sections have been listed as threatened ecosystems | regarded as a Critical Biodiversity Area, of which remaining sections have been listed as threatened ecosystems |
| 7. Land Types | » Ag4 occupies the lower lying land<br>» Af7 the higher lying flat land | » Af7 the higher lying flat land | » Ag4 occupies the lower lying land<br>» Af7 the higher lying flat land |
| 8. Agricultural Potential | Low | Low | Low |
| 9. Vegetation types | » Bushmanland Arid Grassland, Lower Gariep Broken Veld and Gonia Duneveld<br>» All three vegetation types are regarded as least threatened. | » Gonia Duneveld (SVkd 1).<br>» Regarded as least threatened. | » Bushmanland Arid Grassland (Nkb 3),) and Gonia Duneveld (SVkd 1).<br>» Both vegetation types are regarded as least threatened. |
| 10 Heritage and Palaeontology | Unfossiliferous calcrete, Zonderhuis and Groblershoop Formations | Unfossiliferous calcrete, Zonderhuis and Groblershoop Formations | Unfossiliferous calcrete, Zonderhuis and Groblershoop Formations |
| 11 Social Characteristics | » Low levels of education and skills (more than 50% having only primary school or no education)<br>» Low incomes with high dependency on social grants<br>» High levels of unemployment (relative to national levels)<br>» Out-migration of youth for employment elsewhere<br>» Disparity between the rich and the poor<br>» HIV/AIDS and alcohol abuse are key health concerns<br>» Petty crime linked to alcohol and substance abuse is prevalent<br>» Dominant extensive agricultural sector<br>» Potential for growth in tourism, which is currently struggling<br>» Good roads network with a lack of public transport in rural areas<br>» Some communities struggle with access to basic services | | |

# ASSESSMENT OF POTENTIAL IMPACTS: KHEIS SOLAR PARK 1 CHAPTER 6

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the development of the proposed Kheis Solar Park 1 and associated infrastructure (refer to **Figure 6.1**). This assessment has considered the construction of a 75 MW facility and all related and ancillary infrastructure, including:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings.
» Cabling between the structures, to be lain underground where practical.
» Central invertor/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
» An on-site substation (50m x 50m) and power line (100m) to evacuate the power from the facility into the Eskom grid via the existing Garona-Gordonia 132kV power line that traverses the site (Portion 9 of Portion 4 of the Farm Namakwari 656)
» Internal access roads (5m wide).
» Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity (approximate footprint (±100 m²)

The proposed Kheis Solar Park 1 will have a development footprint of approximately 280 ha. The development of the facility will comprise the following phases:

» *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of the access road, electricity generation infrastructure, power line servitudes, construction camps, laydown areas, transportation of components/construction equipment to site; and undertaking site rehabilitation including implementation of a storm water management plan. The construction phase for the Kheis Solar Park 1 is expected to take approximately 16 months.
» *Operation* – will include operation of the facility and the generation of electricity which will be fed into the national grid via the on-site substation and an overhead powder line. The operational phase of the Kheis Solar Park 1 is expected to extend in excess of 20 - 25 years.

» *Decommissioning* – depending on the economic viability of the plant, the length of the operational phase may be extended. Alternatively decommissioning will include site preparation; disassembling of the components of the facility; clearance of the site and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to construction. Therefore, these impacts are not considered separately within this chapter.

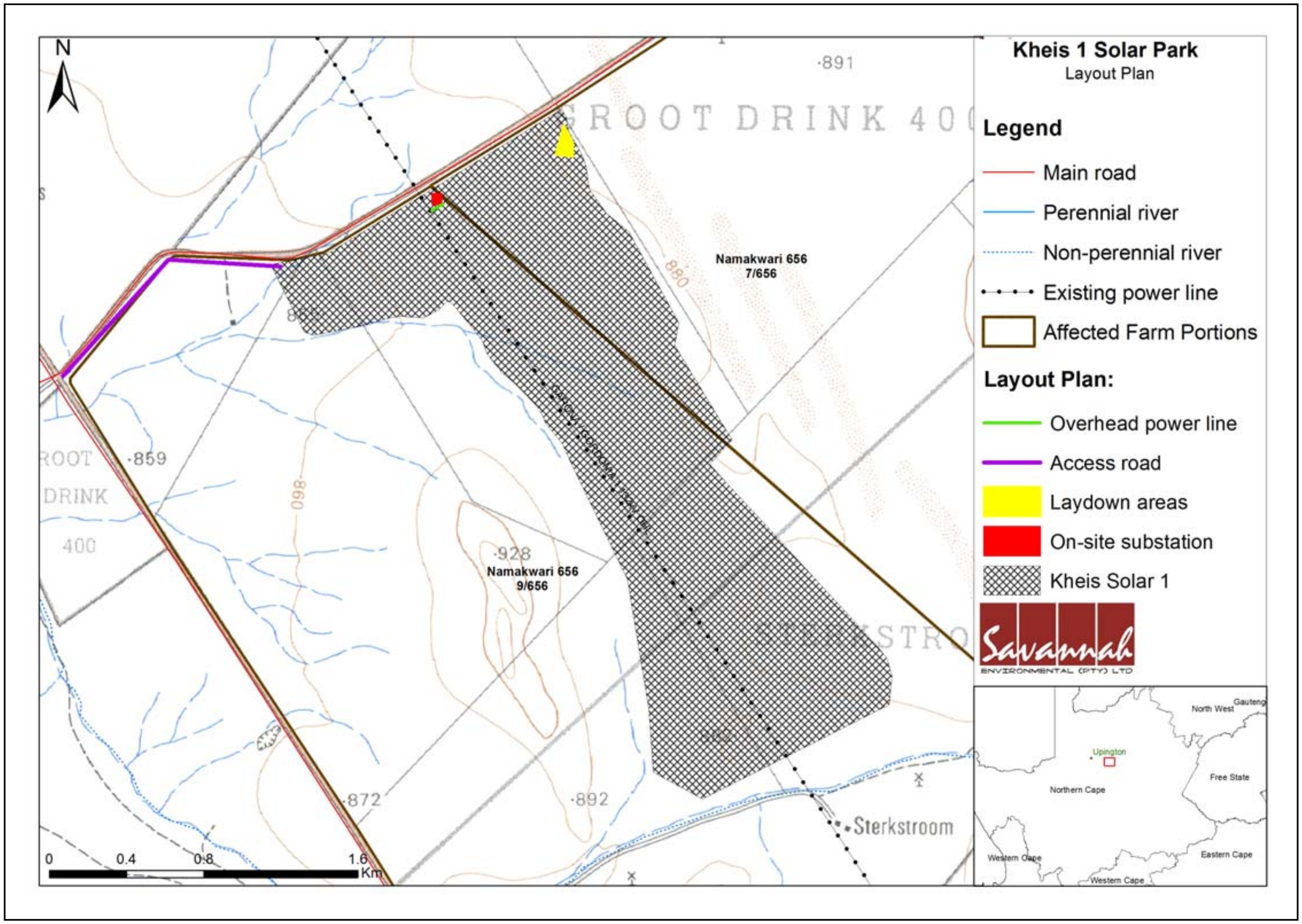


**Figure 6.1:** Layout map showing Kheis Solar Park 1 of the proposed Kheis Solar Energy Facility and associated infrastructure on Portion 7 and 9 of Portion 4 of the Farm Namakwari 656

## 6.1. Alternatives Assessment

### *Technology Alternatives*

Impacts on the environment associated with the project will be influenced by the type of PV panel array to be used. PV technologies being considered for the proposed project are fixed and tracking. As the panels will not differ in height with the two technologies under consideration, the most important differences in impact between the technologies relate to the ecological environment (Tsoutsos *et al*. 2005, Turney and Fthenakis 2011, Strohbach 2012) and are summarised in the table below:

Each of the impacts assessed below provides a comparative assessment of the two technology alternative.

## 6.2. Assessment of the Potential Impacts associated with the Construction and Operation Phases

The sections which follow provide a summary of the findings of the assessment of potential impacts associated with the construction and operation of the proposed Kheis Solar Park 1 facility on a development footprint of ~280ha on the identified site Portion 7 and 9 of portion 4 of the Farm Namakwari 646 (covering an area of 3600 ha in extent). The assessment of potential issues presented in this chapter has involved key input from specialist consultants, the public and the project developer. Issues were assessed in terms of the criteria detailed in Chapter 4 (section 4.3.3). The nature of the potential impact is discussed, and the significance is calculated with and without the implementation of mitigation measures. Recommendations are made regarding mitigation/enhancement and management measures for potentially significant impacts and the possibility of residual and cumulative impacts are noted. Cumulative impacts for Kheis Solar Park 1 are assessed in further detail in Chapter 7, as well as within the specialist studies contained in Appendix E

### *6.2.1. Potential Impacts on Ecology*

The study area is located in an area characterised by Lower Gariep Broken Veld (NKb 1), Bushmanland Arid Grassland (NKb 3), Gordonia Duneveld (SVkd 1) and fractions of the Kalahari Karroid Shrubland (NKb 5) as described by Mucina and Rutherford (2006). Riparian vegetation occurs on the banks of small ephemeral water washes that drain into the nearby Orange River west of the study area. Only the vegetation along the Orange River itself is currently regarded as a threatened ecosystem, and will only be impacted on if impacts of the proposed development are not adequately mitigated.

Vegetation units that could be identified within the Kheis Solar Park 1 site are listed below with their sensitivity and their sensitivity is mapped on Figure 6.2.

» Association 1: *Leucosphaera bainesii – Zygophyllum dregeanum* calcareous low shrub plains occupy most of the developable parts of the study area. Species composition is very diverse, with forb and low shrub dominating most areas.
  - Conservation value: Medium
  - Sensitivity: **Low**

» Association 3: *Rhigozum trichotomum – Stipagrostis ciliata* mixed shrub occur as a transition between the calcareous plains and dune fields. More surface sand creates a more favourable environment for perennial grasses, but soil depth is restricted by underlying calcrete, hence the density of large trees is considerably lower than on the duneveld.
  - Conservation value: Medium to high
  - Sensitivity: **Medium-High** (where the vegetation structure consists of open grassed areas interspersed with smaller groups of higher trees and shrubs) and **Medium-low** (where there is excessive disturbance from bush encroachment). NB: of Kheis Solar Park 1 falls within the Medium-low of this vegetation unit.

The duneveld, larger drainage channels, and outcrops should be treated as No Go Zones due to their high conservation value. Even on the undulating calcrete and sandy plains, ground disturbance should be minimised, and existing gravel roads and tracks used as far as possible to lower the extent of the footprint. These no-go and high sensitivity areas are not impacted by the facility as indicated in Figure 5.1.

Solar energy facilities require relatively large areas of land for placement of infrastructure. The proposed Kheis Solar Park 1 and associated infrastructure requires ~280ha for the establishment of the proposed panels and associated infrastructure. The main expected negative impact from an ecological perspective will be due to loss of vegetation, loss of species of conservation concern, and loss of habitat which may have direct or indirect impacts on individual species. Potential impacts and the relative significance of the impacts are summarised in the tables which follow (refer to **Appendix E - Ecology Report** for more details).

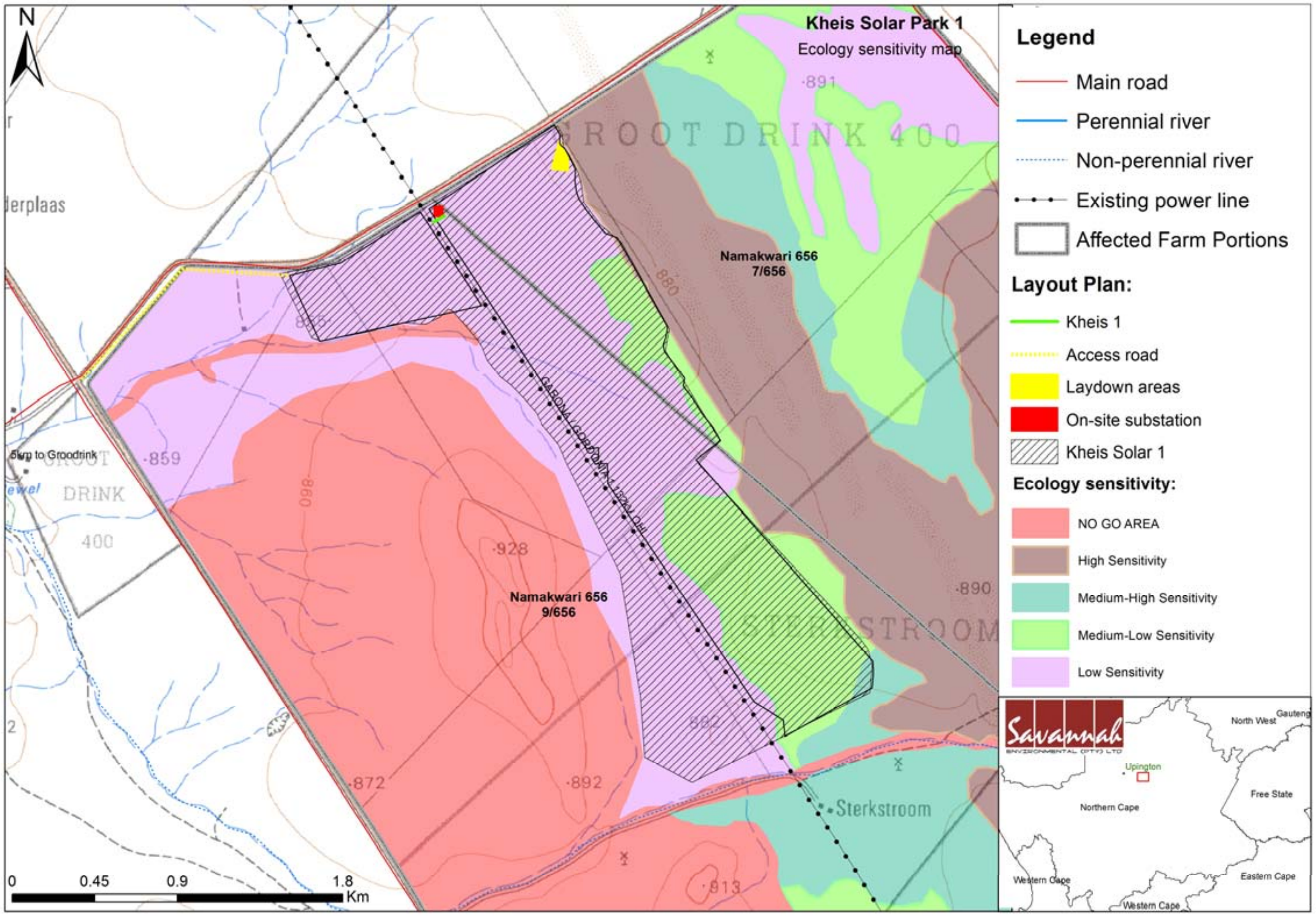


**Figure 6.2:** Sensitivity map indicating sensitive ecological areas within the proposed Kheis Solar Park 1 Facility and surrounding area

**a) Summary of ecological impacts associated with the proposed solar energy facility during the construction and operational phase**

<table>
<tr><td colspan="3">Nature: Upgrading and/or creation of site access and internal maintenance roads<br><br>Loss of vegetation, increase in runoff and erosion, possible distribution and increased establishment of alien invasive species, possible disturbance and reduction of habitat or injury to burrowing vertebrates, possible rise of road-kill incidences of fauna, possible change of natural runoff and drainage patterns, possible loss of protected species, possible permanent loss of revegetation potential of soil surface, increase in dust levels.<br><br>Note: relatively large access roads already exist on and to the land portion, as well as provide access to portion 7 and 9 of the Farm Namakwari 656.</td></tr>
<tr><td colspan="3">Listed activities:<br>GN 544 activity 11(x)(xi) & 18(i);<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i)</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent (E)</td><td>Local (2)</td><td>Local (1)</td></tr>
<tr><td>Duration (D)</td><td>Long-term (4)</td><td>Long-term (4)</td></tr>
<tr><td>Magnitude (M)</td><td>Low (4)</td><td>Minor (2)</td></tr>
<tr><td>Probability (P)</td><td>Definite (5)</td><td>Definite (5)</td></tr>
<tr><td>Significance<br>(S = E+D+M)*P</td><td>Medium (50)</td><td>Medium (35)</td></tr>
<tr><td>Status (positive, neutral or negative)</td><td>Negative</td><td>Negative<br>Notes: reduced impact on existing roads and tracks</td></tr>
<tr><td>Reversibility</td><td>Not reversible</td><td>Relatively reversible</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>Probable</td><td>Not likely</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Reasonably well</td></tr>
<tr><td colspan="3">Mitigation:<br>» Treat all outcrop areas and dunes as No-Go Zones<br>» Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains<br>* Ensure adequate drainage where ephemeral drainage lines crossed<br>* Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines<br>» Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:<br>* Protected geophytic and succulent plant species: must be relocated<br>* Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor<br>* Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so,</td></tr>
</table>

the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated
    * All social weavers nests that may be affected by the development must be moved by a qualified specialist or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
    * Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanisation

- During construction:
  - Create designated turning areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
  - Ensure that concrete, tar or other construction material is not spilled or discarded next to newly built roads or storm water structures, but disposed of at a designated area
- Keep the clearing of natural vegetation to a minimum
- Dust levels must be controlled and minimised
- If filling material is to be used, this must be sourced from discontinued mining areas on the adjacent property or other authorised and permitted sources
- Topsoil (the upper 25 cm of soil) is an important natural resource; where it must (and can) be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas
- Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated (erosion management plan required)
- Prevent leakage of oil or other chemicals or any other form of pollution, as this may infiltrate local groundwater reserves or end up in the Orange River where it can affect all downstream users
- Monitor the establishment of (alien) invasive species and remove as soon as detected, whenever possible before regenerative material can be formed
- Strictly enforce a speed limit of 30 km/hour on all construction and access routes as appropriate and limit driving to daytime hours to try and prevent collisions with fauna, especially nocturnal mammals
- After decommissioning, if access roads or portions thereof will not be of further use to the landowner, remove all foreign material and rip area to facilitate the establishment of vegetation, followed by a suitable revegetation programme

**Cumulative impacts:**

- Possible erosion of areas lower than the access road, possible contamination of groundwater reserves due to oil or other spillage
- Possible spread and establishment of alien invasive species
- Increased transformed areas (together with surrounding developments) that may affect local fauna and flora population dynamics and runoff patterns

**Residual impacts:**

- Localised loss of vegetation
- Altered topsoil conditions
- Potential barren areas remaining after decommissioning

» Potential for erosion and invasion by weed or alien species
» Potential for increased dust and its impact on surrounding environments and biodiversity

| | | |
|---|---|---|
| **Nature:** Fencing area – may also serve as fire-break and assumed to run alongside maintenance track<br><br>Loss of vegetation and specifically protected or red data species, window of opportunity for the establishment of alien invasive species, altered topsoil characteristics prone to capping and sheet erosion, increased runoff and storm water volumes, temporary disturbance of burrowing fauna, possible reduction of habitat and forage availability to terrestrial vertebrates<br><br>*Note: existing fencing already exists that restricts movement of larger terrestrial fauna, fencing areas will be re-aligned as necessitated by the development* | | |
| **Listed activities:**<br>GN 544 activity 11(x)(xi) & 18(i);<br>GN 546, 18 June 2010 activity 14(i) | | |
| | **Without mitigation** | **With mitigation** |
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Long-term (4) | Long term (4) |
| **Magnitude (M)** | Low (4) | Minor (2) |
| **Probability (P)** | Definite (5) | Highly Probable (4) |
| **Significance (S = E+D+M)*P** | **Medium (50)** | **Low (28)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Partially reversible | Reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |
| **Can impacts be mitigated?** | Reasonably well | |

**Mitigation:**

» Treat all outcrop areas and dunes as No-Go Zones
» Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains
  * Ensure adequate drainage where ephemeral drainage lines crossed
  * Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines
» Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
  * Protected geophytic plant and succulent species: must be relocated
  * Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor

- * Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated
- * All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
- * Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanization

» During construction: create designated turning areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
» During the design phase, the possible impact of burrowing vertebrates and rodents on the development must be determined, and fencing must be designed to either exclude such fauna if it will be detrimental or enable occasional migration of smaller vertebrates onto and across the site (which could be beneficial to small vertebrate populations)
» Minimise area affected, especially during construction
» During construction: strictly prohibit any off-road driving or parking of vehicles and machinery outside the footprint areas
» Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind
» Monitor the establishment of alien and indigenous invasive species and remove as soon as detected, whenever possible *before* regenerative material can be formed
» If the area will be used as a fire-break, maintain a suitably low grass layer by regular mowing or appropriate plant species selection, but do not leave soil bare. Alternatively, ensure that the soil has a covering of gravel or small rock that prevents erosion. The firebreak and fencing area must be kept clear of all weeds and indigenous invasive species to enable continued effective maintenance until decommissioning

**Cumulative impacts:**
» Possible erosion of cleared areas and associated accelerated erosion from surrounding areas
» Possible loss of ecosystem functioning due to increase in invasive species
» Increased habitat fragmentation and displacement of terrestrial vertebrates in the region

**Residual impacts:**
» Altered vegetation composition
» Compacted topsoils
» Possibility for erosion and invasion by alien invasives

**Nature:** Construction and operation of PV panels on natural vegetation within development footprint (**tracking panel option**)

Removal of or excessive damage to existing vegetation cover (approx. 3ha per MW). Loss of vegetation and/or species of conservation concern, loss of and alteration of many niche microhabitats, altered vegetation cover, site-specific altered distribution of rainfall and resultant runoff patterns, increase in runoff from PV panels and/or bare areas and accelerated erosion, loss of habitat and resource availability for terrestrial fauna, possible increase of storm water and dust effects during periods of extreme weather events, e.g.

<table>
<tr><td colspan="3">increased erosion or dust due to lower buffering capacity of sparser vegetation for the construction and operation of PV panels (tracking panel option).</td></tr>
<tr><td colspan="3">Listed activities:<br>GN 544 activity 11(x)(xi) & 18(i);<br>GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i)</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent (E)</td><td>Regional(3)</td><td>Local (2)</td></tr>
<tr><td>Duration (D)</td><td>Long-term (4)</td><td>Long-term (4)</td></tr>
<tr><td>Magnitude (M)</td><td>High (8)</td><td>Moderate (6)</td></tr>
<tr><td>Probability (P)</td><td>Definite (5)</td><td>Definite (5)</td></tr>
<tr><td>Significance<br>(S = E+D+M)*P</td><td>High (75)</td><td>Medium (60)</td></tr>
<tr><td>Status (positive, neutral or negative)</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td>Low reversibility</td><td>Partially reversible</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>Highly Probable</td><td>Moderate Probability</td></tr>
<tr><td>Can impacts be mitigated?</td><td>Reasonably but with limited full restoration potential</td><td></td></tr>
<tr><td colspan="3">Mitigation:<br>» Treat all outcrop areas and dunes as No-Go Zones<br>» Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains<br>* Ensure adequate drainage where ephemeral drainage lines crossed<br>* Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines<br>» Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:<br>* Protected geophytic and succulent plant species: must be relocated<br>* Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor<br>* Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated<br>* All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding<br>* Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanization<br>» Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area</td></tr>
</table>

- Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer where permissible according to rehabilitation recommendations of the relevant EMPr
  - Shred all shrubs and trees cleared and used the chips for dust and erosion control
  - Use only species that were part of the original non-invasive indigenous species composition as listed in the specialist report for revegetation
- After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr
  - It is expected that where topsoils were not excessively disturbed, revegetation should occur naturally
  - The higher level of shading anticipated from the PV panels may prevent or slow the re-establishment of desirable species, thus re-establishment must be monitored and species composition adapted if a desirable vegetation cover fails to establish within 24 months after construction.

Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum and Prosopis* species

- Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning
- If filling material is to be used, this should be sourced from discontinued mines on the adjacent property
- Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan
- Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro topography and revegetation efforts accordingly
- Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind

**Cumulative impacts:**

- If mitigation measures are not strictly implemented the following could occur:
  - Considerable loss of biodiversity
  - Erosion of areas around the panels and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands
  - Spread and establishment of invasive species
- Increased habitat fragmentation and displacement of terrestrial vertebrates in the region
- Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns that may affect downstream ecosystems

**Residual impacts:**

- Altered topsoil characteristics
- Loss of and alteration of microhabitats
- Altered vegetation composition, lower vegetative cover and loss of species diversity
- Increased habitat fragmentation and displacement of terrestrial vertebrates

- Higher risk of invasion by alien plant species

| | | |
|---|---|---|
| **Nature:** Construction and operation of PV panels on natural vegetation within development footprint (**fixed panel option** )<br><br>Loss of vegetation and/or species of conservation concern, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from PV panels and higher volumes of storm water and accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible increase of detrimental effects during periods of extreme weather events, e.g. increased erosion or dust due to lower buffering capacity of sparser vegetation. Ecological impacts are greater where fixed panel technology is used. | | |
| **Listed activities:**<br>GN 544 activity 11(x)(xi) & 18(i);<br>GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i). | | |
| | **Without mitigation** | **With mitigation** |
| **Extent (E)** | Regional (3) | Local (2) |
| **Duration (D)** | Long-term (4) | Long-term (4) |
| **Magnitude (M)** | High (9) | High (8) |
| **Probability (P)** | Definite (5) | Definite (5) |
| **Significance (S = E+D+M)*P** | **High (80)** | **High (70)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Low reversibility | Partially reversible |
| **Irreplaceable loss of resources?** | Highly Probable | Medium Probability |
| **Can impacts be mitigated?** | Yes to some extent, but with limited full restoration potential | |

**Mitigation:**

- Treat all outcrop areas and dunes as No-Go Zones
- Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains
  - Ensure adequate drainage where ephemeral drainage lines crossed
  - Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines
- Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
  - Protected geophytic and succulent plant species: must be relocated
  - Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
  - Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so,

the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated

- * All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
- * Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanisation

» Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area

» Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer where permissible according to rehabilitation recommendations of the relevant EMPr

- * Shred all shrubs and trees cleared and used the chips for dust and erosion control
- * Use only species that were part of the original non-invasive indigenous species composition as listed in the specialist report for revegetation

» After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr

- * It is expected that where topsoils were not excessively disturbed, revegetation should occur naturally
- * The higher level of shading anticipated from the PV panels may prevent or slow the re-establishment of desirable species, thus re-establishment must be monitored and species composition adapted if a desirable vegetation cover fails to establish within 24 months after construction.

» Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum and Prosopis species*

» Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning

» If filling material is to be used, this should be sourced from discontinued mines on the adjacent property

» Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil

» Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan

» Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro topography and revegetation efforts accordingly

» Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind

**Cumulative impacts:**

» If mitigation measures are not strictly implemented the following could occur:

- * Considerable loss of biodiversity
- * Possible accelerated erosion of areas around the panels and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands

| |
|---|
| * possible contamination of drainage lines, lower-lying rivers or wetlands<br>* possible spread and establishment of invasive species<br>» Increased habitat fragmentation and displacement of terrestrial vertebrates in the region<br>» Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns |
| **Residual impacts:**<br>» Altered topsoil characteristics<br>» Loss of and alteration of microhabitats<br>» Altered vegetation composition, lower vegetative cover and loss of species diversity<br>» Potential for increased dust and its impact on surrounding environments and biodiversity<br>» Higher risk of invasion by alien plant species |

| | | |
|---|---|---|
| **Nature:** Construction of power line from Kheis Solar Park 1 PV array as part of the grid connection – with direct connection to the existing Eskom power line traversing the land portion (~100m).<br><br>Loss of vegetation, potential loss of large trees and associated microhabitats, increase in runoff and erosion, disturbance of burrowing animals | | |
| **Listed activities:**<br>GN 544, 18 June 2010 activity 10(i), 11(ii) & 18(i);<br>GN 546, 18 June 2010 activity 14(i). | | |
| | **Without mitigation** | **With mitigation** |
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Long-term (4) | Long-term (4) |
| **Magnitude (M)** | Minor (2) | Small (0) |
| **Probability (P)** | Definite (5) | Highly Probable (4) |
| **Significance (S = E+D+M)*P** | **Medium (40)** | **Low (20)** |
| **Status (positive, neutral or negative)** | Negative | Slightly negative |
| **Reversibility** | Partially reversible | Reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |
| **Can impacts be mitigated?** | Yes to some extent | |
| **Mitigation:**<br>» Treat all outcrop areas and dunes as No-Go Zones, power lines from the PV array furthest from the ESKOM line must be routed along the gravel road servitude and may not cross the dunefield (also due to high bird presence, including raptors in the dunefields)<br>» Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains<br>* Ensure adequate drainage where ephemeral drainage lines crossed<br>* Design the access routes to enter directly from the district gravel road and then | | |

follow existing jeep tracks on the property and along existing power-lines

- Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
  - Protected geophytic and succulent plant species: must be relocated
  - Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
  - Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated
  - All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
  - Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanization
- Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area
- Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development
  - Aim to minimise the destruction of indigenous large shrubs and trees
  - Limit clearing of indigenous vegetation to pylon positions only
  - Shred all shrubs and trees cleared and used the chips for dust and erosion control
- After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr
  - It is expected that where topsoils were not excessively disturbed, revegetation should occur naturally
- Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum and Prosopis* species
- Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning
- Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan
  - Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind
  - Shred all shrubs cleared and used the chips for dust and erosion control
- Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution

**Cumulative impacts:**

- Possible erosion of surrounding areas if no mitigation is implemented, no major cumulative impact on flora or fauna expected (excluding avifauna)

**Residual impacts:**

- Localised alteration of soil surface characteristics
- Localised loss of flora and displacement of fauna

**Nature:** Construction of substation and other associated infrastructure and buildings

Loss of vegetation and/or species of conservation concern, loss of microhabitats, reduced vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from sealed surfaces and possibly higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible pollution from permanent infrastructure and/or facilities

**Listed activities:**
GN 544, 18 June 2010 activity 10(i), 11(ii) & 18(i);
GN 546, 18 June 2010 activity 14(i).

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Long-term (4) | Long-term (4) |
| **Magnitude (M)** | Moderate (6) | Low (3) |
| **Probability (P)** | Definite (5) | Definite (5) |
| **Significance (S = E+D+M)*P** | **Medium (60)** | **Medium (40)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Partially reversible | Reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |
| **Can impacts be mitigated?** | Yes to some extent | |

**Mitigation:**

- Treat all outcrop areas and dunes as No-Go Zones
- Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains
  - Ensure adequate drainage where ephemeral drainage lines crossed
  - Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines
- Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
  - Protected geophytic and succulent plant species: must be relocated
  - Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
  - Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated

- All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
- Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanisation

» Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area
» Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development
- Aim to minimise the destruction of indigenous large shrubs and trees
- Shred all shrubs and trees cleared and used the chips for dust and erosion control

» After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr
- It is expected that where topsoils were not excessively disturbed, revegetation should occur naturally

» Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum and Prosopis species*
» Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning
» Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
» Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan
- Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind
- Shred all shrubs cleared and used the chips for dust and erosion control

» Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution

**Cumulative impacts:**

» If mitigation measures are not strictly implemented the following could occur:
- Erosion of areas around sealed surfaces and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands
- Contamination of ground water resources and possibly the Orange River
- Spread and establishment of invasive species

» Increased habitat fragmentation and displacement of terrestrial vertebrates in the region
» Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics

**Residual impacts:**

» Altered topsoil characteristics
» Loss of and alteration of microhabitats
» Altered vegetation composition, lower vegetative cover and temporary loss of local species diversity
» Low functionality and productivity of cleared areas that may remain susceptible to further degradation for many years after decommissioning

» Increased habitat fragmentation and displacement of terrestrial vertebrates
» Higher risk of the establishment by alien and indigenous invasive plant species

**Nature:** Temporary equipment camps and laydown sites where machinery and material is kept during construction.

Loss of vegetation and/or species of conservation concern, alteration and loss of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from sealed or compacted surfaces and possibly higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible contaminated topsoil, possible contaminated ground water or wetlands, possible increased dust levels

**Listed activities:** none.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Moderate-term (3) | Short-term (2) |
| **Magnitude (M)** | Moderate (6) | Low (3) |
| **Probability (P)** | Definite (5) | Definite (5) |
| **Significance (S = E+D+M)*P** | **Medium (55)** | **Medium (30)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Partially reversible | Reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |
| **Can impacts be mitigated?** | Yes to some extent | |

**Mitigation:**

» Treat all outcrop areas and dunes as No-Go Zones
» Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains
  * Ensure adequate drainage where ephemeral drainage lines crossed
  * Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines
» Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
  * Protected geophytic and succulent plant species: must be relocated
  * Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
  * Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated
  * All social weavers nests that may be affected by the development must be moved

by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
    * Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanisation
- » Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area
- » Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development
    * Aim to minimise the destruction of indigenous large shrubs and trees
    * Shred all shrubs and trees cleared and used the chips for dust and erosion control
- » Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum and Prosopis species*
- » Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning
- » Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- » Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan
    * Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind
    * Shred all shrubs cleared and used the chips for dust and erosion control
- » Prevent spillage of construction material and other pollutants, contain and treat any spillages immediately, strictly prohibit any pollution/littering according to the relevant EMPr
- » No fires may be lit for cooking or any other purposes
- » Facilities may not be used as accommodation for general construction staff
- » No vehicles may be washed, serviced or repaired on the property
- » After construction remove all foreign material prior to starting the rehabilitation
- » The rehabilitation plan for all temporarily affected areas must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover
- » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

**Cumulative impacts:**

- » If mitigation measures are not strictly implemented the following could occur:
    * Considerable loss of biodiversity
    * Erosion of the development area
    * Contamination of ground water and the Orange River
    * Spread and establishment of invasive species
    * Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns

**Residual impacts:**

- » Altered topsoil characteristics
- » Loss of and alteration of microhabitats
- » Altered vegetation composition

» Higher risk of invasion by alien plant species
» Potential for increased dust and its impact on surrounding environments and biodiversity

| **Nature:** Sourcing of fill material that may be required during or after construction<br><br>Reduction of existing overburden material from disused mines on adjacent property, source of dust during crushing and transportation of fill material | | |
|---|---|---|
| **Listed activities:** None | | |
| | **Without mitigation** | **With mitigation** |
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Long-term (4) | Short-term (2) |
| **Magnitude (M)** | Low (4) | Low (4) |
| **Probability (P)** | Highly Probable (4) | Probable (3) |
| **Significance (S = E+D+M)*P** | **Medium (40)** | **Low (21)** |
| **Status (positive, neutral or negative)** | Neutral | Positive |
| **Reversibility** | Partially reversible | not reversible |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes to some extent | |
| **Mitigation:**<br>» Aim to keep crusher and loaders on previously transformed sites, use existing tracks for transport<br>    ∗ Strictly enforce a speed limit of 30 km/h to lower dust levels<br>    ∗ Limit all operations to daylight hours to avoid collision with nocturnal animals<br>» Stay within demarcated areas and access routes for movement of materials<br>» Strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas<br>» Prevent spillage of pollutants; contain and treat any spillages immediately; strictly prohibit any pollution<br>» Monitor erosion of areas and control where necessary<br>» After construction remove all foreign material prior to starting the rehabilitation<br>» Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed | | |
| **Cumulative impacts:**<br>» If mitigation measures are not strictly followed the following could occur:<br>  ∗ Continued erosion of the altered surfaces with associated degradation of the site and surrounding areas<br>  ∗ Spread and establishment of invasive species | | |
| **Residual impacts:**<br>» Altered topsoil characteristics<br>» Reduction of currently existing unsightly overburden heaps from discontinued mining operations | | |

» Higher risk of invasion by alien plant species

<table>
<tr><td colspan="3">Nature: Transport of materials to site, movement of vehicles on site during construction and maintenance<br><br>Loss of vegetation, increase in runoff and erosion, disturbance or possible mortality incidents of terrestrial fauna, possible contamination of soil and groundwater by oil- or fuel spillages, possible establishment and spread of undesirable weeds and alien invasive species that could further damage ecosystem functionality</td></tr>
<tr><td colspan="3">Listed activities:None</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent (E)</td><td>Regional (4)</td><td>Local (1)</td></tr>
<tr><td>Duration (D)</td><td>Long-term (4)</td><td>Long-term (4)</td></tr>
<tr><td>Magnitude (M)</td><td>Low (4)</td><td>Small (0)</td></tr>
<tr><td>Probability (P)</td><td>Definite (5)</td><td>Highly Probable (4)</td></tr>
<tr><td>Significance<br>(S = E+D+M)*P</td><td>Medium (60)</td><td>Low (20)</td></tr>
<tr><td>Status (positive, neutral or negative)</td><td>Negative</td><td>Neutral</td></tr>
<tr><td>Reversibility</td><td>Partially reversible</td><td>Reversible</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>Probable</td><td>Not likely</td></tr>
<tr><td>Can impacts be mitigated?</td><td>Reasonably</td><td></td></tr>
<tr><td colspan="3">Mitigation:<br>» Avoid all natural pans if found, and a buffer of at least 50 m around such areas<br>» Avoid as much as possible of the eastern tree-rich sections of the study area<br>» Strictly restrict all movement of vehicles and heavy machinery to permissible areas, these being designated access roads, maintenance roads, turning points and parking areas. No off-road driving beyond designated areas is to be allowed<br>» Parking areas should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary storm water control) if oil and fuel spillages are highly likely to occur<br>» Wheels of large machinery should be checked prior to entering the site and cleared of seed material of alien invasive plants if transport routes go through infested areas (especially of species with spiny or bur-like seeds). Such seed must be destroyed.<br>» Strict speed limits must be set and adhered to<br>    ∗ Animals accidentally injured by moving vehicles or machinery must be taken to a local veterinarian to be treated or put down in a humane manner<br>» Dust levels must be controlled and minimised<br>» Driving between dusk and dawn should be permissible during emergency situations only<br>» Prevent spillage of any fuels, oils or other chemicals, strictly prohibit other pollution<br>» Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment</td></tr>
</table>

| **Cumulative impacts:** |
|---|
| » Possible pollution of surrounding areas if no mitigation is implemented<br>» Possible spread of alien invasive species beyond the site if no mitigation is implemented<br>» Possible increased road collisions and road kill of fauna |
| **Residual impacts:** |
| » Related to access roads and internal maintenance tracks |

## b) Comparative Assessment of PV Panel technology (Fixed vs Tracking):

The table below provides a comparison of the potential ecological impacts associated with the two technologies under investigation.

Table 6.1: Fixed panel technology vs tracking panel (single axis)

| **Aspect influenced** | **Fixed panel** | **Tracking panel (single axis)** |
|---|---|---|
| Size of land needed | approx. 2ha per MW | approx. 3ha per MW |
| Shading and associated change of vegetation | More continuous and intense shading.<br>Less stable and dense vegetation expected, reduced buffering capacity of extreme weather events by vegetation expected. | More variable and less intense overall shading.<br>More stable and denser vegetation cover expected, smaller reduction of buffering capacity of extreme weather events expected. |
| Effect on runoff and accelerated erosion | Larger continuous panel area, more concentrated runoff, constant runoff edges potentially create more erosion, especially where vegetation is weakened. | Smaller continuous panel areas, runoff more dissipated, moderate variation of runoff edges that are expected to create less erosion where vegetation is weakened. |
| Mounting height of panel | PV panels may be as low as 30 cm above ground to reduce total height, increasing the limits of permissible vegetation due to maintenance and fire risks. | Expected to be more than 1 m off the ground, increasing the possibility of low vegetation establishment and small fauna movement without compromising safety. |
| Height of top of panel | 3.5m | 3.5 -4m |

**Tracking PV technology** is ecologically a preferred technology alternative. Considering the aridity of the area and the difficulty of new vegetation establishment, the impact of tracking systems appears to be lower than that of a fixed panel array, even if the latter may occupy less space because the vegetation below the panels will receive more sunlight with the tracking technology option. This effect will become especially pronounced after decommissioning, when it is expected that seedbanks under a fixed panel system will have vanished as there will be little new inputs of seeds and old seeds will die over time. Topsoil quality most likely will have deteriorated to such an extent due to absence of vegetation that re-establishment of vegetation will be very difficult, as most of the microbiota on which many of these species depend for survival will no longer be present in the soil. The difference in the potential impacts on ecology associated with the two technology alternatives. Therefore, **tracking PV technology** is nominated as the preferred alternative (refer to Table 6.1)

**c) Implications for Project Implementation**

» Excluding all dune systems and outcrop areas in planning the development footprint, as is proposed for this facility. This will ensure that important ecosystem components can be maintained.
» The proposed photovoltaic facility development on the site will create a localised reduction of some slow-growing indigenous trees and shrubs, geophytes and other species restricted to certain microhabitats. This effect may be further exacerbated by surrounding and regional developments. At this stage, however, it is not anticipated that the development will change the current conservation status of any species.
» Potentially significant negative impacts on the ecological environment could be associated with soil erosion and associated degradation on and beyond the development area, possible introduction of alien invasive plants and a long-term (more than 8 months) low or absent vegetation cover after construction. With the diligent implementation of mitigating measures by the developer, contractors, and operational staff, the severity of these impacts can be significantly reduced.
» The impact on fauna is expected to be small for the development if mitigation measures are followed from the design phase, but this may become more of an issue if the cumulative impact of regional developments is considered. Presence of indigenous terrestrial vertebrates within the study area is relatively low due to absence of permanent surface water. Animals that may be permanently present can be relocated or will move away during construction, and may resettle after construction, depending on safety specifications necessitated by the development. Specific habitats of vertebrates within the study area are restricted to duneveld and outcrop area, which will be excluded from the proposed development.
» **Tracking PV technology** is nominated as the preferred alternative from an ecological perspective.

### *6.2.2 Potential Impacts on Soils and Agricultural Potential*

**a) Summary of impacts associated with the proposed solar energy facility during the construction and operational phase**

There are three land types across the broader site with the entire development footprint of Kheis Solar Park 1 is located two of the land types Af7 and Ag4. Soils across this land type are moderately deep to deep, red, very sandy soils of the Hutton soil form. The Ag4 land type includes very similar soils to Af7, but it also includes over 48% of its surface area, much shallower soils on underlying rock and rock outcrops.

Predominantly as a result of the aridity constraints of the area, but also because of poor soils, agricultural land use is restricted to low intensity grazing. The natural grazing capacity is low, being 40-60 hectares per large stock unit over most of the site, but slightly higher in places. Agricultural potential is fairly uniform across the farm and the choice of placement of the facility on the farm or choice of technology therefore has minimal influence on the significance of agricultural impacts. No agriculturally sensitive areas occur within the proposed development footprint.

Aspects of the facility that may have an impact on soils include:

» Solar facility footprint (i.e. an array of PV panels, mounting structures, underground cabling between project components and fencing)
» Construction and positioning of internal access roads
» Use of potential sources of contaminants on the site (i.e. oil, petrol, diesel and other substances used by the vehicles and equipment)
» Construction and operation of the on-site substation
» Construction and positioning of the on-site workshop area for maintenance, storage, and offices and temporary construction/ laydown areas.

The potential impacts on soil include:

» Soil loss and erosion
» Loss of agricultural land use
» Generation of alternative land use income
» Degradation of veld vegetation

The two alternative PV technologies do not differ in any significant way as far as soils and agricultural potential is concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

| |
|---|
| ***Nature:*** Loss of agricultural land use<br><br>Caused by: direct occupation of land by footprint of energy facility infrastructure; |

| | | |
|---|---|---|
| And having the effect of: taking affected portions of land out of agricultural production. | | |
| **Listed activities:**<br>GN 545 activity 15<br>GN 546 activity 14(a)(i) | | |
| | **Without mitigation** | **With Mitigation** |
| ***Extent*** | Low (1) - Site | n/a |
| ***Duration*** | Long term (4) | n/a |
| ***Magnitude*** | Small (1) | n/a |
| ***Probability*** | Definite (5) | n/a |
| ***Significance*** | **Medium (30)** | n/a |
| ***Status*** | Negative | n/a |
| ***Reversibility*** | High | |
| ***Irreplaceable loss of resources?*** | No (as the site can be returned to agriculture after decommissioning) | |
| ***Can impacts be mitigated?*** | No | |
| ***Cumulative impacts:***<br>The overall loss of agricultural land in the region due to a number of developments. The significance is low due to the limited agricultural potential of the area. | | |
| ***Residual impacts:***<br>No mitigation possible and therefore residual impacts are the same as impacts without mitigation | | |

| | | |
|---|---|---|
| ***Nature:*** Generation of alternative land use income<br><br>Caused by: the alternative land use of energy facility rental on low productivity agricultural land, in combination with continued farming on the remainder of the farm;<br>And having the effect of: providing land owners with increased cash flow and rural livelihood, as well as promoting the sustainability of the farming practices. | | |
| **Listed activities:**<br>GN 545 activity 15<br>GN 546 activity 14(a)(i) | | |
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Low (1) - Site | N/A |
| ***Duration*** | Long term (4) | N/A |
| ***Magnitude*** | Minor (3) | N/A |
| ***Probability*** | Highly probable (4) | N/A |
| ***Significance*** | **Medium (32)** | N/A |
| ***Status*** | Positive | N/A |
| ***Reversibility*** | High | N/A |
| ***Irreplaceable loss of resources?*** | Not required. | N/A |
| ***Can impacts be mitigated?*** | No | |
| ***Cumulative impacts:*** | | |

| |
|---|
| None |
| ***Residual impacts:*** |
| None |

| | | |
|---|---|---|
| ***Nature:*** Soil Erosion<br><br>Caused by: alteration of run-off characteristics due to hard surfaces and access roads;<br>And having the effect of: loss and deterioration of soil resources (There is low risk of erosion due to the very gentle slopes). | | |
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Low (1) - Site | Low (1) - Site |
| ***Duration*** | Long term (4) | Long term (4) |
| ***Magnitude*** | Low (4) | Minor (3) |
| ***Probability*** | Probable (3) | Very improbable (1) |
| ***Significance*** | **Low (27)** | **Low (8)** |
| ***Status*** | Negative | Negative |
| ***Reversibility*** | Low | Low |
| ***Irreplaceable loss of resources?*** | No | No |
| ***Can impacts be mitigated?*** | Yes | |
| ***Mitigation:***<br>Implement an effective system of run-off control, where it is required, that collects and disseminates run-off water from hardened surfaces and prevents potential down slope erosion. This should be in place and maintained during all phases of the development. | | |
| ***Cumulative impacts:***<br>Increase erosion from other developments in the area | | |
| ***Residual impacts:***<br>Soil erosion isuues in the area if impacts are not mitigated? | | |

### Impacts associated only with the construction phase of the development

| | | |
|---|---|---|
| ***Nature:*** Loss of topsoil<br><br>Caused by: poor topsoil management (burial, erosion, etc.) during construction related soil profile disturbance (levelling, excavations, disposal of spoils from excavations etc.)<br>And having the effect of: loss of soil fertility on disturbed areas after rehabilitation. | | |
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | **Without mitigation** | **With mitigation** |

| | | |
|---|---|---|
| ***Extent*** | Low (1) - Site | Low (1) - Site |
| ***Duration*** | Long term (4) | Long term (4) |
| ***Magnitude*** | Minor (3) | Minor (2) |
| ***Probability*** | Probable (3) | Very improbable (1) |
| ***Significance*** | **Low (24)** | **Low (7)** |
| ***Status*** | Negative | Negative |
| ***Reversibility*** | Low | Low |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be mitigated?*** | Yes | |
| ***Mitigation:*** <br> » Strip and stockpile topsoil from all areas where soil will be disturbed. <br> » After cessation of disturbance, re-spread topsoil over the surface. <br> » Dispose of any sub-surface spoils from excavations where they will not impact on agricultural land, or where they can be effectively covered with topsoil. | | |
| ***Cumulative impacts:*** <br> Increasing topsoil loss with other developments in the area | | |
| ***Residual impacts:*** <br> Loss of topsoil in the area if impacts are not mitigated? | | |

| | | |
|---|---|---|
| ***Nature:*** Degradation of veld vegetation surrounding construction activities <br><br> Caused by: Trampling due to vehicle passage. | | |
| **Listed activities:** <br> GN 546 activity 14(a)(i) | | |
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Low (1) - Site | Low (1) - Site |
| ***Duration*** | Short (2) | Short (2) |
| ***Magnitude*** | Minor (2) | Small (1) |
| ***Probability*** | Probable (3) | Improbable (2) |
| ***Significance*** | **Low (15)** | **Low (8)** |
| ***Status*** | Negative | Negative |
| ***Reversibility*** | Medium | Medium |
| ***Irreplaceable loss of resources?*** | No | No |
| ***Can impacts be mitigated?*** | Yes | |
| ***Mitigation:*** <br> Minimise road footprint beyond construction site and prohibit vehicular passage off designated roads. | | |
| ***Cumulative impacts:*** <br> None | | |
| ***Residual impacts:*** <br> Very low and limited to site | | |

#### b) Comparative Assessment of PV Panel technology (Fixed vs Tracking):

In terms of impact arising from soils and agricultural potential, there is **no significance** difference in the potential impacts associated with the two technology alternatives. Tracking panels can occupy more land than fixed panel technology; however a total of 280ha of low potential agricultural land would be available for the proposed Kheis Solar Park 1 on Portion 7 and 9 of Portion 4 of the Farm Namakwari 656, regardless of the type of technology used. The agricultural potential for this site is low. Therefore, in terms of impact arising from soils and agricultural potential, there is no significance difference in the potential impacts associated with the two technology alternatives. Therefore, there is **no preference** between the alternative technologies.

#### c) Implications for Project Implementation

- The proposed site for Kheis Solar Park 1 is situated on soils of low agricultural potential and this therefore has no implications on project development.
- The land has a low to moderate erosion risk, although the steeper slopes of the mountain features have higher risk. The susceptibility to wind erosion of most of the site is high due to the sandy texture of the soil. Therefore, appropriate mitigation is required to limit impacts in this regard.
- There is **no preference** between the alternative technologies in terms of soils and agricultural potential.

### *6.2.3 Assessment of Potential Impacts on Heritage & Palaeontology*

#### *a) Heritage impacts associated with the construction and operation phase of the proposed facility*

In terms of the significance, most of the archaeological sites observations within the Kheis Solar Park 1 development footprint fall under Landforms L3 Type 1 and Type 2 (Bedrock exposed and some soil patches respectively). In terms of archaeological traces they all, furthermore, fall under Class A3 Type 1 (dispersed scatter). These ascriptions reflect poor contexts and likely low significance for these sites. For site attribute and value assessment, all of the observations noted fall under Type 1 (No sequence Poor context, dispersed distribution for Classes), reflecting low significance, low potential and absence of contextual and key types of evidence. A colonial era farm dwelling, modified through time, and now in a state of ruin, was recorded at Sterkstroom[12]. It is not considered to be of major heritage significance.

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[12] Some portions of these farms have and have been compined to Portion 7 and 9 of the Farm Namakwari 656.

On archaeological and heritage grounds, the occurrences observed can be said to be of low significance for proposed development footprints in areas of the proposed Kheis Solar Park 1 and associated infrastructure.

The two alternative PV technologies do not differ in any significant way as far as the impacts on heritage resources is concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

| | | |
|---|---|---|
| ***Nature:*** Acts or activities resulting in disturbance of surfaces and/or sub-surfaces containing artefacts (causes) resulting in the destruction, damage, excavation, alteration, removal or collection from its original position (consequences), of any archaeological material or object (what affected). | | |
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Local 1 | None |
| ***Duration*** | Permanent 5 | None |
| ***Magnitude*** | Minor 2 | None |
| ***Probability*** | Improbable 2 | None |
| ***Significance*** | **Low (16)** | None |
| ***Status (positive or negative)*** | Negative | None |
| ***Reversibility*** | No | |
| ***Irreplaceable loss of resources?*** | Yes, where present – but occurrence is generally extremely low density and of low significance. | |
| ***Can impacts be mitigated?*** | Yes – but not considered necessary. | |
| ***Mitigation:***<br>Artefact densities and heritage structures are low over the Kheis Solar Park 1 development footprint areas that were investigated. Unlike biological processes, heritage destruction generally has a once-off permanent impact and in view of this the mitigation measures are not considered necessary. | | |
| ***Cumulative impacts:***<br>Loss of heritage/archaeological resources over the region | | |
| ***Residual Impacts:***<br>Where any archaeological contexts occur the impacts are once-off permanent destructive events. | | |

### b) Palaeontology impacts associated with the construction and operation phase of the proposed facility

The majority of the Kheis Solar Park 1 site area is underlain by unconsolidated sands of the Gordonia Formation. The south western quadrant of the site contains extensive exposures of the Zonderhuis Formation. This formation appears to underlie the Gordonia Formation throughout the extent of the development area.

It is improbable that there will be any negative impact on the palaeontological heritage of the Gordonia Formation as **no fossil materials were identified during the site visit**. The calcrete as well as the Zonderhuis and Groblershoop Formations are considered to be unfossiliferous.

The two alternative PV technologies do not differ in any significant way as far as the impacts on palaeontology resources is concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

| **Nature:** Destruction, damage and loss of provenance of fossil materials | | |
|---|---|---|
| | **Without Mitigation** | **With Mitigation** |
| **Extent:** | Low (2) | Low (2) |
| **Duration:** | Permanent (5) | Permanent (5) |
| **Magnitude:** | High (10) | Minor (2) |
| **Probability:** | Improbable (1) | Improbable (1) |
| **Significance:** | **Low (17)** | **Low (8)** |
| **Status:** | Positive | Positive |
| **Reversibility:** | Impossible | Impossible |
| **Irreplaceable loss of resources:** | Low | Low |
| **Can impacts be mitigated:** | Yes | |
| **Mitigation:** All excavations must be inspected for fossil content by the ECO/EO. Should fossils be located the relevant exaction must be halted and SAHRA informed of the find. SAHRA may instruct that a palaeontologist should evaluate the fossil material and suggest appropriate protocols to either excavate or protect the fossil material. | | |
| **Cumulative impacts:** Loss of fossils if destroyed by multiple developments | | |
| **Residual impacts:** Permanent loss of fossil heritage if no mitigation is implemented. | | |

### c) Comparative Assessment of PV Panel technology (Fixed vs Tracking):

In terms of impacts arising from Heritage and Palaeontology, there is **no significance** difference in the potential impacts associated with the two technology alternatives. Therefore, there is **no preference** between the alternative technologies.

#### *d) Implications for Project Implementation*

» The impacts to heritage resources and sites by the proposed development are not considered to be highly significant and the impact on archaeological sites can very easily be mitigated.
» There is a potential for negative impact on the palaeontological heritage of the project area throughout the eastern portion of Kheis Solar Park 1 due to the extensive coverage of thick deposits of the Gordonia Formation in those locations. The potential risk for any negative impact on the palaeontological heritage in Kheis Solar Park 1 is categorised as improbable due to the general scarcity of fossils in the unit and as no fossil materials were located within the project area.
» There is **no preference** between the alternative technologies in terms of heritage and palaeontology.

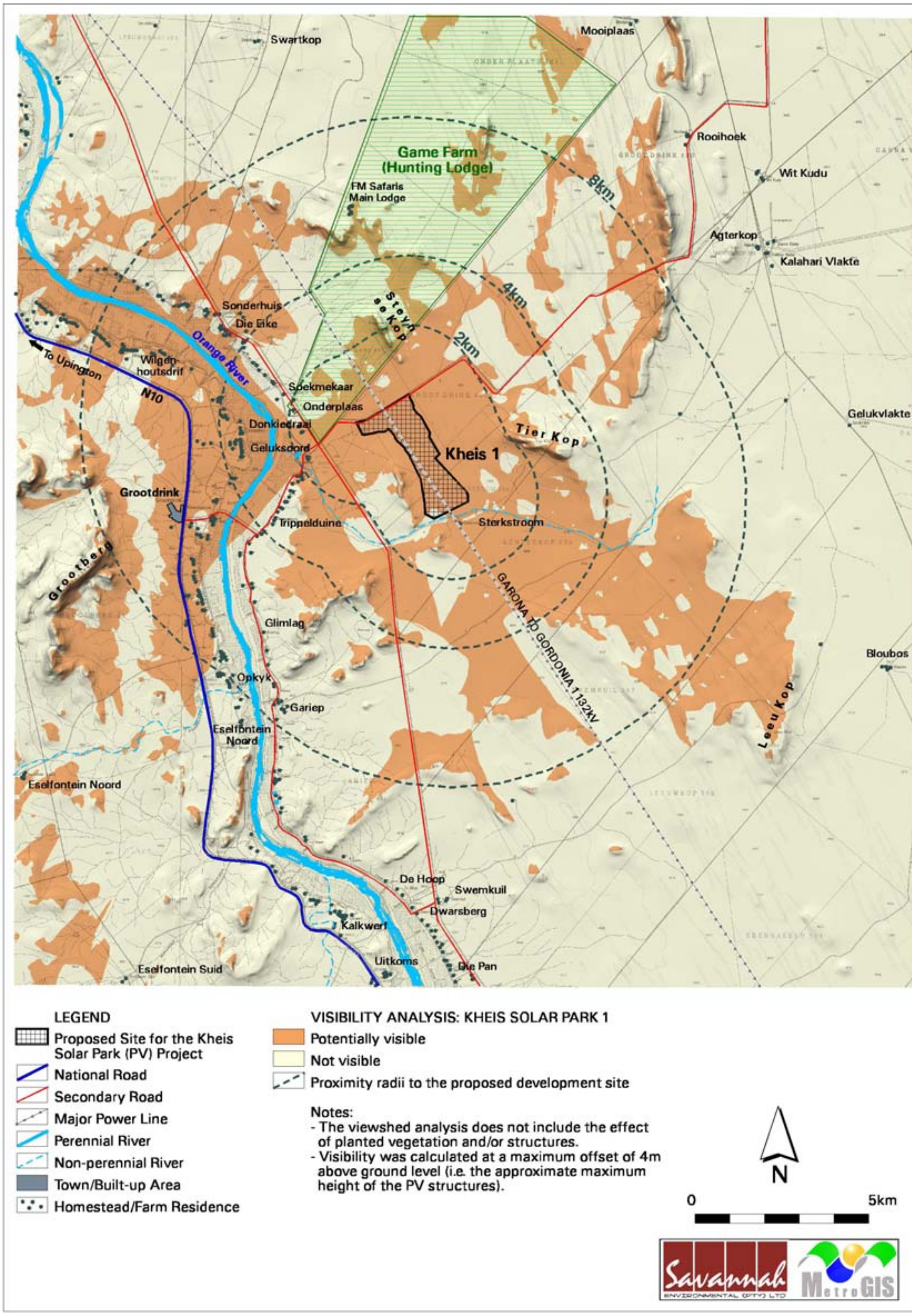
### *6.2.3 Assessment of Potential Visual Impacts*

**Potential visual exposure:** The preliminary viewshed analyses show that the proposed facility would have a fairly contained area of potential visibility (i.e. within a 4km radius of the site), especially to the south and east of the site and is described as follow (refer to Figure 6.3):

» **2 – 4km**
Visibility between the 2 - 4km radii includes sections of the secondary roads and a number of residences, mainly located west of the Orange River. Parts of the game farm north of the PV facility may also be exposed.
» **4 – 8km**
The intensity of visual exposure is expected to subside beyond a 4km radius with the predominant visibility expected to the west. This zone includes a number of potentially sensitive visual receptors located along the Orange River. The relatively long distance and the agricultural activities within this zone are however expected to greatly negate the potential visual exposure. This zone also includes the small town of Grootdrink located approximately 6km to the west of the site. The built-up nature of this town and the occurrence of urban visual clutter are however expected to nullify the potential visual exposure. The FM Safaris main lodge may be exposed to partial views of the facility at distances exceeding 5km.
» **Greater than 8km**

Visibility beyond 8km from the proposed development is expected to be negligible and highly unlikely due

**Viewer incidence / viewer perception:** Viewer incidence is calculated to be the highest along the N10 national road and secondary road (east of the river), traversing between Upington and Groblershoop to the south. The secondary road traversing north of the Kheis 1 site is also considered sensitive, although it is expected to carry fewer motorists than the aforementioned road. Commuters using these roads could be negatively impacted upon by visual exposure to the Solar Energy Facility, and are thus considered to be sensitive to visual intrusion. The FM Safaris Game Farm, located north-west of the Kheis 1 site, is also considered as a sensitive visual receptor. Visitors (mainly hunters) to this farm and game lodge generally would not expect to view electricity generation infrastructure when visiting the region for recreational purposes. These observers may be negatively affected by the Kheis Solar Park 1 development.




**Map 6.3:** Potential visual exposure of the proposed Kheis Solar Park 1.

**Visual absorption capacity:** The vegetation units present in the study area surrounding the solar facility (predominantly *Ticket and Bushland* and *Shrubland*) are on average only 2 m high. This, coupled with the sparse distribution of the plant species, the dimensions of the facility and height of structures, it was determined that the Visual Absorption Capacity (VAC) is low to negligible for virtually the entire study area.

**Visual impact index:** The combined result of the visual exposure, viewer incidence/perception and visual distance of the proposed Kheis Solar Park 1 facility is displayed on Figure 6.4. Observers travelling along the secondary roads near or adjacent to this project may experience a high visual impact, but only for a short period as they pass by the facility. The exposed sections of the FM Safaris Game Farm, north of the development, are also highlighted as an area of likely visual impact, although this impact os expected to be limited (shown as very low on Figure 5.3). The only homesteads within a 2km radius of the Kheis Solar Park 1 are *Donkiesdraai*, *Geluksoord*, Soekmekaar and Ons se Plaas?

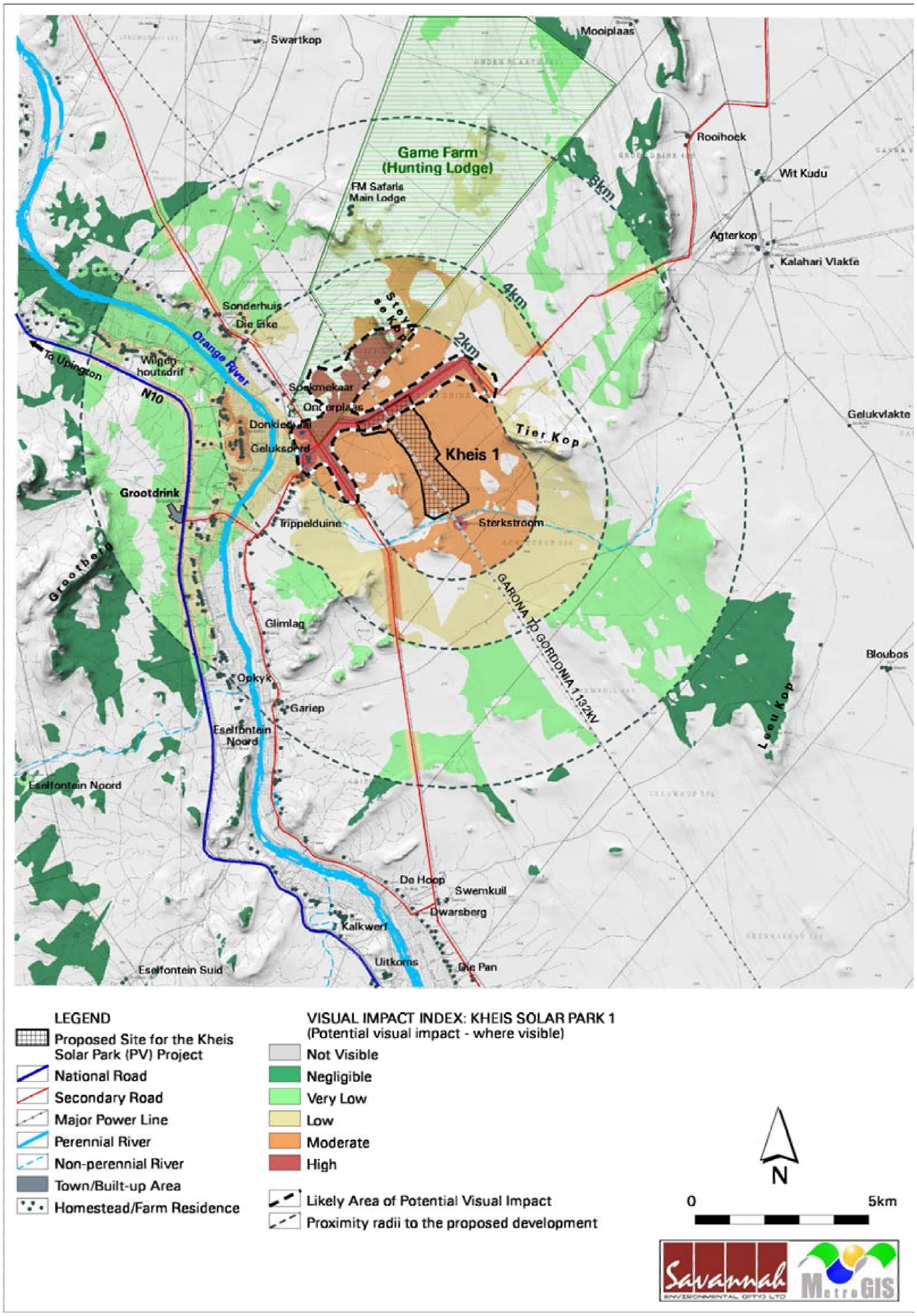



**Figure 6.4:** Map illustrating Visual Impact Index for the Kheis Solar Park 1 facility on Portion 7 and 9 of Farm Namakwari 656

## a) Impact tables summarising the significance of visual impacts of the PV facility during the construction and operation

| | | |
|---|---|---|
| **Nature of Impact:** Visual impact on users of the secondary roads in close proximity to the proposed Solar Energy Facility | | |
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local **(4)** | Local **(4)** |
| **Duration** | Long term **(4)** | Long term **(4)** |
| **Magnitude** | High **(8)** | Moderate **(6)** |
| **Probability** | Highly probable **(4)** | Probable **(3)** |
| **Significance** | High **(64)** | Moderate **(42)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Recoverable **(3)** | Recoverable **(3)** |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |
| ***General mitigation / management:***<br><br>Planning:<br>» Retain and maintain natural vegetation in all areas outside of the development footprint.<br>Operations:<br>» Maintain the general appearance of the facility as a whole.<br>Decommissioning:<br>» Remove infrastructure not required for the post-decommissioning use of the facility.<br>» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.<br>» Monitor rehabilitated areas post-decommissioning and implement remedial actions.<br><br>***Site specific mitigation measures:***<br>Plant vegetation barriers or vegetated berms along the northern boundaries (bordering the road) of the Kheis Solar Park 1 in order to shield the structures from observers travelling along these roads. | | |
| ***Cumulative impacts:***<br>The construction of the up to three Solar facilities and associated facilities on the site is expected to increase the cumulative visual impact within the immediate area. Alternatively, the relatively close proximity of the proposed facilities to each other (and the existing power line) consolidates the potential visual exposure of solar energy generation infrastructure within the region. The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 7. | | |

| |
|---|
| ***Residual impacts:*** The visual impact will be removed after decommissioning, provided the Solar Energy Facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain. |

| ***Nature of Impact:*** Visual impact on visitors to the FM Safari Lodge located in close proximity to the proposed Solar Energy Facility | | |
|---|---|---|
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local (4) | Local (4) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | High (8) | Moderate (6) |
| **Probability** | Probable (3) | Improbable (2) |
| **Significance** | **Moderate (48)** | **Low (28)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Recoverable (3) | Recoverable (3) |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |
| ***General mitigation/management:***<br><br><u>Planning:</u><br>» Retain and maintain natural vegetation in all areas outside of the development footprint.<br><u>Operations:</u><br>» Maintain the general appearance of the facility as a whole.<br><u>Decommissioning:</u><br>» Remove infrastructure not required for the post-decommissioning use of the facility.<br>» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.<br>» Monitor rehabilitated areas post-decommissioning and implement remedial actions.<br><br>***Site specific mitigation measures:***<br>Plant vegetation barriers or vegetated berms along the northern boundaries (bordering the road) of the Kheis Solar Park 1 in order to shield the structures from visitors at the FM Safari Lodge. Engage the land owner in question in the planning, placement and implementation of the mitigation measures. | | |

| |
|---|
| ***Cumulative impacts:***<br>The construction of the up to three Solar Parks is expected to increase the cumulative visual impact within the immediate area. Alternatively, the relatively close proximity of the proposed facilities to each other (and the existing power line) consolidates the potential visual exposure of solar energy generation infrastructure within the region. The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 7. |
| ***Residual impacts:***<br>The visual impact will be removed after decommissioning, provided the Solar Energy Facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain. |

| | | |
|---|---|---|
| **Nature of Impact:** Visual impact on sensitive visual receptors within the region (i.e. 5-8km) | | |
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | | |
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Regional **(3)** | Regional **(3)** |
| **Duration** | Long term **(4)** | Long term **(4)** |
| **Magnitude** | Low **(4)** | Low **(4)** |
| **Probability** | Improbable **(2)** | Very Improbable **(1)** |
| **Significance** | Low **(22)** | Low **(11)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Recoverable **(3)** | Recoverable **(3)** |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |

| |
|---|
| **General mitigation / management:**<br>Planning:<br>» Retain and maintain natural vegetation in all areas outside of the development footprint.<br>Operations:<br>» Maintain the general appearance of the facility as a whole.<br>Decommissioning:<br>» Remove infrastructure not required for the post-decommissioning use of the facility.<br>» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.<br>» Monitor rehabilitated areas post-decommissioning and implement remedial actions.<br><br>**Site specific mitigation measures:**<br>» Plant vegetation barriers along the western borders of the Kheis Solar Park 1 PV plant in order to shield the structures from observers residing in 2km.<br>» Engage with landowners in order to inform, plan and execute mitigation measures. |
| **Cumulative impacts:**<br>The close proximity of the proposed projects to each other and to the existing visual disturbances (power lines) allows for the effective connection with the power grid without incurring any additional expanded visual impacts (i.e. lengthy overhead power lines). The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 7. |
| **Residual impacts:**<br>The visual impact will be removed after decommissioning, provided the solar energy facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain. |

| **Nature of Impact**: Visual impact of construction on sensitive visual receptors within 2km | | |
|---|---|---|
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) | | |
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local (4) | Local (4) |
| **Duration** | Short Term (2) | Short Term (2) |
| **Magnitude** | High (8) | Moderate (6) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Moderate (42)** | **Moderate (36)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Recoverable (3) | Recoverable (3) |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |

| |
|---|
| ***Mitigation:***<br>» Ensure that vegetation is not unnecessarily cleared or removed during the construction period.<br>» Reduce the construction period through careful logistical planning and productive implementation of resources.<br>» 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.<br>» Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.<br>» Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.<br>» Reduce and control construction dust through the use of approved dust suppression techniques as and when required, especially on the dirt road giving access to the site (i.e. whenever dust becomes apparent).<br>» Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.<br>» Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works. |
| ***Cumulative impacts:***<br>The close proximity of the proposed projects to each other and to the existing visual disturbances (power lines) allows for the effective connection with the power grid without incurring any additional expanded visual impacts (i.e. lengthy overhead power lines). The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 7. |
| ***Residual impacts:***<br>The visual impact will be removed after construction on the site is completed provided the disturbed areas are rehabilitated. |

| **Nature of Impact**: Visual impact of lighting on sensitive visual receptors. | | |
|---|---|---|
| **Listed activities:**<br>GN 545 activity 1 &15 | | |
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local (4) | Local (4) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Moderate (6) | Low (4) |
| **Probability** | Probable (3) | Improbable (2) |
| **Significance** | **Moderate (42)** | **Low (24)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Recoverable (3) | Recoverable (3) |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |

***Mitigation:***

Planning:

» 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

***Cumulative impacts:***

The development of three solar parks will contribute to an increase in light sources within the region, and as a result an increase in lighting impact at night. The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 7

***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**: Visual impact associated with the of the operation of PV panels (fixed panel option) at 4m height

**Listed activities:**

GN 544 activity 10(i)

GN 545 activity 1 & 15

GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i)

| | ***Without mitigation*** | ***With mitigation*** |
|---|---|---|
| ***Extent*** | Local (2) | Local (2) |
| ***Duration*** | Long - term (4) | Long – term (4) |
| ***Magnitude*** | Moderate low (3) | Low (1) |
| ***Probability*** | Highly Probable (4) | Highly Probable (3) |
| ***Significance*** | **Medium (36)** | **Low (21)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | High | High |
| ***Irreplaceable loss of resources?*** | No | |
| ***Can impacts be mitigated?*** | Yes | |

**Mitigation:**

» No clearing of land outside the demarcated footprint
» Rehabilitate cleared areas

**Cumulative impacts**:

The proposed infrastructure would provide a cumulative impact increasing the existing industrial land uses in the area and the additional two projects proposed on the same site. The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred

| |
|---|
| bidder projects), as discussed in Chapter 7. |
| **Residual Impacts**:<br>The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant and power lines. Providing that the site is rehabilitated to its current state, the visual impact will also be removed. |

| **Nature**: Visual impact of the operation of PV panels (tracking panel option) at 4m height | | |
|---|---|---|
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) | | |
| | ***Without mitigation*** | ***With mitigation*** |
| ***Extent*** | Local (2) | Local (2) |
| ***Duration*** | Long - term (4) | Long – term (4) |
| ***Magnitude*** | Moderate low (4) | Low (1) |
| ***Probability*** | Highly Probable (4) | Highly Probable (3) |
| ***Significance*** | **Medium (40)** | **Low (21)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | High | High |
| ***Irreplaceable loss of resources?*** | No | |
| ***Can impacts be mitigated?*** | Yes | |
| **Mitigation:**<br>» No clearing of land outside the demarcated footprint<br>» Rehabilitate cleared areas | | |
| **Cumulative impacts**:<br>The proposed infrastructure would provide a cumulative impact increasing the existing industrial land uses in the area and the additional two projects proposed on the same site. The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 7. | | |
| **Residual Impacts**:<br>The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant and power lines. Providing that the site is rehabilitated to its current state, the visual impact will also be removed. | | |

### b) <u>Comparative Assessment of PV Panel technology (Fixed vs Tracking):</u>

Sensitive receptors on the 2 - 4km radii (including sections of the secondary roads and a number of residences, mainly located west of the Orange River and parts of the game farm north of the PV facility) may be exposed by either the fixed or tracking panels on the proposed development area due to their close proximity to the site regardless of the type of technology used since they are proposed to be both of the same height. Tracking panels can result in a higher visual intrusion than fixed panels due to the more mechanically complex structure. However, for this particular site there is **very little difference in the significance** in the potential impacts associated with the two technology alternatives. There is therefore no preference regarding technology.

#### c) Implications for Project Implementation

- The proposed Kheis 1 Solar Park may have a moderate visual impact on visitors to the FM Safari Game Farm, especially within the southern section of the farm. This impact may be mitigated to low with the implementation of site specific mitigation measures.
- The visual impact on the users of roads and the residents of towns, settlements and homesteads within the region (i.e. beyond a 2km radius) is expected to be low and moderate (within 2km radium) for the proposed Kheis Solar Park 1 facility with the implementation of mitigation measures.
- For this particular site there is very little difference in the significance in the potential impacts associated with the two technology alternatives. There is therefore no preference regarding technology from a visual perspective.

### *6.2.4 Assessment of Potential Social Impacts*

#### a) Impact tables summarising the significance of Social impacts of the PV facility during the construction and operation

Impacts associated with the construction phase of a project are usually of a short duration, temporary in nature, but could have long term effects on the surrounding environment. The operational life of a PV facility is between 20 - 25 years, after which the facility would possibly be upgraded to continue its lifespan if feasible, or decommissioned. The impacts usually associated with the operational phase are therefore perceived by affected parties to be more severe.

The two alternative PV technologies do not differ in any significant way as far as the impacts on the social environment is concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

**The following listed activities are applicable to all the social impacts in the construction and operational phase:**
GN 544 activity 10(i)
GN 545 activity 1 & 15
GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc)

The following social impacts are anticipated as part of the **construction phase** of Kheis Solar Park 1 development:

<table>
<tr><td colspan="3">Nature of the impact: The impact on the health status of the local community due to an increase in male migrant workers. As TB, HIV/AIDS and alcohol related diseases are already on the district's radar due to its high occurrence; migrant workers without family structures may increase this health risk during construction.</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent</td><td>National (4)</td><td>Local/District(2)</td></tr>
<tr><td>Duration</td><td>Long term(3)</td><td>Short term(1)</td></tr>
<tr><td>Magnitude</td><td>High(3)</td><td>Medium(2)</td></tr>
<tr><td>Probability</td><td>Probable(3)</td><td>Possible(2)</td></tr>
<tr><td>Significance</td><td>Low(30)</td><td>Low(18)</td></tr>
<tr><td>Status (positive or negative)</td><td>Negative</td><td></td></tr>
<tr><td>Reversibility</td><td>Irreplaceable</td><td></td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No</td><td></td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes, to some extent</td></tr>
<tr><td colspan="3">Mitigation:<br>» The developer or the contractor should appoint a service provider or local NGO to develop, implement and manage a "Wellness Programme" which includes HIV/AIDS, TB, and alcohol abuse prevention, extendable to the local community<br>» By connecting with local community programmes and NGOs, health training and information can be provided on-site to workers at the start of the project<br>» Ensure workers have information and sign a "code of conduct" at the start of employment which gives an overview of acceptable behaviour and information regarding health & safety on the site</td></tr>
<tr><td colspan="3">Cumulative Impacts:<br>As alcohol abuse and related risky behaviour which may impact HIV infections is already prevalent in the area, the cumulative impact during the construction phase may be increased.</td></tr>
<tr><td colspan="3">Residual Impacts:<br>The residual impact of health related risks cannot be reversed to the status quo after the construction or decommissioning of the plant has taken place.</td></tr>
</table>

<table>
<tr><td colspan="3">Nature of the impact: The local roads and associated infrastructure will be affected by the increase in construction vehicles and traffic to the site. The roads connecting the site to the N10 and N14 are gravel and in disrepair, with a high sensitivity to increased traffic, especially during harvest time.</td></tr>
<tr><td></td><td>Without Mitigation</td><td>With Mitigation<br>Score</td></tr>
<tr><td>Extent</td><td>Local (2)</td><td>Site(1))</td></tr>
<tr><td>Duration</td><td>Medium term (2)</td><td>Low(1)</td></tr>
</table>

| | | |
|---|---|---|
| ***Magnitude*** | High(3) | Low(1) |
| ***Probability*** | Definite(5) | Probable(2) |
| ***Significance*** | **Medium(35)** | **Low(6)** |
| ***Status (+/-)*** | Negative | |
| ***Reversible*** | NONE | |
| ***Irreplaceable*** | NONE | |
| ***Can impacts be mitigated?*** | Yes | |

**Mitigation:**

- Consulting with local authorities (including SANRAL) and stakeholders (including cooperatives, farmers and wine cellars) on the most appropriate route to the site will ensure local cooperation
- Upkeep and maintenance of the roads used
- Part of the construction phase needs to include the upgrade of the road to be able to handle the increase in traffic and excessive dust as a result of the gravel roads
- Plans should aim to avoid construction of the plant over the harvest period (Feb-Apr), especially from the N14, when an increase in traffic would adversely affect the accessibility of the site

**Cumulative Impacts:**

The impact on the selected route to the site could be increased significantly should it also be an access road to another project. By including local authorities and planning construction outside of the harvest period, the cumulative impact should remain low.

**Residual Impacts:**

The proposed development is of such a nature that the status quo could be regained after decommissioning the plant, with upgraded local infrastructure a residual benefit.

***Nature of the impact:*** **The presence of construction workers** on the site and possible social mobilisation. As the local communities are perceived as relatively closed to outsiders, the socio-cultural impact of having an influx of migrants from other areas could result in conflict.

*Note: As it would be difficult for the contractor to control conflict situations where they occur when construction workers spend their free time in the local community, this assessment focuses on conflict situations that the contractor can control.*

| | ***Without Mitigation Score*** | ***With Mitigation Score*** |
|---|---|---|
| **Extent** | Province/Region(3) | Local/District(2) |
| **Duration** | Short term(1) | Short term(1)1 |
| **Magnitude** | Low (4) | Minor (2) |
| **Probability** | Probable(3) | Improbable(2) |
| **Significance** | **Low(24)** | **Low(14)** |
| **Status (+/-)** | Negative | |
| **Reversible** | Yes | |
| **Irreplaceable** | NONE | |
| **Can impacts be mitigated?** | Yes | |

**Mitigation:**

- By ensuring that the local community is aware and involved in the public consultation through local ward councillors, relevant information may clarify misgivings and assumptions
- Implementing a "local first" recruitment policy should decrease migrant workers influx which may upset social structures
- Establishing a MF (Management Forum) consisting of representatives from the project and local community stakeholders to share and manage on-going matters. Problem areas that are brought under the attention of the contractor/developer could be referred to the MF to ensure that an equitable solution is implemented
- Invite neighbouring stakeholder to sit on the MF to enable involvement and information sharing
- All mitigation measures contained in the EMPr should be implemented and monitored. Remedial action should be taken where the contractor fails to comply with the EMPr
- Ensure that the process is well managed and all neighbours and local communities are informed beforehand of when to expect an influx, as part of good governance
- Establish a "code of conduct" with the workers to respect the site and neighbours in surrounding area which must also be part of the managing the discipline on site

**Cumulative Impacts:**

Notwithstanding the Kheis development, there are also the Bokpoort and Kleinbegin PV and KaroshoekKaroshoek developments just within the local municipal area, as well as Albany being considered in the neighbouring District. A conflict situation can spread to other sites so that communities can become antagonistic against the development even before construction commences.

**Residual Impacts:**

The proposed development is of such a nature that the status quo could be regained after construction, which is usually the high risk phase.

***Nature of the impact:*** **Perceptions from and attitudes** towards the Kheis Solar Park 1 Facility, either positive (economic injection) or negative (safety, inconvenience, risk to property). The public consultation is still on-going, but comments and feedback received thus far from stakeholders are varied. The site visit also confirmed that depending on the stakeholder's own perspective, attitudes vary significantly. For this purpose, the SEIA will aim to present an objective and scientific assessment.

| | ***Without Mitigation Score*** | ***With Mitigation Score*** |
|---|---|---|
| **Extent** | Regional (3) | Local (2) |
| **Duration** | Medium term(3) | Short (2) |
| **Magnitude** | Low (4) | Minor (2) |
| **Probability** | Probable (3) | Possible(2) |
| **Significance** | **Medium (30)** | **Low(12)** |
| **Status (+/-)** | Positive or Negative (depending on individual perceptions) | |
| **Reversible** | Yes | |
| **Irreplaceable** | NONE | |
| **Can impacts be mitigated?** | Yes | |

| |
|---|
| **Mitigation:**<br>» Ensure that the public participation also includes stakeholders directly affected as listed in the study (land owner, workers, close neighbours and the local community)<br>» Ensure that safety procedures regarding veld fires are part of the training of all new workers<br>» Include values as well as health & safety procedures in a "code of conduct" with the workers which are to form part of their employment contracts |
| **Cumulative Impacts:**<br>The significance of this impact is rated low, but due to the number and proximity of other PV plants in the area, the cumulative impact affecting the general sentiment around alternative energy projects and specifically this development, may change. |
| **Residual Impacts:**<br>The site may be rehabilitated to its current state after decommissioning, but the perceptions could still linger in the altered socio-cultural attitudes. |

| ***Nature of the impact:*** **The impact on local and regional industry** due to linkage effects. The capital investment in the area will have a multiplier effect on local industry and businesses, resulting in a wider indirect positive economic impact than the jobs directly anticipated for the Kheis Solar Park 1 Facility. Areas most positively affected may be transport, consumables and construction materials. | | |
|---|---|---|
| | ***Without Mitigation*** | ***With Mitigation*** |
| **Extent** | ***Without Mitigation*** | ***With Mitigation*** |
| **Duration** | Local (2) | Regional (3) |
| **Magnitude** | Short term (1) | Short term (1) |
| **Probability** | Low (1) | High (8) |
| **Significance** | Probable (3) | Highly probable (4) |
| **Status (+/-)** | **Low (12)** | **Medium (48)** |
| **Reversible** | Positive | |
| **Irreplaceable** | N/A | |
| **Can impacts be mitigated?** | N/A | |
| **Mitigation:**<br>» Government gives preference to projects with high levels of local content through the REIPPPP. A target of 60% local content may be required from certain technologies during the next round REIPPPP, which will require linking new and existing local businesses to the supply chain of the Kheis Solar Park 1 Facility<br>» Ensuring that principle of "local first" when procuring consumables, construction materials etc. | | |
| **Cumulative Impacts:**<br>The scale, extent and proximity of similar developments in the Northern Cape will have an increase in the cumulative linkage effect. | | |
| **Residual Impacts:**<br>The proposed development is of such a nature that the status quo could be regained after decommissioning the plant. | | |

| ***Nature of the impact:*** **A change in the employment status** and income levels of the local population due to the creation of jobs. The 75MW plant will require 192 jobs over the 16 months of construction, aiming to keep around 95% of the labour local. A further 80 direct jobs are anticipated during the operational phase of the first phase of the Kheis Solar Park 1 Facility. | | |
|---|---|---|
| | **Without Enhancement** | **With Enhancement** |
| **Extent** | Local (2) | Regional(4) |
| **Duration** | Short term(1) | Medium(3) |
| **Magnitude** | Minor (2) | Low(3) |
| **Probability** | Probable(3) | Definite(4) |
| **Significance** | **Low (12)** | **Medium (40)** |
| **Status (+/-)** | Positive | |
| **Reversible** | NONE | |
| **Irreplaceable** | NONE | |
| **Can impacts be mitigated?** | Yes | |
| **Enhancement:**<br>» Implementing a "local first" recruitment policy will ensure that the positive impact is mostly ring-fenced for locals<br>» Ensure that the benefit is equitable and that the principles underpinned by Black Economic Empowerment Act of 2003 are honoured<br>» Also that the local jobs created are linked to a skills development programme for permanent employment | | |
| **Cumulative Impacts:**<br>The impact is measured as a result of direct employment creation for the first phase of the project. The indirect effects on employment creation, the multiplier effect on local business, as well as the subsequent phases will increase the cumulative positive impact on the employment status, contributing to the provincial and national employment creation initiatives. | | |
| **Residual Impacts:**<br>The proposed development is of such a nature that the status quo could be regained after decommissioning the plant. From a socio-economic perspective, the residual impact will be the end of the job opportunities which locals may have become dependent, unless skills development and training enable permanent employment. | | |

The following impacts are anticipated as part of the **operational phase** of the Kheis Solar Park 1 development:

| ***Nature of the impact:*** A possible **permanent change in the land use pattern** of the area. The site earmarked for the development comprises of 3600 hectares of agricultural land, which currently used for extensive animal farming. The PV Solar Energy Facility will alter the use on this piece of land for at least the next 20 years. | | |
|---|---|---|
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Regional(3) | Local(2) |

| | | |
|---|---|---|
| **Duration** | Medium term (3) | Medium term (3) |
| **Magnitude** | Minor (2) | Minor(1) |
| **Probability** | Probable(3) | Possible (2) |
| **Significance** | **Low(24)** | **Low(12)** |
| **Status (+/-)** | Positive or Negative | |
| **Reversible** | Yes | |
| **Irreplaceable** | No | |
| **Can impacts be mitigated?** | Yes | |
| **Mitigation:** » After decommissioning, the land use status quo on the site must be returned to the current state, provided this is economical at the time. | | |
| **Cumulative Impacts:** This project, together with the other mentioned PV Solar Energy Facility's such as Bokpoort, Karoshoek and Grootdrink solar projects in the area will have a significant cumulative impact on the land use pattern. This impact may affect the Northern Cape agricultural sectors' contribution to GGP. | | |
| **Residual Impacts:** The proposed development is of such a nature that the status quo could be regained after decommissioning the plant. Provided the site is rehabilitated to its current state, the socio-economic impact would be negligible. | | |

| | | |
|---|---|---|
| ***Nature of the impact:*** The current **agricultural value of the land** may change with the development of the site. Economically it is a positive, as agricultural land value is estimated to increase from around R2500/hectare to R5000/hectare. The environmental "value" may however be negatively affected, although reversible. | | |
| | ***Without Mitigation*** | ***With Mitigation*** |
| **Extent** | Local(1) | Local(2) |
| **Duration** | Medium term (3) | Medium term (3) |
| **Magnitude** | Minor(2) | Low(3) |
| **Probability** | Probable(3) | Probable(3) |
| **Significance** | **Low(18)** | **Low(24)** |
| **Status (+/-)** | Positive | |
| **Reversible** | Yes | |
| **Irreplaceable** | NONE | |
| **Can impacts be mitigated?** | Yes | |
| **Mitigation:** » The economic value of the current agricultural land will increase with the value-add in infrastructure and land use rights. To ensure that the benefit extends to the local communities, the local job creation initiatives (local first), as well as the RFP requirements of minimum of 2.5% local community shareholding should mitigate concerns regarding the allocation of the positive impact » By implementing this project with all the mitigations and care as prescribed by NEMA, any other developments in the future will be more acceptable to the community and | | |

other stakeholders

- Mitigate environmental impact through following the recommendations from the specialist studies as well as implementing a comprehensive EMPr

**Cumulative Impacts:**

The positive economic impact of this development, combined with similar developments in the District will increase the significant of the positive impact on a struggling economy.

**Residual Impacts:**

Provided the site is rehabilitated to its current state, the socio-economic impact could however be significant if a source of stimulation to the local economy is removed.

***Nature of the impact:*** The impact of the development on **local tourism and hospitality industry**.

Although the province has the lowest tourism contribution to GDP at only 2%, it is more reflective of the poverty level of the province than the real contribution of the sector. Attractions include the Augrabies Falls National Park, the Kgalagadi Transfrontier Park and the local award-winning Orange River Cellars made up of five wineries situated in Upington, Kakamas, Keimoes and most importantly Grootdrink and Groblershoop, which are close to the proposed development site. Smaller enterprises in the area include eco-tourism initiatives and safari experiences like neighbouring FM Safaris.

| | ***Without Mitigation*** | ***With Mitigation*** |
|---|---|---|
| **Extent** | Regional(3) | Local(2) |
| **Duration** | Medium term (3) | Medium term (3) |
| **Magnitude** | Minor 2 | Minor1 |
| **Probability** | Probable(3) | Improbable(2) |
| **Significance** | **Low(24)** | **Low(12)** |
| **Status (+/-)** | Negative | |
| **Reversible** | Yes | |
| **Irreplaceable** | No | |
| **Can impacts be mitigated?** | Yes | |

**Mitigation:**

- Ensure that the I&AP are supplied with the relevant and detailed information pertaining to the impact of a PV Solar Energy Facility plant
- A MF for the Kheis development could manage issues arising from the development, which may affect the local tourism industry
- Ensure that mitigation actions as recommended specifically in the VIA be implemented.

**Cumulative Impacts:**

As this development is part of a greater strategic development initiative of the Northern Cape, the cumulative impact may be significant.

**Residual Impacts:**

The proposed development is of such a nature that the status quo could be regained after decommissioning the plant. Provided the site is rehabilitated to its current state, the socio-economic impact pertaining to the tourism industry will be negligible.

| **Nature of the impact:** Impact on the **"way of life"** and **"sense of place"**. This impact is related to the way people make a living and their quality of life. People stay and travel to this area to experience the unique landscape and culture. The impact should be considered in the context of the study area as a whole, as the impact will also depend on a number of variables, such as the visual impact, the biodiversity impact, the related activities on the surrounding land, etc. | | |
|---|---|---|
| | ***Without Mitigation*** | ***With Mitigation*** |
| **Extent** | Local(2) | Local(1) |
| **Duration** | Medium term (3) | Medium term (3) |
| **Magnitude** | Medium(2) | Low(1) |
| **Probability** | Probable(3) | Improbable(2) |
| **Significance** | **Low(21)** | **Low(10)** |
| **Status (+/-)** | Negative | |
| **Reversible** | Yes | |
| **Irreplaceable** | NONE | |
| **Can impacts be mitigated?** | Yes | |
| **Mitigation:**<br>» Implement mitigation measures detailed in the Visual Impact Assessment | | |
| **Cumulative Impacts:**<br>The presence of such infrastructure can also set an unintended precedent for further land use change in the near vicinity in future, which could further alter people's way of life and their sense of place. | | |
| **Residual Impacts:**<br>The impact on sense of place can be reversed after decommissioning, provided that rehabilitation is done to as satisfactory level. | | |

**b) <u>Comparative Assessment of PV Panel technology (Fixed vs Tracking):</u>**

There is **no difference** in social / economic impacts from either technology alternatives. Therefore there is no preference from a social perspective on the implementation of either technology.

**<u>c) Implication for project implementation</u>**

» The findings of the SIA undertaken for the proposed Kheis Solar Park 1 indicate that the development will create employment and business opportunities for locals during both the construction and operational phase of the project.
» The establishment of a Community Trust will also create an opportunity to support local economic development in the area.
» The development of renewable energy has also been identified as a key growth sector by the NCSDF and also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

» There is no preference from a social perspective on the implementation of either technology under consideration.
» It is therefore recommended that the Kheis Solar Park 1 Energy Facility as proposed be supported, subject to the implementation of the recommended enhancement and mitigation measures contained in the SIA report.

## 6.3. Assessment of the Do Nothing Alternative

The 'do nothing' alternative will do little to influence the macro-level renewable energy targets set by government due to competition in the sector, and the number of renewable energy projects being bid to the DoE. However, as the site experiences some of the best irradiation in the country and optimal grid connection opportunities are available, not developing the project would see such an opportunity being lost. In addition the Northern Cape grid will be deprived of an opportunity to benefit from the additional generated power being evacuated directly into the Province's grid. The greater farm portions are not being farmed intensively due to climate and agricultural constraints and it is unlikely that the farm will become productive from this perspective in the long-term. The loss of the land to this project is therefore not considered significant.

At a local level, the level of unemployment will remain the same and there will not be any transfer of skills to people in terms of the construction and operation of the solar energy facility. The landowner would have lost an opportunity of receiving an alternative form of income from the project, which could contribute to the use of his land in a sustainable manner. Furthermore, the community would lose the opportunity to improve and uplift their infrastructures through the community trust.

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. Although the facility is only proposed to contribute 75 MW to the grid capacity, this would assist in meeting the growing electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy. 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*:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.

» ***Resource saving*:** Conventional coal fired plants are major consumers of water during their requisite cooling processes. 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, when compared with wet cooled conventional power stations. This translates into revenue savings of R26.6 million. 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.

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

» ***Pollution reduction:*** The releases of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation. The use of solar radiation for power generation is considered a non-consumptive use of a natural resource which produces zero greenhouse gas emissions.

» ***Climate friendly development:*** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be responsible for approximately 1% of global GHG emissions and is currently ranked $9^{th}$ worldwide in terms of per capita carbon dioxide emissions.

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

» ***Employment creation:*** The sale, development, installation, maintenance and management of renewable energy facilities have significant potential for job creation in South Africa.

» ***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.

The 'do nothing' alternative will not assist the South African government in addressing climate change, in reaching the set targets for renewable energy, nor will it assist in supplying the increasing electricity demand within the country. In addition the Northern Cape Province power grid will lose an opportunity to benefit from the additional generated power being evacuated directly into the Province's grid at the Garona-Gordonia 132kV power line. The 'do nothing alternative is, therefore, not a preferred alternative.

## 6.4. Summary of Impacts

Table 6.1 summarises all potential impacts associated with the proposed Kheis Solar Park 1 Facility and the associated EIA regulation listed activities.

**Table 6.1:** Summary of impacts associated with the proposed Kheis Solar Park 1 Facility and its relevant EIA listed activities.

| Construction / Decommissioning Impacts | Significance of Impact | | | EIA Regulation Listed activity assessed |
|---|---|---|---|---|
| | Without mitigation | With mitigation | Status | |
| **Ecology** | | | | |
| Loss of vegetation & increase in runoff and erosion, | M (50) | M (35) | Negative | GN 544 activity 11(x)(xi) & 18(i)<br>GN 545, activity 1 & 15<br>GN 546, activity 14(i) |
| Loss of protected or red data species | M (50) | L (28) | Negative | GN 544 activity 11(x)(xi) & 18(i)<br>GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i). |
| Loss species of conservation concern | H (75) | H (60) | Negative | GN 544 activity 11(x)(xi) & 18(i)<br>GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i). |
| **Soils & Agriculture Potential** | | | | |
| Loss of agricultural land use | M (30) | M (30) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| Generation of alternative land use income | M (32) | M (32) | Positive | none |
| Soil erosion | L (27) | L (8) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Loss of topsoil | L (24) | L (7) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Degradation of veld vegetation | L (15) | L (8) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| **Heritage & Palaeontology** | | | | |
| Destruction, damage, excavation, alteration, removal or collection of heritage | L (16) | | Negative | GN 544 activity 10(i) |

| | | | | |
|---|---|---|---|---|
| artefacts from its original position (consequences) | | | | GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| **Visual** | | | | |
| Visual impact of construction on sensitive visual receptors | M(42) | M(36) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impact of lighting on sensitive visual receptors. | M (42) | L (24) | Negative | GN 545 activity 1 &15 |
| **Social** | | | | |
| The impact on the health status of the local community due to an increase in male migrant workers | M(30) | L(8) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| The local roads and associated infrastructure will be affected by the increase in construction vehicles and traffic to the site. | M(35) | L(6) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| The presence of construction workers on the site and possible social mobilisation. | L(24) | L(14) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| Perceptions from and attitudes towards the Kheis Solar Park 1 Facility, either positive (economic injection) or negative (safety, inconvenience, risk to property). | L(30) | L(12) | Positive/Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| The impact on local and regional industry due to linkage effects. The capital investment in the area will have a multiplier effect on local industry and businesses. | L(12) | M(48) | Positive | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| A change in the employment status and income levels of the local population due to the creation of jobs | L(12) | M(40) | Positive | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |

| **Operational Impacts** | **Significance of Impact** | | | **Listed Activities (18 June 2010)** |
|---|---|---|---|---|
| | **Without mitigation** | **With mitigation** | **Status** | |
| **Ecology** | | | | |

| | | | | |
|---|---|---|---|---|
| Loss of vegetation and/or species of conservation concern | H (80) | H (65) | Negative | GN 544 activity 11(x)(xi) & 18(i)<br>GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i). |
| Increase in runoff and erosion, disturbance or possible mortality incidents of terrestrial fauna, possible contamination of soil and groundwater by oil- or fuel spillages, possible establishment and spread of undesirable weeds and alien invasive species | M (60) | L (20) | Negative | GN 544 activity 11(x)(xi) & 18(i)<br>GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i). |
| **Soils & Agriculture Potential** | | | | |
| Loss of agricultural land use | M (30) | M (30) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| Generation of alternative land use income | M (32) | M (32) | Positive | None |
| Soil erosion | L (27) | L (8) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| **Visual** | | | | |
| Visual impact on users of the secondary roads in close proximity to the proposed Solar Energy Facility | H (64) | M (42) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impact on visitors to the FM Safari Lodge located in close proximity to the proposed Solar Energy Facility | H (48) | M (28) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impact on sensitive visual receptors within the region | L (22) | L (11) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impacts related to the ancillary infrastructure | Negligible | Negligible | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impact associated with the of the operation of PV panels (fixed panel | Medium (36) | Low (24) | Negative | GN 544 activity 10(i) |

| | | | | |
|---|---|---|---|---|
| option) | | | | GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impact associated with the of the operation of PV panels (tracking panel option) | Medium (40) | Low (21) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc) 19 (a)(ii)(cc) |
| **Social** | | | | |
| A possible permanent change in the land use pattern of the area | L (24) | L (12) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| The current agricultural value of the land will change with the development of the site | L (18) | L (24) | Positive | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| The impact of the development on local tourism and hospitality industry | L (24) | L (12) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| Impact on the "way of life" and "sense of place". | L (21) | L (10) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |

| | | | | | |
|---|---|---|---|---|---|
| L | **Low** | M | **Medium** | H | **High** |

# ASSESSMENT OF CUMULATIVE IMPACTS KHEIS SOLAR PARK 1 CHAPTER 7

Cumulative impacts in relation to an activity are defined in the Environmental Impact Assessment Regulations (Government Notice R543) as meaning "the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area".

There has been a substantial increase in renewable energy developments recently in South Africa as legislation is evolving to facilitate the introduction of Independent Power Producers (IPPs) and renewable energy into the electricity generation mix. Due to the recent substantial increase in interest in renewable energy developments in South Africa, it is important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts are considered and avoided where possible.

The Department of Energy has, under the REIPPP Programme released a request for proposals (RfP) to contribute towards Government's renewable energy target of 3725 MW ( 1450 MW of which has been allocated to solar PV energy) and to stimulate the industry in South Africa. The bid selection process will consider the suggested tariff as well as socio-economic development opportunities provided by the project and the bidder.

There is a legislated requirement to assess cumulative impacts associated with a proposed development. This chapter looks at whether the proposed project's potential impacts become more significant when considered in combination with the other known or proposed solar farm projects within the area.

## 7.1 Approach Taken to Assess Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertaking in the area[13].

Significant cumulative impacts that could occur due to the development of the solar energy facilities and its associated infrastructure in proximity to each other include impacts such as:

[13] Definition as provided by DEA in the EIA Regulations.

» Loss of vegetation and impacts on ecology
» Soil and agricultural potential impacts
» Heritage impacts
» Visual impacts
» Social impacts

The cumulative effect or impacts are presented as follows:

» Cumulative impacts potentially as a result of the cumulative effects of the three Kheis Solar Park PV facilities proposed to be located on Portion 7 and Portion 9 of the Farm Namakwari 656 (Kheis Solar Park 1-3).
» Cumulative impacts potentially as a result of the cumulative effects of the Kheis Solar Park 1 added to all other renewable energy facilities proposed to be developed in and around the Grootdrink area (south west of Upington).

Table 7.1 shows the proposed location of the Kheis Solar Park 1 in relation to all other known renewable energy applications. These projects were identified by CSIR using the Department of Environmental Affairs Geographic Information System digital data (CSIR, 2013)

| **Project** | **Applicant / Developer** | **DEA Ref. No** | **Location** | **Status** | **Distance from Kheis Solar Park 1** |
|---|---|---|---|---|---|
| 1. Kheis Solar Park 2 (55MW) | Gestamp Asetym Solar South Africa (Pty) Ltd | 14/12/16/3/3/2/570 | Portion 7 of the farm Namakwari 656 | EIA underway - considered in this EIA report | 1km |
| 2. Kheis Solar Park 3 (20MW) | Gestamp Asetym Solar South Africa (Pty) Ltd | 14/12/16/3/3/2/571 | Portion 9 of the farm Namakwari 656 | EIA underway - considered in this EIA report | 500m |
| 3. Grootdrink solar facility (75MW) | Grootdrink Solar (Pty) Ltd | 14/12/16/3/3/2/639 | Remaining extent of farm Albany 405 | EIA underway | 15km |
| 4. Concentrating Solar Thermal Power Plant on the farm Bokpoort (50MW) | Solafrica | 12/12/20/1920 | RE of the Farm Bokpoort 390, south east of Upington | Environmental Authorisation issued - round 2 preferred bidder | 20km |
| 5. Karoshoek Solar Valley Development (900MW comprising CSP and CPV technology of 11 separate projects | FG Emvelo Energy (Pty) Ltd | 14/12/16/3/3/2/289<br>14/12/16/3/3/2/290<br>14/12/16/3/3/2/291<br>14/12/16/3/3/2/292<br>14/12/16/3/3/2/293<br>14/12/16/3/3/2/294<br>14/12/16/3/3/2/295<br>14/12/16/3/3/2/296<br>14/12/16/3/3/2/297<br>14/12/16/3/3/2/298 | Matjesriver RE and 2/41, Annashoek 3/41, Karos 956 and Zandemm 944 east of Upington | Environmental Authorisation issued | 25km |

| **Project** | **Applicant / Developer** | **DEA Ref. No** | **Location** | **Status** | **Distance from Kheis Solar Park 1** |
|---|---|---|---|---|---|
| | | 14/12/16/3/3/2/299 | | | |
| 6. Ilanga CSP Facility (100MW) | Ilangalethu Solar Power (Pty) Ltd | 12/12/20/2056 | Zandemm 944 east of Upington | Environmental Authorisation issued – round 3 preferred bidder | 25km |
| 7. Kleinbegin Solar Energy (50MW) | Vanguard Solar (Pty) Ltd | 12/12/20/2198 | Klein Begin 2/115, south east of Upington | Environmental Authorisation issued | 35km |

**Table 7.1:** Proposed solar energy facilities within the Kheis Solar Park 1 project development site and surrounding areas

Kleinbegin Solar Energy facility is considered to be too far afield to result in cumulative impacts with the Kheis Solar Park 1, and is not considered further.

The combined effect of the solar energy facilities for this area will have a cumulative visual impact, impact on the landscape character, social impact, and impacts on ecology and soil erosion.

In the sections below the potential cumulative impacts of other solar facilities within the immediate vicinity (i..e within 25km) of the proposed Kheis Solar Park 1 are explored. The discussion and associated conclusions must be understood in the context of the uncertainty associated with the proposed developments and the qualitative nature of the assessment.

## 7.2 Cumulative impacts of three Kheis Solar Park projects on the Portion 7 and Portion 9 of the Farm Namakwari 656

The location of the three solar facilities on Portion 7 and Portion 9 of the Farm Namakwari 656 is illustrated in Figure 7.2. The potential cumulative impacts over Portion 7 and Portion 9 of the Farm Namakwari 656, should the development of all three Kheis Solar Park PV projects be realised, are likely to be contained within the boundaries of the farm site site (with the exception of visual and social), and with the application of the necessary mitigation measures, contained within each of the respective PV projects areas. This is deducted based on the following:

» **Ecology**: The development footprints of all three PV projects are aligned with areas of low and medium- low ecological sensitivity and outside of the identified high sensitive areas. The cumulative impacts on ecology within the site are expected to increase due with each development of the Kheis Solar Park projects; the overall impact on ecology within the site due to 3 projects similar developments is expected to be of **medium-low** significance due to the fact that the facilities are placed to avoid highly sensitive areas.

» **Soil and agricultural potential:** The broader farm portions, portion 7 and 9 of Namakwari 656, are 3600ha in extent, and the development of the three proposed Kheis Solar Park projects will result in the loss of ~17% of the farm for agricultural activities. The remainder of the farm portion can be continued to be utilised for agricultural activities. The development footprints are aligned with areas characterised by Hutton soil form (moderately deep to deep, red, very sandy soils; much shallower soils on underlying rock and rock) and low agricultural potential. The overall cumulative impact on agricultural land within the site is of **low** significance due to the limited agricultural potential of the area.

» **Heritage and Palaeontology**: From an archaeological perspective the observed heritage resources over the areas surveyed were found to be of low density and low significance. A colonial era farm dwelling, modified through time, and now in a state of ruin, was recorded at Sterkstroom. It is not considered to be of major heritage significance. The proposed projects will have **low** cumulative impacts on the heritage artefacts on site.

» **Visual Impacts**: Figure 7.1 shows the frequency of PV facility sightings, highlighting areas that may have a view of all three projects. Areas with a higher frequency of exposure generally correlate with elevated topographical units, such as hills and ridges, where the observer is elevated above the average ground level. In terms of the shorter distance sightings where potentially sensitive visual receptors are expected; the area located north of the solar parks (along the secondary road and parts of the game farm) is of relevance. Observers within this area are expected to have a linear view of the PV facilities along the north-south axis of the overall development. Kheis Solar Parks 1, 2 and 3 is generally expected to increase the cumulative visual impact within the immediate area. However, the close proximity of the proposed facilities to each other consolidates the potential visual exposure of solar energy generation infrastructure within a development node, thereby avoiding the proliferation of similar developments within the region and making it low-medium significance.

Based on the above, the cumulative impacts associated with the combination of all three projects occurring on Portion 7 and Portion 9 of Portion 4 the Farm Namakwari 656 are considered to be of low-moderate significance provided that environmental impacts are mitigated to suitable standards.

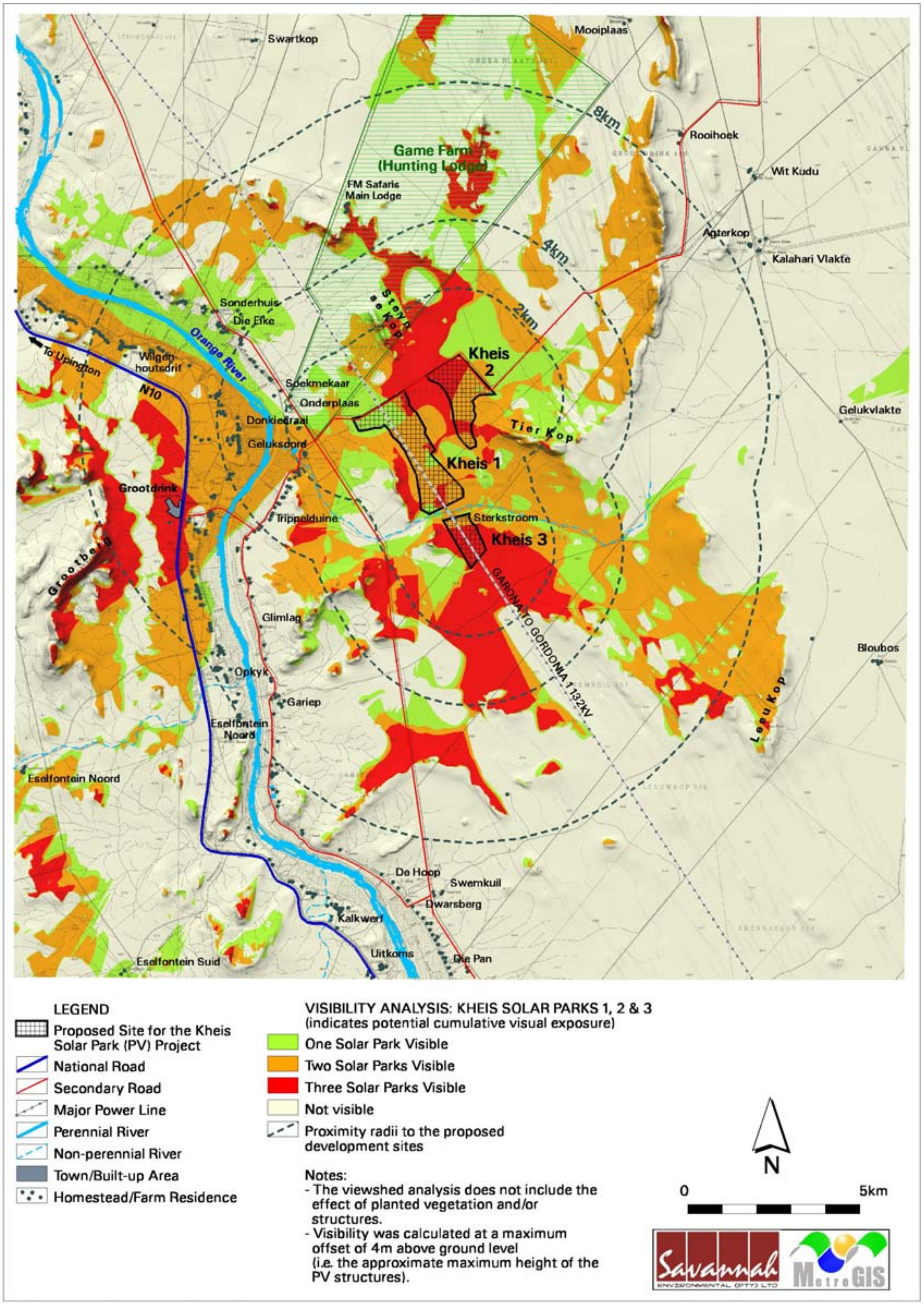



**Figure 7.1**: Potential cumulative visual exposure of the proposed Kheis Solar Parks 1, 2 and 3

## 7.3 Cumulative impacts of renewable energy facilities in the region

Including the three projects of the Kheis Solar Park, there are sixteen (16) renewable projects within a 25 km radius of the Kheis Solar Park 1 site (refer to Figure 7.2). At the time of writing this EIA report, the Bokpoort Trough CSP Project is under construction (being a Round 2 preferred bidder) and Ilanga CSP Facility is a Round 3 preferred bidder.

The potential for cumulative impacts as a result of similar developments planned to be developed around the renewable energy node of Grootdrink, is considered below.

The potential for cumulative impacts as a result of similar developments planned to be developed around the renewable energy node of Grootdrink, is considered below

### *7.3.1 Loss of vegetation and impacts on ecology*

Excessive clearing of slow growing trees, especially *Boscia albitrunca* and *Acacia erioloba* as a result of multiple project could significantly impact local and regional (within ZF Mgcawu District Municipality) population dynamics, and microhabitats and their resources associated with larger trees of these species. This can influence runoff and storm water flow patterns and dynamics, which could cause excessive accelerated erosion of plains, small ephemeral drainage lines, rivers and this could also have detrimental effects on the lower lying Orange River. Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasives into adjacent agricultural land and rangelands. Cumulative impacts on ecology are expected to be of **low to moderate significance** as several of the solar developments planned in the 25km radius of the project are on similar habitats.

### *7.3.2 Cumulative impacts on soil and agricultural potential*

The overall loss of agricultural land in the region due to other similar developments is expected to be of **low** significance due to the limited agricultural potential of the area. Due to the limited crop production in the wider study area, and the fact that grazing can continue on the farm in areas not affected by the proposed facility, the development of multiple solar energy facilities within the region of Grootdrink will not affect food security in the region.

### *7.3.3 Cumulative impacts on heritage and palaeontology*

Cumulative impacts in terms of archaeological and paleontological contexts are once-off permanent destructive events. Infrastructure development may lead to spatially extended impacts in the vicinity, hence the need to demarcate areas for zero to low impact. Cumulative negative impacts on heritage and paleontological resources are expected be low**-medium significance** due to the fact that the potential for the loss of or discovery of heritage artefacts in the region will also increase with the increased numbers of similar developments in the area.

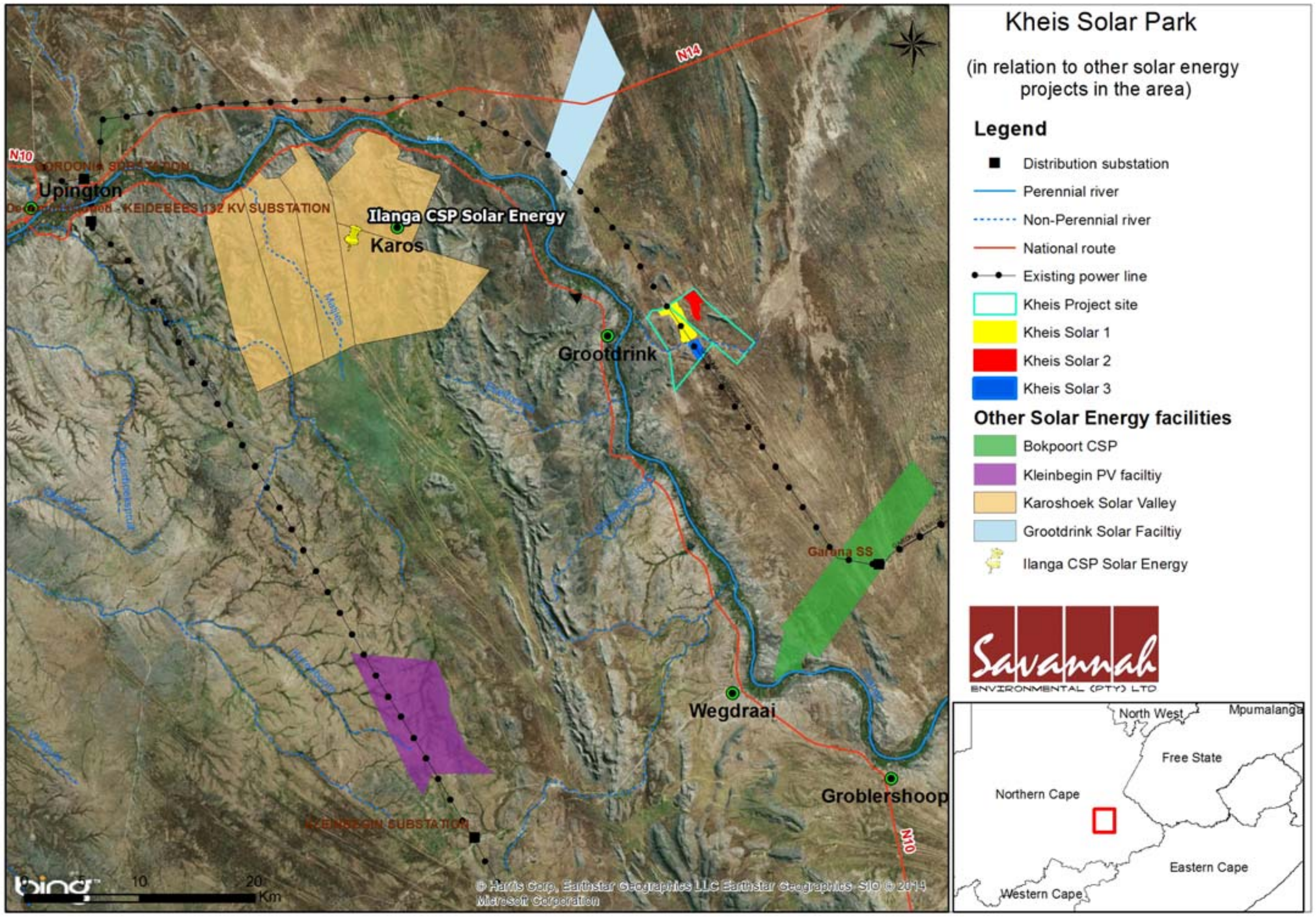



**Figure 7.2:** Map showing the proximity of other renewable energy facility projects to the Kheis Solar Park 1 in order to understand the potential for cumulative impacts

#### *7.3.4 Cumulative Visual Impacts*

The visual cumulative impact of Kheis Solar Park 1 in relation to other solar facilities beyond 8km radius is not of concern due to the relative long distance; the other facilities are more than 8km from the Kheis Solar Park 1 site which makes the visual impact **low**.

#### *7.3.5 Cumulative Impacts on the Social and Economic Environment*

Benefits to the local, regional and national economy through employment and procurement of services could be substantial should many of the renewable energy facilities proceed. This benefit will increase significantly should critical mass be reached that allows local companies to develop the necessary skills to support construction and maintenance activities and that allows for components of the renewable energy facilities to be manufactured in South Africa. Furthermore at municipal level, the cumulative impact could be positive and could incentivise operation and maintenance companies to centralise and expand their activities towards education and training and more closely to the projects.

The cumulative impact in terms of loss of agricultural land is unlikely to be significant due to the limited land take and in most cases agricultural activities would be allowed to proceed on the remaining portions of the sites not affected by the solar facilities. Property prices in these areas are likely to increase as a result of the added value that energy generation offers. However, once the renewable energy sector is saturated, property prices that are dependent on the sense of place value rather than on the agricultural potential may be compromised due to the changes in landscape and sense of place. **Cumulative positive social and economic** impacts and **negative social impacts** (visual, sense of place, noise and disturbance during construction) will be of **moderate significance**.

### 7.4 Conclusion regarding Cumulative Impacts of Kheis Solar Park 1

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study.

The alignment of renewable energy developments with South Africa’s Integrated Resource Plan (IRP) and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The CSIR has released an initial identification of geographical areas best suited for the roll-out of wind and solar photovoltaic (PV) energy projects in South Africa. The aim of the assessment is to designate renewable energy development zones (REDZ) within which such development will be incentivised and streamlined. The Kheis Solar Park 1 falls within the REDZ/ identified geographical area most suitable for the rollout of the development of solar energy projects within the Northern Cape Province. In addition, the site is located within the Solar Corridor identified within then NCSDF. Both the REDZ and Solar Corridor initiatives imply that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented. The site location is therefore in line with this rationale.

It is also important to note that it is unlikely that all proposed renewable energy facilities located in the 25km radius will be built in the short to medium term (i.e. 5years) due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets by the DoE. This will reduce the potential for cumulative impacts within this period. Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Kheis Solar Park 1 facility will be of **low to moderate** significance in the region and **low to moderate** within the Kheis Solar Park project site.

# CONCLUSIONS AND RECOMMENDATIONS FOR KHEIS SOLAR PARK 1: (DEA REF. NO.: 14/12/16/3/3/2/569) CHAPTER 8

Gestamp Asetym Solar South Africa (Pty) Ltd is proposing to establish three commercial photovoltaic solar energy facilities on Portion 7 and 9 of Portion 4 of Farm Namakwari 656 south west of Upington, Northern Cape Province. The site is located within the Kheis Local Municipality. ***This Chapter of the EIA report deals only with the conclusions and recommendations of the EIA for the Kheis Solar Park 1 of the larger Kheis (PV) Solar Park project***. The purpose of the proposed facility is to add new capacity for generation of power from renewable energy to the national electricity supply (which is short of generation capacity to meet current and expected demand), and to aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE).

Globally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as climate change and exploitation of non-renewable resources. In order to meet the long-term goal of a sustainable renewable energy industry, a goal of 17,8GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to ~42% of all new power generation being derived from renewable energy forms by 2030. In addition, the need for renewable energy development, specifically solar facilities, has been identified as an opportunity in the Northern Cape Spatial Development Framework (SDF).

In response to the need at a National and Provincial level, Gestamp Asetym Solar South Africa (Pty) Ltd, as an IPP, is proposing the establishment of a 75 MW photovoltaic solar energy facility and associated infrastructure for the purpose of commercial electricity generation. The proposed facility will require a development footprint area of approximately 280 ha (within a larger site of 3600ha in extent), and will be comprised of the following primary elements (refer to Figure 8.1):

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings.
» Cabling between the structures, to be lain underground where practical.

» Central invertor/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
» An on-site substation (50m x 50m) and power line (100m) to evacuate the power from the facility into the Eskom grid via the existing Garona-Gordonia 132kV power line that traverses the site (Portion 9 of Portion 4 of the Farm Namakwari 656)
» Internal access roads (5m wide)
» Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity (approximate footprint ±100 m²)

An EIA process, as defined in the NEMA EIA Regulations, is a systematic process of identifying, assessing, and reporting environmental impacts associated with an activity. The EIA process forms part of the planning of a project and informs the final design of a development. In terms of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998), Gestamp Asetym Solar South Africa (Pty) Ltd requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Northern Cape Department of Environmental and Nature Conservation (DENC)) for the establishment of the Kheis Solar Park 1 facility. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543, GNR544, GNR545; and GNR546, a Scoping and an EIA Phase have been undertaken for the proposed project. As part of this EIA process comprehensive, independent environmental studies have been undertaken in accordance with the EIA Regulations. The following key phases have been undertaken to date in the EIA Process.

» *Notification Phase* - organs of state, stakeholders, and interested and affected parties (I&APs) were notified of the proposed project through adverts placed in a local and regional newspapers, site notices, and stakeholder letters. Details of registered parties have been included within an I&AP database for the project.
» *Scoping Phase* – identification of potential issues associated with the proposed project and environmental sensitivities (i.e. over the broader project development site - entire extent of Portion 7 and 9 of Portion 4 of Farm Namakwari 656), as well as definition of the extent of studies required within the EIA Phase were defined.
» *EIA Phase* – potentially significant biophysical and social impacts[14] and identified feasible alternatives put forward as part of the project have been comprehensively assessed through specialist investigations. Appropriate

[14] Direct, indirect, cumulative that may be either positive or negative.

mitigation measures have been recommended as part of a draft Environmental Management Programme (EMPr) (refer to Appendix K).

The Conclusions and Recommendations of this EIA for Kheis Solar Park 1 are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area. During the public consultation process, it was recommended by stakeholders that the facilities are not placed close to the western road and that they should rather be placed behind the small koppie on Portion 9 in order to reduce direct visibility. After field investigations, it was concluded that the area closest to this road is of higher sensitivity from an ecological perspective as well as a visual perspective. Therefore, the layout has been design to avoid these areas, thereby addressing the concerns raised through the public consultation process.

A summary of the recommendations and conclusions for the proposed Kheis Solar Park 1 facility project is provided in this Chapter.

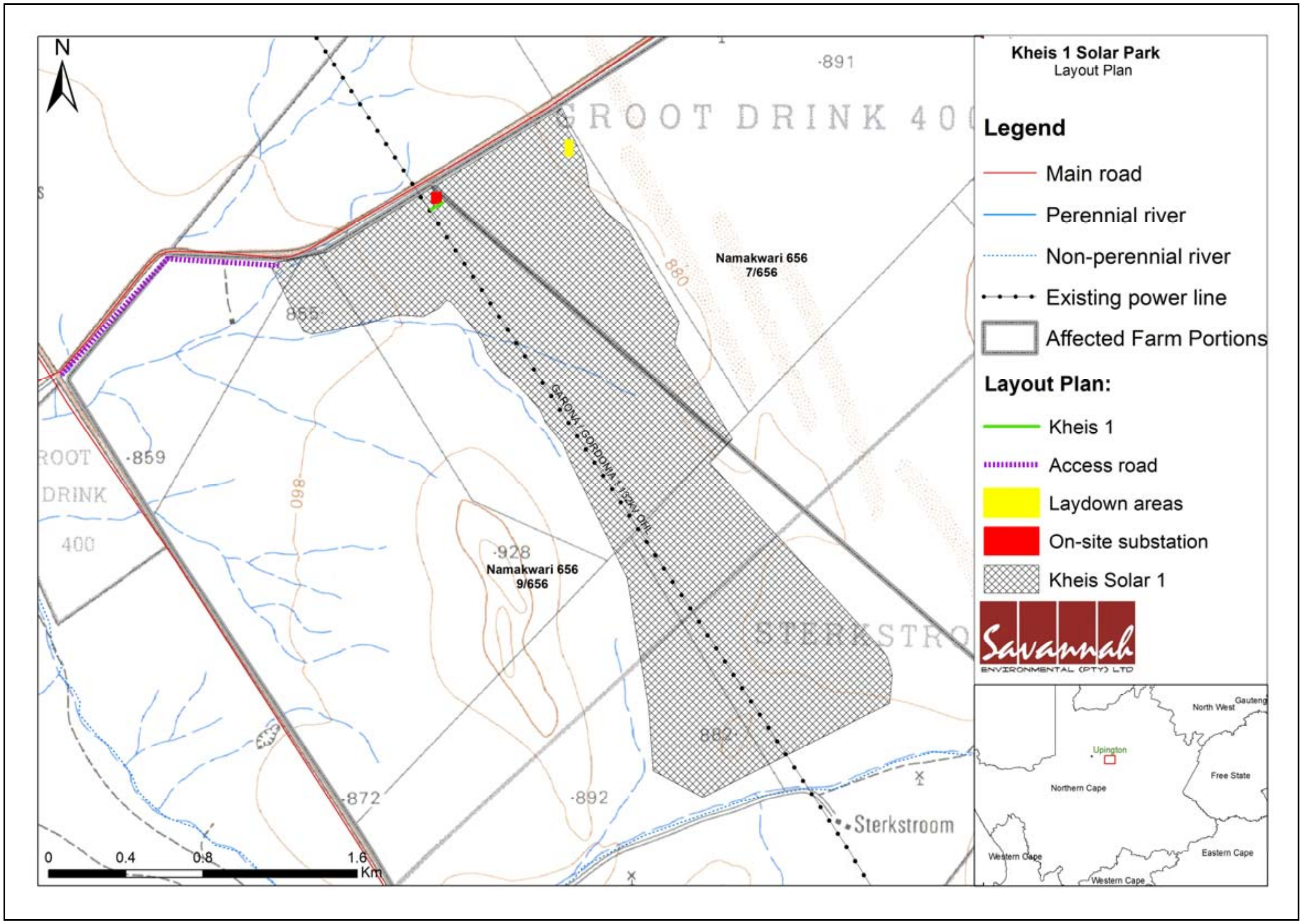



**Figure 8.1:** Map illustrating the location of the development footprint for Kheis Solar Park 1 facility and associated infrastructure and the proposed layout of the proposed facility on Portion 7 and 9 of Portion 4 of Farm Namakwari 656.

## 8.1. Summary of Conclusions and Recommendations relevant to the Kheis Solar Park 1 facility and Associated Infrastructure

The preceding chapters of this report together with the specialist studies contained within **Appendices E-J** provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for Kheis Solar Park 1 facility by providing a summary of the conclusions of the assessment of the proposed site for the development of the PV solar energy facility. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental specialist consultants and presents an informed opinion of the environmental impacts associated with the proposed project.

From the conclusions of the detailed EIA studies undertaken, sensitive areas within the development footprint area were identified and flagged for consideration and avoidance by the facility layout (refer to Figure 8.2). Potential impacts which could occur as a result of the proposed project are summarised in the sections which follow.

The most significant environmental impacts identified and assessed to be associated with the proposed Kheis Solar Park 1 include:

» Impacts on ecology occurring on the site.

Other impacts which could have an impact on the environment include:

» Impacts on the local soils, land capability and agricultural potential of the site.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure (power line, access road etc.).
» Impacts on heritage and paleontological resources.
» Social and economic impacts.
» Impacts associated with the power line.

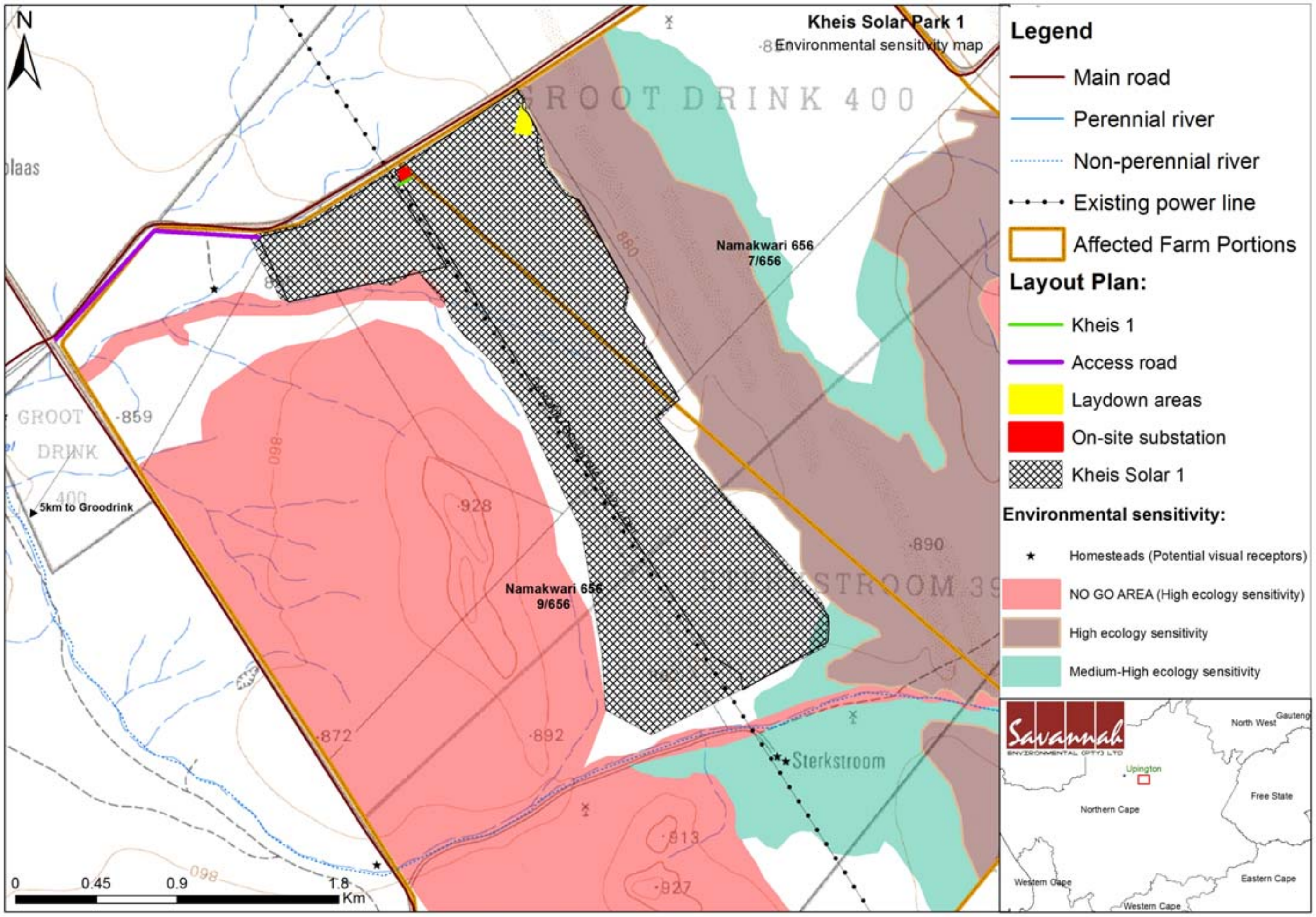



**Figure 8.2:** Environmental Sensitivity map of the proposed Kheis Solar Park 1 facility located on Portion 7 and 9 of Farm Namakwari.

#### *8.1.1. Impacts on Ecology*

Two vegetation units were identified within the Kheis Solar Park 1 footprint, Calcareous low shrub plains occupy most of the Kheis Solar Park 1 site and are of lower sensitivity. The second vegetation association is the mixed shrub (occurs as a transition between the calcareous plains and dune fields) with a Medium-Low sensitivity. The ecological sensitivity assessment identified those parts of the site that have high conservation value or that may be sensitive to disturbance. The habitats considered most sensitive on the site include:

» Duneveld
» Larger drainage channels
» Rocky outcrops
» Undulating calcrete and sandy plains

These areas are avoided by the proposed infrastructure, which is located largely in an area of low sensitivity as is indicated in Figure 8.2. From an ecology perspective, it is not expected that the development will compromise the survival of any specific flora or terrestrial vertebrate species on the study area or beyond if mitigation measures are fully implemented. The most significant impacts are expected to be on ecosystem health and functionality, which should remain relatively intact if all mitigation recommendations are implemented.

#### *8.1.2. Impact on Soils, Land Capability and Agricultural Potential*

Hutton soils which occur on the broader site (Portion 7 and 9 of Farm Namakwari 656) are highly prone to wind erosion due to the sandy texture of the soil. It is, therefore, important that there should be strict adherence to the Environmental Management Programme and good soil management measures regarding the management of stormwater runoff and water erosion control should be implemented during all phases of the project. With the implementation of good soil management measures the impact of the PV Facility on soils can be managed to an acceptable level, without significant erosion issues during the lifespan of the facility.

The study area has limited agricultural potential, and the proposed development area is aligned to avoid key grazing areas located in dune areas. The significance of agricultural impacts is influenced by the fact that the site has extremely limited agricultural potential, with a land capability of class 7, non-arable, low potential grazing land. The site is used only for grazing of cattle. No agriculturally sensitive areas occur within the proposed Kheis Solar Park 1 footprint. The major limitations to agriculture are the aridity and lack of access to water, as well as the very sandy soils with limited water and nutrient holding capacity, and in some places limited soil depth. The development will have **low to medium** negative impacts on agricultural resources and productivity. The conclusion of this assessment is that from an agricultural impact perspective the development can proceed as proposed, subject to the recommended mitigation measures provided being implemented.

#### *8.1.3. Visual Impacts*

The visual surroundings of the proposed Kheis Solar Park 1 site, especially within a 2km radius, will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 30 years). There are no major urban developments near (within 4km of) the proposed Kheis Solar Park 1 development site, but additional viewer incidence (and expected negative viewer perception) will be concentrated within the homesteads and farm residences within the study area at 2km, located primarily along the Orange River. The FM Safaris Game Farm, located north-west of the Kheis Solar Park 1, is also considered as a sensitive visual receptor. Visitors (mainly hunters) to this farm and game lodge generally would not expect to view electricity generation infrastructure when visiting the region for recreational purposes. These observers may be negatively affected by the Kheis Solar Park 1 development. Additionally, Kheis Solar Park 1 could potentially have a high visual impact on road users travelling along the secondary road (for a short period when they pass the facility) located north of the Kheis Solar Park 1, site-specific mitigation measures are recommended in order to reduce/mitigate the potential visual impact to moderate.

During the decommissioning or post-closure phase of the project, all of the infrastructure will be removed, recycled or re-used off-site. The residual visual impacts of the site are expected to include scarring of the landscape in the areas affected by infrastructure. With the implementation of appropriate management measures such as rehabilitation of disturbed areas and planting of vegetation and visual screening methods at receptors / key viewpoints, this scarring and visual impact could be reduced and removed in the long-term.

The anticipated visual impacts identified through the EIA process (post mitigation measures) are on average expected to be of low to moderate significance. The Kheis Solar Park 1 development is therefore not considered to be fatally flawed from a visual perspective.

#### *8.1.4. Impacts on Heritage and Paleontological Resources*

There were no heritage sensitive areas identified on the Kheis Solar Park 1 site. Two heritage artefacts of low heritage significance occur outside the development footprint for Kheis Solar Park 1 and will not be impacted by the development footprint of the PV facility. There is no heritage no go areas within the site development footprint for Kheis Solar Park 1.

This study has identified that of the geological units that underlie the project area only the Gordonia Formation is potentially fossiliferous and may be negatively impacted. There is a potential for negative impact on the palaeontological heritage of the project area throughout the eastern portion of Kheis Solar Park 1 due to the extensive coverage of thick deposits of the Gordonia Formation in those locations. The potential risk for any negative impact on the palaeontological heritage in Kheis Solar Park 1 is categorised as improbable due to the general scarcity of fossils in the unit and as *no fossil materials* were located within the project area.

The impact of the project on **heritage resource** is rated as **low significance**. However, a preconstruction walk-through survey by an archaeologist is recommended to be undertaken for the PV facility and associated infrastructure. Should substantial archaeological or paleontological (fossils) remains or graves be exposed during construction, SAHRA should be alerted as soon as possible such that appropriate action (e.g. recording, sampling or collection) can be taken by a professional archaeologist or palaeontologist. It is recommended that a close examination of all excavations be made while they are occurring during construction within the Gordonia Formation sands.

#### *8.1.5. Social and Economic Impacts*

The proposed project could have negative and positive **social and economic impacts** of **low (negative) and high (positive) significance** for post mitigation and enhancement respectively. Kheis Solar Park 1 75MW facility will provide opportunities for employment and skills development in the local area during both the construction and operational phases. Another potential spin-off from the development is the stimulation of the local economy, including development of industries specifically to provide services and goods for solar facilities, and general retail businesses and accommodation. Potential negative impacts include the threats to public safety from construction and traffic activity, potential increased crime and health risks such as HIV/Aids particularly during construction and if people move into the area hoping to secure jobs. Social dissent is also possible if people perceive that recruitment processes are unfair and biased. Other impacts on the social environment include impacts associated with traffic and infrastructure (such as local roads). It is important that potential negative effects are managed as per the recommended mitigation measures to prevent these from developing into unacceptable cumulative impacts. Positive impacts of job creation and stimulation of the local economy can be progressed and cumulatively contribute to a desired outcome if enhancements measures (as contained in the socio-economic specialist study and draft EMPr) are implemented.

## 8.2. Assessment of Potential Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site-specific developments. This however, is beyond the scope of this study. The alignment of renewable energy developments with South Africa's IRP and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The Kheis Solar Park 1 facility falls within the identified geographical areas most suitable for the rollout of the development of solar energy projects within the Northern Cape Province, as identified within the Northern Cape SDF. This implies that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented. It is also important to note that it is unlikely that all proposed renewable energy facilities located in the 25km radius (as detailed in chapter 7) will be built in the short to medium term (i.e. 5years) due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets by the DoE. This will reduce the potential for cumulative impacts within this period. Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Kheis Solar Park 21 facility will be of **low to moderate** significance in the region and **low to moderate** within the Kheis Solar Park project site.

## 8.3 Comparison of Technology Alternatives

Impacts on the environment associated with the project will be influenced by the type of PV panel array to be implemented. PV technologies being considered for the proposed project are fixed and tracking, to be developed with a 280ha development footprint. For the majority of impacts, the two alternative PV technologies do not differ in any significant way. Therefore, there is no significant difference in the potential impacts associated with the alternatives. In terms of the specialist studies undertaken, the following conclusions were made regarding the preferred PV technology alternatives:

| | **Fixed** | **Tracking** |
|---|---|---|
| Ecology | Less preferred | Preferred |
| Soils and agricultural potential | No preference | No preference |

| | | |
|---|---|---|
| Visual | Preferred | Less preferred |
| Heritage & palaeontology | No preference | No preference |
| Social | No preference | No preference |

- ***Ecology*** – Tracking PV technology is ecologically a preferred technology alternative, due to the aridity of the area and the difficulty of new vegetation establishment. Solar panels create a shading effect to the vegetation in the affected area, thereby limiting growth in some cases. Tracking technology results in reduced shading when the panels are tracking the sun (due to the angle in relation to the ground surface). The impact of tracking systems therefore appears to be lower than that of a fixed panel array, even if the latter may occupy less space.
- **Soils and agricultural potential -** The agricultural potential for the proposed development site is low, in terms of impact arising from soils and agricultural potential. There is no significance difference in the potential impacts associated with the two technology alternatives.
- **Visual -** Fixed technology is preferred being that it is less intrusive to sensitive receptors. However, for this particular site there is very little difference in the significance in the potential impacts associated with the two technology alternatives, with views being restricted to within 4km.
- **Heritage and palaeontology -** There is no significance difference in the potential impacts associated with the two technology alternatives as the footprint remains unchanged.
- **Social** - There is no difference in social / economic impacts from either technology alternatives.

There are no impacts of unacceptably high significance associated with either technology alternative assessed for the proposed Kheis Solar Park 1 facility. In addition, there is little or no difference between the impacts associated with the two technology alternatives, apart from the expected difference in impact expected to be associated with ecology. From an environmental perspective both technologies are considered to be environmentally acceptable for implementation at the Kheis Solar Park 1 facility, with a slight preference for tracking technology. The technology preference should therefore be determined on the basis of technical considerations.

From a technical and financial view, a single axis tracker (HIASA) compared to the fixed structure yields production between 20% and 25% higher, depending on the site of installation and on the parameters of the tracker. Although the installation is more expensive initially, the higher yield makes it possible to offer a higher efficiency of the facility and subsequent lower electricity tariffs, making the project more competitive as a business unit. Thus, it is recommended that tracking technology be implemented for the Kheis Solar Park 1 facility.

The developer has confirmed that this is the preferred technology from a technical perspective and can therefore be implemented at this site.

### 8.4 Environmental Costs of the Project versus Benefits of the Project

Environmental (natural environment, economic and social) costs can be expected to arise as a result of the project proceeding. This could include:

- Direct loss of biodiversity, flora, fauna and soils due to the clearing of land for the construction and utilisation of land for the PV project (which is limited to the development footprint of 280 hectares). The cost of loss of biodiversity has been minimised on the Kheis Solar Park 1 PV site through the careful location of the development to avoid key areas supporting biodiversity of particularly high conservation importance.
- 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 being visually impacted to some extent by power lines.
- Change in land-use and loss of land available for grazing on the development footprint. The cost in this regard is expected to be limited due to the low agricultural potential and carrying capacity of the property and the fact that current agricultural activities can continue on the remainder of the property during construction and operation.

These costs are expected to occur at a local and site level and are considered acceptable provided the mitigation measures as outlined in this EIA and the EMPr are implemented.

Benefits of the project include the following:

- The project will result in important economic benefits at the local and regional scale through job creation, procurement of materials and provision of services and other associated downstream economic development. These will persist during the preconstruction/ construction and operational phases of the project.
- The project contributes towards the Provincial and Local goals for the development of renewable energy (specifically solar developments) as outlined in the respective SDFs and IDPs.
- The project serves to diversify the economy and electricity generation mix of South Africa by addition of solar energy to the mix.
- South Africa's per capita greenhouse gas emissions are amongst the highest in the world due to reliance on fossil fuels. The proposed project will contribute to South Africa achieving goals for implementation of non-renewable energy and 'green' energy. Greenhouse gas emission load is

estimated to reduce by 0.86% for a 500MW coal-fired power station compared to a similar MW PV project, on a like for like basis.

The benefits of the project are expected to occur at a national, regional and local level. As the economic costs to the environment have been largely limited through the appropriate placement of infrastructure on the site within low sensitivity areas, the expected benefits of the project will partially offset the localised environmental costs of the project.

## 8.5. Overall Conclusion (Impact Statement)

The principles of NEMA have been considered in this assessment through the implementation of the principle of sustainable development where appropriate mitigation measures have been recommended for impacts which cannot be avoided. In addition, the successful implementation and appropriate management of this proposed project will aid in achieving the principles of minimisation of pollution and environmental degradation at a national scale.

The EIA process has been undertaken in accordance with the requirements of the EIA Regulations and all effort has been made to involve interested and affected parties, stakeholders and relevant Organs of State such that an informed decision regarding the project can be made by the Regulating Authority. The general objectives of Integrated Environmental Management have been taken into account for this EIA report by means of identifying, predicting and evaluating the actual and potential impacts on the biophysical environment, socio-economic conditions and cultural heritage component. The risks, consequences, alternatives as well as options for mitigation of activities have also been considered with a view to minimise negative impacts, maximise benefits, and promote compliance with the principles of sustainable environmental management.

The technical viability of establishing a solar energy facility with a net generating capacity of 75 MW on a site located on Portion 7 and 9 of Portion 4 of Farm Namakwari 656 has been established by Gestamp Asetym Solar South Africa (Pty) Ltd. The positive implications of establishing the Kheis Solar Park 1 facility on the identified site include the following:

» The potential to harness and utilise solar energy resources within the Northern Cape Province.
» The project will assist the South African government at a national, provincial and local level in reaching their set targets for renewable energy.
» The project will assist the South African government in the implementation of its green growth strategy and job creation targets.

» The project will assist the district and local municipalities in reducing levels of unemployment through the creation of jobs, skills development opportunities and support of local business.
» The National electricity grid in the Northern Cape Province will benefit from the additional generated power.
» The project will contribute towards the promotion of clean, renewable energy in South Africa.
» Kheis Solar Park 1 site is located near Grootdrink which located within this Solar Corridor area has which has been ear-marked as a hub for the development of solar energy projects due to the excellent solar resource of the area, as well as the larger centre of Upington acting as load centre.
» Kheis Solar Park 1 site is appropriately located for easy access via a secondary (gravel) road that bridges the Orange River from the N10 national road near Grootdrink; or alternatively via the N14 onto a secondary road heading south next to the site
» Garona- Gordonia 1 132kV OHL power line traversing the proposed site, the project proximity to the national grid connection reduces some of the impacts related to building longer power line to connect to the grid.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that there are **no environmental fatal flaws** that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. The significance levels of the majority of identified negative impacts have been reduced to acceptable levels by implementing the mitigation measures recommended by the specialist team during the EIA process, and this specifically included the consideration of the facility layout in relation to site-specific sensitivities identified. The avoidance of areas of sensitivity is illustrated by the facility layout drawing overlain on the sensitivity map included as Figure 8.2. The project has all environmental constraints, and is considered to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) for the Kheis Solar Park 1 facility included within **Appendix K**.

With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable** provided all measures are taken to protect and preserve surrounding environment.

### 8.6. Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the impacts associated with the development of the Kheis Solar Park 1 project can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation.

The layout plan as presented in Figure 8.2 has been designed to avoid the majority of the sensitive environments on the site including:

- Duneveld
- Larger drainage channels
- Rocky outcrops
- Undulating calcrete and sandy plains
- Heritage sites identified on the broader property

Therefore this layout as presented is considered acceptable and is recommended as the preferred layout for the facility.

The following conditions would be required to be included within an authorisation issued for the project:

- Tracking technology is implemented as a preferred technology alternative from both an environmental and technical perspective.
- The draft Environmental Management Programme (EMPr) as contained within Appendix K of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be the main key in achieving the appropriate environmental management standards as detailed for this project.
- Following the final design of the facility, a final layout indicating all relevant infrastructure and affected areas (permanent and temporary) must be submitted to DEA for review and approval prior to commencing with construction.
- Duneveld, larger drainage channels, and outcrops should be treated as No Go Zones due to their high conservation value. Even on the undulating calcrete and sandy plains, ground disturbance should be minimised, and existing

gravel roads and tracks used as far as possible to lower the extent of the footprint.

» If any protected plant or tree species will be removed/destroyed by the developer, a collection/destruction permit to be obtained from Northern Cape Department of Environment and Nature Conservation and/or DAFF for the protected species found on site as well from the provincial permitting authority.
» A detailed Invasive Plant Management Plan will have to be in place prior to commencement of activity and be diligently followed and updated throughout the project cycle up to the decommissioning phase.
» Sociable weavers' nests occur within the development area should be avoided as far as possible. Nests may only be removed with a permit and by a suitably qualified specialist, supervised by conservation staff. Undertake pre-construction walk-through footprint investigations for protected flora and burrowing terrestrial vertebrates.
» Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be implemented.
» All infrastructures, including access roads and other on-site infrastructure must be planned so that the clearing of vegetation is minimised.
» Site rehabilitation of temporary laydown and construction areas to be undertaken immediately after construction.
» Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to provide input into rehabilitation specifications.
» Develop an emergency maintenance plan to deal with any event of contamination, pollution, or spillages during construction and operation.
» Compile a comprehensive storm-water management method statement, as part of the final design of the project and implement during construction and operation.
» All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.
» An independent Environmental Control Officer (ECO) must be appointed by the project developer prior to the commencement of any authorised activities.
» Applications for all other relevant and required permits required to be obtained by the developer and must be submitted to the relevant regulating authorities.

# ASSESSMENT OF POTENTIAL IMPACTS: KHEIS SOLAR PARK 2 — CHAPTER 9

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the development of the proposed Kheis Solar Park 2 and associated infrastructure (refer to **Figure 9.1**). This assessment has considered the construction of a 55 MW facility and all related and ancillary infrastructure, including:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings.
» Cabling between the structures, to be lain underground where practical.
» Central invertor/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
» An on-site substation (50m x 50m) and power line (1800m) to evacuate the power from the facility into the Eskom grid via the existing Garona-Gordonia 132kV power line that traverses the site (Portion 9 of Portion 4 of the Farm Namakwari 656)
» Internal access roads (5m wide).
» Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity (approximate footprint (±100 m²)

The proposed Kheis Solar Park 2 will have a development footprint of approximately 210 ha. The development of the facility will comprise the following phases:

» *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of the access road, electricity generation infrastructure, power line servitudes, construction camps, laydown areas, transportation of components/construction equipment to site; and undertaking site rehabilitation including implementation of a storm water management plan. The construction phase for the Kheis Solar Park 2 is expected to take approximately 16 months.
» *Operation* – will include operation of the facility and the generation of electricity which will be fed into the national grid via the on-site substation and an overhead powder line. The operational phase of the Kheis Solar Park 2 is expected to extend in excess of 20 - 25 years.

» *Decommissioning* – depending on the economic viability of the plant, the length of the operational phase may be extended. Alternatively decommissioning will include site preparation; disassembling of the components of the facility; clearance of the site and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to construction. Therefore, these impacts are not considered separately within this chapter.

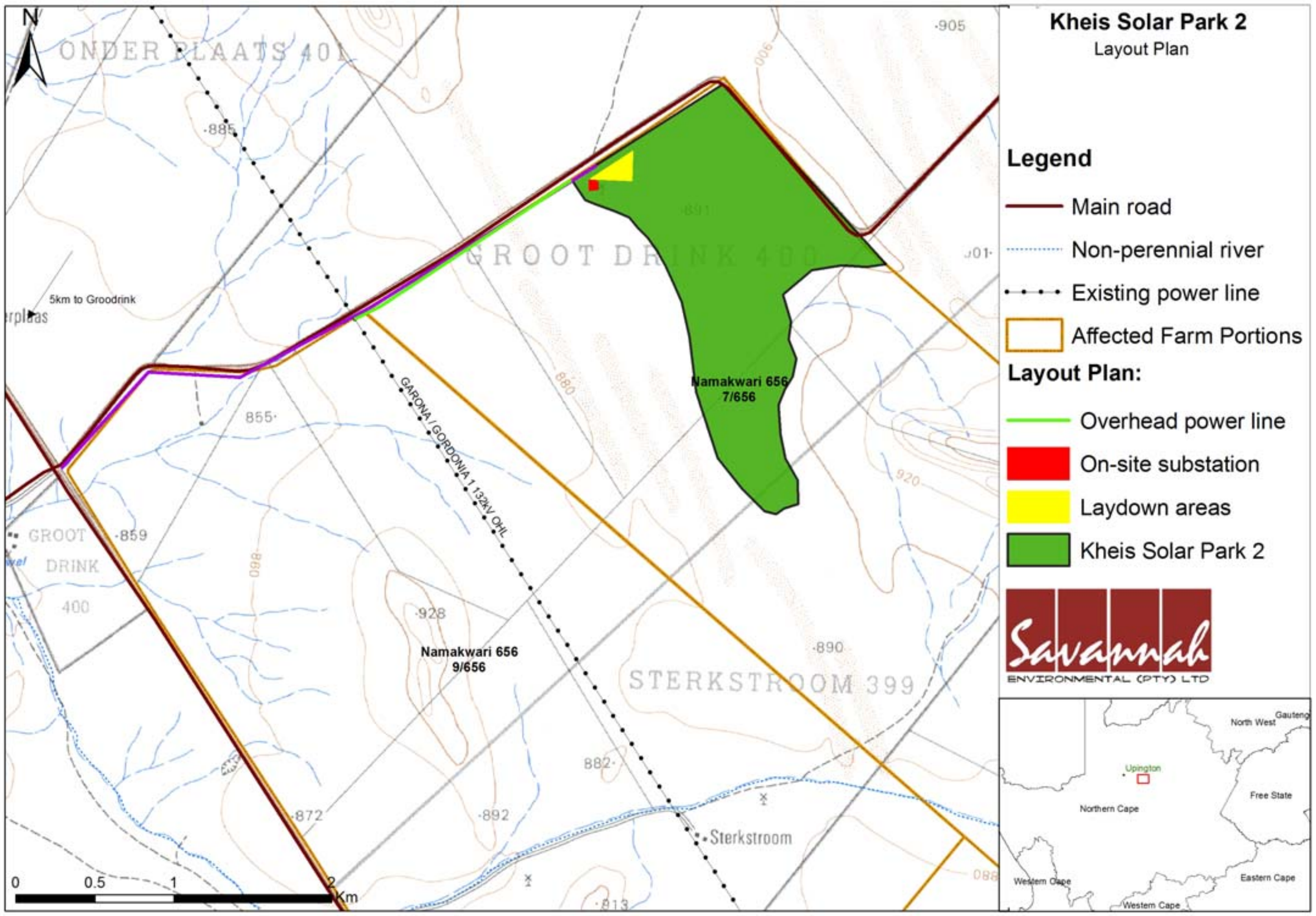



**Figure 9.1:** Layout map showing Kheis Solar Park 2 of the proposed Kheis Solar Energy Facility and associated infrastructure on Portion 7 of Portion 4 of the Farm Namakwari 656

## 9.1 Alternatives Assessment

### *Technology Alternatives*

Impacts on the environment associated with the project will be influenced by the type of PV panel array to be used. PV technologies being considered for the proposed project are fixed and tracking. As the panels will not differ in height with the two technologies under consideration, the most important differences in impact between the technologies relate to the ecological environment (Tsoutsos *et al*. 2005, Turney and Fthenakis 2011, Strohbach 2012) and are summarised in the table below:

Each of the impacts assessed below provides a comparative assessment of the two technology alternative.

## 9.2 Assessment of the Potential Impacts associated with the Construction and Operation Phases

The sections which follow provide a summary of the findings of the assessment of potential impacts associated with the construction and operation of the proposed Kheis Solar Park 2 facility on a development footprint of ~210ha on the identified site Portion 7 of Portion 4 of the Farm Namakwari 656 (covering an area of ~1800 ha in extent). The assessment of potential issues presented in this chapter has involved key input from specialist consultants, the public and the project developer. Issues were assessed in terms of the criteria detailed in Chapter 4 (section 4.3.3). The nature of the potential impact is discussed, and the significance is calculated with and without the implementation of mitigation measures. Recommendations are made regarding mitigation/enhancement and management measures for potentially significant impacts and the possibility of residual and cumulative impacts are noted. Cumulative impacts for Kheis Solar Park 2 are assessed in further detail in Chapter 11, as well as within the specialist studies contained in Appendix E.

### *9.2.1. Potential Impacts on Ecology*

The study area is located in an area characterised by Lower Gariep Broken Veld (NKb 1), Bushmanland Arid Grassland (NKb 3), Gordonia Duneveld (SVkd 1) and fractions of the Kalahari Karroid Shrubland (NKb 5) as described by Mucina and Rutherford (2006). Riparian vegetation occurs on the banks of small ephemeral water washes that drain into the nearby Orange River west of the study area. Only the vegetation along the Orange River itself is currently regarded as a threatened ecosystem, and will only be impacted on if impacts of the proposed development are not adequately mitigated.

Vegetation units that could be identified within the Kheis Solar Park 2 site are listed below with their sensitivity and their sensitivity is mapped on Figure 9.2.

» Association 1: *Leucosphaera bainesii – Zygophyllum dregeanum* calcareous low shrub plains occupy most of the developable parts of the study area. Species composition is very diverse, with forb and low shrub dominating most areas.
  - Conservation value: Medium
  - Sensitivity: **Low**

» Association 3: *Rhigozum trichotomum – Stipagrostis ciliata* mixed shrub occur as a transition between the calcareous plains and dune fields. More surface sand creates a more favourable environment for perennial grasses, but soil depth is restricted by underlying calcrete, hence the density of large trees is considerably lower than on the duneveld.
  - Conservation value: Medium to high
  - Sensitivity: **Medium-High** (where the vegetation structure consists of open grassed areas interspersed with smaller groups of higher trees and shrubs) and **Medium-low** (where there is excessive disturbance from bush encroachment). NB: the majority of Kheis Solar Park 2 falls within the Medium-low portion of this vegetation unit (with a small part occupying the Medium-High area).

The duneveld, larger drainage channels, and outcrops should be treated as No Go Zones due to their high conservation value. Even on the undulating calcrete and sandy plains, ground disturbance should be minimised, and existing gravel roads and tracks used as far as possible to lower the extent of the footprint. These no-go and high sensitivity areas are not impacted by the facility as indicated in Figure 9.2.

Solar energy facilities require relatively large areas of land for placement of infrastructure. The proposed Kheis Solar Park 2 and associated infrastructure requires ~210ha for the establishment of the proposed panels and associated infrastructure. The main expected negative impact from an ecological perspective will be due to loss of vegetation, loss of species of conservation concern, and loss of habitat which may have direct or indirect impacts on individual species. Potential impacts and the relative significance of the impacts are summarised in the tables which follow (refer to **Appendix E - Ecology Report** for more details).

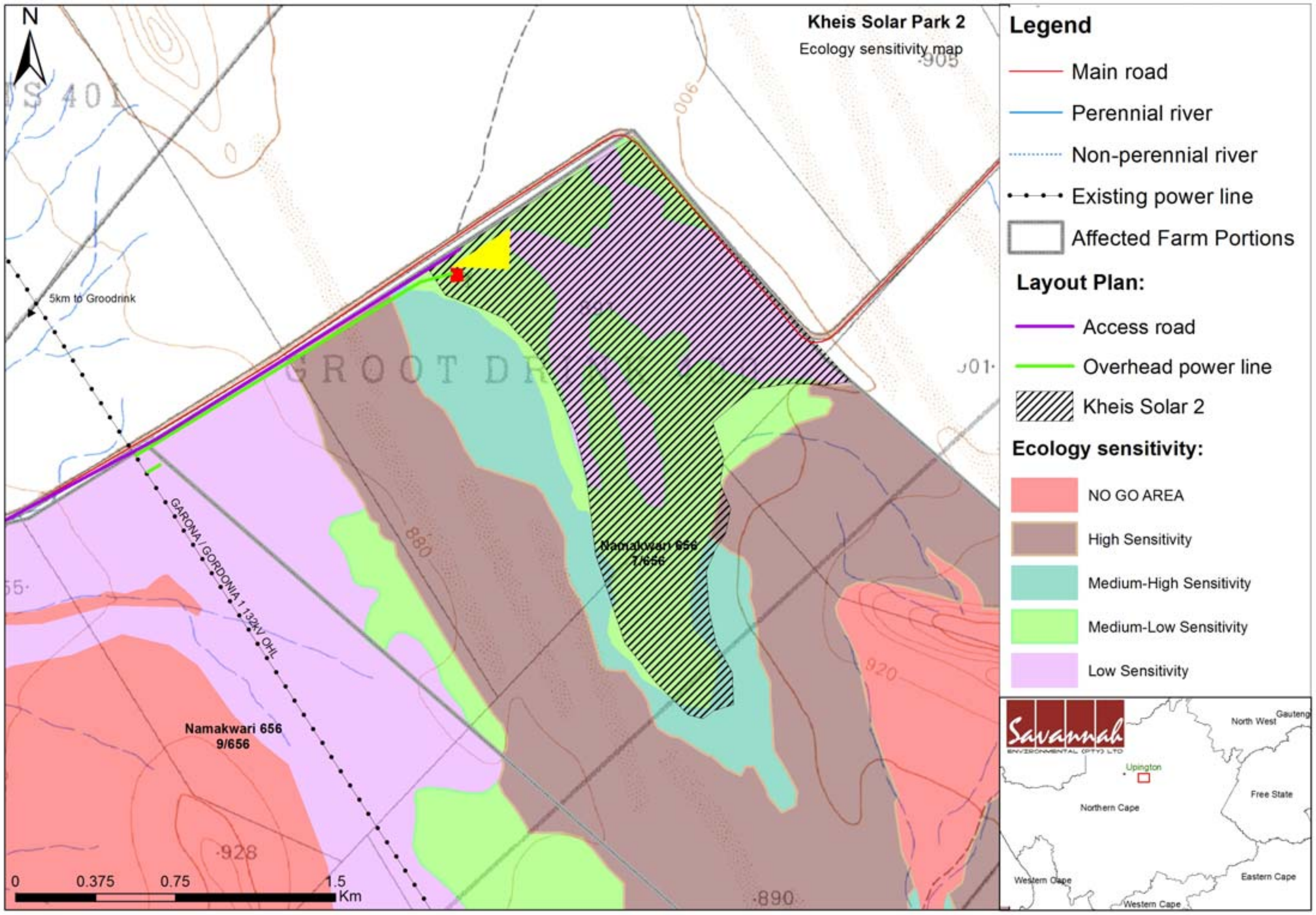



**Figure 9.2:** Sensitivity map indicating sensitive ecological areas within the proposed Kheis Solar Park 2 Facility and surrounding area

## a) Summary of ecological impacts associated with the proposed solar energy facility during the construction and operational phase

**Nature:** Upgrading and/or creation of site access and internal maintenance roads

Loss of vegetation, increase in runoff and erosion, possible distribution and increased establishment of alien invasive species, possible disturbance and reduction of habitat or injury to burrowing vertebrates, possible rise of road-kill incidences of fauna, possible change of natural runoff and drainage patterns, possible loss of protected species, possible permanent loss of revegetation potential of soil surface, increase in dust levels.

*Note: relatively large access roads already exist on and to the land portion, as well as provide access to portion 7 and 9 of the Farm Namakwari 656.*

**Listed activities:**
GN 544 activity 11(x)(xi) & 18(i);
GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i)

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Long-term (4) | Long-term (4) |
| **Magnitude (M)** | Low (4) | Minor (2) |
| **Probability (P)** | Definite (5) | Definite (5) |
| **Significance (S = E+D+M)*P** | **Medium (50)** | **Medium (35)** |
| **Status (positive, neutral or negative)** | Negative | Negative<br>Notes: reduced impact on existing roads and tracks |
| **Reversibility** | Not reversible | Relatively reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |
| **Can impacts be mitigated?** | Reasonably well | |

**Mitigation:**

- » Treat all outcrop areas and dunes as No-Go Zones
- » Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains
  - ∗ Ensure adequate drainage where ephemeral drainage lines crossed
  - ∗ Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines
- » Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
  - ∗ Protected geophytic and succulent plant species: must be relocated
  - ∗ Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
  - ∗ Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so,

the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated

  * All social weavers nests that may be affected by the development must be moved by a qualified specialist or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
  * Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanisation

» During construction:
  * Create designated turning areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
  * Ensure that concrete, tar or other construction material is not spilled or discarded next to newly built roads or storm water structures, but disposed of at a designated area

» Keep the clearing of natural vegetation to a minimum
» Dust levels must be controlled and minimised
» If filling material is to be used, this must be sourced from discontinued mining areas on the adjacent property or other authorised and permitted sources
» Topsoil (the upper 25 cm of soil) is an important natural resource; where it must (and can) be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
» Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas
» Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated (erosion management plan required)
» Prevent leakage of oil or other chemicals or any other form of pollution, as this may infiltrate local groundwater reserves or end up in the Orange River where it can affect all downstream users
» Monitor the establishment of (alien) invasive species and remove as soon as detected, whenever possible before regenerative material can be formed
» Strictly enforce a speed limit of 30 km/hour on all construction and access routes as appropriate and limit driving to daytime hours to try and prevent collisions with fauna, especially nocturnal mammals
» After decommissioning, if access roads or portions thereof will not be of further use to the landowner, remove all foreign material and rip area to facilitate the establishment of vegetation, followed by a suitable revegetation programme

**Cumulative impacts:**

» Possible erosion of areas lower than the access road, possible contamination of groundwater reserves due to oil or other spillage
» Possible spread and establishment of alien invasive species
» Increased transformed areas (together with surrounding developments) that may affect local fauna and flora population dynamics and runoff patterns

**Residual impacts:**

» Localised loss of vegetation
» Altered topsoil conditions
» Potential barren areas remaining after decommissioning

» Potential for erosion and invasion by weed or alien species
» Potential for increased dust and its impact on surrounding environments and biodiversity

**Nature:** Fencing area – may also serve as fire-break and assumed to run alongside maintenance track

Loss of vegetation and specifically protected or red data species, window of opportunity for the establishment of alien invasive species, altered topsoil characteristics prone to capping and sheet erosion, increased runoff and storm water volumes, temporary disturbance of burrowing fauna, possible reduction of habitat and forage availability to terrestrial vertebrates

*Note: existing fencing already exists that restricts movement of larger terrestrial fauna, fencing areas will be re-aligned as necessitated by the development*

**Listed activities:**
GN 544 activity 11(x)(xi) & 18(i);
GN 546, 18 June 2010 activity 14(i)

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Long-term (4) | Long term (4) |
| **Magnitude (M)** | Low (4) | Minor (2) |
| **Probability (P)** | Definite (5) | Highly Probable (4) |
| **Significance (S = E+D+M)*P** | **Medium (50)** | **Low (28)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Partially reversible | Reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |
| **Can impacts be mitigated?** | Reasonably well | |

**Mitigation:**
» Treat all outcrop areas and dunes as No-Go Zones
» Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains
  * Ensure adequate drainage where ephemeral drainage lines crossed
  * Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines
» Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
  * Protected geophytic plant and succulent species: must be relocated
  * Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor

- * Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated
- * All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
- * Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanisation

» During construction: create designated turning areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
» During the design phase, the possible impact of burrowing vertebrates and rodents on the development must be determined, and fencing must be designed to either exclude such fauna if it will be detrimental or enable occasional migration of smaller vertebrates onto and across the site (which could be beneficial to small vertebrate populations)
» Minimise area affected, especially during construction
» During construction: strictly prohibit any off-road driving or parking of vehicles and machinery outside the footprint areas
» Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind
» Monitor the establishment of alien and indigenous invasive species and remove as soon as detected, whenever possible *before* regenerative material can be formed
» If the area will be used as a fire-break, maintain a suitably low grass layer by regular mowing or appropriate plant species selection, but do not leave soil bare. Alternatively, ensure that the soil has a covering of gravel or small rock that prevents erosion. The firebreak and fencing area must be kept clear of all weeds and indigenous invasive species to enable continued effective maintenance until decommissioning

**Cumulative impacts:**
» Possible erosion of cleared areas and associated accelerated erosion from surrounding areas
» Possible loss of ecosystem functioning due to increase in invasive species
» Increased habitat fragmentation and displacement of terrestrial vertebrates in the region

**Residual impacts:**
» Altered vegetation composition
» Compacted topsoils
» Possibility for erosion and invasion by alien invasives

**Nature:** Construction and operation of PV panels on natural vegetation within development footprint (**tracking panel option**)

Removal of or excessive damage to existing vegetation cover (approx. 3ha per MW). Loss of vegetation and/or species of conservation concern, loss of and alteration of many niche microhabitats, altered vegetation cover, site-specific altered distribution of rainfall and resultant runoff patterns, increase in runoff from PV panels and/or bare areas and accelerated erosion, loss of habitat and resource availability for terrestrial fauna, possible increase of storm water and dust effects during periods of extreme weather events, e.g.

| | | |
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| increased erosion or dust due to lower buffering capacity of sparser vegetation for the construction and operation of PV panels (tracking panel option). | | |
| **Listed activities:**<br>GN 544 activity 11(x)(xi) & 18(i);<br>GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i) | | |
| | **Without mitigation** | **With mitigation** |
| **Extent (E)** | Regional (3) | Local (2) |
| **Duration (D)** | Long-term (4) | Long-term (4) |
| **Magnitude (M)** | High (8) | Moderate (6) |
| **Probability (P)** | Definite (5) | Definite (5) |
| **Significance (S = E+D+M)*P** | **High (75)** | **Medium (60)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Low reversibility | Partially reversible |
| **Irreplaceable loss of resources?** | Highly Probable | Moderate Probability |
| **Can impacts be mitigated?** | Reasonably but with limited full restoration potential | |
| **Mitigation:**<br>» Treat all outcrop areas and dunes as No-Go Zones<br>» Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains<br>  * Ensure adequate drainage where ephemeral drainage lines crossed<br>  * Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines<br>» Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:<br>    * Protected geophytic and succulent plant species: must be relocated<br>    * Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor<br>    * Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated<br>    * All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding<br>    * Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanisation<br>» Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area | | |

- Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer where permissible according to rehabilitation recommendations of the relevant EMPr
  - Shred all shrubs and trees cleared and used the chips for dust and erosion control
  - Use only species that were part of the original non-invasive indigenous species composition as listed in the specialist report for revegetation
- After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr
  - It is expected that where topsoils were not excessively disturbed, revegetation should occur naturally
  - The higher level of shading anticipated from the PV panels may prevent or slow the re-establishment of desirable species, thus re-establishment must be monitored and species composition adapted if a desirable vegetation cover fails to establish within 24 months after construction.

Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum and Prosopis* species

- Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning
- If filling material is to be used, this should be sourced from discontinued mines on the adjacent property
- Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan
- Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro topography and revegetation efforts accordingly
- Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind

**Cumulative impacts:**

- If mitigation measures are not strictly implemented the following could occur:
  - Considerable loss of biodiversity
  - Erosion of areas around the panels and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands
  - Spread and establishment of invasive species
- Increased habitat fragmentation and displacement of terrestrial vertebrates in the region
- Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns that may affect downstream ecosystems

**Residual impacts:**

- Altered topsoil characteristics
- Loss of and alteration of microhabitats
- Altered vegetation composition, lower vegetative cover and loss of species diversity
- Increased habitat fragmentation and displacement of terrestrial vertebrates

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| » Higher risk of invasion by alien plant species |

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| **Nature:** Construction and operation of PV panels on natural vegetation within development footprint (**fixed panel option**)<br><br>Loss of vegetation and/or species of conservation concern, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from PV panels and higher volumes of storm water and accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible increase of detrimental effects during periods of extreme weather events, e.g. increased erosion or dust due to lower buffering capacity of sparser vegetation. Ecological impacts are greater where fixed panel technology is used. | | |
| **Listed activities:**<br>GN 544 activity 11(x)(xi) & 18(i);<br>GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i). | | |
| | **Without mitigation** | **With mitigation** |
| **Extent (E)** | Regional (3) | Local (2) |
| **Duration (D)** | Long-term (4) | Long-term (4) |
| **Magnitude (M)** | High (9) | High (8) |
| **Probability (P)** | Definite (5) | Definite (5) |
| **Significance (S = E+D+M)*P** | **High (80)** | **High (70)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Low reversibility | Partially reversible |
| **Irreplaceable loss of resources?** | Highly Probable | Medium Probability |
| **Can impacts be mitigated?** | Yes to some extent, but with limited full restoration potential | |
| **Mitigation:**<br>» Treat all outcrop areas and dunes as No-Go Zones<br>» Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains<br>∗ Ensure adequate drainage where ephemeral drainage lines crossed<br>∗ Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines<br>» Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:<br>∗ Protected geophytic and succulent plant species: must be relocated<br>∗ Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor<br>∗ Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so, | | |

the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated

- All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
- Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanisation

» Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area

» Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer where permissible according to rehabilitation recommendations of the relevant EMPr

- Shred all shrubs and trees cleared and used the chips for dust and erosion control
- Use only species that were part of the original non-invasive indigenous species composition as listed in the specialist report for revegetation

» After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr

- It is expected that where topsoils were not excessively disturbed, revegetation should occur naturally
- The higher level of shading anticipated from the PV panels may prevent or slow the re-establishment of desirable species, thus re-establishment must be monitored and species composition adapted if a desirable vegetation cover fails to establish within 24 months after construction.

» Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum and Prosopis species*

» Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning

» If filling material is to be used, this should be sourced from discontinued mines on the adjacent property

» Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil

» Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan

» Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro topography and revegetation efforts accordingly

» Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind

**Cumulative impacts:**

» If mitigation measures are not strictly implemented the following could occur:

- Considerable loss of biodiversity
- Possible accelerated erosion of areas around the panels and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands

    * possible contamination of drainage lines, lower-lying rivers or wetlands
    * possible spread and establishment of invasive species
- » Increased habitat fragmentation and displacement of terrestrial vertebrates in the region
- » Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns

**Residual impacts:**

- » Altered topsoil characteristics
- » Loss of and alteration of microhabitats
- » Altered vegetation composition, lower vegetative cover and loss of species diversity
- » Potential for increased dust and its impact on surrounding environments and biodiversity
- » Higher risk of invasion by alien plant species

**Nature:** Construction of power line from Kheis Solar Park 2 PV array as part of the grid connection – with direct connection to the existing Eskom power line traversing the land portion (~1800m).

Loss of vegetation, potential loss of large trees and associated microhabitats, increase in runoff and erosion, disturbance of burrowing animals

**Listed activities:**
GN 544, 18 June 2010 activity 10(i), 11(ii) & 18(i);
GN 546, 18 June 2010 activity 14(i).

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Long-term (4) | Long-term (4) |
| **Magnitude (M)** | Minor (2) | Small (0) |
| **Probability (P)** | Definite (5) | Highly Probable (4) |
| **Significance (S = E+D+M)*P** | **Medium (40)** | **Low (20)** |
| **Status (positive, neutral or negative)** | Negative | Slightly negative |
| **Reversibility** | Partially reversible | Reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |
| **Can impacts be mitigated?** | Yes to some extent | |

**Mitigation:**

- » Treat all outcrop areas and dunes as No-Go Zones, power lines from the PV array furthest from the ESKOM line must be routed along the gravel road servitude and may not cross the dunefield (also due to high bird presence, including raptors in the dunefields)
- » Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains
    * Ensure adequate drainage where ephemeral drainage lines crossed
    * Design the access routes to enter directly from the district gravel road and then

follow existing jeep tracks on the property and along existing power-lines

- » Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
  - ∗ Protected geophytic and succulent plant species: must be relocated
  - ∗ Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
  - ∗ Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated
  - ∗ All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
  - ∗ Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanization
- » Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area
- » Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development
  - ∗ Aim to minimise the destruction of indigenous large shrubs and trees
  - ∗ Limit clearing of indigenous vegetation to pylon positions only
  - ∗ Shred all shrubs and trees cleared and used the chips for dust and erosion control
- » After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr
  - ∗ It is expected that where topsoils were not excessively disturbed, revegetation should occur naturally
- » Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum and Prosopis* species
- » Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning
- » Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- » Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan
  - ∗ Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind
  - ∗ Shred all shrubs cleared and used the chips for dust and erosion control
- » Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution

**Cumulative impacts:**

- » Possible erosion of surrounding areas if no mitigation is implemented, no major cumulative impact on flora or fauna expected (excluding avifauna)

**Residual impacts:**

» Localised alteration of soil surface characteristics
» Localised loss of flora and displacement of fauna

| **Nature:** Construction of substation and other associated infrastructure and buildings<br><br>Loss of vegetation and/or species of conservation concern, loss of microhabitats, reduced vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from sealed surfaces and possibly higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible pollution from permanent infrastructure and/or facilities | | |
|---|---|---|
| **Listed activities:**<br>GN 544, 18 June 2010 activity 10(i), 11(ii) & 18(i);<br>GN 546, 18 June 2010 activity 14(i). | | |
| | **Without mitigation** | **With mitigation** |
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Long-term (4) | Long-term (4) |
| **Magnitude (M)** | Moderate (6) | Low (3) |
| **Probability (P)** | Definite (5) | Definite (5) |
| **Significance (S = E+D+M)*P** | **Medium (60)** | **Medium (40)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Partially reversible | Reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |
| **Can impacts be mitigated?** | Yes to some extent | |

**Mitigation:**

» Treat all outcrop areas and dunes as No-Go Zones
» Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains
  * Ensure adequate drainage where ephemeral drainage lines crossed
  * Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines
» Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
    * Protected geophytic and succulent plant species: must be relocated
    * Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
    * Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If

so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated
    * All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
    * Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanisation
- Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area
- Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development
    * Aim to minimise the destruction of indigenous large shrubs and trees
    * Shred all shrubs and trees cleared and used the chips for dust and erosion control
- After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr
    * It is expected that where topsoils were not excessively disturbed, revegetation should occur naturally
- Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum and Prosopis species*
- Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning
- Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan
    * Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind
    * Shred all shrubs cleared and used the chips for dust and erosion control
- Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution

**Cumulative impacts:**

- If mitigation measures are not strictly implemented the following could occur:
    * Erosion of areas around sealed surfaces and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands
    * Contamination of ground water resources and possibly the Orange River
    * Spread and establishment of invasive species
- Increased habitat fragmentation and displacement of terrestrial vertebrates in the region
- Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics

**Residual impacts:**

- Altered topsoil characteristics
- Loss of and alteration of microhabitats
- Altered vegetation composition, lower vegetative cover and temporary loss of local

species diversity
- Low functionality and productivity of cleared areas that may remain susceptible to further degradation for many years after decommissioning
- Increased habitat fragmentation and displacement of terrestrial vertebrates
- Higher risk of the establishment by alien and indigenous invasive plant species

**Nature:** Temporary equipment camps and laydown sites where machinery and material is kept during construction.

Loss of vegetation and/or species of conservation concern, alteration and loss of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from sealed or compacted surfaces and possibly higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible contaminated topsoil, possible contaminated ground water or wetlands, possible increased dust levels

**Listed activities:** None.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Moderate-term (3) | Short-term (2) |
| **Magnitude (M)** | Moderate (6) | Low (3) |
| **Probability (P)** | Definite (5) | Definite (5) |
| **Significance (S = E+D+M)*P** | **Medium (55)** | **Medium (30)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Partially reversible | Reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |
| **Can impacts be mitigated?** | Yes to some extent | |

**Mitigation:**
- Treat all outcrop areas and dunes as No-Go Zones
- Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains
  - Ensure adequate drainage where ephemeral drainage lines crossed
  - Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines
- Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
  - Protected geophytic and succulent plant species: must be relocated
  - Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
  - Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so,

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| the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated<br>∗ All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding<br>∗ Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanisation<br>» Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area<br>» Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development<br>∗ Aim to minimise the destruction of indigenous large shrubs and trees<br>∗ Shred all shrubs and trees cleared and used the chips for dust and erosion control<br>» Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum and Prosopis species*<br>» Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning<br>» Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil<br>» Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan<br>∗ Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind<br>∗ Shred all shrubs cleared and used the chips for dust and erosion control<br>» Prevent spillage of construction material and other pollutants, contain and treat any spillages immediately, strictly prohibit any pollution/littering according to the relevant EMPr<br>» No fires may be lit for cooking or any other purposes<br>» Facilities may not be used as accommodation for general construction staff<br>» No vehicles may be washed, serviced or repaired on the property<br>» After construction remove all foreign material prior to starting the rehabilitation<br>» The rehabilitation plan for all temporarily affected areas must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover<br>» Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed |
| **Cumulative impacts:**<br>» If mitigation measures are not strictly implemented the following could occur:<br>∗ Considerable loss of biodiversity<br>∗ Erosion of the development area<br>∗ Contamination of ground water and the Orange River<br>∗ Spread and establishment of invasive species<br>∗ Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns |
| **Residual impacts:** |

- » Altered topsoil characteristics
- » Loss of and alteration of microhabitats
- » Altered vegetation composition
- » Higher risk of invasion by alien plant species
- » Potential for increased dust and its impact on surrounding environments and biodiversity

| | | |
|---|---|---|
| **Nature:** Sourcing of fill material that may be required during or after construction<br><br>Reduction of existing overburden material from disused mines on adjacent property, source of dust during crushing and transportation of fill material | | |
| **Listed activities:** None | | |
| | **Without mitigation** | **With mitigation** |
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Long-term (4) | Short-term (2) |
| **Magnitude (M)** | Low (4) | Low (4) |
| **Probability (P)** | Highly Probable (4) | Probable (3) |
| **Significance (S = E+D+M)*P** | **Medium (40)** | **Low (21)** |
| **Status (positive, neutral or negative)** | Neutral | Positive |
| **Reversibility** | Partially reversible | not reversible |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes to some extent | |
| **Mitigation:**<br>» Aim to keep crusher and loaders on previously transformed sites, use existing tracks for transport<br>    * Strictly enforce a speed limit of 30 km/h to lower dust levels<br>    * Limit all operations to daylight hours to avoid collision with nocturnal animals<br>» Stay within demarcated areas and access routes for movement of materials<br>» Strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas<br>» Prevent spillage of pollutants; contain and treat any spillages immediately; strictly prohibit any pollution<br>» Monitor erosion of areas and control where necessary<br>» After construction remove all foreign material prior to starting the rehabilitation<br>» Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed | | |
| **Cumulative impacts:**<br>» If mitigation measures are not strictly followed the following could occur:<br>  * Continued erosion of the altered surfaces with associated degradation of the site and surrounding areas<br>  * Spread and establishment of invasive species | | |
| **Residual impacts:** | | |

- » Altered topsoil characteristics
- » Reduction of currently existing unsightly overburden heaps from discontinued mining operations
- » Higher risk of invasion by alien plant species

**Nature:** Transport of materials to site, movement of vehicles on site during construction and maintenance

Loss of vegetation, increase in runoff and erosion, disturbance or possible mortality incidents of terrestrial fauna, possible contamination of soil and groundwater by oil- or fuel spillages, possible establishment and spread of undesirable weeds and alien invasive species that could further damage ecosystem functionality

**Listed activities:** None

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent (E)** | Regional (4) | Local (1) |
| **Duration (D)** | Long-term (4) | Long-term (4) |
| **Magnitude (M)** | Low (4) | Small (0) |
| **Probability (P)** | Definite (5) | Highly Probable (4) |
| **Significance (S = E+D+M)*P** | **Medium (60)** | **Low (20)** |
| **Status (positive, neutral or negative)** | Negative | Neutral |
| **Reversibility** | Partially reversible | Reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |
| **Can impacts be mitigated?** | Reasonably | |

**Mitigation:**

- » Avoid all natural pans, if found, and a buffer of at least 50 m around such areas
- » Avoid as much as possible of the eastern tree-rich sections of the study area
- » Strictly restrict all movement of vehicles and heavy machinery to permissible areas, these being designated access roads, maintenance roads, turning points and parking areas. No off-road driving beyond designated areas is to be allowed
- » Parking areas should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary storm water control) if oil and fuel spillages are highly likely to occur (usually associated with areas where vehicles stand for long periods)
- » Wheels of large machinery should be checked prior to entering the site and cleared of seed material of alien invasive plants if transport routes go through infested areas (especially of species with spiny or bur-like seeds). Such seed must be destroyed.
- » Strict speed limits must be set and adhered to
    - * Animals accidentally injured by moving vehicles or machinery must be taken to a local veterinarian to be treated or put down in a humane manner
- » Dust levels must be controlled and minimised
- » Driving between dusk and dawn should be permissible during emergency situations only

| |
|---|
| » Prevent spillage of any fuels, oils or other chemicals, strictly prohibit other pollution<br>» Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment |
| **Cumulative impacts:**<br>» Possible pollution of surrounding areas if no mitigation is implemented<br>» Possible spread of alien invasive species beyond the site if no mitigation is implemented<br>» Possible increased road collisions and road kill of fauna |
| **Residual impacts:**<br>» Related to access roads and internal maintenance tracks |

## b) Comparative Assessment of PV Panel technology (Fixed vs Tracking):

The table below provides a comparison of the potential ecological impacts associated with the two technologies under investigation.

**Table 9.1:** Fixed panel technology vs tracking panel (single axis)

| Aspect influenced | Fixed panel | Tracking panel (single axis) |
|---|---|---|
| Size of land needed | approx. 2ha per MW | approx. 3ha per MW |
| Shading and associated change of vegetation | More continuous and intense shading.<br>Less stable and dense vegetation expected, reduced buffering capacity of extreme weather events by vegetation expected. | More variable and less intense overall shading.<br>More stable and denser vegetation cover expected, smaller reduction of buffering capacity of extreme weather events expected. |
| Effect on runoff and accelerated erosion | Larger continuous panel area, more concentrated runoff, constant runoff edges potentially create more erosion, especially where vegetation is weakened. | Smaller continuous panel areas, runoff more dissipated, moderate variation of runoff edges that are expected to create less erosion where vegetation is weakened. |
| Mounting height of panel | PV panels may be as low as 30 cm above ground to reduce total height, increasing the limits of permissible vegetation due to maintenance and fire risks. | Expected to be more than 1 m off the ground, increasing the possibility of low vegetation establishment and small fauna movement without compromising safety. |
| Height of top of panel | 3.5m | 3.5 -4m |

**Tracking PV technology** is ecologically a preferred technology alternative. Considering the aridity of the area and the difficulty of new vegetation establishment, the impact of tracking systems appears to be lower than that of a fixed panel array, even if the latter may occupy less space because the vegetation below the panels will receive more sunlight with the tracking technology option. This effect will become especially pronounced after decommissioning, when it is expected that seedbanks under a fixed panel system will have vanished as there will be little new inputs of seeds and old seeds will die over time. Topsoil quality most likely will have deteriorated to such an extent due to absence of vegetation that re-establishment of vegetation will be very difficult, as most of the microbiota on which many of these species depend for survival will no longer be present in the soil. The difference in the potential impacts on ecology associated with the two technology alternatives. Therefore, **tracking PV technology** is nominated as the preferred alternative (refer to Table 9.1)

**c) Implications for Project Implementation**

» Excluding all dune systems and outcrop areas in planning the development footprint, as is proposed for this facility. This will ensure that important ecosystem components can be maintained.
» The proposed photovoltaic facility development on the site will create a localised reduction of some slow-growing indigenous trees and shrubs, geophytes and other species restricted to certain microhabitats. This effect may be further exacerbated by surrounding and regional developments. At this stage, however, it is not anticipated that the development will change the current conservation status of any species.
» Potentially significant negative impacts on the ecological environment could be associated with soil erosion and associated degradation on and beyond the development area, possible introduction of alien invasive plants and a long-term (more than 8 months) low or absent vegetation cover after construction. With the diligent implementation of mitigating measures by the developer, contractors, and operational staff, the severity of these impacts can be significantly reduced.
» The impact on fauna is expected to be small for the development if mitigation measures are followed from the design phase, but this may become more of an issue if the cumulative impact of regional developments is considered. Presence of indigenous terrestrial vertebrates within the study area is relatively low due to absence of permanent surface water. Animals that may be permanently present can be relocated or will move away during construction, and may resettle after construction, depending on safety specifications necessitated by the development. Specific habitats of vertebrates within the study area are restricted to duneveld and outcrop area, which will be excluded from the proposed development.

» **Tracking PV technology** is nominated as the preferred alternative from an ecological perspective.

#### *9.2.2 Potential Impacts on Soils and Agricultural Potential*

**a) Summary of impacts associated with the proposed solar energy facility during the construction and operational phase**

There are three land types across the broader site with the entire development footprint of Kheis Solar Park 2 being entirely located within the Ag4 landtype. Soils across the Ag4 land type includes very similar soils to Af7 (moderately deep to deep, red, very sandy soils of the Hutton soil form), but it also includes over 48% of its surface area, much shallower soils on underlying rock and rock outcrops.

Predominantly as a result of the aridity constraints of the area, but also because of poor soils, agricultural land use is restricted to low intensity grazing. The natural grazing capacity is low, being 40-60 hectares per large stock unit over most of the site, but slightly higher in places. Agricultural potential is fairly uniform across the farm and the choice of placement of the facility on the farm or choice of technology therefore has minimal influence on the significance of agricultural impacts. No agriculturally sensitive areas occur within the proposed development footprint.

Aspects of the facility that may have an impact on soils include:
» Solar facility footprint (i.e. an array of PV panels, mounting structures, underground cabling between project components and fencing)
» Construction and positioning of internal access roads
» Use of potential sources of contaminants on the site (i.e. oil, petrol, diesel and other substances used by the vehicles and equipment)
» Construction and operation of the on-site substation
» Construction and positioning of the on-site workshop area for maintenance, storage, and offices and temporary construction/ laydown areas.

The potential impacts on soil include:
» Soil loss and erosion
» Loss of agricultural land use
» Generation of alternative land use income
» Degradation of veld vegetation

The two alternative PV technologies do not differ in any significant way as far as soils and agricultural potential is concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

| | | |
|---|---|---|
| ***Nature:*** Loss of agricultural land use<br><br>Caused by: direct occupation of land by footprint of energy facility infrastructure;<br>And having the effect of: taking affected portions of land out of agricultural production. | | |
| **Listed activities:**<br>GN 545 activity 15<br>GN 546 activity 14(a)(i) | | |
| | **Without mitigation** | **With Mitigation** |
| ***Extent*** | Low (1) - Site | n/a |
| ***Duration*** | Long term (4) | n/a |
| ***Magnitude*** | Small (1) | n/a |
| ***Probability*** | Definite (5) | n/a |
| ***Significance*** | **Medium (30)** | n/a |
| ***Status*** | Negative | n/a |
| ***Reversibility*** | High | |
| ***Irreplaceable loss of resources?*** | No (as the site can be returned to agriculture after decommissioning) | |
| ***Can impacts be mitigated?*** | No | |
| ***Cumulative impacts:***<br>The overall loss of agricultural land in the region due to a number of developments. The significance is low due to the limited agricultural potential of the area. | | |
| ***Residual impacts:***<br>No mitigation possible and therefore residual impacts are the same as impacts without mitigation | | |

| | | |
|---|---|---|
| ***Nature:*** Generation of alternative land use income<br><br>Caused by: the alternative land use of energy facility rental on low productivity agricultural land, in combination with continued farming on the remainder of the farm;<br>And having the effect of: providing land owners with increased cash flow and rural livelihood, as well as promoting the sustainability of the farming practices. | | |
| **Listed activities:**<br>GN 545 activity 15<br>GN 546 activity 14(a)(i) | | |
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Low (1) - Site | N/A |
| ***Duration*** | Long term (4) | N/A |
| ***Magnitude*** | Minor (3) | N/A |
| ***Probability*** | Highly probable (4) | N/A |
| ***Significance*** | **Medium (32)** | N/A |
| ***Status*** | Positive | N/A |

| | | |
|---|---|---|
| ***Reversibility*** | High | N/A |
| ***Irreplaceable loss of resources?*** | No | |
| ***Can impacts be mitigated?*** | Not required. | |
| ***Cumulative impacts:*** None | | |
| ***Residual impacts:*** None | | |

| | | |
|---|---|---|
| ***Nature:*** Soil Erosion<br><br>Caused by: alteration of run-off characteristics due to hard surfaces and access roads;<br>And having the effect of: loss and deterioration of soil resources (There is low risk of erosion due to the very gentle slopes). | | |
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Low (1) - Site | Low (1) - Site |
| ***Duration*** | Long term (4) | Long term (4) |
| ***Magnitude*** | Low (4) | Minor (3) |
| ***Probability*** | Probable (3) | Very improbable (1) |
| ***Significance*** | **Low (27)** | **Low (8)** |
| ***Status*** | Negative | Negative |
| ***Reversibility*** | Low | Low |
| ***Irreplaceable loss of resources?*** | No | No |
| ***Can impacts be mitigated?*** | Yes | |
| ***Mitigation:***<br>Implement an effective system of run-off control, where it is required, that collects and disseminates run-off water from hardened surfaces and prevents potential down slope erosion. This should be in place and maintained during all phases of the development. | | |
| ***Cumulative impacts:***<br>Increase erosion from other developments in the area | | |
| ***Residual impacts:***<br>Soil erosion isuues in the area if impacts are not mitigated? | | |

### Impacts associated only with the construction phase of the development

| |
|---|
| ***Nature:*** Loss of topsoil<br><br>Caused by: poor topsoil management (burial, erosion, etc.) during construction related soil profile disturbance (levelling, excavations, disposal of spoils from excavations etc.)<br>And having the effect of: loss of soil fertility on disturbed areas after rehabilitation. |

| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Low (1) - Site | Low (1) - Site |
| ***Duration*** | Long term (4) | Long term (4) |
| ***Magnitude*** | Minor (3) | Minor (2) |
| ***Probability*** | Probable (3) | Very improbable (1) |
| ***Significance*** | **Low (24)** | **Low (7)** |
| ***Status*** | Negative | Negative |
| ***Reversibility*** | Low | Low |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be mitigated?*** | Yes | |
| ***Mitigation:***<br>» Strip and stockpile topsoil from all areas where soil will be disturbed.<br>» After cessation of disturbance, re-spread topsoil over the surface.<br>» Dispose of any sub-surface spoils from excavations where they will not impact on agricultural land, or where they can be effectively covered with topsoil. | | |
| ***Cumulative impacts:***<br>Increasing topsoil loss with other developments in the area if appropriate mitigation is not implemented. | | |
| ***Residual impacts:***<br>Loss of topsoil in the area if impacts are not mitigated | | |

| ***Nature:*** Degradation of vegetation surrounding construction activities<br><br>Caused by: Trampling due to vehicle passage. | | |
|---|---|---|
| **Listed activities:**<br>GN 546 activity 14(a)(i) | | |
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Low (1) - Site | Low (1) - Site |
| ***Duration*** | Short (2) | Short (2) |
| ***Magnitude*** | Minor (2) | Small (1) |
| ***Probability*** | Probable (3) | Improbable (2) |
| ***Significance*** | **Low (15)** | **Low (8)** |
| ***Status*** | Negative | Negative |
| ***Reversibility*** | Medium | Medium |
| ***Irreplaceable loss of resources?*** | No | No |
| ***Can impacts be mitigated?*** | Yes | |
| ***Mitigation:***<br>Minimise road footprint beyond construction site and prohibit vehicular passage off designated roads. | | |

| |
|---|
| ***Cumulative impacts:***<br>None |
| ***Residual impacts:***<br>Loss of natural vegetation if area is not rehabilitated - Very low and limited to site |

**b) Comparative Assessment of PV Panel technology (Fixed vs Tracking):**

In terms of impact arising from soils and agricultural potential, there is **no significance** difference in the potential impacts associated with the two technology alternatives. Tracking panels can occupy more land than fixed panel technology; however a total of 210ha of low potential agricultural land would be available for the proposed Kheis Solar Park 2 on Portion 7 of Portion 4 of the Farm Namakwari 656, regardless of the type of technology used. The agricultural potential for this site is low. Therefore, in terms of impact arising from soils and agricultural potential, there is no significance difference in the potential impacts associated with the two technology alternatives. Therefore, there is **no preference** between the alternative technologies.

**c) Implications for Project Implementation**

» The proposed site for Kheis Solar Park 2 is situated on soils of low agricultural potential and this therefore has no implications on project development.
» The land has a low to moderate erosion risk, although the steeper slopes of the mountain features have higher risk. The susceptibility to wind erosion of most of the site is high due to the sandy texture of the soil. Therefore, appropriate mitigation is required to limit impacts in this regard.
» There is **no preference** between the alternative technologies in terms of soils and agricultural potential.

### *9.2.3 Assessment of Potential Impacts on Heritage & Palaeontology*

***a) Heritage impacts associated with the construction and operation phase of the proposed facility***

In terms of the significance, most of the archaeological sites observations within the Kheis Solar Park 2 development footprint fall under Landforms L3 Type 1 and Type 2 (exposed bedrock and some soil patches respectively). In terms of archaeological traces they all, furthermore, fall under Class A3 Type 1 (dispersed scatter). These ascriptions reflect poor contexts and likely low significance for these sites. For site attribute and value assessment, all of the observations noted fall under Type 1 (no sequence, Poor context, dispersed distribution for Classes), reflecting low significance, low potential and absence of contextual and key types of evidence. A colonial era farm dwelling, modified through time, and now in a state of ruin, was recorded at Sterkstroom[15]. It is not considered to be of major heritage significance.

On archaeological and heritage grounds, the occurrences observed can be said to be of low significance for proposed development footprints in areas of the proposed Kheis Solar Park 2 and associated infrastructure.

The two alternative PV technologies do not differ in any significant way as far as the impacts on heritage resources is concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

| | | |
|---|---|---|
| ***Nature:*** Acts or activities resulting in disturbance of surfaces and/or sub-surfaces containing artefacts (causes) resulting in the destruction, damage, excavation, alteration, removal or collection from its original position (consequences), of any archaeological material or object (what affected). | | |
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Local 1 | N/a |
| ***Duration*** | Permanent 5 | N/a |
| ***Magnitude*** | Minor 2 | N/a |
| ***Probability*** | Improbable 2 | N/a |
| ***Significance*** | **Low (16)** | N/a |
| ***Status (positive or negative)*** | Negative | N/a |
| ***Reversibility*** | No | |
| ***Irreplaceable loss of resources?*** | Yes, where present – but occurrence is generally extremely low density and of low significance. | |
| ***Can impacts be mitigated?*** | Yes – but not considered necessary. | |
| ***Mitigation:***<br>Artefact densities and heritage structures are low over the Kheis Solar Park 2 development footprint areas that were investigated. Unlike biological processes, heritage destruction generally has a once-off permanent impact and in view of this the mitigation measures are not considered necessary. | | |
| ***Cumulative impacts:***<br>Loss of heritage/archaeological resources over the region | | |

15 Some portions of these farms have and have been compined to Portion 7 and 9 of the Farm Namakwari 656.

| **Residual Impacts:** |
|---|
| Where any archaeological contexts occur the impacts are once-off permanent destructive events. |

### b) Palaeontology impacts associated with the construction and operation phase of the proposed facility

The majority of the Kheis Solar Park 2 site area is underlain by unconsolidated sands of the Gordonia Formation. The south western quadrant of the site contains extensive exposures of the Zonderhuis Formation. This formation appears to underlie the Gordonia Formation throughout the extent of the development area.

It is improbable that there will be any negative impact on the palaeontological heritage of the Gordonia Formation as **no fossil materials were identified during the site visit**. The calcrete as well as the Zonderhuis and Groblershoop Formations are considered to be unfossiliferous.

The two alternative PV technologies do not differ in any significant way as far as the impacts on palaeontology resources is concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

| **Nature:** Destruction, damage and loss of provenance of fossil materials | | |
|---|---|---|
| | **Without Mitigation** | **With Mitigation** |
| **Extent:** | Low (2) | Low (2) |
| **Duration:** | Permanent (5) | Permanent (5) |
| **Magnitude:** | High (10) | Minor (2) |
| **Probability:** | Improbable (1) | Improbable (1) |
| **Significance:** | **Low (17)** | **Low (8)** |
| **Status:** | Positive | Positive |
| **Reversibility:** | Impossible | Impossible |
| **Irreplaceable loss of resources:** | Low | Low |
| **Can impacts be mitigated:** | Yes | |
| **Mitigation:** All excavations must be inspected for fossil content by the ECO/EO. Should fossils be located the relevant exaction must be halted and SAHRA informed of the find. SAHRA may instruct that a palaeontologist should evaluate the fossil material and suggest appropriate protocols to either excavate or protect the fossil material. | | |
| **Cumulative impacts:** Loss of fossils if destroyed by multiple developments | | |
| **Residual impacts:** | | |

| |
|---|
| Permanent loss of fossil heritage if no mitigation is implemented. |

**c) Comparative Assessment of PV Panel technology (Fixed vs Tracking):**

In terms of impacts arising from Heritage and Palaeontology, there is **no significance** difference in the potential impacts associated with the two technology alternatives. Therefore, there is **no preference** between the alternative technologies.

***d) Implications for Project Implementation***

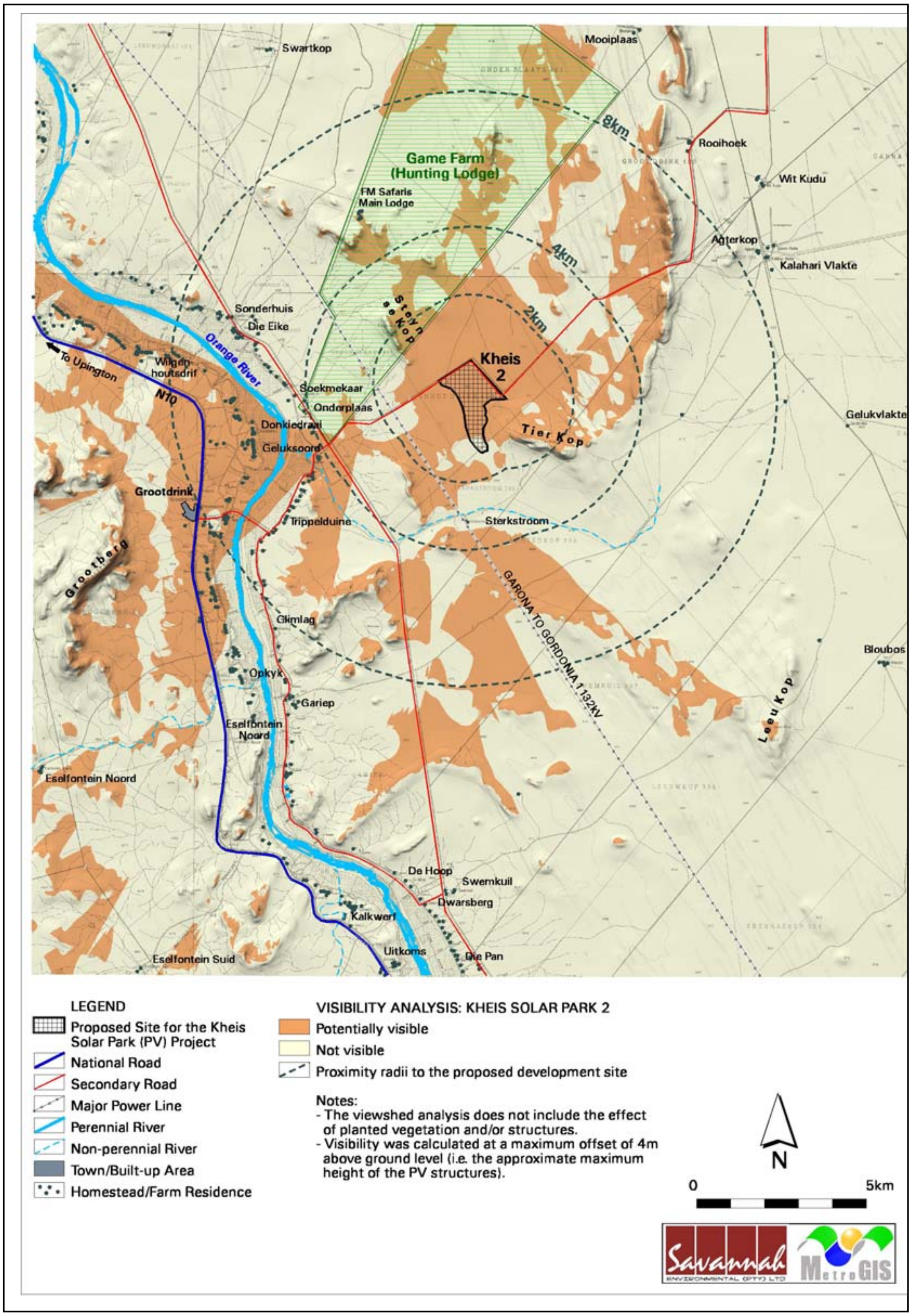
- The impacts to heritage resources and sites by the proposed development are not considered to be highly significant and the impact on archaeological sites can very easily be mitigated.
- There is a potential for negative impact on the palaeontological heritage of the project area throughout most of Kheis Solar Park 2 due to the extensive coverage of thick deposits of the Gordonia Formation in those locations, recommended mitigation measures should apply. The potential risk for any negative impact on the palaeontological heritage in Kheis Solar Park 2 is categorised as improbable due to the general scarcity of fossils in the unit and as *no fossil materials* were located within the project area.
- There is **no preference** between the alternative technologies in terms of heritage and palaeontology.

### *9.2.4 Assessment of Potential Visual Impacts*

**Potential visual exposure:** The Kheis Solar Park 2 is considerably smaller in size than the Kheis Solar Park 1 and displays an even more contained core area of visual exposure (refer to Figure 9.3).

- **0 - 2km**
  Exposure within a 2km radius of the facility is generally restricted to vacant land, the secondary road adjacent to the facility and sections of the FM Safaris to the north of the site (near *Steyn-se-Kop*).
- **2 – 4km**
  Visual exposure within this zone becomes very scattered with limited sightings expected from the FM Safaris and a short section of the secondary road traversing south-west of the facility.
- **4 - 8km**
  The main lodge at the FM Safaris Game Farm may be exposed at a distance of approximately 5km from the facility. Other homesteads and the N10 national road, located west of the Orange River may experience long distance sightings of the PV structures.
- **Greater than 8km**
  Visibility beyond 8km from the proposed development is expected to be negligible and highly unlikely due to the distance between the object (development) and the observer.

**Viewer incidence / viewer perception:** Viewer incidence is calculated to be the highest along the N10 national road and secondary road (east of the river), traversing between Upington and Groblershoop to the south. The secondary road traversing north of the Kheis Solar Park 2 site is also considered sensitive, although it is expected to carry fewer motorists than the aforementioned road. Commuters using these roads could be negatively impacted upon by visual exposure to the Solar Energy Facility (although for only short periods), and are thus considered to be sensitive to visual intrusion. The FM Safaris Game Farm, located north of the Kheis Solar Park 2 site, is also considered as a sensitive visual receptor. Visitors (mainly hunters) to this farm and game lodge generally would not expect to view electricity generation infrastructure when visiting the region for recreational purposes. These observers may be negatively affected by the Kheis Solar Park 2 development.




**Map 9.3:** Potential visual exposure of the proposed Kheis Solar Park 2.

**Visual absorption capacity:** The vegetation units present in the study area surrounding the solar facility (predominantly *Ticket and Bushland* and *Shrubland*) are on average only 2 m high. This, coupled with the sparse distribution of the plant species, the dimensions of the facility and height of structures, it was determined that the Visual Absorption Capacity (VAC) is low to negligible for virtually the entire study area.

**Visual impact index:** The combined result of the visual exposure, viewer incidence/perception and visual distance of the proposed Kheis Solar Park 2 facility is displayed on Figure 9.4. The site location is further east and away from the Orange River, and generally negates any additional visual impacts on residences or other major roads. The main visual impacts are expected along the secondary road traversing adjacent to the facility, and the exposed sections of the FM Safaris Game Farm.

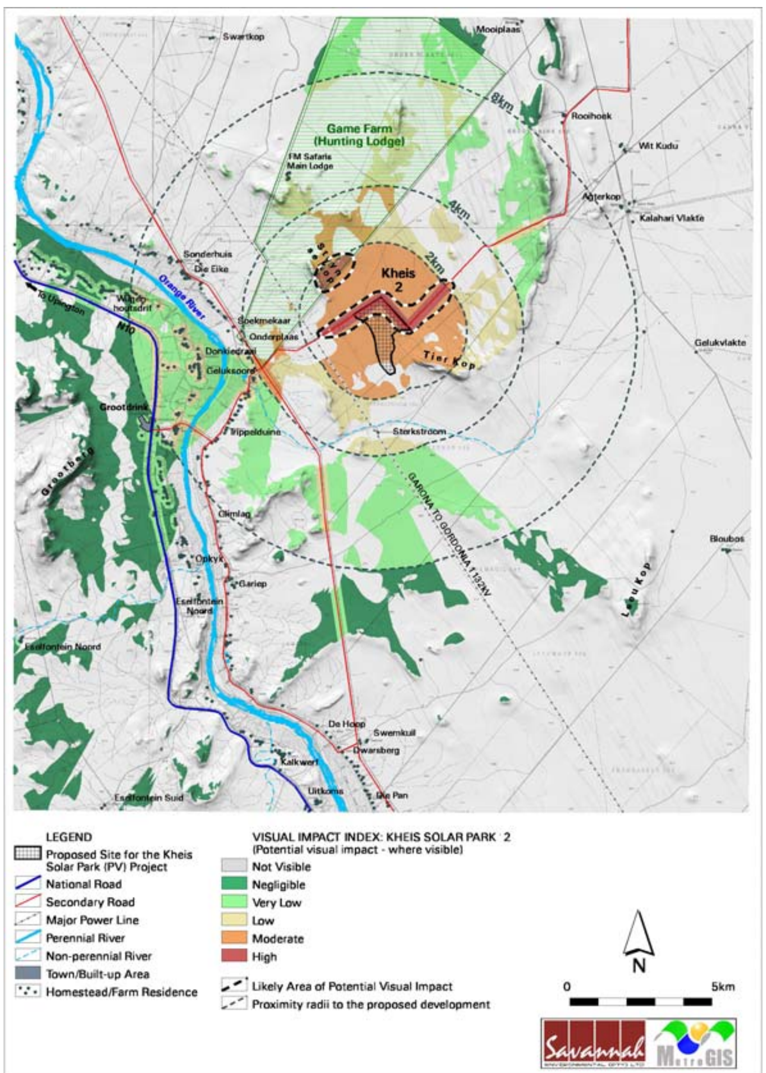



**Figure 9.4:** Map illustrating Visual Impact Index for the Kheis Solar Park 2 facility on Portion 7 of Portion 4 of the Farm Namakwari 656

### d) Impact tables summarising the significance of visual impacts of the PV facility during the construction and operation

| **Nature of Impact:** Visual impact on users of the secondary roads in close proximity to the proposed Solar Energy Facility | | |
|---|---|---|
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local **(4)** | Local **(4)** |
| **Duration** | Long term **(4)** | Long term **(4)** |
| **Magnitude** | High **(8)** | Moderate **(6)** |
| **Probability** | Highly probable **(4)** | Probable **(3)** |
| **Significance** | **High (64)** | **Moderate (42)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Recoverable **(3)** | Recoverable **(3)** |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |

***General mitigation/management:***

Planning:
- Retain and maintain natural vegetation in all areas outside of the development footprint.

Operations:
- Maintain the general appearance of the facility as a whole.

Decommissioning:
- Remove infrastructure not required for the post-decommissioning use of the facility.
- Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

***Site specific mitigation measures:***

Plant vegetation barriers or vegetated berms along the northern boundaries (bordering the road) of the Kheis Solar Park 2 in order to shield the structures from observers travelling along these roads.

***Cumulative impacts:***

The construction of the up to three Solar facilities and associated facilities on the site is expected to increase the cumulative visual impact within the immediate area. Alternatively, the relatively close proximity of the proposed facilities to each other (and the existing power line) consolidates the potential visual exposure of solar energy generation infrastructure within the region. The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 10.

***Residual impacts:***
The visual impact will be removed after decommissioning, provided the Solar Energy Facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain.

***Nature of Impact:*** Visual impact on visitors to the FM Safari Lodge located in close proximity to the proposed Solar Energy Facility

**Listed activities:**
GN 544 activity 10(i)
GN 545 activity 1 & 15
GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i)

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Local (4) | Local (4) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | High (8) | Moderate (6) |
| **Probability** | Probable (3) | Improbable (2) |
| **Significance** | **Moderate (48)** | **Low (28)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Recoverable (3) | Recoverable (3) |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |

***General mitigation/management:***

Planning:
» Retain and maintain natural vegetation in all areas outside of the development footprint.

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

Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the facility.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

***Site specific mitigation measures:***
Plant vegetation barriers or vegetated berms along the northern boundaries (bordering the road) of the Kheis Solar Park 2 in order to shield the structures from visitors at the FM Safari Lodge. Engage the land owner in question in the planning, placement and implementation of the mitigation measures.

***Cumulative impacts:***
The construction of the up to three Solar Parks is expected to increase the cumulative visual impact within the immediate area. Alternatively, the relatively close proximity of the proposed facilities to each other (and the existing power line) consolidates the potential visual exposure of solar energy generation infrastructure within the region. The proposed

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| facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 10 |
| ***Residual impacts:***<br>The visual impact will be removed after decommissioning, provided the Solar Energy Facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain. |

| | | |
|---|---|---|
| **Nature of Impact:** Visual impact on sensitive visual receptors within the region (i.e. 5-8km) | | |
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | | |
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Regional **(3)** | Regional **(3)** |
| **Duration** | Long term **(4)** | Long term **(4)** |
| **Magnitude** | Low **(4)** | Low **(4)** |
| **Probability** | Improbable **(2)** | Very Improbable **(1)** |
| **Significance** | **Low (22)** | **Low (11)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Recoverable **(3)** | Recoverable **(3)** |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |
| **General mitigation/management:**<br><u>Planning:</u><br>» Retain and maintain natural vegetation in all areas outside of the development footprint.<br><u>Operations:</u><br>» Maintain the general appearance of the facility as a whole.<br><u>Decommissioning:</u><br>» Remove infrastructure not required for the post-decommissioning use of the facility.<br>» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.<br>» Monitor rehabilitated areas post-decommissioning and implement remedial actions.<br><br>**Site specific mitigation measures:**<br>» .<br>» Engage with landowners in order to inform, plan and execute mitigation measures. | | |
| **Cumulative impacts:**<br>The close proximity of the proposed projects to each other and to the existing visual disturbances (power lines) allows for the effective connection with the power grid without incurring any additional expanded visual impacts (i.e. lengthy overhead power lines). The proposed facility may have a cumulative visual impact at a regional level when considering | | |

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| the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 10 |
| **Residual impacts:**<br>The visual impact will be removed after decommissioning, provided the solar energy facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain. |

| **Nature of Impact**: Visual impact of construction on sensitive visual receptors within 2km | | |
|---|---|---|
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local (4) | Local (4) |
| **Duration** | Short Term (2) | Short Term (2) |
| **Magnitude** | High (8) | Moderate (6) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Moderate (42)** | **Moderate (36)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Recoverable (3) | Recoverable (3) |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |
| ***Mitigation:***<br>» Ensure that vegetation is not unnecessarily cleared or removed during the construction period.<br>» Plant vegetation barriers along the western borders of the Kheis Solar Park 2 PV plant in order to shield the structures from observers residing in 2km<br>» Reduce the construction period through careful logistical planning and productive implementation of resources.<br>» 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.<br>» Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.<br>» Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.<br>» Reduce and control construction dust through the use of approved dust suppression techniques as and when required, especially on the dirt road giving access to the site (i.e. whenever dust becomes apparent).<br>» Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.<br>» Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works. | | |
| ***Cumulative impacts:*** | | |

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|---|
| The close proximity of the proposed projects to each other and to the existing visual disturbances (power lines) allows for the effective connection with the power grid without incurring any additional expanded visual impacts (i.e. lengthy overhead power lines). The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 10 |
| ***Residual impacts:***<br>The visual impact will be removed after construction on the site is completed provided the disturbed areas are rehabilitated. |

| **Nature of Impact**: Visual impact of lighting on sensitive visual receptors. | | |
|---|---|---|
| **Listed activities:**<br>GN 545 activity 1 &15 | | |
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local (4) | Local (4) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Moderate (6) | Low (4) |
| **Probability** | Probable (3) | Improbable (2) |
| **Significance** | **Moderate (42)** | **Low (24)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Recoverable (3) | Recoverable (3) |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |
| ***Mitigation:***<br>Planning:<br>» Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);<br>» Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;<br>» Making use of minimum lumen or wattage in fixtures;<br>» Making use of down-lighters, or shielded fixtures;<br>» Making use of Low Pressure Sodium lighting or other types of low impact lighting.<br>» 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 | | |
| ***Cumulative impacts:***<br>The development of three solar parks will contribute to an increase in light sources within the region, and as a result an increase in lighting impact at night. The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 10 | | |
| ***Residual impacts:***<br>The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain. | | |

| **Nature**: Visual impact associated with the of the operation of PV panels (fixed panel option) at 4m height | | |
|---|---|---|
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | ***Without mitigation*** | ***With mitigation*** |
| ***Extent*** | Local (2) | Local (2) |
| ***Duration*** | Long - term (4) | Long – term (4) |
| ***Magnitude*** | Moderate low (3) | Low (1) |
| ***Probability*** | Highly Probable (4) | Highly Probable (3) |
| ***Significance*** | **Medium (36)** | **Low (21)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | High | High |
| ***Irreplaceable loss of resources?*** | No | |
| ***Can impacts be mitigated?*** | Yes | |
| **Mitigation:**<br>» No clearing of land outside the demarcated footprint<br>» Rehabilitate cleared areas | | |
| **Cumulative impacts**:<br>The proposed infrastructure would provide a cumulative impact increasing the existing industrial land uses in the area and the additional two projects proposed on the same site. The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 10. | | |
| **Residual Impacts**:<br>The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant and power lines. Providing that the site is rehabilitated to its current state, the visual impact will also be removed. | | |

| **Nature**: Visual impact of the operation of PV panels (tracking panel option) at 4m height | | |
|---|---|---|
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) | | |
| | ***Without mitigation*** | ***With mitigation*** |
| ***Extent*** | Local (2) | Local (2) |
| ***Duration*** | Long - term (4) | Long – term (4) |
| ***Magnitude*** | Moderate low (4) | Low (1) |
| ***Probability*** | Highly Probable (4) | Highly Probable (3) |
| ***Significance*** | **Medium (40)** | **Low (21)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | High | High |
| ***Irreplaceable loss of resources?*** | No | |
| ***Can impacts be*** | Yes | |

| | |
|---|---|
| ***mitigated?*** | |
| **Mitigation:**<br>» No clearing of land outside the demarcated footprint<br>» Rehabilitate cleared areas | |
| **Cumulative impacts**:<br>The proposed infrastructure would provide a cumulative impact increasing the existing industrial land uses in the area and the additional two projects proposed on the same site. The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 10 | |
| **Residual Impacts**:<br>The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant and power lines. Providing that the site is rehabilitated to its current state, the visual impact will also be removed. | |

**e) Comparative Assessment of PV Panel technology (Fixed vs Tracking):**

Sensitive receptors on the 2 - 4km radii (including sections of the secondary roads and a number of residences, mainly located west of the Orange River and parts of the game farm north of the PV facility) may be exposed by either the fixed or tracking panels on the proposed development area due to their close proximity to the site regardless of the type of technology used since they are proposed to be both of the same height. Tracking panels can result in a higher visual intrusion than fixed panels due to the more mechanically complex structure. However, for this particular site there is **very little difference in the significance** in the potential impacts associated with the two technology alternatives. There is therefore no preference regarding technology.

**f) Implications for Project Implementation**

» The proposed Kheis Solar Park 2 may have a moderate visual impact on visitors to the FM Safari Game Farm, especially within the southern section of the farm. This impact may be mitigated to low with the implementation of site specific mitigation measures.
» The visual impact on the users of roads and the residents of towns, settlements and homesteads within the region (i.e. beyond a 2km radius) is expected to be low and moderate (within 2km radium) for the proposed Kheis Solar Park 2 facility with the implementation of mitigation measures.
» For this particular site there is very little difference in the significance in the potential impacts associated with the two technology alternatives. There is therefore no preference regarding technology from a visual perspective.

### *9.2.5 Assessment of Potential Social Impacts*

### c) Impact tables summarising the significance of Social impacts of the PV facility during the construction and operation

Impacts associated with the construction phase of a project are usually of a short duration, temporary in nature, but could have long term effects on the surrounding environment. The operational life of a PV facility is between 20 - 25 years, after which the facility would possibly be upgraded to continue its lifespan if feasible, or decommissioned. The impacts usually associated with the operational phase are therefore perceived by affected parties to be more severe.

The two alternative PV technologies do not differ in any significant way as far as the impacts on the social environment is concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

**The following listed activities are applicable to all the social impacts in the construction and operational phase:**
GN 544 activity 10(i)
GN 545 activity 1 & 15
GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc)

The following social impacts are anticipated as part of the **construction phase** of Kheis Solar Park 2 development:

| ***Nature of the impact:*** **The impact on the health status** of the local community due to an increase in male migrant workers. As TB, HIV/AIDS and alcohol related diseases are already on the district's radar due to its high occurrence; migrant workers without family structures may increase this health risk during construction. | | |
|---|---|---|
| | ***Without mitigation*** | ***With mitigation*** |
| ***Extent*** | National (4) | Local/District(2) |
| ***Duration*** | Long term(3) | Short term(1) |
| ***Magnitude*** | High(3) | Medium(2) |
| ***Probability*** | Probable(3) | Possible(2) |
| ***Significance*** | **Low(30)** | **Low(18)** |
| ***Status (positive or negative)*** | Negative | |
| ***Reversibility*** | Not reversible | |
| ***Irreplaceable loss of resources?*** | Irreplaceable | |
| ***Can impacts be mitigated?*** | Yes, to some extent | |
| **Mitigation:**<br>» The developer or the contractor should appoint a service provider or local NGO to develop, implement and manage a "Wellness Programme" which includes HIV/AIDS, TB, and alcohol abuse prevention, extendable to the local community<br>» By connecting with local community programmes and NGOs, health training and | | |

| |
|---|
| information can be provided on-site to workers at the start of the project<br>» Ensure workers have information and sign a "code of conduct" at the start of employment which gives an overview of acceptable behaviour and information regarding health & safety on the site |
| **Cumulative Impacts:**<br>As alcohol abuse and related risky behaviour which may impact HIV infections is already prevalent in the area, the cumulative impact during the construction phase may be increased. |
| **Residual Impacts:**<br>The residual impact of health related risks cannot be reversed to the status quo after the construction or decommissioning of the plant has taken place. |

| **_Nature of the impact:_ The local roads and associated infrastructure** will be affected by the increase in construction vehicles and traffic to the site. The roads connecting the site to the N10 and N14 are gravel and in disrepair, with a high sensitivity to increased traffic, especially during harvest time. | | |
|---|---|---|
| | ***Without Mitigation*** | ***With Mitigation*** |
| ***Extent*** | Local (2) | Site (1) |
| ***Duration*** | Medium term (2) | Low (1) |
| ***Magnitude*** | High (3) | Low (1) |
| ***Probability*** | Definite (5) | Probable (2) |
| ***Significance*** | **Medium (35)** | **Low (6)** |
| ***Status (+/-)*** | Negative | |
| ***Reversible*** | N/A | |
| ***Irreplaceable*** | N/A | |
| ***Can impacts be mitigated?*** | Yes | |
| **Mitigation:**<br>» Consulting with local authorities (including SANRAL) and stakeholders (including cooperatives, farmers and wine cellars) on the most appropriate route to the site will ensure local cooperation<br>» Upkeep and maintenance of the roads used<br>» Part of the construction phase needs to include the upgrade of the road to be able to handle the increase in traffic and excessive dust as a result of the gravel roads<br>» Plans should aim to avoid construction of the plant over the harvest period (Feb-Apr), especially from the N14, when an increase in traffic would adversely affect the accessibility of the site | | |
| **Cumulative Impacts:**<br>The impact on the selected route to the site could be increased significantly should it also be an access road to another project. By including local authorities and planning construction outside of the harvest period, the cumulative impact should remain low. | | |
| **Residual Impacts:**<br>The proposed development is of such a nature that the status quo could be regained after decommissioning the plant, with upgraded local infrastructure a residual benefit. | | |

***Nature of the impact:*** **The presence of construction workers** on the site and possible social mobilisation. As the local communities are perceived as relatively closed to outsiders, the socio-cultural impact of having an influx of migrants from other areas could result in conflict.

*Note: As it would be difficult for the contractor to control conflict situations where they occur when construction workers spend their free time in the local community, this assessment focuses on conflict situations that the contractor can control.*

| | ***Without Mitigation Score*** | ***With Mitigation Score*** |
|---|---|---|
| **Extent** | Province/Region (3) | Local/District (2) |
| **Duration** | Short term (1) | Short term (1) |
| **Magnitude** | Low (4) | Minor (2) |
| **Probability** | Probable (3) | Improbable (2) |
| **Significance** | **Low (24)** | **Low (14)** |
| **Status (+/-)** | Negative | |
| **Reversible** | Yes | |
| **Irreplaceable** | N/A | |
| **Can impacts be mitigated?** | Yes | |

**Mitigation:**

- » By ensuring that the local community is aware and involved in the public consultation through local ward councillors, relevant information may clarify misgivings and assumptions
- » Implementing a "local first" recruitment policy should decrease migrant workers influx which may upset social structures
- » Invite neighbouring stakeholder to sit on the MF to enable involvement and information sharing
- » All mitigation measures contained in the EMPr should be implemented and monitored. Remedial action should be taken where the contractor fails to comply with the EMPr
- » Ensure that the process is well managed and all neighbours and local communities are informed beforehand of when to expect an influx, as part of good governance
- » Establish a "code of conduct" with the workers to respect the site and neighbours in surrounding area which must also be part of the managing the discipline on site

**Cumulative Impacts:**

Notwithstanding the Kheis development, there are also the Bokpoort and Kleinbegin PV and Karoshoek developments just within the local municipal area, as well as Albany being considered in the neighbouring District. A conflict situation can spread to other sites so that communities can become antagonistic against the development even before construction commences.

**Residual Impacts:**

The proposed development is of such a nature that the status quo could be regained after construction, which is usually the high risk phase.

***Nature of the impact:*** **Perceptions from and attitudes** towards the Kheis Solar Park 2 Facility, either positive (economic injection) or negative (safety, inconvenience, risk to property). The public consultation is still on-going, but comments and feedback received

| thus far from stakeholders are varied. The site visit also confirmed that depending on the stakeholder's own perspective, attitudes vary significantly. For this purpose, the SEIA will aim to present an objective and scientific assessment. | | |
|---|---|---|
| | ***Without Mitigation Score*** | ***With Mitigation Score*** |
| **Extent** | Regional (3) | Local (2) |
| **Duration** | Medium term (3) | Short (2) |
| **Magnitude** | Low (4) | Minor (2) |
| **Probability** | Probable (3) | Possible (2) |
| **Significance** | **Medium (30)** | **Low(12)** |
| **Status (+/-)** | Positive or Negative (depending on individual perceptions) | |
| **Reversible** | Yes | |
| **Irreplaceable** | N/A | |
| **Can impacts be mitigated?** | Yes | |

**Mitigation:**

» Ensure that public consultation also includes stakeholders directly affected as listed in the study (land owner, workers, close neighbours and the local community)
» Ensure that safety procedures regarding veld fires are part of the training of all new workers
» Include values as well as health & safety procedures in a "code of conduct" with the workers which are to form part of their employment contracts

**Cumulative Impacts:**

The significance of this impact is rated low, but due to the number and proximity of other PV plants in the area, the cumulative impact affecting the general sentiment around alternative energy projects and specifically this development, may change**.**

**Residual Impacts:**

The site may be rehabilitated to its current state after decommissioning, but the perceptions could still linger in the altered socio-cultural attitudes.

***Nature of the impact:*** **The impact on local and regional industry** due to linkage effects. The capital investment in the area will have a multiplier effect on local industry and businesses, resulting in a wider indirect positive economic impact than the jobs directly anticipated for the Kheis Solar Park 2 Facility. Areas most positively affected may be transport, consumables and construction materials.

| | ***Without Mitigation*** | ***With Mitigation*** |
|---|---|---|
| **Extent** | Local (2) | Regional (3) |
| **Duration** | Short term (1) | Short term (1) |
| **Magnitude** | Low (1) | High (8) |
| **Probability** | Probable (3) | Highly probable (4) |
| **Significance** | **Low (12)** | **Medium (48)** |
| **Status (+/-)** | Positive | |
| **Reversible** | N/A | |
| **Irreplaceable** | N/A | |

| | | |
|---|---|---|
| **Can impacts be mitigated?** | Yes | |

**Mitigation:**

- Government gives preference to projects with high levels of local content through the REIPPPP. A target of 60% local content may be required from certain technologies during the next round REIPPPP, which will require linking new and existing local businesses to the supply chain of the Kheis Solar Park 2 Facility
- Ensuring that principle of "local first" when procuring consumables, construction materials etc.

**Cumulative Impacts:**

The scale, extent and proximity of similar developments in the Northern Cape will have an increase in the cumulative linkage effect.

**Residual Impacts:**

The proposed development is of such a nature that the status quo could be regained after decommissioning the plant.

***Nature of the impact:*** **A change in the employment status** and income levels of the local population due to the creation of jobs. The 55MW plant will require 60 – 80 jobs over the 9 months of construction, aiming to keep around 95% of the labour local. A further 20 direct jobs are anticipated during the operational phase of the first phase of the Kheis Solar Park 2

| | **Without Enhancement** | **With Enhancement** |
|---|---|---|
| **Extent** | Local (2) | Regional (4) |
| **Duration** | Short term (1) | Medium (3) |
| **Magnitude** | Minor (2) | Low (3) |
| **Probability** | Probable (3) | Definite (4) |
| **Significance** | **Low (12)** | **Medium (40)** |
| **Status (+/-)** | Positive | |
| **Reversible** | N/A | |
| **Irreplaceable** | N/A | |
| **Can impacts be mitigated?** | Yes | |

**Enhancement:**

- Implementing a "local first" recruitment policy will ensure that the positive impact is mostly ring-fenced for locals
- Ensure that the benefit is equitable and that the principles underpinned by Black Economic Empowerment Act of 2003 are honoured
- Also that the local jobs created are linked to a skills development programme for permanent employment

**Cumulative Impacts:**

The impact is measured as a result of direct employment creation for the first phase of the project. The indirect effects on employment creation, the multiplier effect on local business, as well as the subsequent phases will increase the cumulative positive impact on the employment status, contributing to the provincial and national employment creation initiatives.

**Residual Impacts:**

| |
|---|
| The proposed development is of such a nature that the status quo could be regained after decommissioning the plant. From a socio-economic perspective, the residual impact will be the end of the job opportunities which locals may have become dependent, unless skills development and training enable permanent employment. |

The following impacts are anticipated as part of the **operational phase** of the Kheis Solar Park 2 development:

| | | |
|---|---|---|
| ***Nature of the impact:*** A possible **permanent change in the land use pattern** of the area. The site earmarked for the development comprises of 1800 hectares of agricultural land, which currently used for extensive animal farming. The PV Solar Energy Facility will alter the use on this piece of land for at least the next 20 years. | | |
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Regional (3) | Local (2) |
| **Duration** | Medium term (3) | Medium term (3) |
| **Magnitude** | Minor (2) | Minor (1) |
| **Probability** | Probable (3) | Possible (2) |
| **Significance** | **Low (24)** | **Low (12)** |
| **Status (+/-)** | Positive or Negative | |
| **Reversible** | Yes | |
| **Irreplaceable** | No | |
| **Can impacts be mitigated?** | Yes | |
| **Mitigation:**<br>» After decommissioning, the land use status quo on the site must be returned to the current state, provided this is economical at the time. | | |
| **Cumulative Impacts:**<br>This project, together with the other mentioned PV Solar Energy Facility's such as Bokpoort, Karoshoek and Grootdrink solar projects in the area will have a significant cumulative impact on the land use pattern. This impact may affect the Northern Cape agricultural sectors' contribution to GGP. | | |
| **Residual Impacts:**<br>The proposed development is of such a nature that the status quo could be regained after decommissioning the plant. Provided the site is rehabilitated to its current state, the socio-economic impact would be negligible. | | |

| | | |
|---|---|---|
| ***Nature of the impact:*** The current **agricultural value of the land** may change with the development of the site. | | |
| | ***Without Mitigation*** | ***With Mitigation*** |
| **Extent** | Local(1) | Local(2) |
| **Duration** | Medium term (3) | Medium term (3) |
| **Magnitude** | Minor(2) | Low(3) |
| **Probability** | Probable(3) | Probable(3) |
| **Significance** | **Low(18)** | **Low(24)** |

| | | |
|---|---|---|
| **Status (+/-)** | Positive | |
| **Reversible** | Yes | |
| **Irreplaceable** | N/A | |
| **Can impacts be mitigated?** | Yes | |

**Mitigation:**

» The economic value of the current agricultural land will increase with the value-add in infrastructure and land use rights. To ensure that the benefit extends to the local communities, the local job creation initiatives (local first), as well as the RFP requirements of minimum of 2.5% local community shareholding should mitigate concerns regarding the allocation of the positive impact

» By implementing this project with all the mitigations and care as prescribed by NEMA, any other developments in the future will be more acceptable to the community and other stakeholders

» Mitigate environmental impact through following the recommendations from the specialist studies as well as implementing a comprehensive EMPr

**Cumulative Impacts:**

The positive economic impact of this development, combined with similar developments in the District will increase the significant of the positive impact on a struggling economy.

**Residual Impacts:**

Provided the site is rehabilitated to its current state, the socio-economic impact could however be significant if a source of stimulation to the local economy is removed.

***Nature of the impact:*** The impact of the development on **local tourism and hospitality industry**.

Although the province has the lowest tourism contribution to GDP at only 2%, it is more reflective of the poverty level of the province than the real contribution of the sector. Attractions include the Augrabies Falls National Park, the Kgalagadi Transfrontier Park and the local award-winning Orange River Cellars made up of five wineries situated in Upington, Kakamas, Keimoes and most importantly Grootdrink and Groblershoop, which are close to the proposed development site. Smaller enterprises in the area include eco-tourism initiatives and safari experiences like neighbouring FM Safaris.

| | ***Without Mitigation*** | ***With Mitigation*** |
|---|---|---|
| **Extent** | Regional(3) | Local(2) |
| **Duration** | Medium term (3) | Medium term (3) |
| **Magnitude** | Minor 2 | Minor1 |
| **Probability** | Probable(3) | Improbable(2) |
| **Significance** | **Low(24)** | **Low(12)** |
| **Status (+/-)** | Negative | |
| **Reversible** | Yes | |
| **Irreplaceable** | No | |
| **Can impacts be mitigated?** | Yes | |

**Mitigation:**

» Ensure that the I&AP are supplied with the relevant and detailed information

| |
|---|
| pertaining to the impact of a PV Solar Energy Facility plant<br>» A MF for the Kheis development could manage issues arising from the development, which may affect the local tourism industry<br>» Ensure that mitigation actions as recommended specifically in the VIA be implemented. |
| **Cumulative Impacts:**<br>As this development is part of a greater strategic development initiative of the Northern Cape, the cumulative impact may be significant. |
| **Residual Impacts:**<br>The proposed development is of such a nature that the status quo could be regained after decommissioning the plant. Provided the site is rehabilitated to its current state, the socio-economic impact pertaining to the tourism industry will be negligible. |

| | | |
|---|---|---|
| ***Nature of the impact:*** Impact on the **"way of life"** and **"sense of place"**. This impact is related to the way people make a living and their quality of life. People stay and travel to this area to experience the unique landscape and culture. The impact should be considered in the context of the study area as a whole, as the impact will also depend on a number of variables, such as the visual impact, the biodiversity impact, the related activities on the surrounding land, etc. | | |
| | ***Without Mitigation*** | ***With Mitigation*** |
| **Extent** | Local(2) | Local(1) |
| **Duration** | Medium term (3) | Medium term (3) |
| **Magnitude** | Medium(2) | Low(1) |
| **Probability** | Probable(3) | Improbable(2) |
| **Significance** | **Low(21)** | **Low(10)** |
| **Status (+/-)** | Negative | |
| **Reversible** | Yes | |
| **Irreplaceable** | N/A | |
| **Can impacts be mitigated?** | Yes | |
| **Mitigation:**<br>» Implement mitigation measures detailed in the Visual Impact Assessment | | |
| **Cumulative Impacts:**<br>The presence of such infrastructure can also set an unintended precedent for further land use change in the near vicinity in future, which could further alter people's way of life and their sense of place. | | |
| **Residual Impacts:**<br>The impact on sense of place can be reversed after decommissioning, provided that rehabilitation is done to as satisfactory level. | | |

### d) <u>Comparative Assessment of PV Panel technology (Fixed vs Tracking):</u>

There is **no difference** in social / economic impacts from either technology alternatives. Therefore there is no preference from a social perspective on the implementation of either technology.

**c) Implication for project implementation**

» The findings of the SIA undertaken for the proposed Kheis Solar Park 2 indicate that the development will create employment and business opportunities for locals during both the construction and operational phase of the project.
» The establishment of a Community Trust will also create an opportunity to support local economic development in the area.
» The development of renewable energy has also been identified as a key growth sector by the NCSDF and also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.
» There is no preference from a social perspective on the implementation of either technology under consideration.
» It is therefore recommended that the Kheis Solar Park 2 Energy Facility as proposed be supported, subject to the implementation of the recommended enhancement and mitigation measures contained in the SIA report.

## 9.3 Assessment of the Do Nothing Alternative

The 'do nothing' alternative will do little to influence the macro-level renewable energy targets set by government due to competition in the sector, and the number of renewable energy projects being bid to the DoE. However, as the site experiences some of the best irradiation in the country and optimal grid connection opportunities are available, not developing the project would see such an opportunity being lost. In addition the Northern Cape grid will be deprived of an opportunity to benefit from the additional generated power being evacuated directly into the Province's grid. The greater farm portions are not being farmed intensively due to climate and agricultural constraints and it is unlikely that the farm will become productive from this perspective in the long-term. The loss of the land to this project is therefore not considered significant.

At a local level, the level of unemployment will remain the same and there will not be any transfer of skills to people in terms of the construction and operation of the solar energy facility. The landowner would have lost an opportunity of receiving an alternative form of income from the project, which could contribute to the use of his land in a sustainable manner. Furthermore, the community would lose the opportunity to improve and uplift their infrastructures through the community trust.

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. Although the facility is only proposed to contribute 55 MW to the grid capacity, this would assist in meeting the growing electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy. 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***: The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.

» ***Resource saving***: Conventional coal fired plants are major consumers of water during their requisite cooling processes. 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, when compared with wet cooled conventional power stations. This translates into revenue savings of R26.6 million. 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.

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

» ***Pollution reduction:*** The releases of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation. The use of solar radiation for power generation is considered a non-consumptive use of a natural resource which produces zero greenhouse gas emissions.

» ***Climate friendly development:*** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be responsible for approximately 1% of global GHG emissions and is currently ranked 9$^{th}$ worldwide in terms of per capita carbon dioxide emissions.

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

» ***Employment creation:*** The sale, development, installation, maintenance and management of renewable energy facilities have significant potential for job creation in South Africa.

» ***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.

The 'do nothing' alternative will not assist the South African government in addressing climate change, in reaching the set targets for renewable energy, nor will it assist in supplying the increasing electricity demand within the country. In addition the Northern Cape Province power grid will lose an opportunity to benefit from the additional generated power being evacuated directly into the Province's grid at the Garona-Gordonia 132kV power line. The 'do nothing alternative is, therefore, not a preferred alternative.

## 9.4 Summary of Impacts

Table 9.1 summarises all potential impacts associated with the proposed Kheis Solar Park 2 Facility and the associated EIA regulation listed activities.

**Table 9.1:** Summary of impacts associated with the proposed Kheis Solar Park 2 Facility and its relevant EIA listed activities.

| Construction / Decommissioning Impacts | Significance of Impact | | | EIA Regulation Listed activity assessed |
|---|---|---|---|---|
| | Without mitigation | With mitigation | Status | |
| **Ecology** | | | | |
| Loss of vegetation & increase in runoff and erosion, | M (50) | M (35) | Negative | GN 544 activity 11(x)(xi) & 18(i)<br>GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i). |
| Loss of protected or red data species | M (50) | L (28) | Negative | GN 544 activity 11(x)(xi) & 18(i)<br>GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i). |
| Loss species of conservation concern | H (75) | H (60) | Negative | GN 544 activity 11(x)(xi) & 18(i)<br>GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i). |
| **Soils & Agriculture Potential** | | | | |
| Loss of agricultural land use | M (30) | M (30) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| Generation of alternative land use income | M (32) | M (32) | Positive | none |
| Soil erosion | L (27) | L (8) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Loss of topsoil | L (24) | L (7) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Degradation of veld vegetation | L (15) | L (8) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| **Heritage & Palaeontology** | | | | |
| Destruction, damage, excavation, alteration, removal or collection of heritage | L (16) | None | Negative | GN 544 activity 10(i) |

| **Construction / Decommissioning Impacts** | **Significance of Impact** | | | **EIA Regulation Listed activity assessed** |
|---|---|---|---|---|
| | **Without mitigation** | **With mitigation** | **Status** | |
| artefacts from its original position (consequences) | | | | GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| **Visual** | | | | |
| Visual impact of construction on sensitive visual receptors | M(42) | M(36) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impact of lighting on sensitive visual receptors. | M (42) | L (24) | Negative | GN 545 activity 1 &15 |
| **Social** | | | | |
| The impact on the health status of the local community due to an increase in male migrant workers | M(30) | L(8) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| The local roads and associated infrastructure will be affected by the increase in construction vehicles and traffic to the site. | M(35) | L(6) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| The presence of construction workers on the site and possible social mobilisation. | L(24) | L(14) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| Perceptions from and attitudes towards the Kheis Solar Park 2 Facility, either positive (economic injection) or negative (safety, inconvenience, risk to property). | L(30) | L(12) | Positive/Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| The impact on local and regional industry due to linkage effects. The capital investment in the area will have a multiplier effect on local industry and businesses. | L(12) | M(48) | Positive | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| A change in the employment status and income levels of the local population due to the creation of jobs | L(12) | M(40) | Positive | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| **Operational Impacts** | **Significance of Impact** | | | **Listed Activities (18 June 2010)** |

| | Without mitigation | With mitigation | Status | |
|---|---|---|---|---|
| **Ecology** | | | | |
| Loss of vegetation and/or species of conservation concern | H (80) | H (65) | Negative | GN 544 activity 11(x)(xi) & 18(i)<br>GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i). |
| Increase in runoff and erosion, disturbance or possible mortality incidents of terrestrial fauna, possible contamination of soil and groundwater by oil- or fuel spillages, possible establishment and spread of undesirable weeds and alien invasive species | M (60) | L (20) | Negative | GN 544 activity 11(x)(xi) & 18(i)<br>GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i). |
| **Soils & Agriculture Potential** | | | | |
| Loss of agricultural land use | M (30) | M (30) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| Generation of alternative land use income | M (32) | M (32) | Positive | n/a |
| Soil erosion | L (27) | L (8) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| **Visual** | | | | |
| Visual impact on users of the secondary roads in close proximity to the proposed Solar Energy Facility | H (64) | M (42) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impact on visitors to the FM Safari Lodge located in close proximity to the proposed Solar Energy Facility | M (48) | L (28) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impact on sensitive visual receptors within the region | L (22) | L (11) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impacts related to the ancillary infrastructure | Negligible | Negligible | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15 |

| Operational Impacts | Significance of Impact | | | Listed Activities (18 June 2010) |
|---|---|---|---|---|
| | Without mitigation | With mitigation | Status | |
| | | | | GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impact associated with the of the operation of PV panels (fixed panel option) | Medium (36) | Low (24) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impact associated with the of the operation of PV panels (tracking panel option) | Medium (40) | Low (21) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc) 19 (a)(ii)(cc) |
| **Social** | | | | |
| A possible permanent change in the land use pattern of the area | L (24) | L (12) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| The current agricultural value of the land will change with the development of the site | L (18) | L (24) | Positive | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| The impact of the development on local tourism and hospitality industry | L (24) | L (12) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| Impact on the "way of life" and "sense of place". | L (21) | L (10) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |

| L | **Low** | M | **Medium** | H | **High** |
|---|---|---|---|---|---|

# ASSESSMENT OF CUMULATIVE IMPACTS KHEIS SOLAR PARK 2 CHAPTER 10

Cumulative impacts in relation to an activity are defined in the Environmental Impact Assessment Regulations (Government Notice R543) as meaning "the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area".

There has been a substantial increase in renewable energy developments recently in South Africa as legislation is evolving to facilitate the introduction of Independent Power Producers (IPPs) and renewable energy into the electricity generation mix. Due to the recent substantial increase in interest in renewable energy developments in South Africa, it is important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts are considered and avoided where possible.

The Department of Energy has, under the REIPPP Programme released a request for proposals (RfP) to contribute towards Government's renewable energy target of 3725 MW ( 1450 MW of which has been allocated to solar PV energy) and to stimulate the industry in South Africa. The bid selection process will consider the suggested tariff as well as socio-economic development opportunities provided by the project and the bidder.

There is a legislated requirement to assess cumulative impacts associated with a proposed development. This chapter looks at whether the proposed project's potential impacts become more significant when considered in combination with the other known or proposed solar farm projects within the area.

## 10.1 Approach Taken to Assess Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertaking in the area[16].

Significant cumulative impacts that could occur due to the development of the solar energy facilities and its associated infrastructure in proximity to each other include impacts such as:

[16] Definition as provided by DEA in the EIA Regulations.

» Loss of vegetation and impacts on ecology
» Soil and agricultural potential impacts
» Heritage impacts
» Visual impacts
» Social impacts

The cumulative effect or impacts are presented as follows:

» Cumulative impacts potentially as a result of the cumulative effects of the three Kheis Solar Park PV facilities proposed to be located on Portion 7 and Portion 9 of the Farm Namakwari 656 (Kheis Solar Park 1-3).
» Cumulative impacts potentially as a result of the cumulative effects of the Kheis Solar Park 2 added to all other renewable energy facilities proposed to be developed in and around the Grootdrink area (south west of Upington).

Table 10.1 shows the proposed location of the Kheis Solar Park 2 in relation to all other known renewable energy applications. These projects were identified by CSIR using the Department of Environmental Affairs Geographic Information System digital data (CSIR, 2013)

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**Table 10.1:** Proposed solar energy facilities within the Kheis Solar Park 2 project development site and surrounding areas

| Project | Applicant / Developer | DEA Ref. No | Location | Status | Distance from Kheis Solar Park 2 |
|---|---|---|---|---|---|
| 8. Kheis Solar Park 1(75MW) | Gestamp Asetym Solar South Africa (Pty) Ltd | 14/12/16/3/3/2/569 | Portion 7 and 9 of the farm Namakwari 656 | EIA underway - considered in this EIA report | 1km |
| 9. Kheis Solar Park 3 (20MW) | Gestamp Asetym Solar South Africa (Pty) Ltd | 14/12/16/3/3/2/571 | Portion 9 of the farm Namakwari 656 | EIA underway - considered in this EIA report | 500m |
| 10. Grootdrink solar facility (75MW) | Grootdrink Solar (Pty) Ltd | 14/12/16/3/3/2/639 | Remaining extent of farm Albany 405 | EIA underway | 15km |
| 11. Concentrating Solar Thermal Power Plant on the farm Bokpoort (50MW) | Solafrica | 12/12/20/1920 | RE of the Farm Bokpoort 390, south east of Upington | Environmental Authorisation issued - round 2 preferred bidder | 20km |
| 12. Karoshoek Solar Valley Development (900MW comprising CSP and CPV technology) – 11 separate projects | FG Emvelo Energy (Pty) Ltd | 14/12/16/3/3/2/289<br>14/12/16/3/3/2/290<br>14/12/16/3/3/2/291<br>14/12/16/3/3/2/292<br>14/12/16/3/3/2/293<br>14/12/16/3/3/2/294<br>14/12/16/3/3/2/295<br>14/12/16/3/3/2/296<br>14/12/16/3/3/2/297<br>14/12/16/3/3/2/298<br>14/12/16/3/3/2/299 | Matjesriver RE and 2/41, Annashoek 3/41, Karos 956 and Zandemm 944 east of Upington | Environmental Authorisation issued | 25km |
| 13. Ilanga CSP Facility (100MW) | Ilangalethu Solar Power (Pty) Ltd | 12/12/20/2056 | Zandemm 944 east of Upington | Environmental Authorisation issued – round 3 preferred bidder | 25km |

| Project | Applicant / Developer | DEA Ref. No | Location | Status | Distance from Kheis Solar Park 2 |
|---|---|---|---|---|---|
| 14. Kleinbegin Solar Energy (50MW) | Vanguard Solar (Pty) Ltd | 12/12/20/2198 | Klein Begin 2/115, south east of Upington | Environmental Authorisation issued | 35km |

Kleinbegin Solar Energy facility is considered to be too far afield to result in cumulative impacts with the Kheis Solar Park 2, and is not considered further.

The combined effect of the solar energy facilities for this area will have a cumulative visual impact, impact on the landscape character, social impact, and impacts on ecology and soil erosion.

In the sections below the potential cumulative impacts of other solar facilities within the immediate vicinity (i..e within 25km) of the proposed Kheis Solar Park 2 are explored. The discussion and associated conclusions must be understood in the context of the uncertainty associated with the proposed developments and the qualitative nature of the assessment.

## 10.2 Cumulative impacts of three Kheis Solar Park projects on the Portion 7 and Portion 9 of the Farm Namakwari 656

The location of the three solar facilities on Portion 7 and Portion 9 of the Farm Namakwari 656 is illustrated in Figure 10.2. The potential cumulative impacts over Portion 7 and Portion 9 of the Farm Namakwari 656, should the development of all three Kheis Solar Park PV projects be realised, are likely to be contained within the boundaries of the farm site (with the exception of visual and social), and with the application of the necessary mitigation measures, contained within each of the respective PV projects areas. This is deducted based on the following:

» **Ecology**: The development footprints of all three PV projects are aligned with areas of low and medium- low ecological sensitivity and outside of the identified high sensitive areas. The cumulative impacts on ecology within the site are expected to increase due with each development of the Kheis Solar Park projects; the overall impact on ecology within the site due to 3 projects similar developments is expected to be of **medium-low** significance due to the fact that the facilities are placed to avoid highly sensitive areas.
» **Soil and agricultural potential:** The broader farm portions, portion 7 and 9 of Namakwari 656, are 3600ha in extent, and the development of the three proposed Kheis Solar Park projects will result in the loss of ~17% of the farm for agricultural activities. The remainder of the farm portion can be continued to be utilised for agricultural activities. The development footprints are aligned with areas characterised by Hutton soil form (moderately deep to deep, red, very sandy soils; much shallower soils on underlying rock and rock) and low agricultural potential. The overall cumulative impact on agricultural land within the site is of **low** significance due to the limited agricultural potential of the area.
» **Heritage and Palaeontology**: From an archaeological perspective the observed heritage resources over the areas surveyed were found to be of low density and low significance. A colonial era farm dwelling, modified through time, and now in a state of ruin, was recorded at Sterkstroom. It is not

considered to be of major heritage significance. The proposed projects will have **low** cumulative impacts on the heritage artefacts on site.

» **Visual Impacts**: Figure 10.1 shows the frequency of PV facility sightings, highlighting areas that may have a view of all three projects. Areas with a higher frequency of exposure generally correlate with elevated topographical units, such as hills and ridges, where the observer is elevated above the average ground level. In terms of the shorter distance sightings where potentially sensitive visual receptors are expected; the area located north of the solar parks (along the secondary road and parts of the game farm) is of relevance. Observers within this area are expected to have a linear view of the PV facilities along the north-south axis of the overall development. Kheis Solar Parks 1, 2 and 3 is generally expected to increase the cumulative visual impact within the immediate area. However, the close proximity of the proposed facilities to each other consolidates the potential visual exposure of solar energy generation infrastructure within a development node, thereby avoiding the proliferation of similar developments within the region and making it low-medium significance.

Based on the above, the cumulative impacts associated with the combination of all three projects occurring on Portion 7 and Portion 9 of Portion 4 the Farm Namakwari 656 are considered to be of low-moderate significance provided that environmental impacts are mitigated to suitable standards.

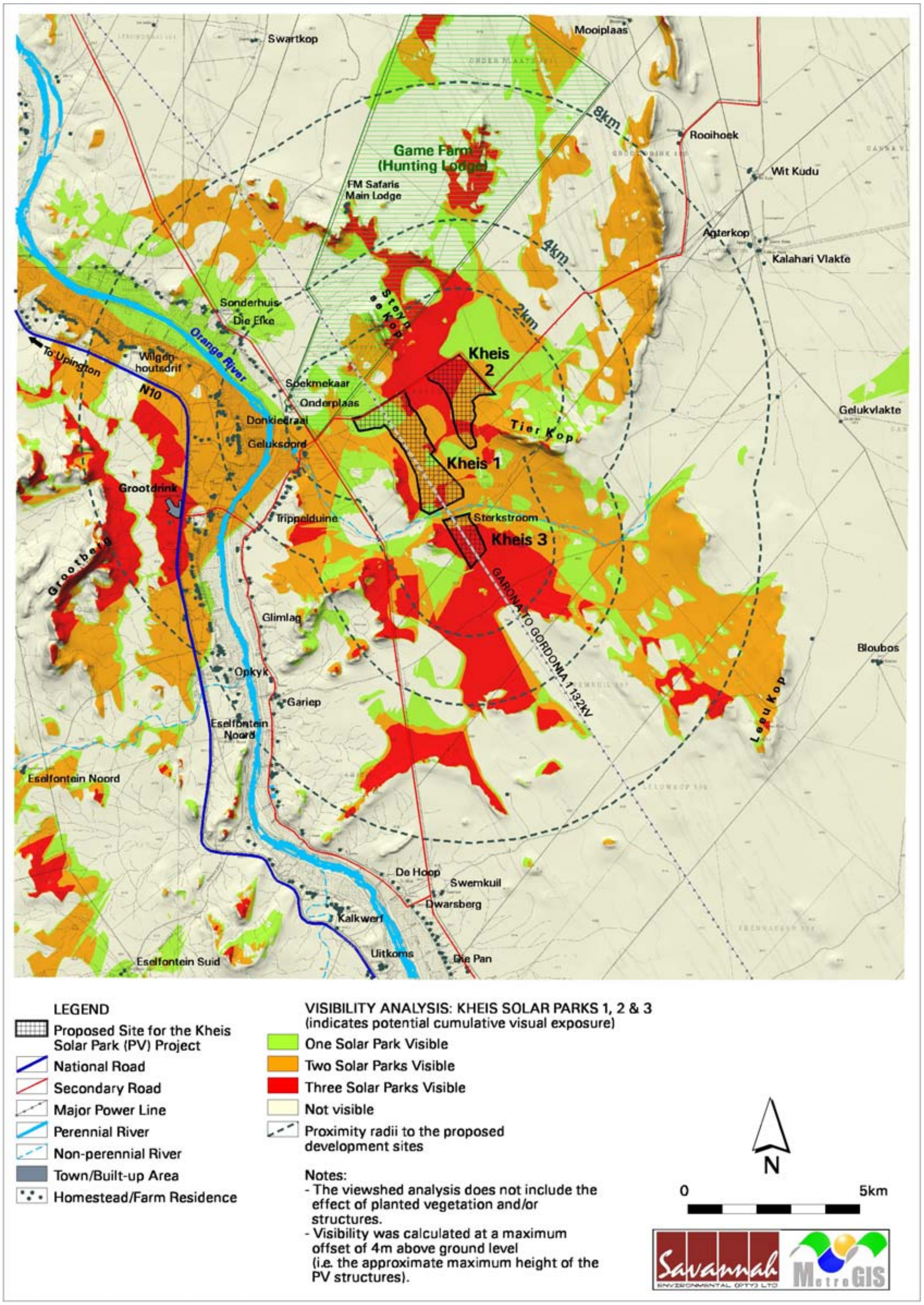


**Figure 10.1**: Potential cumulative visual exposure of the proposed Kheis Solar Parks 1, 2 and 3

## 10.3 Cumulative impacts of renewable energy facilities in the region

Including the three projects of the Kheis Solar Park, there are sixteen (16) renewable projects within a 25 km radius of the Kheis Solar Park 2 site (refer to Figure 10.2). At the time of writing this EIA report, the Bokpoort Trough CSP Project is under construction (being a Round 2 preferred bidder) and Ilanga CSP Facility is a Round 3 preferred bidder.

The potential for cumulative impacts as a result of similar developments planned to be developed around the renewable energy node of Grootdrink, is considered below.

### *10.3.1Loss of vegetation and impacts on ecology*

Excessive clearing of slow growing trees, especially *Boscia albitrunca* and *Acacia erioloba* as a result of multiple project could significantly impact local and regional (within ZF Mgcawu District Municipality) population dynamics, and microhabitats and their resources associated with larger trees of these species. This can influence runoff and storm water flow patterns and dynamics, which could cause excessive accelerated erosion of plains, small ephemeral drainage lines, rivers and this could also have detrimental effects on the lower lying Orange River. Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasives into adjacent agricultural land and rangelands. Cumulative impacts on ecology are expected to be of **low to moderate significance** as several of the solar developments planned in the 25km radius of the project are on similar habitats.

### *10.3.2Cumulative impacts on soil and agricultural potential*

The overall loss of agricultural land in the region due to other similar developments is expected to be of **low** significance due to the limited agricultural potential of the area. Due to the limited crop production in the wider study area, and the fact that grazing can continue on the farm in areas not affected by the proposed facility, the development of multiple solar energy facilities within the region of Grootdrink will not affect food security in the region.

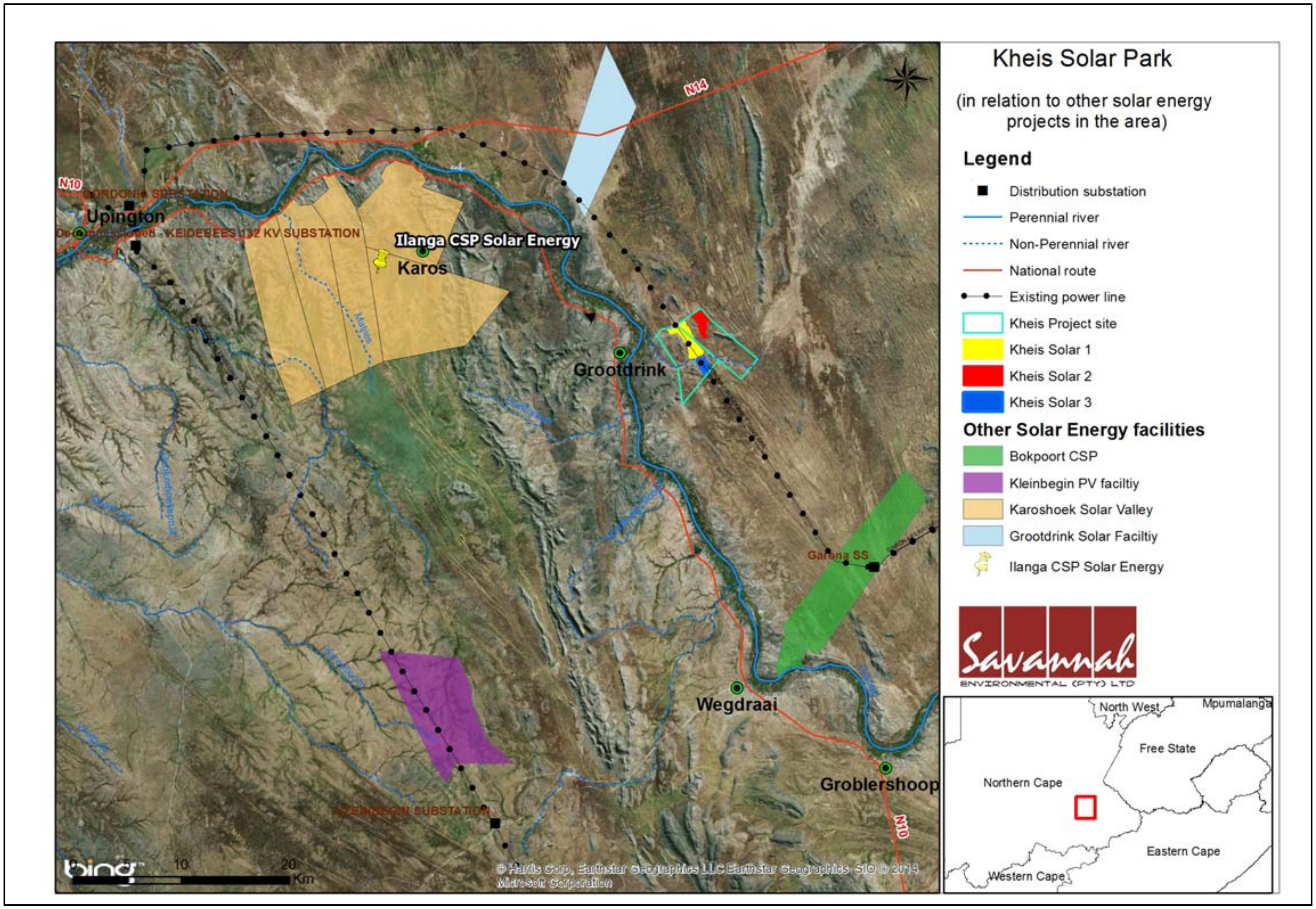


**Figure 10.2:** Map showing the proximity of other renewable energy facility projects to the Kheis Solar Park 2 in order to understand the potential for cumulative impacts

#### *10.3.3Cumulative impacts on heritage and palaeontology*

Cumulative impacts in terms of archaeological and paleontological contexts are once-off permanent destructive events. Infrastructure development may lead to spatially extended impacts in the vicinity, hence the need to demarcate areas for zero to low impact. Cumulative negative impacts on heritage and paleontological resources are expected be low**-medium significance** due to the fact that the potential for the loss of or discovery of heritage artefacts in the region will also increase with the increased numbers of similar developments in the area.

#### *103.4 Cumulative Visual Impacts*

The visual cumulative impact of Kheis Solar Park 2 in relation to other solar facilities beyond 8km radius is not of concern due to the relative long distance; the other facilities are more than 8km from the Kheis Solar Park 2 site which makes the visual impact **low**.

#### *10.3.5Cumulative Impacts on the Social and Economic Environment*

Benefits to the local, regional and national economy through employment and procurement of services could be substantial should many of the renewable energy facilities proceed. This benefit will increase significantly should critical mass be reached that allows local companies to develop the necessary skills to support construction and maintenance activities and that allows for components of the renewable energy facilities to be manufactured in South Africa. Furthermore at municipal level, the cumulative impact could be positive and could incentivise operation and maintenance companies to centralise and expand their activities towards education and training and more closely to the projects.

The cumulative impact in terms of loss of agricultural land is unlikely to be significant due to the limited land take and in most cases agricultural activities would be allowed to proceed on the remaining portions of the sites not affected by the solar facilities. Property prices in these areas are likely to increase as a result of the added value that energy generation offers. However, once the renewable energy sector is saturated, property prices that are dependent on the sense of place value rather than on the agricultural potential may be compromised due to the changes in landscape and sense of place. **Cumulative positive social and economic** impacts and **negative social impacts** (visual, sense of place, noise and disturbance during construction) will be of **moderate significance**.

### 10.4 Conclusion regarding Cumulative Impacts of Kheis Solar Park 2

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study.

The alignment of renewable energy developments with South Africa's Integrated Resource Plan (IRP) and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The CSIR has released an initial identification of geographical areas best suited for the roll-out of wind and solar photovoltaic (PV) energy projects in South Africa. The aim of the assessment is to designate renewable energy development zones (REDZ) within which such development will be incentivised and streamlined. The Kheis Solar Park 2 falls within the REDZ/ identified geographical area most suitable for the rollout of the development of solar energy projects within the Northern Cape Province. In addition, the site is located within the Solar Corridor identified within then NCSDF. Both the REDZ and Solar Corridor initiatives imply that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented. The site location is therefore in line with this rationale.

It is also important to note that it is unlikely that all proposed renewable energy facilities located in the 25km radius will be built in the short to medium term (i.e. 5years) due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets by the DoE. This will reduce the potential for cumulative impacts within this period. Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Kheis Solar Park 2 facility will be of **low to moderate** significance in the region and **low to moderate** within the Kheis Solar Park project site.

# CONCLUSIONS AND RECOMMENDATIONS FOR KHEIS SOLAR PARK 2: (DEA REF. NO.: 14/12/16/3/3/2/570) CHAPTER 11

Gestamp Asetym Solar South Africa (Pty) Ltd is proposing to establish three commercial photovoltaic solar energy facilities on Portion 7 and 9 of Portion 4 of Farm Namakwari 656 south west of Upington, Northern Cape Province. The site is located within the Kheis Local Municipality. ***This Chapter of the EIA report deals only with the conclusions and recommendations of the EIA for the Kheis Solar Park 2 of the larger Kheis (PV) Solar Park project***. The purpose of the proposed facility is to add new capacity for generation of power from renewable energy to the national electricity supply (which is short of generation capacity to meet current and expected demand), and to aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE).

Globally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as climate change and exploitation of non-renewable resources. In order to meet the long-term goal of a sustainable renewable energy industry, a goal of 17,8GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to ~42% of all new power generation being derived from renewable energy forms by 2030. In addition, the need for renewable energy development, specifically solar facilities, has been identified as an opportunity in the Northern Cape Spatial Development Framework (SDF).

In response to the need at a National and Provincial level, Gestamp Asetym Solar South Africa (Pty) Ltd, as an IPP, is proposing the establishment of a 55 MW photovoltaic solar energy facility and associated infrastructure for the purpose of commercial electricity generation. The proposed facility will require a development footprint area of approximately 210 ha (within a larger site of 1800ha in extent), and will be comprised of the following primary elements (refer to Figure 11.1):

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings.
» Cabling between the structures, to be lain underground where practical.
» Central invertor/transformer stations to collect all energy generated from the PV panels. The inverter’s role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.

» An on-site substation (50m x 50m) and power line (1800m) to evacuate the power from the facility into the Eskom grid via the existing Garona-Gordonia 132kV power line that traverses the site (Portion 9 of Portion 4 of the Farm Namakwari 656)
» Internal access roads (5m wide)
» Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity (approximate footprint ±100 m²)

An EIA process, as defined in the NEMA EIA Regulations, is a systematic process of identifying, assessing, and reporting environmental impacts associated with an activity. The EIA process forms part of the planning of a project and informs the final design of a development. In terms of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998), Gestamp Asetym Solar South Africa (Pty) Ltd requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Northern Cape Department of Environmental and Nature Conservation (DENC)) for the establishment of the Kheis Solar Park 2 facility. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543, GNR544, GNR545; and GNR546, a Scoping and an EIA Phase have been undertaken for the proposed project. As part of this EIA process comprehensive, independent environmental studies have been undertaken in accordance with the EIA Regulations. The following key phases have been undertaken to date in the EIA Process.

» *Notification Phase* - organs of state, stakeholders, and interested and affected parties (I&APs) were notified of the proposed project through adverts placed in local and regional newspapers, site notices, and stakeholder letters. Details of registered parties have been included within an I&AP database for the project.
» *Scoping Phase* – identification of potential issues associated with the proposed project and environmental sensitivities (i.e. over the broader project development site - entire extent of Portion 7 of Portion 4 of Farm Namakwari 656), as well as definition of the extent of studies required within the EIA Phase were defined.

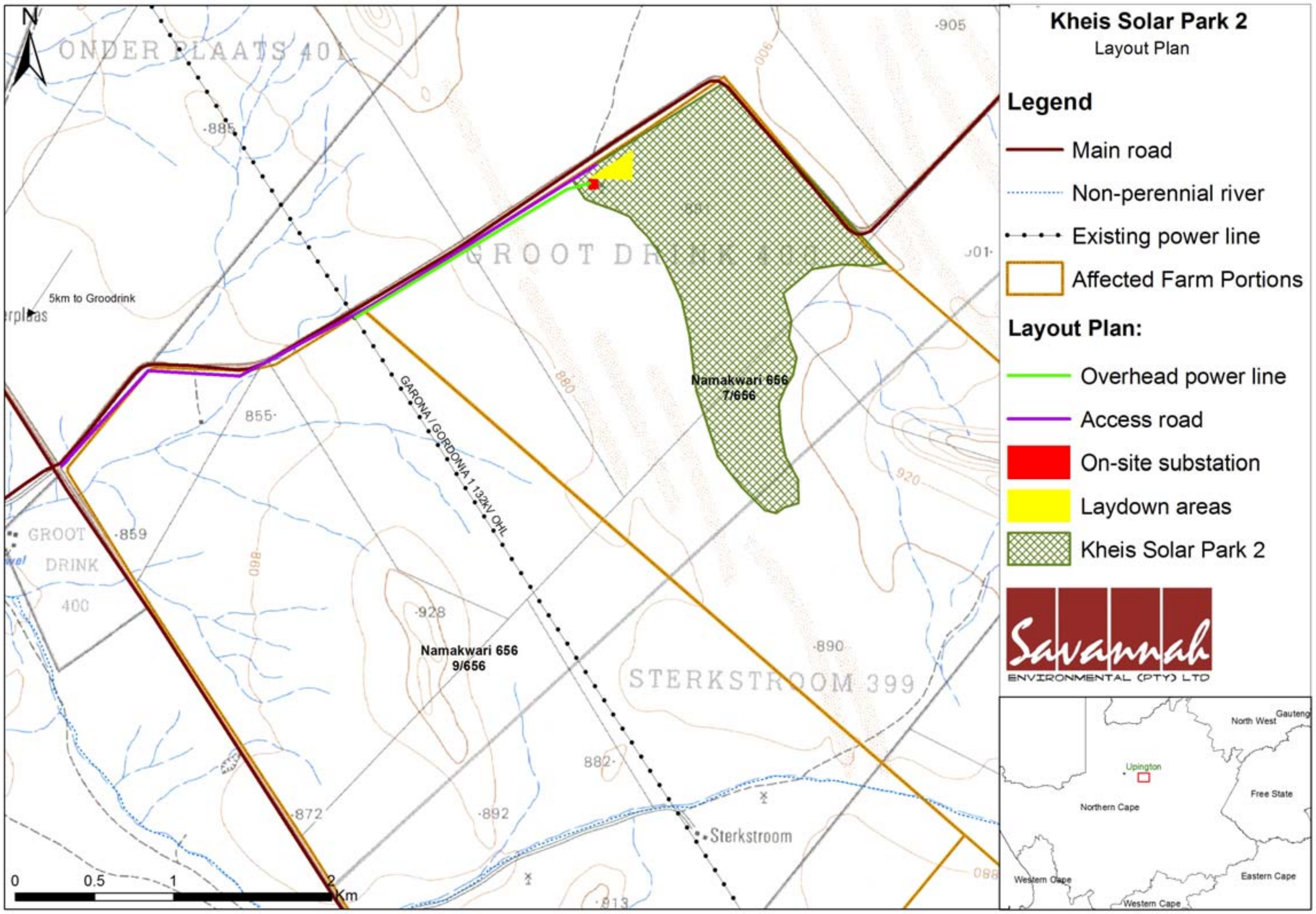


**Figure 11.1:** Map illustrating the location of the development footprint for Kheis Solar Park 2 facility and associated infrastructure and the proposed layout of the proposed facility on Portion 7 of Portion 4 of Farm Namakwari 656.

» *EIA Phase* – potentially significant biophysical and social impacts[17] and identified feasible alternatives put forward as part of the project have been comprehensively assessed through specialist investigations. Appropriate mitigation measures have been recommended as part of a draft Environmental Management Programme (EMPr) (refer to Appendix L).

The Conclusions and Recommendations of this EIA for Kheis Solar Park 2 are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area. During the public consultation process, it was recommended by stakeholders that the facilities are not placed close to the western road and that they should rather be placed behind the small koppie on Portion 9 in order to reduce direct visibility. After field investigations, it was concluded that the area closest to this road is of higher sensitivity from an ecological perspective as well as a visual perspective. Therefore, the layout has been design to avoid these areas, thereby addressing the concerns raised through the public consultation process.

A summary of the recommendations and conclusions for the proposed Kheis Solar Park 2 facility project is provided in this Chapter.

## 11.1. Summary of Conclusions and Recommendations relevant to the Kheis Solar Park 2 facility and Associated Infrastructure

The preceding chapters of this report together with the specialist studies contained within **Appendices E-J** provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for Kheis Solar Park 2 facility by providing a summary of the conclusions of the assessment of the proposed site for the development of the PV solar energy facility. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental specialist consultants and presents an informed opinion of the environmental impacts associated with the proposed project.

From the conclusions of the detailed EIA studies undertaken, sensitive areas within the development footprint area were identified and flagged for consideration and avoidance by the facility layout (refer to Figure 11.2). Potential impacts which could occur as a result of the proposed project are summarised in the sections which follow.

[17] Direct, indirect, cumulative that may be either positive or negative.

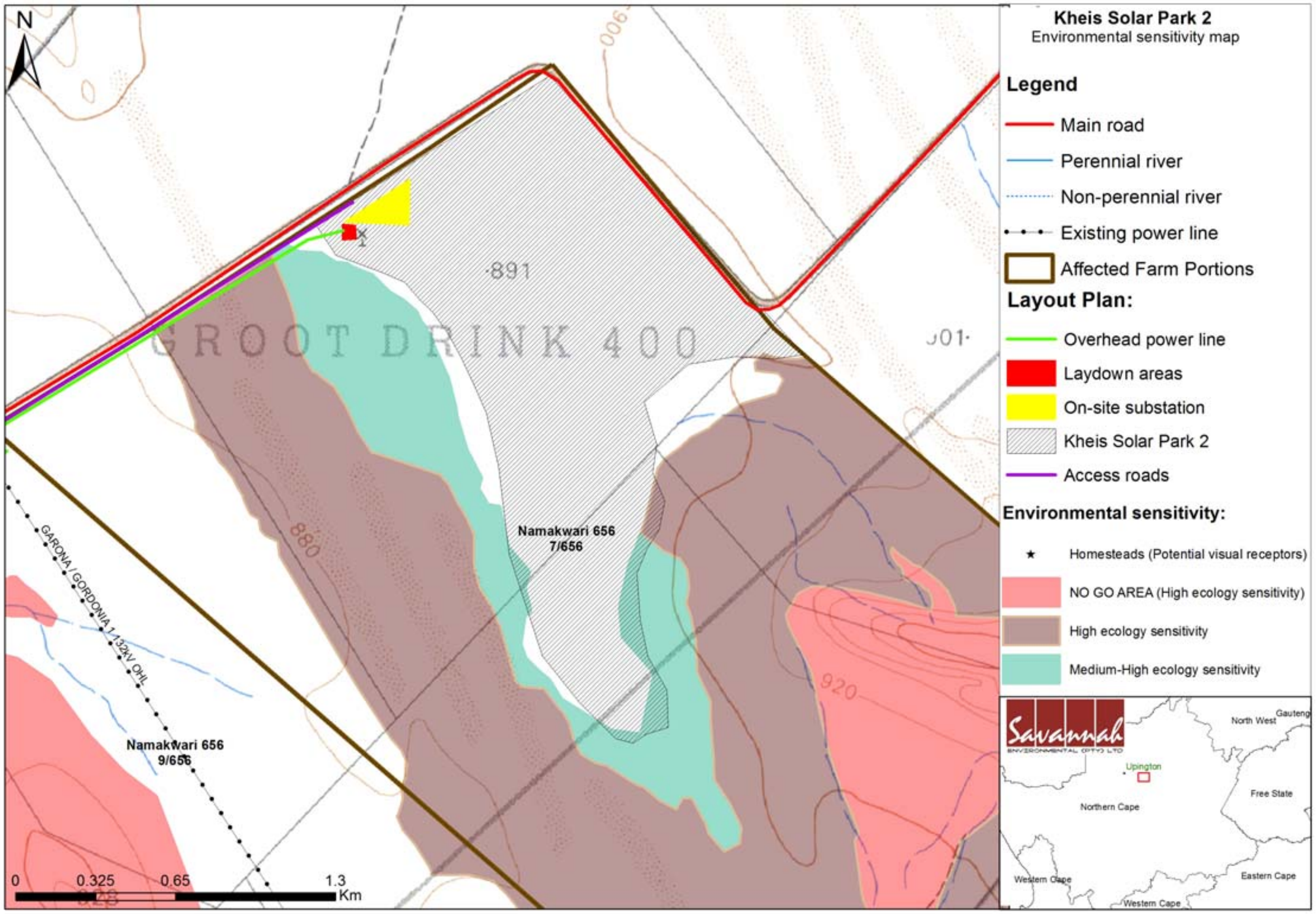


**Figure 11.2:** Environmental Sensitivity map of the proposed Kheis Solar Park 2 facility located on Portion 7 of Farm Namakwari.

The most significant environmental impacts identified and assessed to be associated with the proposed Kheis Solar Park 2 include:

» Impacts on ecology occurring on the site.

Other impacts which could have an impact on the environment include:

» Impacts on the local soils, land capability and agricultural potential of the site.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure (power line, access road etc.).
» Impacts on heritage and paleontological resources.
» Social and economic impacts.
» Impacts associated with the power line.

#### *11.1.1. Impacts on Ecology*

Two vegetation units were identified within the Kheis Solar Park 2 footprint. Calcareous low shrub plains occupy most of the Kheis Solar Park 2 site and are of lower sensitivity. The second vegetation association is the mixed shrub (occurs as a transition between the calcareous plains and dune fields) classified as having a Medium-Low sensitivity. A small footprint of the layout falls within the medium-high sensitivity of this unit with high value grasslands. Impacts in these are considered to be acceptable to some degree due to sections of these system-fringes that are severely affected by bush encroachment resulting in reduced sensitivity in some areas. The ecological sensitivity assessment identified those parts of the site that have high conservation value or that may be sensitive to disturbance. The habitats considered most sensitive on the site include:

» Duneveld
» Larger drainage channels
» Rocky outcrops
» Undulating calcrete and sandy plains

These areas are avoided by the proposed infrastructure, which is located largely in an area of low sensitivity as is indicated in Figure 11.2. From an ecology perspective, it is not expected that the development will compromise the survival of any specific flora or terrestrial vertebrate species on the study area or beyond if mitigation measures are fully implemented. The most significant impacts are expected to be on ecosystem health and functionality, which should remain relatively intact if all mitigation recommendations are implemented.

#### *11.1.2. Impact on Soils, Land Capability and Agricultural Potential*

Hutton soils which occur on the broader site (Portion 7 and 9 of Farm Namakwari 656) are highly prone to wind erosion due to the sandy texture of the soil. It is, therefore, important that there should be strict adherence to the Environmental Management Programme and good soil management measures regarding the management of stormwater runoff and water erosion control should be implemented during all phases of the project. With the implementation of good soil management measures the impact of the PV Facility on soils can be managed to an acceptable level, without significant erosion issues during the lifespan of the facility.

The study area has limited agricultural potential, and the proposed development area is aligned to avoid key grazing areas located in dune areas. The significance of agricultural impacts is influenced by the fact that the site has extremely limited agricultural potential, with a land capability of class 7, non-arable, low potential grazing land. The site is used only for grazing of cattle. No agriculturally sensitive areas occur within the proposed Kheis Solar Park 2 footprint. The major limitations to agriculture are the aridity and lack of access to water, as well as the very sandy soils with limited water and nutrient holding capacity, and in some places limited soil depth. The development will have **low to medium** negative impacts on agricultural resources and productivity. The conclusion of this assessment is that from an agricultural impact perspective the development can proceed as proposed, subject to the recommended mitigation measures provided being implemented.

### *11.1.3. Visual Impacts*

The visual surroundings of the proposed Kheis Solar Park 2 site, especially within a 2km radius, will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 30 years). There are no major urban developments near (within 4km of) the proposed Kheis Solar Park 2 development site, but additional viewer incidence (and expected negative viewer perception) will be concentrated within the homesteads and farm residences within the study area at 2km, located primarily along the Orange River. The FM Safaris Game Farm, located north-west of the Kheis Solar Park 2, is also considered as a sensitive visual receptor. Visitors (mainly hunters) to this farm and game lodge generally would not expect to view electricity generation infrastructure when visiting the region for recreational purposes. These observers may be negatively affected by the Kheis Solar Park 2 development. Additionally, Kheis Solar Park 2 could potentially have a high visual impact on road users travelling along the secondary road (for a short period when they pass the facility) located north of the Kheis Solar Park 2, site-specific mitigation measures are recommended in order to reduce/mitigate the potential visual impact to moderate.

During the decommissioning or post-closure phase of the project, all of the infrastructure will be removed, recycled or re-used off-site. The residual visual impacts of the site are expected to include scarring of the landscape in the areas affected by infrastructure. With the implementation of appropriate management measures such as rehabilitation of disturbed areas and planting of vegetation and visual screening methods at receptors / key viewpoints, this scarring and visual impact could be reduced and removed in the long-term.

The anticipated visual impacts identified through the EIA process (post mitigation measures) are on average expected to be of low to moderate significance. The Kheis Solar Park 2 development is therefore not considered to be fatally flawed from a visual perspective.

### *11.1.4. Impacts on Heritage and Paleontological Resources*

There were no heritage sensitive areas identified on the Kheis Solar Park 2 site. Two heritage artefacts of low heritage significance occur outside the development footprint for Kheis Solar Park 2 and will not be impacted by the development footprint of the PV facility. There is no heritage no go areas within the site development footprint for Kheis Solar Park 2.

This study has identified that of the geological units that underlie the project area only the Gordonia Formation is potentially fossiliferous and may be negatively impacted. There is a potential for negative impact on the palaeontological heritage of the project area throughout most of Kheis Solar Park 2 due to the extensive coverage of thick deposits of the Gordonia Formation in those locations, recommended mitigation measures should apply. The potential risk for any negative impact on the palaeontological heritage in Kheis Solar Park 2 is categorised as improbable due to the general scarcity of fossils in the unit and as *no fossil materials* were located within the project area.

The impact of the project on **heritage resource** is rated as **low significance**. However, a preconstruction walk-through survey by an archaeologist is recommended to be undertaken for the PV facility and associated infrastructure. Should substantial archaeological or paleontological (fossils) remains or graves be exposed during construction, SAHRA should be alerted as soon as possible such that appropriate action (e.g. recording, sampling or collection) can be taken by a professional archaeologist or palaeontologist. It is recommended that a close examination of all excavations be made while they are occurring during construction within the Gordonia Formation sands.

### *11.1.5. Social and Economic Impacts*

The proposed project could have negative and positive **social and economic impacts** of **low (negative) and high (positive) significance** for post mitigation and enhancement respectively. Kheis Solar Park 2 55MW facility will provide opportunities for employment and skills development in the local area during both the construction and operational phases. Another potential spin-off from the development is the stimulation of the local economy, including development of industries specifically to provide services and goods for solar facilities, and general retail businesses and accommodation. Potential negative impacts include the threats to public safety from construction and traffic activity, potential increased crime and health risks such as HIV/Aids particularly during construction and if people move into the area hoping to secure jobs. Social dissent is also possible if people perceive that recruitment processes are unfair and biased. Other impacts on the social environment include impacts associated with traffic and infrastructure (such as local roads). It is important that potential negative effects are managed as per the recommended mitigation measures to prevent these from developing into unacceptable cumulative impacts. Positive impacts of job creation and stimulation of the local economy can be progressed and cumulatively contribute to a desired outcome if enhancements measures (as contained in the socio-economic specialist study and draft EMPr) are implemented.

## 11.2. Assessment of Potential Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site-specific developments. This however, is beyond the scope of this study. The alignment of renewable energy developments with South Africa's IRP and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The Kheis Solar Park 2 facility falls within the identified geographical areas most suitable for the rollout of the development of solar energy projects within the Northern Cape Province, as identified within the Northern Cape SDF. This implies that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented. It is also important to note that it is unlikely that all proposed renewable energy facilities located in the 25km radius (as detailed in chapter 10) will be built in the short to medium term (i.e. 5 years) due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets by the DoE. This will reduce the potential for cumulative impacts within this period. Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Kheis Solar

Park 2 facility will be of **low to moderate** significance in the region and **low to moderate** within the Kheis Solar Park project site.

### 11.3 Comparison of Technology Alternatives

Impacts on the environment associated with the project will be influenced by the type of PV panel array to be implemented. PV technologies being considered for the proposed project are fixed and tracking, to be developed with a 210ha development footprint. For the majority of impacts, the two alternative PV technologies do not differ in any significant way. Therefore, there is no significant difference in the potential impacts associated with the alternatives. In terms of the specialist studies undertaken, the following conclusions were made regarding the preferred PV technology alternatives:

| | **Fixed** | **Tracking** |
|---|---|---|
| Ecology | Less preferred | Preferred |
| Soils and agricultural potential | No preference | No preference |
| Visual | No preference | Less preferred |
| Heritage & palaeontology | No preference | No preference |
| Social | No preference | No preference |

- ***Ecology*** – Tracking PV technology is ecologically a preferred technology alternative, due to the aridity of the area and the difficulty of new vegetation establishment. Solar panels create a shading effect to the vegetation in the affected area, thereby limiting growth in some cases. Tracking technology results in reduced shading when the panels are tracking the sun (due to the angle in relation to the ground surface). The impact of tracking systems therefore appears to be lower than that of a fixed panel array, even if the latter may occupy less space.
- **Soils and agricultural potential -** The agricultural potential for the proposed development site is low, in terms of impact arising from soils and agricultural potential. There is no significance difference in the potential impacts associated with the two technology alternatives.
- **Visual -** Fixed technology is preferred being that it is less intrusive to sensitive receptors. However, for this particular site there is very little difference in the significance in the potential impacts associated with the two technology alternatives, with views being restricted to within 4km.
- **Heritage and palaeontology -** There is no significance difference in the potential impacts associated with the two technology alternatives as the footprint remains unchanged.
- **Social** - There is no difference in social / economic impacts from either technology alternatives.

There are no impacts of unacceptably high significance associated with either technology alternative assessed for the proposed Kheis Solar Park 2 facility. In addition, there is little or no difference between the impacts associated with the two technology alternatives, apart from the expected difference in impact expected to be associated with ecology. From an environmental perspective both technologies are considered to be environmentally acceptable for implementation at the Kheis Solar Park 2 facility, with a slight preference for tracking technology. The technology preference should therefore be determined on the basis of technical considerations.

From a technical and financial view, a single axis tracker (HIASA) compared to the fixed structure yields production between 20% and 25% higher, depending on the site of installation and on the parameters of the tracker. Although the installation is more expensive initially, the higher yield makes it possible to offer a higher efficiency of the facility and subsequent lower electricity tariffs, making the project more competitive as a business unit. Thus, it is recommended that tracking technology be implemented for the Kheis Solar Park 2 facility. The developer has confirmed that this is the preferred technology from a technical perspective and can therefore be implemented at this site.

## 11.4 Environmental Costs of the Project versus Benefits of the Project

Environmental (natural environment, economic and social) costs can be expected to arise as a result of the project proceeding. This could include:

» Direct loss of biodiversity, flora, fauna and soils due to the clearing of land for the construction and utilisation of land for the PV project (which is limited to the development footprint of 210 hectares). The cost of loss of biodiversity has been minimised on the Kheis Solar Park 2 PV site through the careful location of the development to avoid key areas supporting biodiversity of particularly high conservation importance.
» 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 being visually impacted to some extent by power lines.
» Change in land-use and loss of land available for grazing on the development footprint. The cost in this regard is expected to be limited due to the low agricultural potential and carrying capacity of the property and the fact that current agricultural activities can continue on the remainder of the property during construction and operation.

These costs are expected to occur at a local and site level and are considered acceptable provided the mitigation measures as outlined in this EIA and the EMPr are implemented.

Benefits of the project include the following:

» The project will result in important economic benefits at the local and regional scale through job creation, procurement of materials and provision of services and other associated downstream economic development. These will persist during the preconstruction/ construction and operational phases of the project.
» The project contributes towards the Provincial and Local goals for the development of renewable energy (specifically solar developments) as outlined in the respective SDFs and IDPs.
» The project serves to diversify the economy and electricity generation mix of South Africa by addition of solar energy to the mix.
» South Africa's per capita greenhouse gas emissions are amongst the highest in the world due to reliance on fossil fuels. The proposed project will contribute to South Africa achieving goals for implementation of non-renewable energy and 'green' energy. Greenhouse gas emission load is estimated to reduce by 0.86% for a 500MW coal-fired power station compared to a similar MW PV project, on a like for like basis.

The benefits of the project are expected to occur at a national, regional and local level. As the economic costs to the environment have been largely limited through the appropriate placement of infrastructure on the site within low sensitivity areas, the expected benefits of the project will partially offset the localised environmental costs of the project.

## 11.5. Overall Conclusion (Impact Statement)

The principles of NEMA have been considered in this assessment through the implementation of the principle of sustainable development where appropriate mitigation measures have been recommended for impacts which cannot be avoided. In addition, the successful implementation and appropriate management of this proposed project will aid in achieving the principles of minimisation of pollution and environmental degradation at a national scale.

The EIA process has been undertaken in accordance with the requirements of the EIA Regulations and all effort has been made to involve interested and affected parties, stakeholders and relevant Organs of State such that an informed decision regarding the project can be made by the Regulating Authority. The general objectives of Integrated Environmental Management have been taken into account for this EIA report by means of identifying, predicting and evaluating the actual and potential impacts on the biophysical environment, socio-economic conditions and cultural heritage component. The risks, consequences, alternatives as well as options for mitigation of activities have also been considered with a view to minimise negative impacts, maximise benefits, and promote compliance with the principles of sustainable environmental management.

The technical viability of establishing a solar energy facility with a net generating capacity of 55 MW on a site located on Portion 7 of Portion 4 of Farm Namakwari 656 has been established by Gestamp Asetym Solar South Africa (Pty) Ltd. The positive implications of establishing the Kheis Solar Park 2 facility on the identified site include the following:

» The potential to harness and utilise solar energy resources within the Northern Cape Province.
» The project will assist the South African government at a national, provincial and local level in reaching their set targets for renewable energy.
» The project will assist the South African government in the implementation of its green growth strategy and job creation targets.
» The project will assist the district and local municipalities in reducing levels of unemployment through the creation of jobs, skills development opportunities and support of local business.
» The National electricity grid in the Northern Cape Province will benefit from the additional generated power.
» The project will contribute towards the promotion of clean, renewable energy in South Africa.
» Kheis Solar Park 2 site is located near Grootdrink which located within this Solar Corridor area has which has been ear-marked as a hub for the development of solar energy projects due to the excellent solar resource of the area, as well as the larger centre of Upington acting as load centre.
» Kheis Solar Park 2 site is appropriately located for easy access via a secondary (gravel) road that bridges the Orange River from the N10 national road near Grootdrink; or alternatively via the N14 onto a secondary road heading south next to the site
» Garona- Gordonia 1 132kV OHL power line traversing the proposed site, the project proximity to the national grid connection reduces some of the impacts related to building longer power line to connect to the grid.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that there are **no environmental fatal flaws** that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. The significance levels of the majority of identified negative impacts have been reduced to acceptable levels by implementing the mitigation measures recommended by the specialist team during the EIA process, and this specifically included the consideration of the facility layout in relation to site-specific sensitivities identified. The avoidance of areas of sensitivity is illustrated by the facility layout drawing overlain on the sensitivity map included as Figure 11.2. The project has all environmental constraints, and is considered to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) for the Kheis Solar Park 2 facility included within **Appendix L**.

With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable** provided all measures are taken to protect and preserve surrounding environment.

## 11.6. Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the impacts associated with the development of the Kheis Solar Park 2 project can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation.

The layout plan as presented in Figure 11.2 has been designed to avoid the majority of the sensitive environments on the site including:

» Duneveld
» Larger drainage channels
» Rocky outcrops
» Undulating calcrete and sandy plains
» Heritage sites identified on the broader property

Therefore this layout as presented is considered acceptable and is recommended as the preferred layout for the facility.

The following conditions would be required to be included within an authorisation issued for the project:

» Tracking technology is implemented as a preferred technology alternative from both an environmental and technical perspective.

» The draft Environmental Management Programme (EMPr) as contained within Appendix L of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be the main key in achieving the appropriate environmental management standards as detailed for this project.
» Following the final design of the facility, a final layout indicating all relevant infrastructure and affected areas (permanent and temporary) must be submitted to DEA for review and approval prior to commencing with construction.
» Duneveld, larger drainage channels, and outcrops should be treated as No Go Zones due to their high conservation value. Even on the undulating calcrete and sandy plains, ground disturbance should be minimised, and existing gravel roads and tracks used as far as possible to lower the extent of the footprint.
» If any protected plant or tree species will be removed/destroyed by the developer, a collection/destruction permit to be obtained from Northern Cape Department of Environment and Nature Conservation and/or DAFF for the protected species found on site as well from the provincial permitting authority.
» A detailed Invasive Plant Management Plan will have to be in place prior to commencement of activity and be diligently followed and updated throughout the project cycle up to the decommissioning phase.
» Sociable weavers' nests occur within the development area should be avoided as far as possible. Nests may only be removed with a permit and by a suitably qualified specialist, supervised by conservation staff. Undertake pre-construction walk-through footprint investigations for protected flora and burrowing terrestrial vertebrates.
» Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be implemented.
» All infrastructures, including access roads and other on-site infrastructure must be planned so that the clearing of vegetation is minimised.
» Site rehabilitation of temporary laydown and construction areas to be undertaken immediately after construction.
» Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to provide input into rehabilitation specifications.
» Develop an emergency maintenance plan to deal with any event of contamination, pollution, or spillages during construction and operation.

» Compile a comprehensive storm-water management method statement, as part of the final design of the project and implement during construction and operation.
» All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.
» An independent Environmental Control Officer (ECO) must be appointed by the project developer prior to the commencement of any authorised activities.
» Applications for all other relevant and required permits required to be obtained by the developer and must be submitted to the relevant regulating authorities.

# ASSESSMENT OF POTENTIAL IMPACTS: KHEIS SOLAR PARK 3 CHAPTER 12

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the development of the proposed Kheis Solar Park 3 and associated infrastructure (refer to **Figure 12.1**). This assessment has considered the construction of a 20 MW facility and all related and ancillary infrastructure, including:

» Arrays of either static or tracking photovoltaic (PV) panels.
» Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings.
» Cabling between the structures, to be lain underground where practical.
» Central invertor/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
» An on-site substation (50m x 50m) and power line (100m) to evacuate the power from the facility into the Eskom grid via the existing Garona-Gordonia 132kV power line that traverses the site (Portion 9 of Portion 4 of Farm Namakwari)
» Internal access roads (5m wide).
» Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity (approximate footprint (±100 m²)

The proposed Kheis Solar Park 3 will have a development footprint of approximately 110 ha. The development of the facility will comprise the following phases:

» *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of the access road, electricity generation infrastructure, power line servitudes, construction camps, laydown areas, transportation of components/construction equipment to site; and undertaking site rehabilitation including implementation of a storm water management plan. The construction phase for the Kheis Solar Park 3 is expected to take approximately 16 months.
» *Operation* – will include operation of the facility and the generation of electricity which will be fed into the national grid via the on-site substation and an overhead powder line. The operational phase of the Kheis Solar Park 3 is expected to extend in excess of 20 - 25 years.

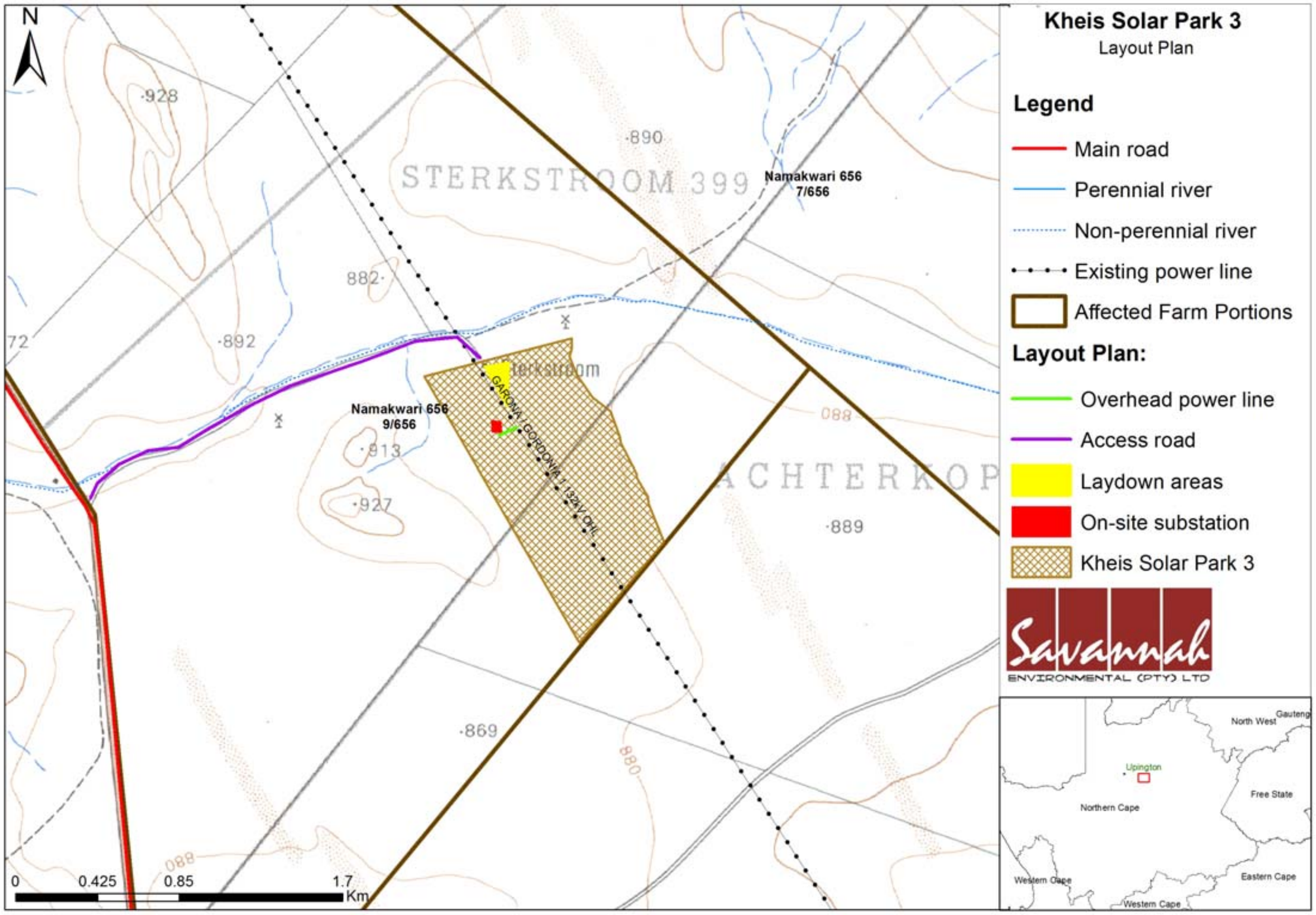


**Figure 12.1:** Layout map showing Kheis Solar Park 3 of the proposed Kheis Solar Energy Facility and associated infrastructure on Portion 9 of Portion 4 of the Farm Namakwari 656

» *Decommissioning* – depending on the economic viability of the plant, the length of the operational phase may be extended. Alternatively decommissioning will include site preparation; disassembling of the components of the facility; clearance of the site and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to construction. Therefore, these impacts are not considered separately within this chapter.

## 12.1 Alternatives Assessment

***Technology Alternatives***

Impacts on the environment associated with the project will be influenced by the type of PV panel array to be used. PV technologies being considered for the proposed project are fixed and tracking. As the panels will not differ in height with the two technologies under consideration, the most important differences in impact between the technologies relate to the ecological environment (Tsoutsos *et al*. 2005, Turney and Fthenakis 2011, Strohbach 2012) and are summarised in the table below:

Each of the impacts assessed below provides a comparative assessment of the two technology alternative.

## 12.2 Assessment of the Potential Impacts associated with the Construction and Operation Phases

The sections which follow provide a summary of the findings of the assessment of potential impacts associated with the construction and operation of the proposed Kheis Solar Park 3 facility on a development footprint of ~110ha on the identified site Portion 9 of Portion 4 of the Farm Namakwari 656 (covering an area of 1800 ha in extent). The assessment of potential issues presented in this chapter has involved key input from specialist consultants, the public and the project developer. Issues were assessed in terms of the criteria detailed in Chapter 4 (section 4.3.3). The nature of the potential impact is discussed, and the significance is calculated with and without the implementation of mitigation measures. Recommendations are made regarding mitigation/enhancement and management measures for potentially significant impacts and the possibility of residual and cumulative impacts are noted. Cumulative impacts for Kheis Solar Park 3 are assessed in further detail in Chapter 13, as well as within the specialist studies contained in Appendix E

### *12.2.1. Potential Impacts on Ecology*

The study area is located in an area characterised by Lower Gariep Broken Veld (NKb 1), Bushmanland Arid Grassland (NKb 3), Gordonia Duneveld (SVkd 1) and fractions of the Kalahari Karroid Shrubland (NKb 5) as described by Mucina and

Rutherford (2006). Riparian vegetation occurs on the banks of small ephemeral water washes that drain into the nearby Orange River west of the study area. Only the vegetation along the Orange River itself is currently regarded as a threatened ecosystem, and will only be impacted on if impacts of the proposed development are not adequately mitigated.

Vegetation units that could be identified within the Kheis Solar Park 3 site are listed below with their sensitivity and their sensitivity is mapped on Figure 12.2.

- Association 1: *Leucosphaera bainesii – Zygophyllum dregeanum* calcareous low shrub plains occupy most of the developable parts of the study area. Species composition is very diverse, with forb and low shrub dominating most areas.
    - Conservation value: Medium
    - Sensitivity: **Low**

- Association 3: *Rhigozum trichotomum – Stipagrostis ciliata* mixed shrub occur as a transition between the calcareous plains and dune fields. More surface sand creates a more favourable environment for perennial grasses, but soil depth is restricted by underlying calcrete, hence the density of large trees is considerably lower than on the duneveld.
    - Conservation value: Medium to high
    - Sensitivity: **Medium-High** (where the vegetation structure consists of open grassed areas interspersed with smaller groups of higher trees and shrubs) and **Medium-low**(where there is excessive disturbance from bush encroachment). *NB: Half of the Kheis Solar Park 3 footprint falls within the Medium-high vegetation unit. This is considered to be acceptable to some degree even if some big trees will be impacted as there are sections of these system-fringes that are severely affected by bush encroachment.).*

The duneveld, larger drainage channels, and outcrops should be treated as No Go Zones due to their high conservation value. Even on the undulating calcrete and sandy plains, ground disturbance should be minimised, and existing gravel roads and tracks used as far as possible to lower the extent of the footprint. These no-go and high sensitivity areas are not impacted by the facility as indicated in Figure 12.2.

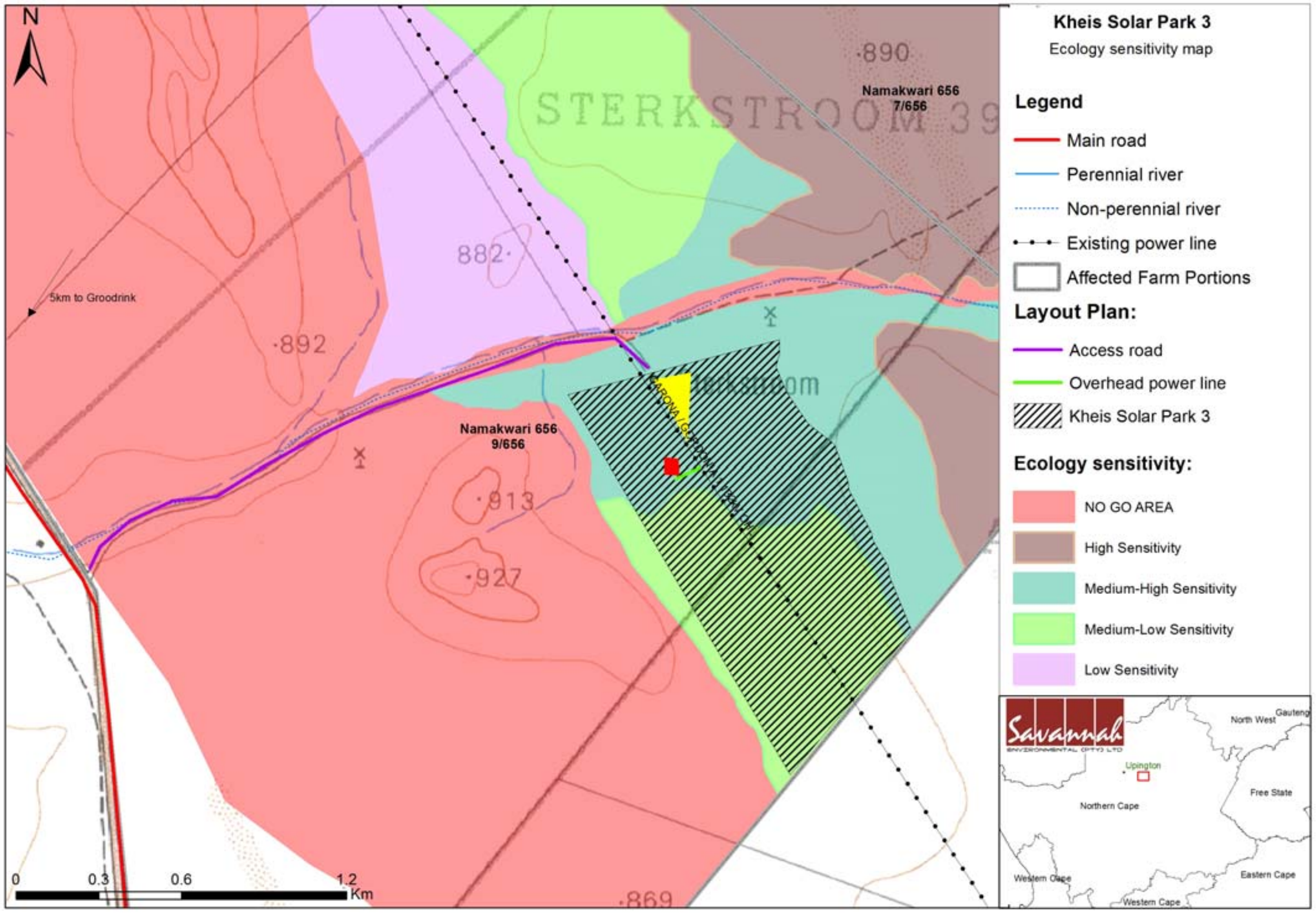


**Figure 12.2:** Sensitivity map indicating sensitive ecological areas within the proposed Kheis Solar Park 3 Facility and surrounding area

Solar energy facilities require relatively large areas of land for placement of infrastructure. The proposed Kheis Solar Park 3 and associated infrastructure requires ~110ha for the establishment of the proposed panels and associated infrastructure. The main expected negative impact from an ecological perspective will be due to loss of vegetation, loss of species of conservation concern, and loss of habitat which may have direct or indirect impacts on individual species. Potential impacts and the relative significance of the impacts are summarised in the tables which follow (refer to **Appendix E - Ecology Report for more details**).

### a) Summary of ecological impacts associated with the proposed solar energy facility during the construction and operational phase

| | | |
|---|---|---|
| **Nature:** Upgrading and/or creation of site access and internal maintenance roads<br><br>Loss of vegetation, increase in runoff and erosion, possible distribution and increased establishment of alien invasive species, possible disturbance and reduction of habitat or injury to burrowing vertebrates, possible rise of road-kill incidences of fauna, possible change of natural runoff and drainage patterns, possible loss of protected species, possible permanent loss of revegetation potential of soil surface, increase in dust levels.<br><br>*Note: relatively large access roads already exist on and to the land portion, as well as provide access to portion 7 and 9 of the Farm Namakwari 656.* | | |
| **Listed activities:**<br>GN 544 activity 11(x)(xi) & 18(i);<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | **Without mitigation** | **With mitigation** |
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Long-term (4) | Long-term (4) |
| **Magnitude (M)** | Low (4) | Minor (2) |
| **Probability (P)** | Definite (5) | Definite (5) |
| **Significance (S = E+D+M)*P** | **Medium (50)** | **Medium (35)** |
| **Status (positive, neutral or negative)** | Negative | Negative<br>Notes: reduced impact on existing roads and tracks |
| **Reversibility** | Not reversible | Relatively reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |
| **Can impacts be mitigated?** | Reasonably well | |
| **Mitigation:**<br>» Treat all outcrop areas and dunes as No-Go Zones<br>» Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains<br>  * Ensure adequate drainage where ephemeral drainage lines crossed<br>  * Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines | | |

- Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
  - Protected geophytic and succulent plant species: must be relocated
  - Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
  - Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated
  - All social weavers nests that may be affected by the development must be moved by a qualified specialist or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
  - Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanisation
- During construction:
  - Create designated turning areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
  - Ensure that concrete, tar or other construction material is not spilled or discarded next to newly built roads or storm water structures, but disposed of at a designated area
- Keep the clearing of natural vegetation to a minimum
- Dust levels must be controlled and minimised
- If filling material is to be used, this must be sourced from discontinued mining areas on the adjacent property or other authorised and permitted sources
- Topsoil (the upper 25 cm of soil) is an important natural resource; where it must (and can) be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas
- Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated (erosion management plan required)
- Prevent leakage of oil or other chemicals or any other form of pollution, as this may infiltrate local groundwater reserves or end up in the Orange River where it can affect all downstream users
- Monitor the establishment of (alien) invasive species and remove as soon as detected, whenever possible before regenerative material can be formed
- Strictly enforce a speed limit of 30 km/hour on all construction and access routes as appropriate and limit driving to daytime hours to try and prevent collisions with fauna, especially nocturnal mammals
- After decommissioning, if access roads or portions thereof will not be of further use to the landowner, remove all foreign material and rip area to facilitate the establishment of vegetation, followed by a suitable revegetation programme

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| **Cumulative impacts:**<br>» Possible erosion of areas lower than the access road, possible contamination of groundwater reserves due to oil or other spillage<br>» Possible spread and establishment of alien invasive species<br>» Increased transformed areas (together with surrounding developments) that may affect local fauna and flora population dynamics and runoff patterns |
| **Residual impacts:**<br>» Localised loss of vegetation<br>» Altered topsoil conditions<br>» Potential barren areas remaining after decommissioning<br>» Potential for erosion and invasion by weed or alien species<br>» Potential for increased dust and its impact on surrounding environments and biodiversity |

| | | |
|---|---|---|
| **Nature:** Fencing area – may also serve as fire-break and assumed to run alongside maintenance track<br><br>Loss of vegetation and specifically protected or red data species, window of opportunity for the establishment of alien invasive species, altered topsoil characteristics prone to capping and sheet erosion, increased runoff and storm water volumes, temporary disturbance of burrowing fauna, possible reduction of habitat and forage availability to terrestrial vertebrates<br><br>*Note: existing fencing already exists that restricts movement of larger terrestrial fauna, fencing areas will be re-aligned as necessitated by the development* | | |
| **Listed activities:**<br>GN 544 activity 11(x)(xi) & 18(i);<br>GN 546, 18 June 2010 activity 14(i) | | |
| | **Without mitigation** | **With mitigation** |
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Long-term (4) | Long term (4) |
| **Magnitude (M)** | Low (4) | Minor (2) |
| **Probability (P)** | Definite (5) | Highly Probable (4) |
| **Significance (S = E+D+M)*P** | **Medium (50)** | **Low (28)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Partially reversible | Reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |
| **Can impacts be mitigated?** | Reasonably well | |
| **Mitigation:**<br>» Treat all outcrop areas and dunes as No-Go Zones<br>» Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains | | |

  * Ensure adequate drainage where ephemeral drainage lines crossed
  * Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines
- » Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
  * Protected geophytic plant and succulent species: must be relocated
  * Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
  * Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated
  * All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
  * Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanization
- » During construction: create designated turning areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
- » During the design phase, the possible impact of burrowing vertebrates and rodents on the development must be determined, and fencing must be designed to either exclude such fauna if it will be detrimental or enable occasional migration of smaller vertebrates onto and across the site (which could be beneficial to small vertebrate populations)
- » Minimise area affected, especially during construction
- » During construction: strictly prohibit any off-road driving or parking of vehicles and machinery outside the footprint areas
- » Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind
- » Monitor the establishment of alien and indigenous invasive species and remove as soon as detected, whenever possible *before* regenerative material can be formed
- » If the area will be used as a fire-break, maintain a suitably low grass layer by regular mowing or appropriate plant species selection, but do not leave soil bare. Alternatively, ensure that the soil has a covering of gravel or small rock that prevents erosion. The firebreak and fencing area must be kept clear of all weeds and indigenous invasive species to enable continued effective maintenance until decommissioning

**Cumulative impacts:**

- » Possible erosion of cleared areas and associated accelerated erosion from surrounding areas
- » Possible loss of ecosystem functioning due to increase in invasive species
- » Increased habitat fragmentation and displacement of terrestrial vertebrates in the region

**Residual impacts:**

- » Altered vegetation composition
- » Compacted topsoils
- » Possibility for erosion and invasion by alien invasives

**Nature:** Construction and operation of PV panels on natural vegetation within development footprint (**tracking panel option**)

Removal of or excessive damage to existing vegetation cover (approx. 3ha per MW). Loss of vegetation and/or species of conservation concern, loss of and alteration of many niche microhabitats, altered vegetation cover, site-specific altered distribution of rainfall and resultant runoff patterns, increase in runoff from PV panels and/or bare areas and accelerated erosion, loss of habitat and resource availability for terrestrial fauna, possible increase of storm water and dust effects during periods of extreme weather events, e.g. increased erosion or dust due to lower buffering capacity of sparser vegetation for the construction and operation of PV panels (tracking panel option).

**Listed activities:**
GN 544 activity 11(x)(xi) & 18(i);
GN 545, 18 June 2010 activity 1 & 15
GN 546, 18 June 2010 activity 14(i)

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent (E)** | Regional(3) | Local (2) |
| **Duration (D)** | Long-term (4) | Long-term (4) |
| **Magnitude (M)** | High (8) | Moderate (6) |
| **Probability (P)** | Definite (5) | Definite (5) |
| **Significance (S = E+D+M)*P** | **High (75)** | **Medium (60)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Low reversibility | Partially reversible |
| **Irreplaceable loss of resources?** | Highly Probable | Moderate Probability |
| **Can impacts be mitigated?** | Reasonably but with limited full restoration potential | |

**Mitigation:**

- » Treat all outcrop areas and dunes as No-Go Zones
- » Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains
  - ∗ Ensure adequate drainage where ephemeral drainage lines crossed
  - ∗ Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines
- » Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
  - ∗ Protected geophytic and succulent plant species: must be relocated
  - ∗ Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
  - ∗ Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If

so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated

- * All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
- * Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanization

- » Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area
- » Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer where permissible according to rehabilitation recommendations of the relevant EMPr
  - * Shred all shrubs and trees cleared and used the chips for dust and erosion control
  - * Use only species that were part of the original non-invasive indigenous species composition as listed in the specialist report for revegetation
- » After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr
  - * It is expected that where topsoils were not excessively disturbed, revegetation should occur naturally
  - * The higher level of shading anticipated from the PV panels may prevent or slow the re-establishment of desirable species, thus re-establishment must be monitored and species composition adapted if a desirable vegetation cover fails to establish within 24 months after construction.

Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum and Prosopis* species

- » Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning
- » If filling material is to be used, this should be sourced from discontinued mines on the adjacent property
- » Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- » Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan
- » Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro topography and revegetation efforts accordingly
- » Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind

**Cumulative impacts:**

- » If mitigation measures are not strictly implemented the following could occur:
  - * Considerable loss of biodiversity
  - * Erosion of areas around the panels and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands

|  |
|---|
| * Spread and establishment of invasive species<br>» Increased habitat fragmentation and displacement of terrestrial vertebrates in the region<br>» Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns that may affect downstream ecosystems |
| **Residual impacts:**<br>» Altered topsoil characteristics<br>» Loss of and alteration of microhabitats<br>» Altered vegetation composition, lower vegetative cover and loss of species diversity<br>» Increased habitat fragmentation and displacement of terrestrial vertebrates<br>» Higher risk of invasion by alien plant species |

| **Nature:** Construction and operation of PV panels on natural vegetation within development footprint (**fixed panel option** )<br><br>Loss of vegetation and/or species of conservation concern, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from PV panels and higher volumes of storm water and accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible increase of detrimental effects during periods of extreme weather events, e.g. increased erosion or dust due to lower buffering capacity of sparser vegetation. Ecological impacts are greater where fixed panel technology is used. | | |
|---|---|---|
| **Listed activities:**<br>GN 544 activity 11(x)(xi) & 18(i);<br>GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i). | | |
| | **Without mitigation** | **With mitigation** |
| **Extent (E)** | Regional (3) | Local (2) |
| **Duration (D)** | Long-term (4) | Long-term (4) |
| **Magnitude (M)** | High (9) | High (8) |
| **Probability (P)** | Definite (5) | Definite (5) |
| **Significance (S = E+D+M)*P** | **High (80)** | **High (70)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Low reversibility | Partially reversible |
| **Irreplaceable loss of resources?** | Highly Probable | Medium Probability |
| **Can impacts be mitigated?** | Yes to some extent, but with limited full restoration potential | |
| **Mitigation:**<br>» Treat all outcrop areas and dunes as No-Go Zones<br>» Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains<br>* Ensure adequate drainage where ephemeral drainage lines crossed | | |

- ∗ Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines
- » Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
  - ∗ Protected geophytic and succulent plant species: must be relocated
  - ∗ Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
  - ∗ Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated
    - ∗ All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
    - ∗ Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanisation
- » Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area
- » Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer where permissible according to rehabilitation recommendations of the relevant EMPr
    - ∗ Shred all shrubs and trees cleared and used the chips for dust and erosion control
    - ∗ Use only species that were part of the original non-invasive indigenous species composition as listed in the specialist report for revegetation
- » After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr
    - ∗ It is expected that where topsoils were not excessively disturbed, revegetation should occur naturally
    - ∗ The higher level of shading anticipated from the PV panels may prevent or slow the re-establishment of desirable species, thus re-establishment must be monitored and species composition adapted if a desirable vegetation cover fails to establish within 24 months after construction.
- » Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum and Prosopis species*
- » Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning
- » If filling material is to be used, this should be sourced from discontinued mines on the adjacent property
- » Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil

| |
|---|
| » Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan<br>» Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro topography and revegetation efforts accordingly<br>» Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind |
| **Cumulative impacts:**<br>» If mitigation measures are not strictly implemented the following could occur:<br>* Considerable loss of biodiversity<br>* Possible accelerated erosion of areas around the panels and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands<br>* possible contamination of drainage lines, lower-lying rivers or wetlands<br>* possible spread and establishment of invasive species<br>» Increased habitat fragmentation and displacement of terrestrial vertebrates in the region<br>» Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns |
| **Residual impacts:**<br>» Altered topsoil characteristics<br>» Loss of and alteration of microhabitats<br>» Altered vegetation composition, lower vegetative cover and loss of species diversity<br>» Potential for increased dust and its impact on surrounding environments and biodiversity<br>» Higher risk of invasion by alien plant species |

| | | |
|---|---|---|
| **Nature:** Construction of power line from Kheis Solar Park 3 PV array as part of the grid connection – with direct connection to the existing Eskom power line traversing the land portion (~100m).<br><br>Loss of vegetation, potential loss of large trees and associated microhabitats, increase in runoff and erosion, disturbance of burrowing animals | | |
| **Listed activities:**<br>GN 544, 18 June 2010 activity 10(i), 11(ii) & 18(i);<br>GN 546, 18 June 2010 activity 14(i). | | |
| | **Without mitigation** | **With mitigation** |
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Long-term (4) | Long-term (4) |
| **Magnitude (M)** | Minor (2) | Small (0) |
| **Probability (P)** | Definite (5) | Highly Probable (4) |
| **Significance (S = E+D+M)*P** | **Medium (40)** | **Low (20)** |
| **Status (positive, neutral or negative)** | Negative | Slightly negative |
| **Reversibility** | Partially reversible | Reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |

| | |
|---|---|
| **Can impacts be mitigated?** | Yes to some extent |

**Mitigation:**

- Treat all outcrop areas and dunes as No-Go Zones, powerlines from the PV array furthest from the ESKOM line must be routed along the gravel road servitude and may not cross the dunefield (also due to high bird presence, including raptors in the dunefields)
- Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains
  - Ensure adequate drainage where ephemeral drainage lines crossed
  - Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines
- Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
  - Protected geophytic and succulent plant species: must be relocated
  - Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
  - Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated
  - All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
  - Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanisation
- Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area
- Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development
  - Aim to minimise the destruction of indigenous large shrubs and trees
  - Limit clearing of indigenous vegetation to pylon positions only
  - Shred all shrubs and trees cleared and used the chips for dust and erosion control
- After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr
    - It is expected that where topsoils were not excessively disturbed, revegetation should occur naturally
- Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum and Prosopis* species
- Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning
- Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it

| |
|---|
| separately until it can be re-applied, minimise handling of topsoil<br>» Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan<br>* Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind<br>* Shred all shrubs cleared and used the chips for dust and erosion control<br>» Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution |
| **Cumulative impacts:**<br>» Possible erosion of surrounding areas if no mitigation is implemented, no major cumulative impact on flora or fauna expected (excluding avifauna) |
| **Residual impacts:**<br>» Localised alteration of soil surface characteristics<br>» Localised loss of flora and displacement of fauna |

| **Nature:** Construction of substation and other associated infrastructure and buildings<br><br>Loss of vegetation and/or species of conservation concern, loss of microhabitats, reduced vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from sealed surfaces and possibly higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible pollution from permanent infrastructure and/or facilities | | |
|---|---|---|
| **Listed activities:**<br>GN 544, 18 June 2010 activity 10(i), 11(ii) & 18(i);<br>GN 546, 18 June 2010 activity 14(i). | | |
| | **Without mitigation** | **With mitigation** |
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Long-term (4) | Long-term (4) |
| **Magnitude (M)** | Moderate (6) | Low (3) |
| **Probability (P)** | Definite (5) | Definite (5) |
| **Significance (S = E+D+M)*P** | **Medium (60)** | **Medium (40)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Partially reversible | Reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |
| **Can impacts be mitigated?** | Yes to some extent | |
| **Mitigation:**<br>» Treat all outcrop areas and dunes as No-Go Zones<br>» Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains<br>* Ensure adequate drainage where ephemeral drainage lines crossed<br>* Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines<br>» Conduct a thorough footprint investigation after the final layout has been approved, to | | |

determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:

- ∗ Protected geophytic and succulent plant species: must be relocated
- ∗ Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
- ∗ Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated
- ∗ All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
- ∗ Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanisation

» Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area

» Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development

- ∗ Aim to minimise the destruction of indigenous large shrubs and trees
- ∗ Shred all shrubs and trees cleared and used the chips for dust and erosion control

» After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr

- ∗ It is expected that where topsoils were not excessively disturbed, revegetation should occur naturally

» Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum and Prosopis species*

» Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning

» Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil

» Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan

- ∗ Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind
- ∗ Shred all shrubs cleared and used the chips for dust and erosion control

» Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution

**Cumulative impacts:**

» If mitigation measures are not strictly implemented the following could occur:

- ∗ Erosion of areas around sealed surfaces and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands
- ∗ Contamination of ground water resources and possibly the Orange River

- * Spread and establishment of invasive species
- » Increased habitat fragmentation and displacement of terrestrial vertebrates in the region
- » Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics

**Residual impacts:**

- » Altered topsoil characteristics
- » Loss of and alteration of microhabitats
- » Altered vegetation composition, lower vegetative cover and temporary loss of local species diversity
- » Low functionality and productivity of cleared areas that may remain susceptible to further degradation for many years after decommissioning
- » Increased habitat fragmentation and displacement of terrestrial vertebrates
- » Higher risk of the establishment by alien and indigenous invasive plant species

**Nature:** Temporary equipment camps and laydown sites where machinery and material is kept during construction.

Loss of vegetation and/or species of conservation concern, alteration and loss of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from sealed or compacted surfaces and possibly higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible contaminated topsoil, possible contaminated ground water or wetlands, possible increased dust levels

**Listed activities:** none.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Moderate-term (3) | Short-term (2) |
| **Magnitude (M)** | Moderate (6) | Low (3) |
| **Probability (P)** | Definite (5) | Definite (5) |
| **Significance (S = E+D+M)*P** | **Medium (55)** | **Medium (30)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Partially reversible | Reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |
| **Can impacts be mitigated?** | Yes to some extent | |

**Mitigation:**

- » Treat all outcrop areas and dunes as No-Go Zones
- » Avoid or reduce impact on all vegetation in and around large drainage lines, interdunal areas and sandy plains
  - * Ensure adequate drainage where ephemeral drainage lines crossed
  - * Design the access routes to enter directly from the district gravel road and then follow existing jeep tracks on the property and along existing power-lines

- Conduct a thorough footprint investigation after the final layout has been approved, to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species and take the following actions:
  - Protected geophytic and succulent plant species: must be relocated
  - Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
  - Note: a breeding ostrich pair has been observed in the area – these must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated
  - All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant authorities; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding
  - Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanisation
- Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area
- Clear as little vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development
  - Aim to minimise the destruction of indigenous large shrubs and trees
  - Shred all shrubs and trees cleared and used the chips for dust and erosion control
- Remove all invasive vegetation, completely uproot potentially resprouting high shrubs, especially *Rhigozum trichotomum and Prosopis species*
- Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning
- Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan
  - Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind
  - Shred all shrubs cleared and used the chips for dust and erosion control
- Prevent spillage of construction material and other pollutants, contain and treat any spillages immediately, strictly prohibit any pollution/littering according to the relevant EMPr
- No fires may be lit for cooking or any other purposes
- Facilities may not be used as accommodation for general construction staff
- No vehicles may be washed, serviced or repaired on the property
- After construction remove all foreign material prior to starting the rehabilitation
- The rehabilitation plan for all temporarily affected areas must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover
- Monitor the establishment of invasive species and remove as soon as detected,

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| whenever possible before regenerative material can be formed |
| **Cumulative impacts:**<br>» If mitigation measures are not strictly implemented the following could occur:<br>∗ Considerable loss of biodiversity<br>∗ Erosion of the development area<br>∗ Contamination of ground water and the Orange River<br>∗ Spread and establishment of invasive species<br>∗ Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns |
| **Residual impacts:**<br>» Altered topsoil characteristics<br>» Loss of and alteration of microhabitats<br>» Altered vegetation composition<br>» Higher risk of invasion by alien plant species<br>» Potential for increased dust and its impact on surrounding environments and biodiversity |

| **Nature:** Sourcing of fill material that may be required during or after construction<br><br>Reduction of existing overburden material from disused mines on adjacent property, source of dust during crushing and transportation of fill material | | |
|---|---|---|
| **Listed activities:** None | | |
| | **Without mitigation** | **With mitigation** |
| **Extent (E)** | Local (2) | Local (1) |
| **Duration (D)** | Long-term (4) | Short-term (2) |
| **Magnitude (M)** | Low (4) | Low (4) |
| **Probability (P)** | Highly Probable (4) | Probable (3) |
| **Significance (S = E+D+M)*P** | **Medium (40)** | **Low (21)** |
| **Status (positive, neutral or negative)** | Neutral | Positive |
| **Reversibility** | Partially reversible | not reversible |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes to some extent | |
| **Mitigation:**<br>» Aim to keep crusher and loaders on previously transformed sites, use existing tracks for transport<br>∗ Strictly enforce a speed limit of 30 km/h to lower dust levels<br>∗ Limit all operations to daylight hours to avoid collision with nocturnal animals<br>» Stay within demarcated areas and access routes for movement of materials<br>» Strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas<br>» Prevent spillage of pollutants; contain and treat any spillages immediately; strictly | | |

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| prohibit any pollution<br>» Monitor erosion of areas and control where necessary<br>» After construction remove all foreign material prior to starting the rehabilitation<br>» Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed |
| **Cumulative impacts:**<br>» If mitigation measures are not strictly followed the following could occur:<br>* Continued erosion of the altered surfaces with associated degradation of the site and surrounding areas<br>* Spread and establishment of invasive species |
| **Residual impacts:**<br>» Altered topsoil characteristics<br>» Reduction of currently existing unsightly overburden heaps from discontinued mining operations<br>» Higher risk of invasion by alien plant species |

| **Nature:** Transport of materials to site, movement of vehicles on site during construction and maintenance<br><br>Loss of vegetation, increase in runoff and erosion, disturbance or possible mortality incidents of terrestrial fauna, possible contamination of soil and groundwater by oil- or fuel spillages, possible establishment and spread of undesirable weeds and alien invasive species that could further damage ecosystem functionality | | |
|---|---|---|
| **Listed activities:** None | | |
| | **Without mitigation** | **With mitigation** |
| **Extent (E)** | Regional (4) | Local (1) |
| **Duration (D)** | Long-term (4) | Long-term (4) |
| **Magnitude (M)** | Low (4) | Small (0) |
| **Probability (P)** | Definite (5) | Highly Probable (4) |
| **Significance (S = E+D+M)*P** | **Medium (60)** | **Low (20)** |
| **Status (positive, neutral or negative)** | Negative | Neutral |
| **Reversibility** | Partially reversible | Reversible |
| **Irreplaceable loss of resources?** | Probable | Not likely |
| **Can impacts be mitigated?** | Reasonably | |
| **Mitigation:**<br>» Avoid all natural pans if found, and a buffer of at least 50 m around such areas<br>» Avoid as much as possible of the eastern tree-rich sections of the study area<br>» Strictly restrict all movement of vehicles and heavy machinery to permissible areas, these being designated access roads, maintenance roads, turning points and parking areas. No off-road driving beyond designated areas is to be allowed<br>» Parking areas should be regularly inspected for oil spills and covered with an | | |

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| impermeable or absorbent layer (with the necessary storm water control) if oil and fuel spillages are highly likely to occur<br>» Wheels of large machinery should be checked prior to entering the site and cleared of seed material of alien invasive plants if transport routes go through infested areas (especially of species with spiny or bur-like seeds). Such seed must be destroyed.<br>» Strict speed limits must be set and adhered to<br>    * Animals accidentally injured by moving vehicles or machinery must be taken to a local veterinarian to be treated or put down in a humane manner<br>» Dust levels must be controlled and minimised<br>» Driving between dusk and dawn should be permissible during emergency situations only<br>» Prevent spillage of any fuels, oils or other chemicals, strictly prohibit other pollution<br>» Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment |
| **Cumulative impacts:**<br>» Possible pollution of surrounding areas if no mitigation is implemented<br>» Possible spread of alien invasive species beyond the site if no mitigation is implemented<br>» Possible increased road collisions and road kill of fauna |
| **Residual impacts:**<br>» Related to access roads and internal maintenance tracks |

### b) Comparative Assessment of PV Panel technology (Fixed vs Tracking):

The table below provides a comparison of the potential ecological impacts associated with the two technologies under investigation.

**Table 12.1:** Fixed panel technology vs tracking panel (single axis)

| **Aspect influenced** | **Fixed panel** | **Tracking panel (single axis)** |
|---|---|---|
| Size of land needed | approx. 2ha per MW | approx. 3ha per MW |
| Shading and associated change of vegetation | More continuous and intense shading.<br>Less stable and dense vegetation expected reduced buffering capacity of extreme weather events by vegetation expected. | More variable and less intense overall shading.<br>More stable and denser vegetation cover expected, smaller reduction of buffering capacity of extreme weather events expected. |
| Effect on runoff and accelerated erosion | Larger continuous panel area, more concentrated runoff, constant runoff edges potentially create more erosion, especially where vegetation is weakened. | Smaller continuous panel areas, runoff more dissipated, moderate variation of runoff edges that are expected to create less erosion where vegetation is weakened. |

| Aspect influenced | Fixed panel | Tracking panel (single axis) |
|---|---|---|
| Mounting height of panel | PV panels may be as low as 30 cm above ground to reduce total height, increasing the limits of permissible vegetation due to maintenance and fire risks. | Expected to be more than 1 m off the ground, increasing the possibility of low vegetation establishment and small fauna movement without compromising safety. |
| Height of top of panel | 3.5m | 3.5 -4m |

**Tracking PV technology** is ecologically a preferred technology alternative. Considering the aridity of the area and the difficulty of new vegetation establishment, the impact of tracking systems appears to be lower than that of a fixed panel array, even if the latter may occupy less space because the vegetation below the panels will receive more sunlight with the tracking technology option. This effect will become especially pronounced after decommissioning, when it is expected that seedbanks under a fixed panel system will have vanished as there will be little new inputs of seeds and old seeds will die over time. Topsoil quality most likely will have deteriorated to such an extent due to absence of vegetation that re-establishment of vegetation will be very difficult, as most of the microbiota on which many of these species depend for survival will no longer be present in the soil. The difference in the potential impacts on ecology associated with the two technology alternatives. Therefore, **tracking PV technology** is nominated as the preferred alternative (refer to Table 12.1)

**c) Implications for Project Implementation**

» Excluding all dune systems and outcrop areas in planning the development footprint, as is proposed for this facility. This will ensure that important ecosystem components can be maintained.
» The proposed photovoltaic facility development on the site will create a localised reduction of some slow-growing indigenous trees and shrubs, geophytes and other species restricted to certain microhabitats. This effect may be further exacerbated by surrounding and regional developments. At this stage, however, it is not anticipated that the development will change the current conservation status of any species.
» Potentially significant negative impacts on the ecological environment could be associated with soil erosion and associated degradation on and beyond the development area, possible introduction of alien invasive plants and a long-term (more than 8 months) low or absent vegetation cover after construction. With the diligent implementation of mitigating measures by the developer,

contractors, and operational staff, the severity of these impacts can be significantly reduced.

» The impact on fauna is expected to be small for the development if mitigation measures are followed from the design phase, but this may become more of an issue if the cumulative impact of regional developments is considered. Presence of indigenous terrestrial vertebrates within the study area is relatively low due to absence of permanent surface water. Animals that may be permanently present can be relocated or will move away during construction, and may resettle after construction, depending on safety specifications necessitated by the development. Specific habitats of vertebrates within the study area are restricted to duneveld and outcrop area, which will be excluded from the proposed development.
» **Tracking PV technology** is nominated as the preferred alternative from an ecological perspective.

#### *12.2.2 Potential Impacts on Soils and Agricultural Potential*

**a) Summary of impacts associated with the proposed solar energy facility during the construction and operational phase**

There are three land types across the broader site with the entire development footprint of Kheis Solar Park 3 (i.e. Af7). Soils across this land type are moderately deep to deep, red, very sandy soils of the Hutton soil form.

Predominantly as a result of the aridity constraints of the area, but also because of poor soils, agricultural land use is restricted to low intensity grazing. The natural grazing capacity is low, being 40-60 hectares per large stock unit over most of the site, but slightly higher in places. Agricultural potential is fairly uniform across the farm and the choice of placement of the facility on the farm or choice of technology therefore has minimal influence on the significance of agricultural impacts. No agriculturally sensitive areas occur within the proposed development footprint.

Aspects of the facility that may have an impact on soils include:

» Solar facility footprint (i.e. an array of PV panels, mounting structures, underground cabling between project components and fencing)
» Construction and positioning of internal access roads
» Use of potential sources of contaminants on the site (i.e. oil, petrol, diesel and other substances used by the vehicles and equipment)
» Construction and operation of the on-site substation
» Construction and positioning of the on-site workshop area for maintenance, storage, and offices and temporary construction/ laydown areas.

The potential impacts on soil include:

» Soil loss and erosion

- Loss of agricultural land use
- Generation of alternative land use income
- Degradation of veld vegetation

The two alternative PV technologies do not differ in any significant way as far as soils and agricultural potential is concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

<table>
<tr><td colspan="3">Nature: Loss of agricultural land use<br><br>Caused by: direct occupation of land by footprint of energy facility infrastructure;<br>And having the effect of: taking affected portions of land out of agricultural production.</td></tr>
<tr><td colspan="3">Listed activities:<br>GN 545 activity 15<br>GN 546 activity 14(a)(i)</td></tr>
<tr><td></td><td>Without mitigation</td><td>With Mitigation</td></tr>
<tr><td>Extent</td><td>Low (1)</td><td>n/a</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>n/a</td></tr>
<tr><td>Magnitude</td><td>Small (1)</td><td>n/a</td></tr>
<tr><td>Probability</td><td>Definite (5)</td><td>n/a</td></tr>
<tr><td>Significance</td><td>Medium (30)</td><td>n/a</td></tr>
<tr><td>Status</td><td>Negative</td><td>n/a</td></tr>
<tr><td>Reversibility</td><td>High</td><td></td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No (as the site can be returned to agriculture after decommissioning)</td><td></td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">No</td></tr>
<tr><td colspan="3">Cumulative impacts:<br>The overall loss of agricultural land in the region due to a number of developments. The significance is low due to the limited agricultural potential of the area.</td></tr>
<tr><td colspan="3">Residual impacts:<br>No mitigation possible and therefore residual impacts are the same as impacts without mitigation</td></tr>
</table>

<table>
<tr><td>Nature: Generation of alternative land use income<br><br>Caused by: the alternative land use of energy facility rental on low productivity agricultural land, in combination with continued farming on the remainder of the farm;<br>And having the effect of: providing land owners with increased cash flow and rural livelihood, as well as promoting the sustainability of the farming practices.</td></tr>
<tr><td>Listed activities:<br>GN 545 activity 15</td></tr>
</table>

| GN 546 activity 14(a)(i) | | |
|---|---|---|
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Low (1) | N/A |
| ***Duration*** | Long term (4) | N/A |
| ***Magnitude*** | Minor (3) | N/A |
| ***Probability*** | Highly probable (4) | N/A |
| ***Significance*** | **Medium (32)** | N/A |
| ***Status*** | Positive | N/A |
| ***Reversibility*** | High | N/A |
| ***Irreplaceable loss of resources?*** | No | N/A |
| ***Can impacts be mitigated?*** | No required | |
| ***Cumulative impacts:***<br>None | | |
| ***Residual impacts:***<br>None | | |

| ***Nature:*** Soil Erosion<br><br>Caused by: alteration of run-off characteristics due to hard surfaces and access roads; And having the effect of: loss and deterioration of soil resources (There is low risk of erosion due to the very gentle slopes). | | |
|---|---|---|
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Low (1) | Low (1) |
| ***Duration*** | Long term (4) | Long term (4) |
| ***Magnitude*** | Low (4) | Minor (3) |
| ***Probability*** | Probable (3) | Very improbable (1) |
| ***Significance*** | **Low (27)** | **Low (8)** |
| ***Status*** | Negative | Negative |
| ***Reversibility*** | Low | Low |
| ***Irreplaceable loss of resources?*** | No | No |
| ***Can impacts be mitigated?*** | Yes | |
| ***Mitigation:***<br>Implement an effective system of run-off control, where it is required, that collects and disseminates run-off water from hardened surfaces and prevents potential down slope erosion. This should be in place and maintained during all phases of the development. | | |
| ***Cumulative impacts:***<br>Increase erosion from other developments in the area | | |
| ***Residual impacts:*** | | |

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| Soil erosion issues in the area if impacts are not mitigated? |

**Impacts associated only with the construction phase of the development**

| | | |
|---|---|---|
| ***Nature:*** Loss of topsoil<br><br>Caused by: poor topsoil management (burial, erosion, etc.) during construction related soil profile disturbance (levelling, excavations, disposal of spoils from excavations etc.)<br>And having the effect of: loss of soil fertility on disturbed areas after rehabilitation. | | |
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Low (1) - Site | Low (1) - Site |
| ***Duration*** | Long term (4) | Long term (4) |
| ***Magnitude*** | Minor (3) | Minor (2) |
| ***Probability*** | Probable (3) | Very improbable (1) |
| ***Significance*** | **Low (24)** | **Low (7)** |
| ***Status*** | Negative | Negative |
| ***Reversibility*** | Low | Low |
| ***Irreplaceable loss of resources?*** | Yes | Yes |
| ***Can impacts be mitigated?*** | Yes | |
| ***Mitigation:***<br>» Strip and stockpile topsoil from all areas where soil will be disturbed.<br>» After cessation of disturbance, re-spread topsoil over the surface.<br>» Dispose of any sub-surface spoils from excavations where they will not impact on agricultural land, or where they can be effectively covered with topsoil. | | |
| ***Cumulative impacts:***<br>Increasing topsoil loss with other developments in the area | | |
| ***Residual impacts:***<br>Loss of topsoil in the area if impacts are not mitigated? | | |

| | | |
|---|---|---|
| ***Nature:*** Degradation of veld vegetation surrounding construction activities<br><br>Caused by: Trampling due to vehicle passage. | | |
| **Listed activities:**<br>GN 546 activity 14(a)(i) | | |
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Low (1) - Site | Low (1) - Site |
| ***Duration*** | Short (2) | Short (2) |
| ***Magnitude*** | Minor (2) | Small (1) |
| ***Probability*** | Probable (3) | Improbable (2) |
| ***Significance*** | **Low (15)** | **Low (8)** |

| | | |
|---|---|---|
| ***Status*** | Negative | Negative |
| ***Reversibility*** | Medium | Medium |
| ***Irreplaceable loss of resources?*** | No | No |
| ***Can impacts be mitigated?*** | Yes | |
| ***Mitigation:*** Minimise road footprint beyond construction site and prohibit vehicular passage off designated roads. | | |
| ***Cumulative impacts:*** None | | |
| ***Residual impacts:*** Very low and limited to site | | |

**b) Comparative Assessment of PV Panel technology (Fixed vs Tracking):**

In terms of impact arising from soils and agricultural potential, there is **no significance** difference in the potential impacts associated with the two technology alternatives. Tracking panels can occupy more land than fixed panel technology; however a total of 110ha of low potential agricultural land would be available for the proposed Kheis Solar Park 3 on Portion 9 of Portion 4 of the Farm Namakwari 656, regardless of the type of technology used. The agricultural potential for this site is low. Therefore, in terms of impact arising from soils and agricultural potential, there is no significance difference in the potential impacts associated with the two technology alternatives. Therefore, there is **no preference** between the alternative technologies.

**c) Implications for Project Implementation**

» The proposed site for Kheis Solar Park 3 is situated on soils of low agricultural potential and this therefore has no implications on project development.
» The land has a low to moderate erosion risk, although the steeper slopes of the mountain features have higher risk. The susceptibility to wind erosion of most of the site is high due to the sandy texture of the soil. Therefore, appropriate mitigation is required to limit impacts in this regard.
» There is **no preference** between the alternative technologies in terms of soils and agricultural potential.

### *12.2.3 Assessment of Potential Impacts on Heritage & Palaeontology*

***a) Heritage impacts associated with the construction and operation phase of the proposed facility***

In terms of the significance, most of the archaeological sites observations within the Kheis Solar Park 3 development footprint fall under Landforms L3 Type 1 and

Type 2 (exposed bedrock and some soil patches respectively). In terms of archaeological traces they all, furthermore, fall under Class A3 Type 1 (dispersed scatter). These ascriptions reflect poor contexts and likely low significance for these sites. For site attribute and value assessment, all of the observations noted fall under Type 1 (no sequence Poor context, dispersed distribution for Classes), reflecting low significance, low potential and absence of contextual and key types of evidence. A colonial era farm dwelling, modified through time, and now in a state of ruin, was recorded at Sterkstroom[18]. It is not considered to be of major heritage significance.

On archaeological and heritage grounds, the occurrences observed can be said to be of low significance for proposed development footprints in areas of the proposed Kheis Solar Park 3 and associated infrastructure.

The two alternative PV technologies do not differ in any significant way as far as the impacts on heritage resources is concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

| | | |
|---|---|---|
| ***Nature:*** Acts or activities resulting in disturbance of surfaces and/or sub-surfaces containing artefacts (causes) resulting in the destruction, damage, excavation, alteration, removal or collection from its original position (consequences), of any archaeological material or object (what affected). | | |
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | **Without mitigation** | **With mitigation** |
| ***Extent*** | Local 1 | None |
| ***Duration*** | Permanent 5 | None |
| ***Magnitude*** | Minor 2 | None |
| ***Probability*** | Improbable 2 | None |
| ***Significance*** | **Low (16)** | None |
| ***Status (positive or negative)*** | Negative | None |
| ***Reversibility*** | No | |
| ***Irreplaceable loss of resources?*** | Yes, where present – but occurrence is generally extremely low density and of low significance. | |
| ***Can impacts be*** | Yes – but not considered | |

[18] Some portions of these farms have and have been compined to Portion 7 and 9 of the Farm Namakwari 656.

| | | |
|---|---|---|
| ***mitigated?*** | necessary. | |
| ***Mitigation:*** Artefact densities and heritage structures are low over the Kheis Solar Park 3 development footprint areas that were investigated. Unlike biological processes, heritage destruction generally has a once-off permanent impact and in view of this the mitigation measures are not considered necessary. | | |
| ***Cumulative impacts:*** Loss of heritage/archaeological resources over the region | | |
| ***Residual Impacts:*** Where any archaeological contexts occur the impacts are once-off permanent destructive events. | | |

### ***b) Palaeontology impacts associated with the construction and operation phase of the proposed facility***

The majority of the Kheis Solar Park 3 site area is underlain by unconsolidated sands of the Gordonia Formation. The south western quadrant of the site contains extensive exposures of the Zonderhuis Formation. This formation appears to underlie the Gordonia Formation throughout the extent of the development area.

It is improbable that there will be any negative impact on the palaeontological heritage of the Gordonia Formation as **no fossil materials were identified during the site visit**. The calcrete as well as the Zonderhuis and Groblershoop Formations are considered to be unfossiliferous.

The two alternative PV technologies do not differ in any significant way as far as the impacts on palaeontology resources is concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

| **Nature:** Destruction, damage and loss of provenance of fossil materials | | |
|---|---|---|
| | **Without Mitigation** | **With Mitigation** |
| **Extent:** | Low (2) | Low (2) |
| **Duration:** | Permanent (5) | Permanent (5) |
| **Magnitude:** | High (10) | Minor (2) |
| **Probability:** | Improbable (1) | Improbable (1) |
| **Significance:** | **Low (17)** | **Low (8)** |
| **Status:** | Positive | Positive |
| **Reversibility:** | Impossible | Impossible |
| **Irreplaceable loss of resources:** | Low | Low |
| **Can impacts be mitigated:** | Yes | |

| |
|---|
| **Mitigation:**<br>All excavations must be inspected for fossil content by the ECO/EO. Should fossils be located the relevant exaction must be halted and SAHRA informed of the find. SAHRA may instruct that a palaeontologist should evaluate the fossil material and suggest appropriate protocols to either excavate or protect the fossil material. |
| **Cumulative impacts:**<br>Loss of fossils if destroyed by multiple developments |
| **Residual impacts:**<br>Permanent loss of fossil heritage if no mitigation is implemented. |

**c) Comparative Assessment of PV Panel technology (Fixed vs Tracking):**

In terms of impacts arising from Heritage and Palaeontology, there is **no significance** difference in the potential impacts associated with the two technology alternatives. Therefore, there is **no preference** between the alternative technologies.

***d) Implications for Project Implementation***

- The impacts to heritage resources and sites by the proposed development are not considered to be highly significant and the impact on archaeological sites can very easily be mitigated.
- The Gordonia Formation is present within Kheis Solar Park 3, but only as a thin veneer of reworked sand. The potential risk of any negative impact within Kheis Solar Park 3 is also categorised as improbable due to the absence of substantial thicknesses of Gordonia Formation sands in that project area
- There is **no preference** between the alternative technologies in terms of heritage and palaeontology.

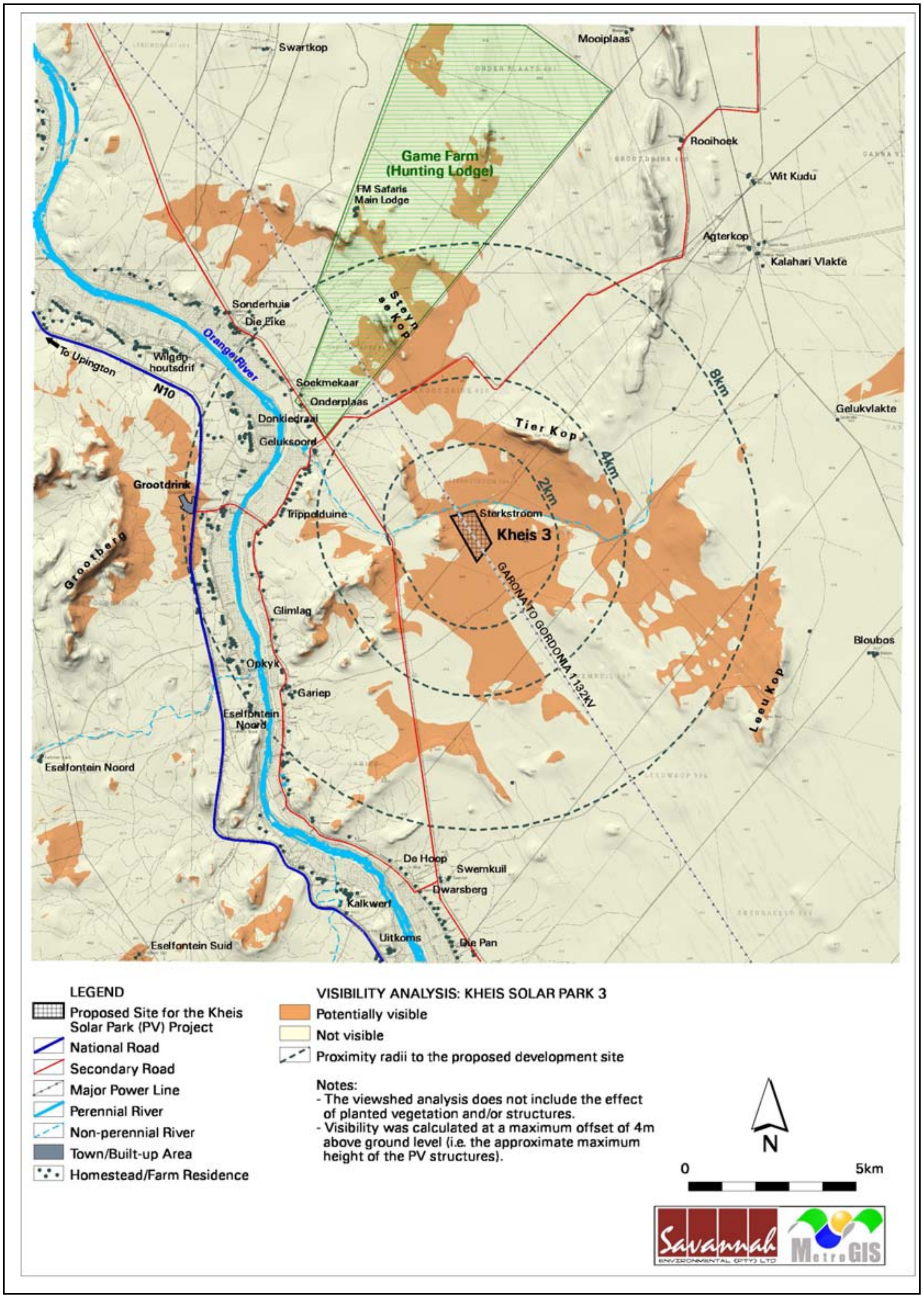
### 12.2.4 Assessment of Potential Visual Impacts

**Potential visual exposure:** This Kheis Solar Park 3 site is the most remotely located of the three solar parks proposed as part of the larger Kheis Solar Park. Its visual exposure is generally very contained (much smaller area of exposure) and primarily falls within vacant natural land. Its relatively long distance away from any of the potentially sensitive visual receptors (or areas of higher viewer incidence) mentioned for the Kheis Solar Parks 1 and 2, virtually negates any unwanted sighting of the facility (refer to Figure 12.3).

**Viewer incidence / viewer perception:** Viewer incidence is calculated to be the highest along the N10 national road and secondary road (east of the river), traversing between Upington and Groblershoop to the south. There are no major urban developments near (within 4km of) the proposed Solar Energy Facility development site, but additional viewer incidence (and expected negative viewer perception) will be concentrated within the homesteads and farm residences within the study area (beyond 4km), located primarily along the Orange River.

**Visual absorption capacity:** The vegetation units present in the study area surrounding the solar facility (predominantly *Ticket and Bushland* and *Shrubland*) are on average only 2 m in height. This, coupled with the sparse distribution of the plant species, the dimensions of the facility and height of structures, it was determined that the Visual Absorption Capacity (VAC) is low to negligible for virtually the entire study area.

**Visual impact index:** The combined result of the visual exposure, viewer incidence/perception and visual distance of the proposed Kheis Solar Park 3 facility is displayed on Figure 12.4. The Kheis Solar Park 3 site is remotely located and is not expected to have a high visual impact on any sensitive visual receptors within a 2km radius of the development due largely to the absence of residences and other sensitive receptors within this area.




**Map 12.3:** Potential visual exposure of the proposed Kheis Solar Park 3.

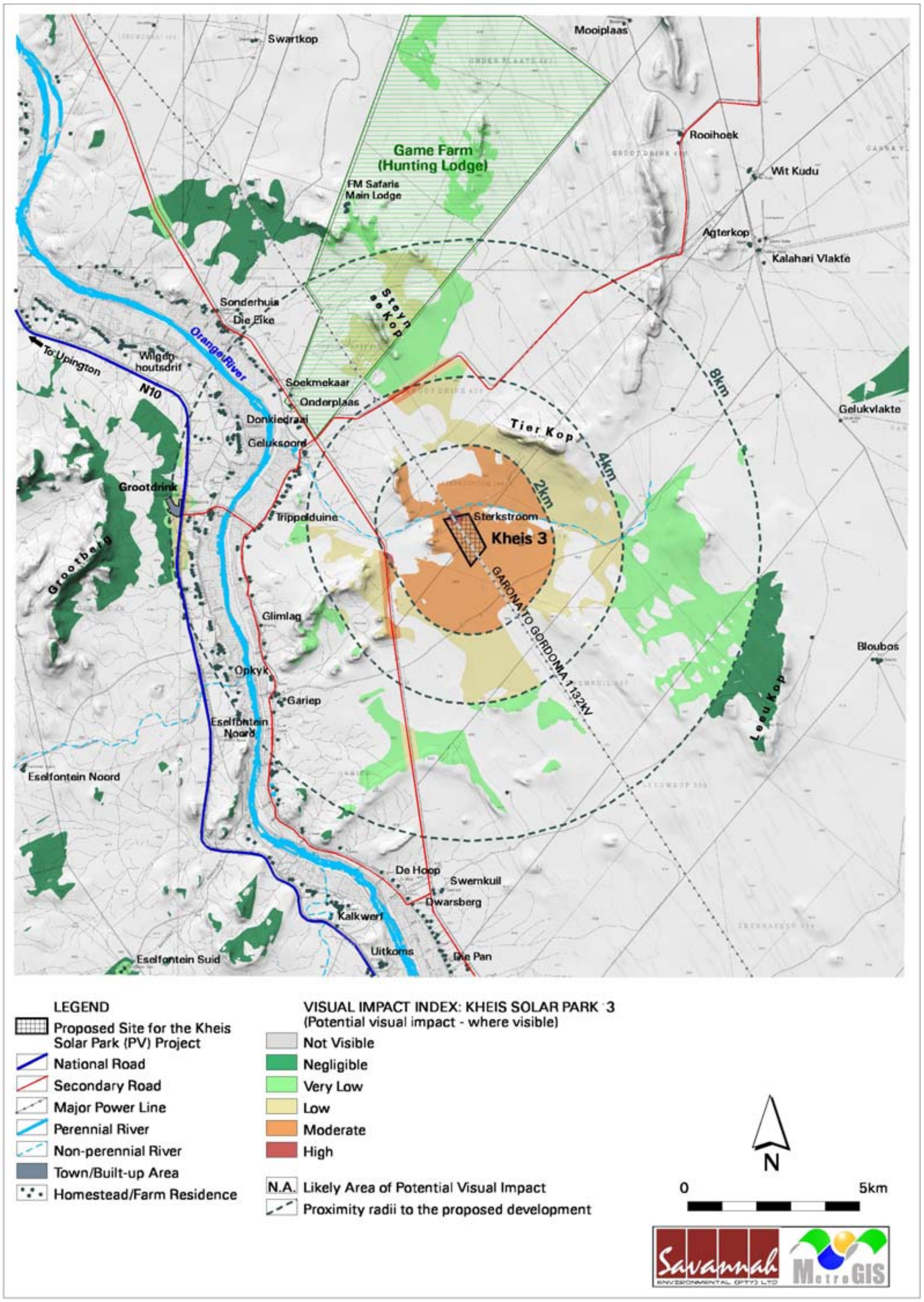



**Figure 12.4:** Map illustrating Visual Impact Index for the Kheis Solar Park 3 facility on Portion 9 of Farm Namakwari 656

## g) Impact tables summarising the significance of visual impacts of the PV facility during the construction and operation

<table>
<tr><td colspan="3">Nature of Impact: Visual impact on users of the secondary roads in close proximity to the proposed Solar Energy Facility</td></tr>
<tr><td colspan="3">Listed activities:<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i)</td></tr>
<tr><td></td><td>Without Mitigation</td><td>With Mitigation</td></tr>
<tr><td>Extent</td><td>Local (4)</td><td>Local (4)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Moderate (6)</td><td>Low (4)</td></tr>
<tr><td>Probability</td><td>Improbable (2)</td><td>Improbable (2)</td></tr>
<tr><td>Significance</td><td>Low (28)</td><td>Low (24)</td></tr>
<tr><td>Status (positive, neutral or negative)</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td>Yes (3)</td><td>Yes (3)</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No</td><td>No</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">General mitigation / management:<br><br><u>Planning:</u><br>» Retain and maintain natural vegetation in all areas outside of the development footprint.<br><u>Operations:</u><br>» Maintain the general appearance of the facility as a whole.<br><u>Decommissioning:</u><br>» Remove infrastructure not required for the post-decommissioning use of the facility.<br>» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.<br>» Monitor rehabilitated areas post-decommissioning and implement remedial actions.<br><br>Site specific mitigation measures:<br>Plant vegetation barriers or vegetated berms along the northern boundaries (bordering the road) of the Kheis Solar Park 3 in order to shield the structures from observers travelling along these roads.</td></tr>
<tr><td colspan="3">Cumulative impacts:<br>The construction of the up to three Solar facilities and associated facilities on the site is expected to increase the cumulative visual impact within the immediate area. Alternatively, the relatively close proximity of the proposed facilities to each other (and the existing power line) consolidates the potential visual exposure of solar energy generation infrastructure within the region. The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 13.</td></tr>
</table>

| |
|---|
| ***Residual impacts:*** The visual impact will be removed after decommissioning, provided the Solar Energy Facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain. |

| ***Nature of Impact:*** Visual impact on visitors to the FM Safari Lodge located in close proximity to the proposed Solar Energy Facility | | |
|---|---|---|
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local **(4)** | Local **(4)** |
| **Duration** | Long term **(4)** | Long term **(4)** |
| **Magnitude** | Moderate **(6)** | Low **(4)** |
| **Probability** | Improbable **(2)** | Improbable **(2)** |
| **Significance** | Low **(28)** | Low **(24)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Yes (3) | Yes (3) |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |
| ***General mitigation/management:***<br><br><u>Planning:</u><br>» Retain and maintain natural vegetation in all areas outside of the development footprint.<br><u>Operations:</u><br>» Maintain the general appearance of the facility as a whole.<br><u>Decommissioning:</u><br>» Remove infrastructure not required for the post-decommissioning use of the facility.<br>» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.<br>» Monitor rehabilitated areas post-decommissioning and implement remedial actions.<br><br>***Site specific mitigation measures:***<br>Plant vegetation barriers or vegetated berms along the northern boundaries (bordering the road) of the Kheis Solar Park 3 in order to shield the structures from visitors at the FM Safari Lodge. Engage the land owner in question in the planning, placement and implementation of the mitigation measures. | | |

| |
|---|
| ***Cumulative impacts:***<br>The construction of the up to three Solar Parks is expected to increase the cumulative visual impact within the immediate area. Alternatively, the relatively close proximity of the proposed facilities to each other (and the existing power line) consolidates the potential visual exposure of solar energy generation infrastructure within the region. The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 13 |
| ***Residual impacts:***<br>The visual impact will be removed after decommissioning, provided the Solar Energy Facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain. |

| **Nature of Impact:** Visual impact on sensitive visual receptors within the region (i.e. 5-8km) | | |
|---|---|---|
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | | |
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Regional **(3)** | Regional **(3)** |
| **Duration** | Long term **(4)** | Long term **(4)** |
| **Magnitude** | Low **(4)** | Low **(4)** |
| **Probability** | Improbable **(2)** | Very Improbable **(1)** |
| **Significance** | Low **(22)** | Low **(11)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Recoverable **(3)** | Recoverable **(3)** |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |

| |
|---|
| **General mitigation/management:**<br>Planning:<br>» Retain and maintain natural vegetation in all areas outside of the development footprint.<br>Operations:<br>» Maintain the general appearance of the facility as a whole.<br>Decommissioning:<br>» Remove infrastructure not required for the post-decommissioning use of the facility.<br>» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.<br>» Monitor rehabilitated areas post-decommissioning and implement remedial actions.<br><br>**Site specific mitigation measures:**<br>» Plant vegetation barriers along the western borders of the Kheis Solar Park 3 PV plant in order to shield the structures from observers residing in 5-8km.<br>» Engage with landowners in order to inform, plan and execute mitigation measures. |
| **Cumulative impacts:**<br>The close proximity of the proposed projects to each other and to the existing visual disturbances (power lines) allows for the effective connection with the power grid without incurring any additional expanded visual impacts (i.e. lengthy overhead power lines). The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 13. |
| **Residual impacts:**<br>The visual impact will be removed after decommissioning, provided the solar energy facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain. |

| **Nature of Impact**: Visual impact of construction on sensitive visual receptors within 2km | | |
|---|---|---|
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) | | |
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local (4) | Local (4) |
| **Duration** | Short Term (2) | Short Term (2) |
| **Magnitude** | High (8) | Moderate (6) |
| **Probability** | Probable (3) | Probable (3) |
| **Significance** | **Moderate (42)** | **Moderate (36)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Yes (3) | Yes (3) |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |

| |
|---|
| ***Mitigation:***<br>» Ensure that vegetation is not unnecessarily cleared or removed during the construction period.<br>» Reduce the construction period through careful logistical planning and productive implementation of resources.<br>» 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.<br>» Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.<br>» Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.<br>» Reduce and control construction dust through the use of approved dust suppression techniques as and when required, especially on the dirt road giving access to the site (i.e. whenever dust becomes apparent).<br>» Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.<br>» Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works. |
| ***Cumulative impacts:***<br>The close proximity of the proposed projects to each other and to the existing visual disturbances (power lines) allows for the effective connection with the power grid without incurring any additional expanded visual impacts (i.e. lengthy overhead power lines). The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 13. |
| ***Residual impacts:***<br>The visual impact will be removed after construction on the site is completed provided the disturbed areas are rehabilitated. |

| **Nature of Impact**: Visual impact of lighting on sensitive visual receptors. | | |
|---|---|---|
| **Listed activities:**<br>GN 545 activity 1 &15 | | |
| | **Without Mitigation** | **With Mitigation** |
| **Extent** | Local (4) | Local (4) |
| **Duration** | Long term (4) | Long term (4) |
| **Magnitude** | Moderate (6) | Low (4) |
| **Probability** | Probable (3) | Improbable (2) |
| **Significance** | **Moderate (42)** | **Low (24)** |
| **Status (positive, neutral or negative)** | Negative | Negative |
| **Reversibility** | Yes(3) | Yes (3) |
| **Irreplaceable loss of resources?** | No | No |
| **Can impacts be mitigated?** | Yes | |

| |
|---|
| ***Mitigation:***<br>Planning:<br>» Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);<br>» Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;<br>» Making use of minimum lumen or wattage in fixtures;<br>» Making use of down-lighters, or shielded fixtures;<br>» Making use of Low Pressure Sodium lighting or other types of low impact lighting.<br>» 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 |
| ***Cumulative impacts:***<br>The development of three solar parks will contribute to an increase in light sources within the region, and as a result an increase in lighting impact at night. The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 13. |
| ***Residual impacts:***<br>The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain. |

| **Nature**: Visual impact associated with the of the operation of PV panels (fixed panel option) at 4m height | | |
|---|---|---|
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) | | |
| | ***Without mitigation*** | ***With mitigation*** |
| ***Extent*** | Local (2) | Local (2) |
| ***Duration*** | Long - term (4) | Long – term (4) |
| ***Magnitude*** | Moderate low (3) | Low (1) |
| ***Probability*** | Probable (3) | Improbable (2) |
| ***Significance*** | **Low (27)** | **Low (14)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | High | High |
| ***Irreplaceable loss of resources?*** | No | |
| ***Can impacts be mitigated?*** | Yes | |
| **Mitigation:**<br>» No clearing of land outside the demarcated footprint<br>» Rehabilitate cleared areas | | |
| **Cumulative impacts**:<br>The proposed infrastructure would provide a cumulative impact increasing the existing industrial land uses in the area and the additional two projects proposed on the same site. The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred | | |

| |
|---|
| bidder projects), as discussed in Chapter 13. |
| **Residual Impacts**:<br>The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant and power lines. Providing that the site is rehabilitated to its current state, the visual impact will also be removed. |

| **Nature**: Visual impact of the operation of PV panels (tracking panel option) at 4m height | | |
|---|---|---|
| **Listed activities:**<br>GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) | | |
| | ***Without mitigation*** | ***With mitigation*** |
| ***Extent*** | Local (2) | Local (2) |
| ***Duration*** | Long - term (4) | Long – term (4) |
| ***Magnitude*** | High (4) | Low (1) |
| ***Probability*** | Probable (3) | Improbable (2) |
| ***Significance*** | **Medium (30)** | **Low (14)** |
| ***Status (positive or negative)*** | Negative | Negative |
| ***Reversibility*** | High | High |
| ***Irreplaceable loss of resources?*** | No | |
| ***Can impacts be mitigated?*** | Yes | |
| **Mitigation:**<br>» No clearing of land outside the demarcated footprint<br>» Rehabilitate cleared areas | | |
| **Cumulative impacts**:<br>The proposed infrastructure would provide a cumulative impact increasing the existing industrial land uses in the area and the additional two projects proposed on the same site. The proposed facility may have a cumulative visual impact at a regional level when considering the proposed other facilities within 20km of the site (including two preferred bidder projects), as discussed in Chapter 13. | | |
| **Residual Impacts**:<br>The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant and power lines. Providing that the site is rehabilitated to its current state, the visual impact will also be removed. | | |

**h) Comparative Assessment of PV Panel technology (Fixed vs Tracking):**

The Kheis Solar Park 3 site is remotely located and is not expected to have a high visual impact on any sensitive visual receptors within a 2km radius of the development or within the region. Tracking panels can result in a higher visual intrusion than fixed panels due to the more mechanically complex structure. However, for this particular site there is **very little difference in the significance** in the potential impacts associated with the two technology alternatives. There is therefore no preference regarding technology.

**i) Implications for Project Implementation**

» The Kheis Solar Park 3 is expected to have a **low** visual impact on the area surrounding the proposed site. For this particular site there is very little difference in the significance in the potential impacts associated with the two technology alternatives. There is therefore no preference regarding technology from a visual perspective.

### *12.2.5Assessment of Potential Social Impacts*

**e) Impact tables summarising the significance of Social impacts of the PV facility during the construction and operation**

Impacts associated with the construction phase of a project are usually of a short duration, temporary in nature, but could have long term effects on the surrounding environment. The operational life of a PV facility is between 20 - 25 years, after which the facility would possibly be upgraded to continue its lifespan if feasible, or decommissioned. The impacts usually associated with the operational phase are therefore perceived by affected parties to be more severe.

The two alternative PV technologies do not differ in any significant way as far as the impacts on the social environment is concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment tables below.

**The following listed activities are applicable to all the social impacts in the construction and operational phase:**
GN 544 activity 10(i)
GN 545 activity 1 & 15
GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc)

The following social impacts are anticipated as part of the **construction phase** of Kheis Solar Park 3 development:

| ***Nature of the impact:* The impact on the health status** of the local community due to an increase in male migrant workers. As TB, HIV/AIDS and alcohol related diseases are already on the district's radar due to its high occurrence; migrant workers without family structures may increase this health risk during construction. | | |
|---|---|---|
| | ***Without mitigation*** | ***With mitigation*** |
| ***Extent*** | National (4) | Local (2) |
| ***Duration*** | Long term(3) | Short term(1) |
| ***Magnitude*** | High(3) | Medium(2) |
| ***Probability*** | Probable(3) | Possible(2) |
| ***Significance*** | **Low(30)** | **Low(18)** |
| ***Status (positive or negative)*** | Negative | |
| ***Reversibility*** | Irreplaceable | |
| ***Irreplaceable loss of resources?*** | No | |
| ***Can impacts be mitigated?*** | Yes, to some extent | |
| **Mitigation:**<br>» The developer or the contractor should appoint a service provider or local NGO to develop, implement and manage a "Wellness Programme" which includes HIV/AIDS, TB, and alcohol abuse prevention, extendable to the local community<br>» By connecting with local community programmes and NGOs, health training and information can be provided on-site to workers at the start of the project<br>» Ensure workers have information and sign a "code of conduct" at the start of employment which gives an overview of acceptable behaviour and information regarding health & safety on the site | | |
| **Cumulative Impacts:**<br>As alcohol abuse and related risky behaviour which may impact HIV infections is already prevalent in the area, the cumulative impact during the construction phase may be increased**.** | | |
| **Residual Impacts:**<br>The residual impact of health related risks cannot be reversed to the status quo after the construction or decommissioning of the plant has taken place. | | |

| ***Nature of the impact:* The local roads and associated infrastructure** will be affected by the increase in construction vehicles and traffic to the site. The roads connecting the site to the N10 and N14 are gravel and in disrepair, with a high sensitivity to increased traffic, especially during harvest time. | | |
|---|---|---|
| | ***Without Mitigation*** | ***With Mitigation*** |
| ***Extent*** | Local (2) | Site(1)) |
| ***Duration*** | Medium term (2) | Low(1) |
| ***Magnitude*** | High(3) | Low(1) |
| ***Probability*** | Definite(5) | Probable(2) |
| ***Significance*** | **Medium(35)** | **Low(6)** |

| | | |
|---|---|---|
| ***Status (+/-)*** | Negative | |
| ***Reversible*** | NONE | |
| ***Irreplaceable*** | NONE | |
| ***Can impacts be mitigated?*** | Yes | |
| **Mitigation:**<br>» Consulting with local authorities (including SANRAL) and stakeholders (including cooperatives, farmers and wine cellars) on the most appropriate route to the site will ensure local cooperation<br>» Upkeep and maintenance of the roads used<br>» Part of the construction phase needs to include the upgrade of the road to be able to handle the increase in traffic and excessive dust as a result of the gravel roads<br>» Plans should aim to avoid construction of the plant over the harvest period (Feb-Apr), especially from the N14, when an increase in traffic would adversely affect the accessibility of the site | | |
| **Cumulative Impacts:**<br>The impact on the selected route to the site could be increased significantly should it also be an access road to another project. By including local authorities and planning construction outside of the harvest period, the cumulative impact should remain low. | | |
| **Residual Impacts:**<br>The proposed development is of such a nature that the status quo could be regained after decommissioning the plant, with upgraded local infrastructure a residual benefit. | | |

| | | |
|---|---|---|
| ***Nature of the impact:*** **The presence of construction workers** on the site and possible social mobilisation. As the local communities are perceived as relatively closed to outsiders, the socio-cultural impact of having an influx of migrants from other areas could result in conflict.<br><br>*Note: As it would be difficult for the contractor to control conflict situations where they occur when construction workers spend their free time in the local community, this assessment focuses on conflict situations that the contractor can control.* | | |
| | ***Without Mitigation*** | ***With Mitigation*** |
| **Extent** | Province/Region(3) | Local/District(2) |
| **Duration** | Short term(1) | Short term(1)1 |
| **Magnitude** | Low (4) | Minor (2) |
| **Probability** | Probable(3) | Improbable(2) |
| **Significance** | **Low(24)** | **Low(14)** |
| **Status (+/-)** | Negative | |
| **Reversible** | Yes | |
| **Irreplaceable** | NONE | |
| **Can impacts be mitigated?** | Yes | |
| **Mitigation:**<br>» By ensuring that the local community is aware and involved in the public consultation through local ward councillors, relevant information may clarify misgivings and assumptions | | |

» Implementing a "local first" recruitment policy should decrease migrant workers influx which may upset social structures
» Invite neighbouring stakeholder to sit on the MF to enable involvement and information sharing
» All mitigation measures contained in the EMPr should be implemented and monitored. Remedial action should be taken where the contractor fails to comply with the EMPr
» Ensure that the process is well managed and all neighbours and local communities are informed beforehand of when to expect an influx, as part of good governance
» Establish a "code of conduct" with the workers to respect the site and neighbours in surrounding area which must also be part of the managing the discipline on site

**Cumulative Impacts:**
Notwithstanding the Kheis development, there are also the Bokpoort and Kleinbegin PV and KaroshoekKaroshoek developments just within the local municipal area, as well as Albany being considered in the neighbouring District. A conflict situation can spread to other sites so that communities can become antagonistic against the development even before construction commences.

**Residual Impacts:**
The proposed development is of such a nature that the status quo could be regained after construction, which is usually the high risk phase.

***Nature of the impact:*** **Perceptions from and attitudes** towards the Kheis Solar Park 3 Facility, either positive (economic injection) or negative (safety, inconvenience, risk to property). The public consultation is still on-going, but comments and feedback received thus far from stakeholders are varied. The site visit also confirmed that depending on the stakeholder's own perspective, attitudes vary significantly. For this purpose, the SEIA will aim to present an objective and scientific assessment.

| | ***Without Mitigation*** | ***With Mitigation*** |
|---|---|---|
| **Extent** | Regional (3) | Local (2) |
| **Duration** | Medium term(3) | Short (2) |
| **Magnitude** | Low (4) | Minor (2) |
| **Probability** | Probable (3) | Possible(2) |
| **Significance** | **Medium (30)** | **Low(12)** |
| **Status (+/-)** | Positive or Negative (depending on individual perceptions) | |
| **Reversible** | Yes | |
| **Irreplaceable** | NONE | |
| **Can impacts be mitigated?** | Yes | |

**Mitigation:**
» Ensure that the public participation also includes stakeholders directly affected as listed in the study (land owner, workers, close neighbours and the local community)
» Ensure that safety procedures regarding veld fires are part of the training of all new workers
» Include values as well as health & safety procedures in a "code of conduct" with the workers which are to form part of their employment contracts

**Cumulative Impacts:**
The significance of this impact is rated low, but due to the number and proximity of other

| |
|---|
| PV plants in the area, the cumulative impact affecting the general sentiment around alternative energy projects and specifically this development, may change**.** |
| **Residual Impacts:**<br>The site may be rehabilitated to its current state after decommissioning, but the perceptions could still linger in the altered socio-cultural attitudes. |

| ***Nature of the impact:*** **The impact on local and regional industry** due to linkage effects. The capital investment in the area will have a multiplier effect on local industry and businesses, resulting in a wider indirect positive economic impact than the jobs directly anticipated for the Kheis Solar Park 3 Facility. Areas most positively affected may be transport, consumables and construction materials. | | |
|---|---|---|
| | ***Without Mitigation*** | ***With Mitigation*** |
| **Extent** | ***Without Mitigation*** | ***With Mitigation*** |
| **Duration** | Local (2) | Regional (3) |
| **Magnitude** | Short term (1) | Short term (1) |
| **Probability** | Low (1) | High (8) |
| **Significance** | Probable (3) | Highly probable (4) |
| **Status (+/-)** | **Low (12)** | **Medium (48)** |
| **Reversible** | Positive | |
| **Irreplaceable** | N/A | |
| **Can impacts be mitigated?** | N/A | |
| **Mitigation:**<br>» Government gives preference to projects with high levels of local content through the REIPPPP. A target of 60% local content may be required from certain technologies during the next round REIPPPP, which will require linking new and existing local businesses to the supply chain of the Kheis Solar Park 3 Facility<br>» Ensuring that principle of "local first" when procuring consumables, construction materials etc. | | |
| **Cumulative Impacts:**<br>The scale, extent and proximity of similar developments in the Northern Cape will have an increase in the cumulative linkage effect. | | |
| **Residual Impacts:**<br>The proposed development is of such a nature that the status quo could be regained after decommissioning the plant. | | |

| ***Nature of the impact:*** **A change in the employment status** and income levels of the local population due to the creation of jobs. The 55MW plant will require 60 – 80 jobs over the 12 months of construction, aiming to keep around 95% of the labour local. A further 20 direct jobs are anticipated during the operational phase of the first phase of the Kheis Solar Park 2 | | |
|---|---|---|
| | **Without Enhancement** | **With Enhancement** |
| **Extent** | Local (2) | Regional(4) |
| **Duration** | Short term(1) | Medium(3) |

| | | |
|---|---|---|
| **Magnitude** | Minor (2) | Low(3) |
| **Probability** | Probable(3) | Definite(4) |
| **Significance** | **Low (12)** | **Medium(40)** |
| **Status (+/-)** | Positive | |
| **Reversible** | NONE | |
| **Irreplaceable** | NONE | |
| **Can impacts be mitigated?** | Yes | |

**Enhancement:**

- Implementing a "local first" recruitment policy will ensure that the positive impact is mostly ring-fenced for locals
- Ensure that the benefit is equitable and that the principles underpinned by Black Economic Empowerment Act of 2003 are honoured
- Also that the local jobs created are linked to a skills development programme for permanent employment

**Cumulative Impacts:**

The impact is measured as a result of direct employment creation for the first phase of the project. The indirect effects on employment creation, the multiplier effect on local business, as well as the subsequent phases will increase the cumulative positive impact on the employment status, contributing to the provincial and national employment creation initiatives.

**Residual Impacts:**

The proposed development is of such a nature that the status quo could be regained after decommissioning the plant. From a socio-economic perspective, the residual impact will be the end of the job opportunities which locals may have become dependent, unless skills development and training enable permanent employment.

The following impacts are anticipated as part of the **operational phase** of the Kheis Solar Park 3 development:

***Nature of the impact:*** A possible **permanent change in the land use pattern** of the area. The site earmarked for the development comprises of 1800 hectares of agricultural land, which currently used for extensive animal farming. The PV Solar Energy Facility will alter the use on this piece of land for at least the next 20 years.

| | **Without Mitigation** | **With Mitigation** |
|---|---|---|
| **Extent** | Regional(3) | Local(2) |
| **Duration** | Medium term (3) | Medium term (3) |
| **Magnitude** | Minor (2) | Minor(1) |
| **Probability** | Probable(3) | Possible (2) |
| **Significance** | **Low(24)** | **Low(12)** |
| **Status (+/-)** | Positive or Negative | |
| **Reversible** | Yes | |
| **Irreplaceable** | No | |
| **Can impacts be mitigated?** | Yes | |

| |
|---|
| **Mitigation:**<br>» After decommissioning, the land use status quo on the site must be returned to the current state, provided this is economical at the time. |
| **Cumulative Impacts:**<br>This project, together with the other mentioned PV Solar Energy Facility's such as Bokpoort, Karoshoek and Grootdrink solar projects in the area will have a significant cumulative impact on the land use pattern. This impact may affect the Northern Cape agricultural sectors' contribution to GGP. |
| **Residual Impacts:**<br>The proposed development is of such a nature that the status quo could be regained after decommissioning the plant. Provided the site is rehabilitated to its current state, the socio-economic impact would be negligible. |

***Nature of the impact:*** The current **agricultural value of the land** may change with the development of the site.

| | ***Without Mitigation*** | ***With Mitigation*** |
|---|---|---|
| **Extent** | Local(1) | Local(2) |
| **Duration** | Medium term (3) | Medium term (3) |
| **Magnitude** | Minor(2) | Low(3) |
| **Probability** | Probable(3) | Probable(3) |
| **Significance** | **Low(18)** | **Low(24)** |
| **Status (+/-)** | Positive | |
| **Reversible** | Yes | |
| **Irreplaceable** | NONE | |
| **Can impacts be mitigated?** | Yes | |

**Mitigation:**

» The economic value of the current agricultural land will increase with the value-add in infrastructure and land use rights. To ensure that the benefit extends to the local communities, the local job creation initiatives (local first), as well as the RFP requirements of minimum of 2.5% local community shareholding should mitigate concerns regarding the allocation of the positive impact

» By implementing this project with all the mitigations and care as prescribed by NEMA, any other developments in the future will be more acceptable to the community and other stakeholders

» Mitigate environmental impact through following the recommendations from the specialist studies as well as implementing a comprehensive EMPr

**Cumulative Impacts:**

The positive economic impact of this development, combined with similar developments in the District will increase the significant of the positive impact on a struggling economy.

**Residual Impacts:**

Provided the site is rehabilitated to its current state, the socio-economic impact could however be significant if a source of stimulation to the local economy is removed.

***Nature of the impact:*** The impact of the development on **local tourism and hospitality industry**.

Although the province has the lowest tourism contribution to GDP at only 2%, it is more reflective of the poverty level of the province than the real contribution of the sector. Attractions include the Augrabies Falls National Park, the Kgalagadi Transfrontier Park and the local award-winning Orange River Cellars made up of five wineries situated in Upington, Kakamas, Keimoes and most importantly Grootdrink and Groblershoop, which are close to the proposed development site. Smaller enterprises in the area include eco-tourism initiatives and safari experiences like neighbouring FM Safaris.

| | ***Without Mitigation*** | ***With Mitigation*** |
|---|---|---|
| **Extent** | Regional(3) | Local(2) |
| **Duration** | Medium term (3) | Medium term (3) |
| **Magnitude** | Minor 2 | Minor1 |
| **Probability** | Probable(3) | Improbable(2) |
| **Significance** | **Low(24)** | **Low(12)** |
| **Status (+/-)** | Negative | |
| **Reversible** | Yes | |
| **Irreplaceable** | No | |
| **Can impacts be mitigated?** | Yes | |

**Mitigation:**

» Ensure that the I&AP are supplied with the relevant and detailed information pertaining to the impact of a PV Solar Energy Facility plant

» A MF for the Kheis development could manage issues arising from the development, which may affect the local tourism industry

» Ensure that mitigation actions as recommended specifically in the VIA be implemented.

**Cumulative Impacts:**

As this development is part of a greater strategic development initiative of the Northern Cape, the cumulative impact may be significant.

**Residual Impacts:**

The proposed development is of such a nature that the status quo could be regained after decommissioning the plant. Provided the site is rehabilitated to its current state, the socio-economic impact pertaining to the tourism industry will be negligible.

***Nature of the impact:*** Impact on the **"way of life"** and **"sense of place"**. This impact is related to the way people make a living and their quality of life. People stay and travel to this area to experience the unique landscape and culture. The impact should be considered in the context of the study area as a whole, as the impact will also depend on a number of variables, such as the visual impact, the biodiversity impact, the related activities on the surrounding land, etc.

| | ***Without Mitigation*** | ***With Mitigation*** |
|---|---|---|
| **Extent** | Local(2) | Local(1) |
| **Duration** | Medium term (3) | Medium term (3) |
| **Magnitude** | Medium(2) | Low(1) |

| | | |
|---|---|---|
| **Probability** | Probable(3) | Improbable(2) |
| **Significance** | **Low(21)** | **Low(10)** |
| **Status (+/-)** | Negative | |
| **Reversible** | Yes | |
| **Irreplaceable** | NONE | |
| **Can impacts be mitigated?** | Yes | |
| **Mitigation:**<br>» Implement mitigation measures detailed in the Visual Impact Assessment | | |
| **Cumulative Impacts:**<br>The presence of such infrastructure can also set an unintended precedent for further land use change in the near vicinity in future, which could further alter people's way of life and their sense of place. | | |
| **Residual Impacts:**<br>The impact on sense of place can be reversed after decommissioning, provided that rehabilitation is done to as satisfactory level. | | |

**f) <u>Comparative Assessment of PV Panel technology (Fixed vs Tracking):</u>**

There is **no difference** in social / economic impacts from either technology alternatives. Therefore there is no preference from a social perspective on the implementation of either technology.

**<u>c) Implication for project implementation</u>**

» The findings of the SIA undertaken for the proposed Kheis Solar Park 3 indicate that the development will create employment and business opportunities for locals during both the construction and operational phase of the project.
» The establishment of a Community Trust will also create an opportunity to support local economic development in the area.
» The development of renewable energy has also been identified as a key growth sector by the NCSDF and also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.
» There is no preference from a social perspective on the implementation of either technology under consideration.
» It is therefore recommended that the Kheis Solar Park 3 Energy Facility as proposed be supported, subject to the implementation of the recommended enhancement and mitigation measures contained in the SIA report.

### 12.3 Assessment of the Do Nothing Alternative

The 'do nothing' alternative will do little to influence the macro-level renewable energy targets set by government due to competition in the sector, and the number of renewable energy projects being bid to the DoE. However, as the site experiences some of the best irradiation in the country and optimal grid connection opportunities are available, not developing the project would see such an opportunity being lost. In addition the Northern Cape grid will be deprived of an opportunity to benefit from the additional generated power being evacuated directly into the Province's grid. The greater farm portions are not being farmed intensively due to climate and agricultural constraints and it is unlikely that the farm will become productive from this perspective in the long-term. The loss of the land to this project is therefore not considered significant.

At a local level, the level of unemployment will remain the same and there will not be any transfer of skills to people in terms of the construction and operation of the solar energy facility. The landowner would have lost an opportunity of receiving an alternative form of income from the project, which could contribute to the use of his land in a sustainable manner. Furthermore, the community would lose the opportunity to improve and uplift their infrastructures through the community trust.

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. Although the facility is only proposed to contribute 20 MW to the grid capacity, this would assist in meeting the growing electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy. 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*:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.

» ***Resource saving*:** Conventional coal fired plants are major consumers of water during their requisite cooling processes. 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, when compared with wet cooled conventional power stations. This translates into revenue savings of R26.6 million. 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.

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

» ***Pollution reduction:*** The releases of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation. The use of solar radiation for power generation is considered a non-consumptive use of a natural resource which produces zero greenhouse gas emissions.

» ***Climate friendly development:*** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be responsible for approximately 1% of global GHG emissions and is currently ranked $9^{th}$ worldwide in terms of per capita carbon dioxide emissions.

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

» ***Employment creation:*** The sale, development, installation, maintenance and management of renewable energy facilities have significant potential for job creation in South Africa.

» ***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.

The 'do nothing' alternative will not assist the South African government in addressing climate change, in reaching the set targets for renewable energy, nor will it assist in supplying the increasing electricity demand within the country. In addition the Northern Cape Province power grid will lose an opportunity to benefit from the additional generated power being evacuated directly into the Province's grid at the Garona-Gordonia 132kV power line. The 'do nothing alternative is, therefore, not a preferred alternative.

## 12.4 Summary of Impacts

Table 12.1 summarises all potential impacts associated with the proposed Kheis Solar Park 3 Facility and the associated EIA regulation listed activities.

**Table 12.2:** Summary of impacts associated with the proposed Kheis Solar Park 3 Facility and its relevant EIA listed activities.

| Construction / Decommissioning Impacts | Significance of Impact | | | EIA Regulation Listed activity assessed |
|---|---|---|---|---|
| | Without mitigation | With mitigation | Status | |
| **Ecology** | | | | |
| Loss of vegetation & increase in runoff and erosion, | M (50) | M (35) | Negative | GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i). |
| Loss of protected or red data species | M (50) | L (28) | Negative | GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i). |
| Loss species of conservation concern | H (75) | H (60) | Negative | GN 545, 18 June 2010 activity 1 & 15<br>GN 546, 18 June 2010 activity 14(i). |
| **Soils & Agriculture Potential** | | | | |
| Loss of agricultural land use | M (30) | M (30) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| Generation of alternative land use income | M (32) | M (32) | Positive | none |
| Soil erosion | L (27) | L (8) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Loss of topsoil | L (24) | L (7) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Degradation of veld vegetation | L (15) | L (8) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| **Heritage & Palaeontology** | | | | |
| Destruction, damage, excavation, alteration, removal or collection of heritage artefacts from its original position (consequences) | L (16) | | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |

| Construction / Decommissioning Impacts | Significance of Impact | | | EIA Regulation Listed activity assessed |
|---|---|---|---|---|
| | Without mitigation | With mitigation | Status | |
| **Visual** | | | | |
| Visual impact of construction on sensitive visual receptors | M(42) | M(36) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impact of lighting on sensitive visual receptors. | M (42) | L (24) | Negative | GN 545 activity 1 &15 |
| **Social** | | | | |
| The impact on the health status of the local community due to an increase in male migrant workers | M(30) | L(8) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| The local roads and associated infrastructure will be affected by the increase in construction vehicles and traffic to the site. | M(35) | L(6) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| The presence of construction workers on the site and possible social mobilisation. | L(24) | L(14) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| Perceptions from and attitudes towards the Kheis Solar Park 3 Facility, either positive (economic injection) or negative (safety, inconvenience, risk to property). | L(30) | L(12) | Positive/Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| The impact on local and regional industry due to linkage effects. The capital investment in the area will have a multiplier effect on local industry and businesses. | L(12) | M(48) | Positive | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| A change in the employment status and income levels of the local population due to the creation of jobs | L(12) | M(40) | Positive | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |

| Operational Impacts | Significance of Impact | | | Listed Activities (18 June 2010) |
|---|---|---|---|---|
| | Without mitigation | With mitigation | Status | |
| **Ecology** | | | | |

| Operational Impacts | Significance of Impact | | | Listed Activities (18 June 2010) |
|---|---|---|---|---|
| | Without mitigation | With mitigation | Status | |
| Loss of vegetation and/or species of conservation concern | H (80) | H (65) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| Increase in runoff and erosion, disturbance or possible mortality incidents of terrestrial fauna, possible contamination of soil and groundwater by oil- or fuel spillages, possible establishment and spread of undesirable weeds and alien invasive species | M (60) | L (20) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| **Soils & Agriculture Potential** | | | | |
| Loss of agricultural land use | M (30) | M (30) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| Generation of alternative land use income | M (32) | M (32) | Positive | None |
| Soil erosion | L (27) | L (8) | Negative | GN 544 activity 10(i); 11(x)(xi)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| **Visual** | | | | |
| Visual impact on users of the secondary roads in close proximity to the proposed Solar Energy Facility | L (28) | L (24) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impact on visitors to the FM Safari Lodge located in close proximity to the proposed Solar Energy Facility | L (28) | L (24) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impact on sensitive visual receptors within the region | L (22) | L (11) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impacts related to the ancillary infrastructure | Negligible | Negligible | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15 |

| Operational Impacts | Significance of Impact | | | Listed Activities (18 June 2010) |
|---|---|---|---|---|
| | Without mitigation | With mitigation | Status | |
| | | | | GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impact associated with the of the operation of PV panels (fixed panel option) | L(23) | Low (14) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc), 19 (a)(ii)(cc) &14(i) |
| Visual impact associated with the of the operation of PV panels (tracking panel option) | M(40) | Low (14) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546, 18 June 2010 activity 4(a)(ii)(cc) 19 (a)(ii)(cc) |
| **Social** | | | | |
| A possible permanent change in the land use pattern of the area | L (24) | L (12) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| The current agricultural value of the land will change with the development of the site | L (18) | L (24) | Positive | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| The impact of the development on local tourism and hospitality industry | L (24) | L (12) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |
| Impact on the "way of life" and "sense of place". | L (21) | L (10) | Negative | GN 544 activity 10(i)<br>GN 545 activity 1 & 15<br>GN 546 activity 14(a)(i) |

| | | | | | |
|---|---|---|---|---|---|
| L | **Low** | M | **Medium** | H | **High** |

# ASSESSMENT OF CUMULATIVE IMPACTS KHEIS SOLAR PARK 3 CHAPTER 13

Cumulative impacts in relation to an activity are defined in the Environmental Impact Assessment Regulations (Government Notice R543) as meaning "the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area".

There has been a substantial increase in renewable energy developments recently in South Africa as legislation is evolving to facilitate the introduction of Independent Power Producers (IPPs) and renewable energy into the electricity generation mix. Due to the recent substantial increase in interest in renewable energy developments in South Africa, it is important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts are considered and avoided where possible.

The Department of Energy has, under the REIPPP Programme released a request for proposals (RfP) to contribute towards Government's renewable energy target of 3725 MW ( 1450 MW of which has been allocated to solar PV energy) and to stimulate the industry in South Africa. The bid selection process will consider the suggested tariff as well as socio-economic development opportunities provided by the project and the bidder.

There is a legislated requirement to assess cumulative impacts associated with a proposed development. This chapter looks at whether the proposed project's potential impacts become more significant when considered in combination with the other known or proposed solar farm projects within the area.

## 13.1 Approach Taken to Assess Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertaking in the area[19].

Significant cumulative impacts that could occur due to the development of the solar energy facilities and its associated infrastructure in proximity to each other include impacts such as:

[19] Definition as provided by DEA in the EIA Regulations.

» Loss of vegetation and impacts on ecology
» Soil and agricultural potential impacts
» Heritage impacts
» Visual impacts
» Social impacts

The cumulative effect or impacts are presented as follows:

» Cumulative impacts potentially as a result of the cumulative effects of the three Kheis Solar Park PV facilities proposed to be located on Portion 7 and Portion 9 of the Farm Namakwari 656 (Kheis Solar Park 1-3).
» Cumulative impacts potentially as a result of the cumulative effects of the Kheis Solar Park 3 added to all other renewable energy facilities proposed to be developed in and around the Grootdrink area (south west of Upington).

Table 13.1 shows the proposed location of the Kheis Solar Park 1 in relation to all other known renewable energy applications. These projects were identified by CSIR using the Department of Environmental Affairs Geographic Information System digital data (CSIR, 2013).

| Project | Applicant / Developer | DEA Ref. No | Location | Status | Distance from Kheis Solar Park 3 |
|---|---|---|---|---|---|
| 15. Kheis Solar Park 1(75MW) | Gestamp Asetym Solar South Africa (Pty) Ltd | 14/12/16/3/3/2/5569 | Portion 7 and 9 of the farm Namakwari 656 | EIA underway - considered in this EIA report | 1km |
| 16. Kheis Solar Park 2 (20MW) | Gestamp Asetym Solar South Africa (Pty) Ltd | 14/12/16/3/3/2/570 | Portion 9 of the farm Namakwari 656 | EIA underway - considered in this EIA report | 500m |
| 17. Grootdrink solar facility (75MW) | Grootdrink Solar (Pty) Ltd | 14/12/16/3/3/2/639 | Remaining extent of farm Albany 405 | EIA underway | 15km |
| 18. Concentrating Solar Thermal Power Plant on the farm Bokpoort (50MW) | Solafrica | 12/12/20/1920 | RE of the Farm Bokpoort 390, south east of Upington | Environmental Authorisation issued - round 2 preferred bidder | 20km |
| 19. Karoshoek Solar Valley Development (900MW comprising CSP and CPV technology) – 11 separate projects | FG Emvelo Energy (Pty) Ltd | 14/12/16/3/3/2/289<br>14/12/16/3/3/2/290<br>14/12/16/3/3/2/291<br>14/12/16/3/3/2/292<br>14/12/16/3/3/2/293<br>14/12/16/3/3/2/294<br>14/12/16/3/3/2/295<br>14/12/16/3/3/2/296<br>14/12/16/3/3/2/297<br>14/12/16/3/3/2/298 | Matjesriver RE and 2/41, Annashoek 3/41, Karos 956 and Zandemm 944 east of Upington | Environmental Authorisation issued | 25km |

| **Project** | **Applicant / Developer** | **DEA Ref. No** | **Location** | **Status** | **Distance from Kheis Solar Park 3** |
|---|---|---|---|---|---|
| | | 14/12/16/3/3/2/299 | | | |
| 20. Ilanga CSP Facility (125MW) | Ilangalethu Solar Power (Pty) Ltd | 12/12/20/2056 | Zandemm 944 east of Upington | Environmental Authorisation issued – round 3 preferred bidder (100MW) | 25km |
| 21. Kleinbegin Solar Energy (50MW) | Vanguard Solar (Pty) Ltd | 12/12/20/2198 | Klein Begin 2/115, south east of Upington | Environmental Authorisation issued | 35km |

**Table 13.1:** Proposed solar energy facilities within the Kheis Solar Park 3. project development site and surrounding areas

Kleinbegin Solar Energy facility is considered to be too far afield to result in cumulative impacts with the Kheis Solar Park 3, and is not considered further.

The combined effect of the solar energy facilities for this area will have a cumulative visual impact, impact on the landscape character, social impact, and impacts on ecology and soil erosion.

In the sections below the potential cumulative impacts of other solar facilities within the immediate vicinity (i..e within 25km) of the proposed Kheis Solar Park 3 are explored. The discussion and associated conclusions must be understood in the context of the uncertainty associated with the proposed developments and the qualitative nature of the assessment.

### 13.2 Cumulative impacts of three Kheis Solar Park projects on the Portion 7 and Portion 9 of the Farm Namakwari 656

The location of the three solar facilities on Portion 7 and Portion 9 of the Farm Namakwari 656 is illustrated in Figure 13.2. The potential cumulative impacts over Portion 7 and Portion 9 of the Farm Namakwari 656, should the development of all three Kheis Solar Park PV projects be realised, are likely to be contained within the boundaries of the farm site (with the exception of visual and social), and with the application of the necessary mitigation measures, contained within each of the respective PV projects areas. This is deducted based on the following:

» **Ecology**: The development footprints of all three PV projects are aligned with areas of low and medium- low ecological sensitivity and outside of the identified high sensitive areas. The cumulative impacts on ecology within the site are expected to increase due with each development of the Kheis Solar Park projects; the overall impact on ecology within the site due to 3 projects similar developments is expected to be of **medium sensitivity** significance due to the fact that the facilities are placed to avoid highly sensitive areas.
» **Soil and agricultural potential:** The broader farm portions, portion 7 and 9 of Namakwari 656, are 3600ha in extent, and the development of the three proposed Kheis Solar Park projects will result in the loss of ~17% of the farm for agricultural activities. The remainder of the farm portion can be continued to be utilised for agricultural activities. The development footprints are aligned with areas characterised by Hutton soil form (moderately deep to deep, red, very sandy soils; much shallower soils on underlying rock and rock) and low agricultural potential. The overall cumulative impact on agricultural land within the site is of **low** significance due to the limited agricultural potential of the area.
» **Heritage and Palaeontology**: From an archaeological perspective the observed heritage resources over the areas surveyed were found to be of low density and low significance. A colonial era farm dwelling, modified through time, and now in a state of ruin, was recorded at Sterkstroom. It is not

considered to be of major heritage significance. The proposed projects will have **low** cumulative impacts on the heritage artefacts on site.

» **Visual Impacts**: Figure 13.1 shows the frequency of PV facility sightings, highlighting areas that may have a view of all three projects. Areas with a higher frequency of exposure generally correlate with elevated topographical units, such as hills and ridges, where the observer is elevated above the average ground level. In terms of the shorter distance sightings where potentially sensitive visual receptors are expected; the area located north of the solar parks (along the secondary road and parts of the game farm) is of relevance. Observers within this area are expected to have a linear view of the PV facilities along the north-south axis of the overall development. Kheis Solar Parks 1, 2 and 3 is generally expected to increase the cumulative visual impact within the immediate area. However, the close proximity of the proposed facilities to each other consolidates the potential visual exposure of solar energy generation infrastructure within a development node, thereby avoiding the proliferation of similar developments within the region and making it low-medium significance.

Based on the above, the cumulative impacts associated with the combination of all three projects occurring on Portion 7 and Portion 9 of Portion 4 the Farm Namakwari 656 are considered to be of low-moderate significance provided that environmental impacts are mitigated to suitable standards.

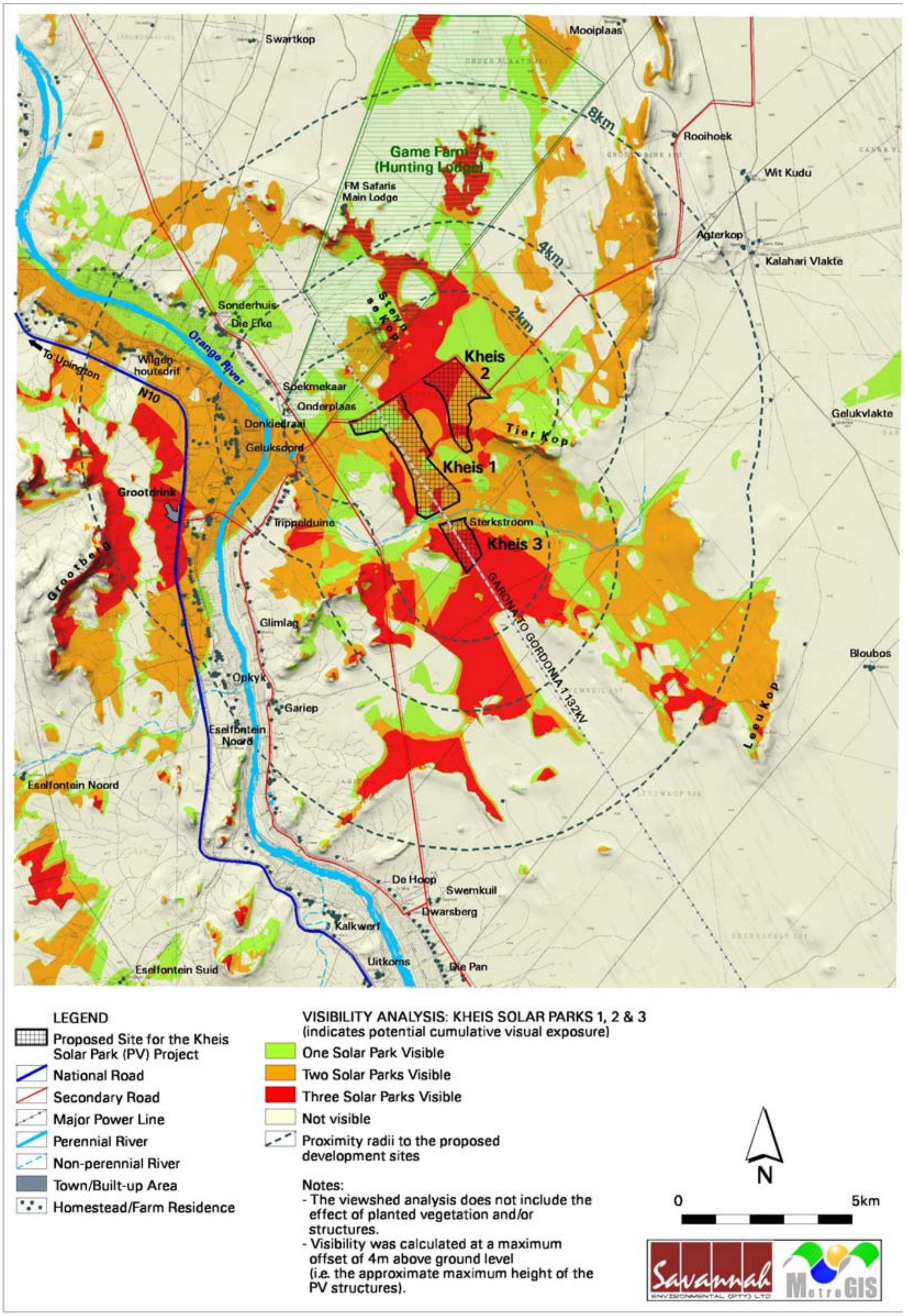



**Figure 13.1**: Potential cumulative visual exposure of the proposed Kheis Solar Parks 1, 2 and 3

## 13.3 Cumulative impacts of renewable energy facilities in the region

Including the three projects of the Kheis Solar Park, there are sixteen (16) renewable projects within a 25 km radius of the Kheis Solar Park 3 site (refer to Figure 13.2). At the time of writing this EIA report, the Bokpoort Trough CSP Project is under construction (being a Round 2 preferred bidder) and Ilanga CSP Facility is a Round 3 preferred bidder.

The potential for cumulative impacts as a result of similar developments planned to be developed around the renewable energy node of Grootdrink, is considered below.

### *13.3.1Loss of vegetation and impacts on ecology*

Excessive clearing of slow growing trees, especially *Boscia albitrunca* and *Acacia erioloba* as a result of multiple project could significantly impact local and regional (within ZF Mgcawu District Municipality) population dynamics, and microhabitats and their resources associated with larger trees of these species. This can influence runoff and storm water flow patterns and dynamics, which could cause excessive accelerated erosion of plains, small ephemeral drainage lines, rivers and this could also have detrimental effects on the lower lying Orange River. Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasives into adjacent agricultural land and rangelands. Cumulative impacts on ecology are expected to be of **low to moderate significance** as several of the solar developments planned in the 25km radius of the project are on similar habitats.

### *13.3.2Cumulative impacts on soil and agricultural potential*

The overall loss of agricultural land in the region due to other similar developments is expected to be of **low** significance due to the limited agricultural potential of the area. Due to the limited crop production in the wider study area, and the fact that grazing can continue on the farm in areas not affected by the proposed facility, the development of multiple solar energy facilities within the region of Grootdrink will not affect food security in the region.

### *13.3.3Cumulative impacts on heritage and palaeontology*

Cumulative impacts in terms of archaeological and paleontological contexts are once-off permanent destructive events. Infrastructure development may lead to spatially extended impacts in the vicinity, hence the need to demarcate areas for zero to low impact. Cumulative negative impacts on heritage and paleontological resources are expected be low**-medium significance** due to the fact that the potential for the loss of or discovery of heritage artefacts in the region will also increase with the increased numbers of similar developments in the area.

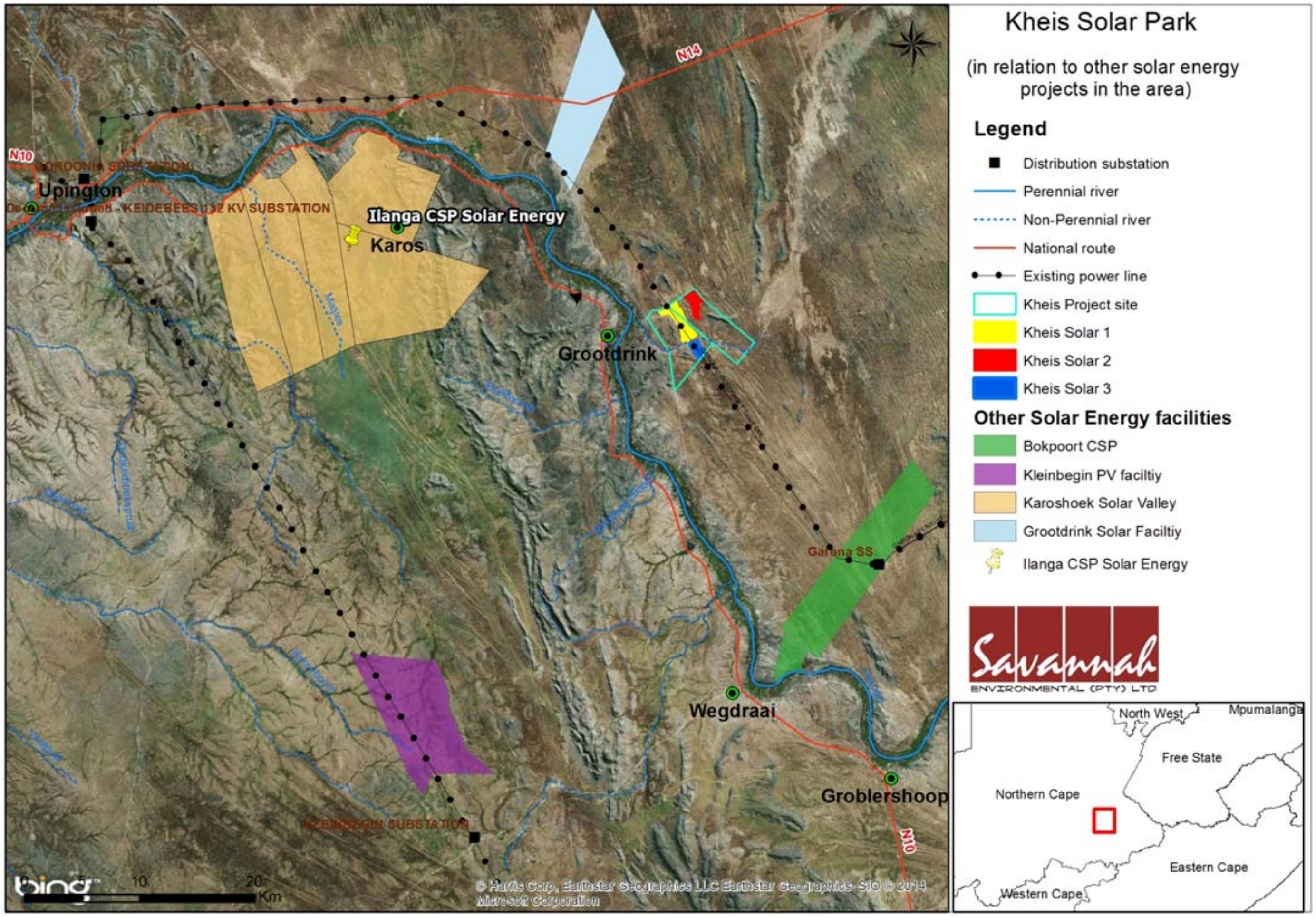



**Figure 13.2:** Map showing the proximity of other renewable energy facility projects to the Kheis Solar Park 3 in order to understand the potential for cumulative impacts

#### *133.4 Cumulative Visual Impacts*

The visual cumulative impact of Kheis Solar Park 3 in relation to other solar facilities beyond 8km radius is not of concern due to the relative long distance; the other facilities are more than 8km from the Kheis Solar Park 3 site which makes the visual impact **low**.

#### *13.3.5Cumulative Impacts on the Social and Economic Environment*

Benefits to the local, regional and national economy through employment and procurement of services could be substantial should many of the renewable energy facilities proceed. This benefit will increase significantly should critical mass be reached that allows local companies to develop the necessary skills to support construction and maintenance activities and that allows for components of the renewable energy facilities to be manufactured in South Africa. Furthermore at municipal level, the cumulative impact could be positive and could incentivise operation and maintenance companies to centralise and expand their activities towards education and training and more closely to the projects.

The cumulative impact in terms of loss of agricultural land is unlikely to be significant due to the limited land take and in most cases agricultural activities would be allowed to proceed on the remaining portions of the sites not affected by the solar facilities. Property prices in these areas are likely to increase as a result of the added value that energy generation offers. However, once the renewable energy sector is saturated, property prices that are dependent on the sense of place value rather than on the agricultural potential may be compromised due to the changes in landscape and sense of place. **Cumulative positive social and economic** impacts and **negative social impacts** (visual, sense of place, noise and disturbance during construction) will be of **moderate significance**.

## 13.4 Conclusion regarding Cumulative Impacts of Kheis Solar Park 3

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study.

The alignment of renewable energy developments with South Africa's Integrated Resource Plan (IRP) and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The CSIR has released an initial identification of geographical areas best suited for the roll-out of wind and solar photovoltaic (PV) energy projects in South Africa. The aim of the assessment is to designate renewable energy development zones (REDZ) within which such development will be incentivised and streamlined. The Kheis Solar Park 3 falls within the REDZ/ identified geographical area most suitable for the rollout of the development of solar energy projects within the Northern Cape Province. In addition, the site is located within the Solar Corridor identified within then NCSDF. Both the REDZ and Solar Corridor initiatives imply that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented. The site location is therefore in line with this rationale.

It is also important to note that it is unlikely that all proposed renewable energy facilities located in the 25km radius will be built in the short to medium term (i.e. 5years) due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets by the DoE. This will reduce the potential for cumulative impacts within this period. Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Kheis Solar Park 3 facility will be of **low to moderate** significance in the region and **low to moderate** within the Kheis Solar Park project site.

# CONCLUSIONS AND RECOMMENDATIONS FOR KHEIS SOLAR PARK 3: (DEA REF. NO.: 14/12/16/3/3/2/571) CHAPTER 14

Gestamp Asetym Solar South Africa (Pty) Ltd is proposing to establish three commercial photovoltaic solar energy facilities on Portion 7 and 9 of Portion 4 of Farm Namakwari 656 south west of Upington, Northern Cape Province. The site is located within the Kheis Local Municipality. ***This Chapter of the EIA report deals only with the conclusions and recommendations of the EIA for the Kheis Solar Park 3 of the larger Kheis (PV) Solar Park project***. The purpose of the proposed facility is to add new capacity for generation of power from renewable energy to the national electricity supply (which is short of generation capacity to meet current and expected demand), and to aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE).

Globally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as climate change and exploitation of non-renewable resources. In order to meet the long-term goal of a sustainable renewable energy industry, a goal of 17,8GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to ~42% of all new power generation being derived from renewable energy forms by 2030. In addition, the need for renewable energy development, specifically solar facilities, has been identified as an opportunity in the Northern Cape Spatial Development Framework (SDF).

In response to the need at a National and Provincial level, Gestamp Asetym Solar South Africa (Pty) Ltd, as an IPP, is proposing the establishment of a 20 MW photovoltaic solar energy facility and associated infrastructure for the purpose of commercial electricity generation. The proposed facility will require a development footprint area of approximately 110 ha (within a larger site of 1800ha in extent), and will be comprised of the following primary elements (refer to Figure 14.1):

- Arrays of either static or tracking photovoltaic (PV) panels.
- Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings.
- Cabling between the structures, to be lain underground where practical.
- Central invertor/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.

» An on-site substation (50m x 50m) and power line (100m) to evacuate the power from the facility into the Eskom grid via the existing Garona-Gordonia 132kV power line that traverses the site (Portion 9 of Portion 4 of the Farm Namakwari 656)
» Internal access roads (5m wide)
» Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity (approximate footprint ±100 m²)

An EIA process, as defined in the NEMA EIA Regulations, is a systematic process of identifying, assessing, and reporting environmental impacts associated with an activity. The EIA process forms part of the planning of a project and informs the final design of a development. In terms of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998), Gestamp Asetym Solar South Africa (Pty) Ltd requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Northern Cape Department of Environmental and Nature Conservation (DENC)) for the establishment of the Kheis Solar Park 3 facility. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543, GNR544, GNR545; and GNR546, a Scoping and an EIA Phase have been undertaken for the proposed project. As part of this EIA process comprehensive, independent environmental studies have been undertaken in accordance with the EIA Regulations. The following key phases have been undertaken to date in the EIA Process.

» *Notification Phase* - organs of state, stakeholders, and interested and affected parties (I&APs) were notified of the proposed project through adverts placed in a local and regional newspapers, site notices, and stakeholder letters. Details of registered parties have been included within an I&AP database for the project.
» *Scoping Phase* – identification of potential issues associated with the proposed project and environmental sensitivities (i.e. over the broader project development site - entire extent of Portion 9 of Portion 4 of Farm Namakwari 656), as well as definition of the extent of studies required within the EIA Phase were defined.

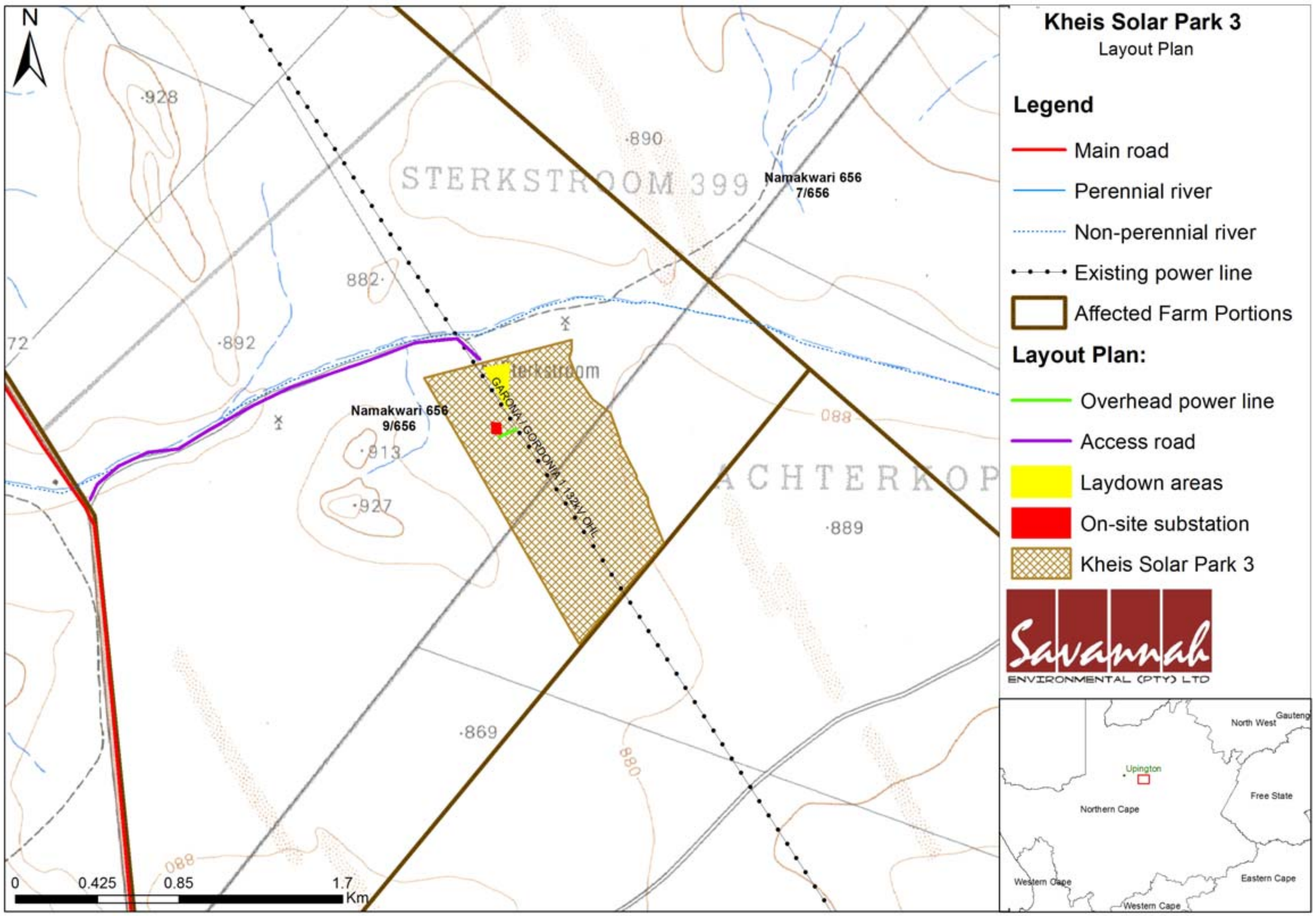



**Figure 14.1:** Map illustrating the location of the development footprint for Kheis Solar Park 3 facility and associated infrastructure and the proposed layout of the proposed facility on Portion 9 of Portion 4 of Farm Namakwari 656.

*EIA Phase* – potentially significant biophysical and social impacts[20] and identified feasible alternatives put forward as part of the project have been comprehensively assessed through specialist investigations. Appropriate mitigation measures have been recommended as part of a draft Environmental Management Programme (EMPr) (refer to Appendix M).

The Conclusions and Recommendations of this EIA for Kheis Solar Park 3 are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area. During the public consultation process, it was recommended by stakeholders that the facilities are not placed close to the western road and that they should rather be placed behind the small koppie on Portion 9 in order to reduce direct visibility. After field investigations, it was concluded that the area closest to this road is of higher sensitivity from an ecological perspective as well as a visual perspective. Therefore, the layout has been design to avoid these areas, thereby addressing the concerns raised through the public consultation process.

A summary of the recommendations and conclusions for the proposed Kheis Solar Park 3 facility project is provided in this Chapter.

## 14.1. Summary of Conclusions and Recommendations relevant to the Kheis Solar Park 3 facility and Associated Infrastructure

The preceding chapters of this report together with the specialist studies contained within **Appendices E-J** provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for Kheis Solar Park 3 facility by providing a summary of the conclusions of the assessment of the proposed site for the development of the PV solar energy facility. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental specialist consultants and presents an informed opinion of the environmental impacts associated with the proposed project.

From the conclusions of the detailed EIA studies undertaken, sensitive areas within the development footprint area were identified and flagged for consideration and avoidance by the facility layout (refer to Figure 14.2). Potential impacts which could occur as a result of the proposed project are summarised in the sections which follow.

[20] Direct, indirect, cumulative that may be either positive or negative.

The most significant environmental impacts identified and assessed to be associated with the proposed Kheis Solar Park 3 include:

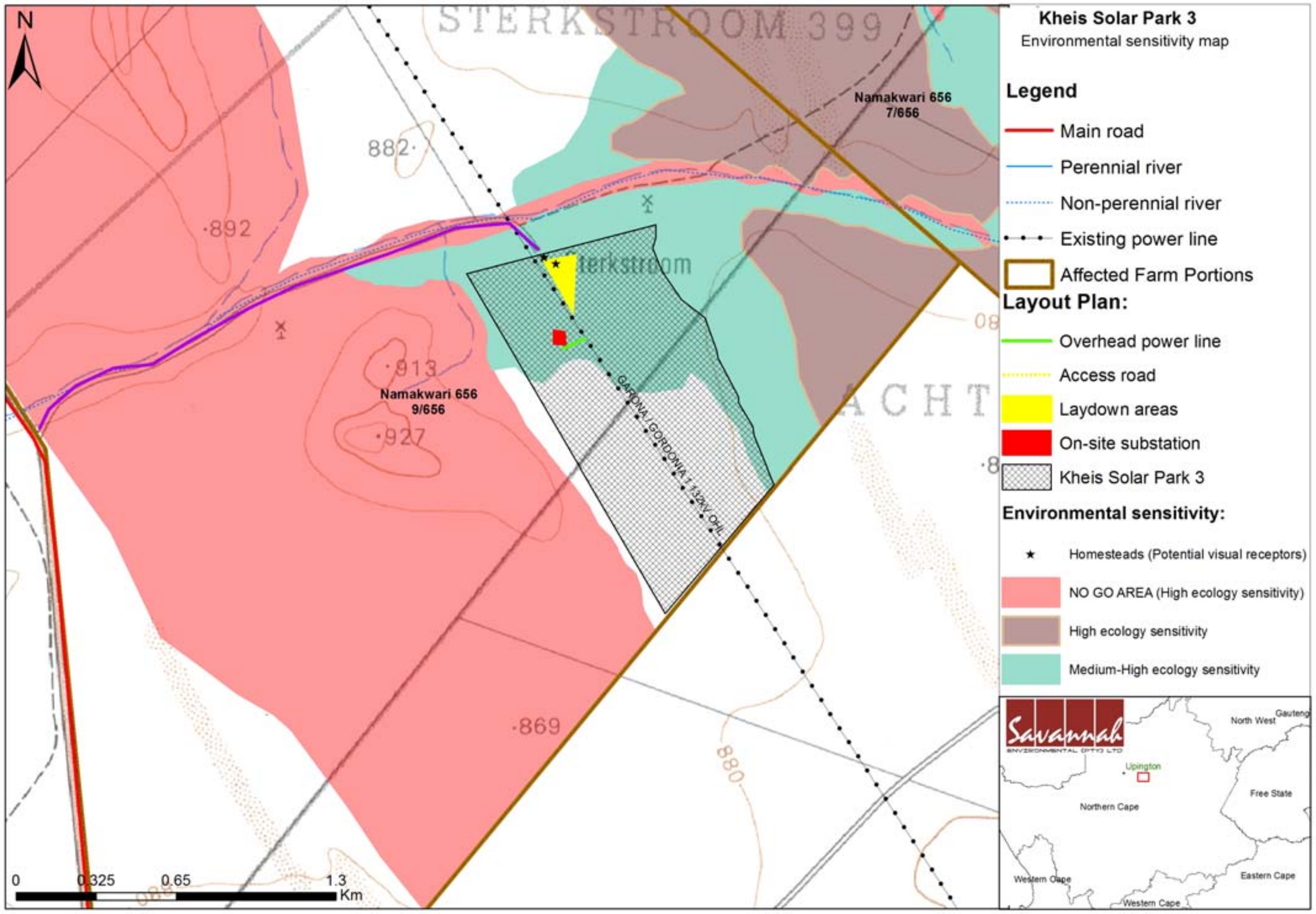



**Figure 14.2:** Environmental Sensitivity map of the proposed Kheis Solar Park 3 facility located on Portion 7 of Farm Namakwari.

» Impacts on ecology occurring on the site.

Other impacts which could have an impact on the environment include:

» Impacts on the local soils, land capability and agricultural potential of the site.
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure (power line, access road etc.).
» Impacts on heritage and paleontological resources.
» Social and economic impacts.
» Impacts associated with the power line.

#### *14.1.1. Impacts on Ecology*

Two vegetation units were identified within the Kheis Solar Park 3 footprint, calcareous low shrub plains occupy most of the Kheis Solar Park 3 site and are of lower sensitivity. The second vegetation association is the mixed shrub (occurs as a transition between the calcareous plains and dune fields) classified as having a Medium-Low sensitivity. Part of the layout footprint falls within the medium-high sensitivity areas of this unit. Impacts in these are considered to be acceptable to some degree due to sections of these system-fringes that are severely affected by bush encroachment resulting in reduced sensitivity in some areas. It is however vital sufficient mitigation measures are implemented in order to minimise impacts as far as possible.

The ecological sensitivity assessment identified those parts of the site that have high conservation value or that may be sensitive to disturbance. The habitats considered most sensitive on the site include:

» Duneveld
» Larger drainage channels
» Rocky outcrops
» Undulating calcrete and sandy plains

These areas are avoided by the proposed infrastructure, which is located largely in an area of low sensitivity as is indicated in Figure 14.2. From an ecology perspective, it is not expected that the development will compromise the survival of any specific flora or terrestrial vertebrate species on the study area or beyond if mitigation measures are fully implemented. The most significant impacts are expected to be on ecosystem health and functionality, which should remain relatively intact if all mitigation recommendations are implemented.

#### *14.1.2. Impact on Soils, Land Capability and Agricultural Potential*

Hutton soils which occur on the broader site (Portion 7 and 9 of Portion 4 of the Farm Namakwari 656) are highly prone to wind erosion due to the sandy texture of the soil. It is, therefore, important that there should be strict adherence to the Environmental Management Programme and good soil management measures regarding the management of stormwater runoff and water erosion control should be implemented during all phases of the project. With the implementation of good soil management measures the impact of the PV Facility on soils can be managed to an acceptable level, without significant erosion issues during the lifespan of the facility.

The study area has limited agricultural potential, and the proposed development area is aligned to avoid key grazing areas located in dune areas. The significance of agricultural impacts is influenced by the fact that the site has extremely limited agricultural potential, with a land capability of class 7, non-arable, low potential grazing land. The site is used only for grazing of cattle. No agriculturally sensitive areas occur within the proposed Kheis Solar Park 3 footprint. The major limitations to agriculture are the aridity and lack of access to water, as well as the very sandy soils with limited water and nutrient holding capacity, and in some places limited soil depth. The development will have **low to medium** negative impacts on agricultural resources and productivity. The conclusion of this assessment is that from an agricultural impact perspective the development can proceed as proposed, subject to the recommended mitigation measures provided being implemented.

#### *14.1.3. Visual Impacts*

Kheis Solar Park 3 is expected to have a negligible visual impact on residents of homesteads in close proximity (2km) from the development due to the absence of these sensitive receptors close to the facility. The facility could potentially have a low visual impact on road users travelling along the secondary road traversing north of the site. Site-specific mitigation measures are recommended in order to reduce/mitigate this potential visual impact. Kheis Solar Park 3 is expected to have a low visual impact on the FM Safari Game Farm due to the separation distance between this game farm and the facility (i.e. more than 4km).

During the decommissioning or post-closure phase of the project, all of the infrastructure will be removed, recycled or re-used off-site. The residual visual impacts of the site are expected to include scarring of the landscape in the areas affected by infrastructure. With the implementation of appropriate management measures such as rehabilitation of disturbed areas and planting of vegetation and visual screening methods at receptors / key viewpoints, this scarring and visual impact could be reduced and removed in the long-term.

The anticipated visual impacts identified through the EIA process (post mitigation measures) are on average expected to be of low significance. The Kheis Solar Park 3 development is therefore not considered to be fatally flawed from a visual perspective.

#### *14.1.4. Impacts on Heritage and Paleontological Resources*

There were no heritage sensitive areas identified on the Kheis Solar Park 3 site. Two heritage artefacts of low heritage significance occur outside the development footprint for Kheis Solar Park 3 and will not be impacted by the development footprint of the PV facility. There is no heritage no go areas within the site development footprint for Kheis Solar Park 3.

This study has identified that of the geological units that underlie the project area only the Gordonia Formation is potentially fossiliferous and may be negatively impacted. The Gordonia Formation is present within Kheis Solar Park 3, but only as a thin veneer of reworked sand. The potential risk of any negative impact within Kheis Solar Park 3 is also categorised as improbable due to the absence of substantial thicknesses of Gordonia Formation sands in that project area

The impact of the project on **heritage resource** is rated as **low significance**. However, a preconstruction walk-through survey by an archaeologist is recommended to be undertaken for the PV facility and associated infrastructure. Should substantial archaeological or paleontological (fossils) remains or graves be exposed during construction, SAHRA should be alerted as soon as possible such that appropriate action (e.g. recording, sampling or collection) can be taken by a professional archaeologist or palaeontologist. It is recommended that a close examination of all excavations be made while they are occurring during construction within the Gordonia Formation sands.

#### *14.1.5. Social and Economic Impacts*

The proposed project could have negative and positive **social and economic impacts** of **low (negative) and high (positive) significance** for post mitigation and enhancement respectively. Kheis Solar Park 3 20MW facility will provide opportunities for employment and skills development in the local area during both the construction and operational phases. Another potential spin-off from the development is the stimulation of the local economy, including development of industries specifically to provide services and goods for solar facilities, and general retail businesses and accommodation. Potential negative impacts include the threats to public safety from construction and traffic activity, potential increased crime and health risks such as HIV/Aids particularly during construction and if people move into the area hoping to secure jobs. Social dissent is also possible if people perceive that recruitment processes are unfair and biased. Other impacts on the social environment include impacts associated with traffic and infrastructure (such as local roads). It is important that potential negative effects are managed as per the recommended mitigation measures to prevent these from developing into unacceptable cumulative impacts. Positive impacts of job creation and stimulation of the local economy can be progressed and cumulatively contribute to a desired outcome if enhancements measures (as contained in the socio-economic specialist study and draft EMPr) are implemented.

### 14.2. Assessment of Potential Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site-specific developments. This however, is beyond the scope of this study. The alignment of renewable energy developments with South Africa's IRP and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The Kheis Solar Park 3 facility falls within the identified geographical areas most suitable for the rollout of the development of solar energy projects within the Northern Cape Province, as identified within the Northern Cape SDF. This implies that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented. It is also important to note that it is unlikely that all proposed renewable energy facilities located in the 25km radius (as detailed in chapter 13) will be built in the short to medium term (i.e. 5years) due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets by the DoE. This will reduce the potential for cumulative impacts within this period. Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Kheis Solar Park 3 facility will be of **low to moderate** significance in the region and **low to moderate** within the Kheis Solar Park project site.

### 14.3 Comparison of Technology Alternatives

Impacts on the environment associated with the project will be influenced by the type of PV panel array to be implemented. PV technologies being considered for the proposed project are fixed and tracking, to be developed with a 110ha development footprint. For the majority of impacts, the two alternative PV technologies do not differ in any significant way. Therefore, there is no significant difference in the potential impacts associated with the alternatives. In terms of the specialist studies undertaken, the following conclusions were made regarding the preferred PV technology alternatives:

| | **Fixed** | **Tracking** |
|---|---|---|
| Ecology | Less preferred | Preferred |
| Soils and agricultural potential | No preference | No preference |
| Visual | No preference | Less preferred |
| Heritage & palaeontology | No preference | No preference |
| Social | No preference | No preference |

» ***Ecology*** – Tracking PV technology is ecologically a preferred technology alternative, due to the aridity of the area and the difficulty of new vegetation establishment. Solar panels create a shading effect to the vegetation in the affected area, thereby limiting growth in some cases. Tracking technology results in reduced shading when the panels are tracking the sun (due to the angle in relation to the ground surface). The impact of tracking systems therefore appears to be lower than that of a fixed panel array, even if the latter may occupy less space.
» **Soils and agricultural potential -** The agricultural potential for the proposed development site is low, in terms of impact arising from soils and agricultural potential. There is no significance difference in the potential impacts associated with the two technology alternatives.
» **Visual -** Fixed technology is preferred being that it is less intrusive to sensitive receptors. However, for this particular site there is very little difference in the significance in the potential impacts associated with the two technology alternatives, with views being restricted to within 4km.
» **Heritage and palaeontology -** There is no significance difference in the potential impacts associated with the two technology alternatives as the footprint remains unchanged.
» **Social** - There is no difference in social / economic impacts from either technology alternatives.

There are no impacts of unacceptably high significance associated with either technology alternative assessed for the proposed Kheis Solar Park 3 facility. In addition, there is little or no difference between the impacts associated with the two technology alternatives, apart from the expected difference in impact expected to be associated with ecology. From an environmental perspective both technologies are considered to be environmentally acceptable for implementation at the Kheis Solar Park 3 facility, with a slight preference for tracking technology. The technology preference should therefore be determined on the basis of technical considerations.

From a technical and financial view, a single axis tracker (HIASA) compared to the fixed structure yields production between 20% and 25% higher, depending on the site of installation and on the parameters of the tracker. Although the installation is more expensive initially, the higher yield makes it possible to offer a higher efficiency of the facility and subsequent lower electricity tariffs, making the project more competitive as a business unit. Thus, it is recommended that tracking technology be implemented for the Kheis Solar Park 3 facility.
The developer has confirmed that this is the preferred technology from a technical perspective and can therefore be implemented at this site.

## 14.4 Environmental Costs of the Project versus Benefits of the Project

Environmental (natural environment, economic and social) costs can be expected to arise as a result of the project proceeding. This could include:

» Direct loss of biodiversity, flora, fauna and soils due to the clearing of land for the construction and utilisation of land for the PV project (which is limited to the development footprint of 110 hectares). The cost of loss of biodiversity has been minimised on the Kheis Solar Park 3 PV site through the careful location of the development to avoid key areas supporting biodiversity of particularly high conservation importance.
» 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 being visually impacted to some extent by power lines, as well as the limited number of sensitive receptors located close to (i.e. within 2km) the development site..
» Change in land-use and loss of land available for grazing on the development footprint. The cost in this regard is expected to be limited due to the low agricultural potential and carrying capacity of the property and the fact that current agricultural activities can continue on the remainder of the property during construction and operation.

These costs are expected to occur at a local and site level and are considered acceptable provided the mitigation measures as outlined in this EIA and the EMPr are implemented.

Benefits of the project include the following:

» The project will result in important economic benefits at the local and regional scale through job creation, procurement of materials and provision of services and other associated downstream economic development. These will persist during the preconstruction/ construction and operational phases of the project.

- The project contributes towards the Provincial and Local goals for the development of renewable energy (specifically solar developments) as outlined in the respective SDFs and IDPs.
- The project serves to diversify the economy and electricity generation mix of South Africa by addition of solar energy to the mix.
- South Africa's per capita greenhouse gas emissions are amongst the highest in the world due to reliance on fossil fuels. The proposed project will contribute to South Africa achieving goals for implementation of non-renewable energy and 'green' energy. Greenhouse gas emission load is estimated to reduce by 0.86% for a 500MW coal-fired power station compared to a similar MW PV project, on a like for like basis.

The benefits of the project are expected to occur at a national, regional and local level. As the economic costs to the environment have been largely limited through the appropriate placement of infrastructure on the site within low sensitivity areas, the expected benefits of the project will partially offset the localised environmental costs of the project.

## 14.5. Overall Conclusion (Impact Statement)

The principles of NEMA have been considered in this assessment through the implementation of the principle of sustainable development where appropriate mitigation measures have been recommended for impacts which cannot be avoided. In addition, the successful implementation and appropriate management of this proposed project will aid in achieving the principles of minimisation of pollution and environmental degradation at a national scale.

The EIA process has been undertaken in accordance with the requirements of the EIA Regulations and all effort has been made to involve interested and affected parties, stakeholders and relevant Organs of State such that an informed decision regarding the project can be made by the Regulating Authority. The general objectives of Integrated Environmental Management have been taken into account for this EIA report by means of identifying, predicting and evaluating the actual and potential impacts on the biophysical environment, socio-economic conditions and cultural heritage component. The risks, consequences, alternatives as well as options for mitigation of activities have also been considered with a view to minimise negative impacts, maximise benefits, and promote compliance with the principles of sustainable environmental management.

The technical viability of establishing a solar energy facility with a net generating capacity of 20 MW on a site located on Portion 9 of Portion 4 of Farm Namakwari 656 has been established by Gestamp Asetym Solar South Africa (Pty) Ltd. The positive implications of establishing the Kheis Solar Park 3 facility on the identified site include the following:

» The potential to harness and utilise solar energy resources within the Northern Cape Province.
» The project will assist the South African government at a national, provincial and local level in reaching their set targets for renewable energy.
» The project will assist the South African government in the implementation of its green growth strategy and job creation targets.
» The project will assist the district and local municipalities in reducing levels of unemployment through the creation of jobs, skills development opportunities and support of local business.
» The National electricity grid in the Northern Cape Province will benefit from the additional generated power.
» The project will contribute towards the promotion of clean, renewable energy in South Africa.
» Kheis Solar Park 3 site is located near Grootdrink which located within this Solar Corridor area has which has been ear-marked as a hub for the development of solar energy projects due to the excellent solar resource of the area, as well as the larger centre of Upington acting as load centre.
» Kheis Solar Park 3 site is appropriately located for easy access via a secondary (gravel) road that bridges the Orange River from the N10 national road near Grootdrink; or alternatively via the N14 onto a secondary road heading south next to the site
» Garona- Gordonia 1 132kV OHL power line traversing the proposed site, the project proximity to the national grid connection reduces some of the impacts related to building longer power line to connect to the grid.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that there are **no environmental fatal flaws** that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. The significance levels of the majority of identified negative impacts have been reduced to acceptable levels by implementing the mitigation measures recommended by the specialist team during the EIA process, and this specifically included the consideration of the facility layout in relation to site-specific sensitivities identified. The avoidance of areas of sensitivity is illustrated by the facility layout drawing overlain on the sensitivity map included as Figure 14.2. The project has all environmental constraints, and is considered to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) for the Kheis Solar Park 3 facility included within **Appendix M**.

With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable** provided all measures are taken to protect and preserve surrounding environment.

## 14.6. Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the impacts associated with the development of the Kheis Solar Park 3 project can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation.

The layout plan as presented in Figure 14.2 has been designed to avoid the majority of the sensitive environments on the site including:

» Duneveld
» Larger drainage channels
» Rocky outcrops
» Undulating calcrete and sandy plains
» Heritage sites identified on the broader property

Therefore this layout as presented is considered acceptable and is recommended as the preferred layout for the facility.

The following conditions would be required to be included within an authorisation issued for the project:

» Tracking technology is implemented as a preferred technology alternative from both an environmental and technical perspective.
» The draft Environmental Management Programme (EMPr) as contained within Appendix M of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be the main key in achieving the appropriate environmental management standards as detailed for this project.
» Following the final design of the facility, a final layout indicating all relevant infrastructure and affected areas (permanent and temporary) must be

submitted to DEA for review and approval prior to commencing with construction.

» Duneveld, larger drainage channels, and outcrops should be treated as No Go Zones due to their high conservation value. Even on the undulating calcrete and sandy plains, ground disturbance should be minimised, and existing gravel roads and tracks used as far as possible to lower the extent of the footprint.
» If any protected plant or tree species will be removed/destroyed by the developer, a collection/destruction permit to be obtained from Northern Cape Department of Environment and Nature Conservation and/or DAFF for the protected species found on site as well from the provincial permitting authority.
» A detailed Invasive Plant Management Plan will have to be in place prior to commencement of activity and be diligently followed and updated throughout the project cycle up to the decommissioning phase.
» Sociable weavers' nests occur within the development area should be avoided as far as possible. Nests may only be removed with a permit and by a suitably qualified specialist, supervised by conservation staff. Undertake pre-construction walk-through footprint investigations for protected flora and burrowing terrestrial vertebrates.
» Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be implemented.
» All infrastructures, including access roads and other on-site infrastructure must be planned so that the clearing of vegetation is minimised.
» Site rehabilitation of temporary laydown and construction areas to be undertaken immediately after construction.
» Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to provide input into rehabilitation specifications.
» Develop an emergency maintenance plan to deal with any event of contamination, pollution, or spillages during construction and operation.
» Compile a comprehensive storm-water management method statement, as part of the final design of the project and implement during construction and operation.
» All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.
» An independent Environmental Control Officer (ECO) must be appointed by the project developer prior to the commencement of any authorised activities.
» Applications for all other relevant and required permits required to be obtained by the developer and must be submitted to the relevant regulating authorities.

# REFERENCES CHAPTER 8

**Ecology Study**

Apps, P. (ed). 2000. Smither's Mammals of Southern Africa. A field guide. Random House Struik, Cape Town, RSA

Bromilow, C. 2010. Problem plants and alien weeds of South Africa. Briza Publications, Pretoria, RSA.

Channing, A. 2001. Amphibians of Central and Southern Africa. Protea, Pretoria.

Channing, A., Poynton, P., Minter, L., Howell, K., & Harrison, J. 2004. *Pyxicephalus adspersus*. In: IUCN Red List of Threatened Species. Version 2013.1.

Germishuizen, G. and Meyer, N.L. (eds). 2003. Plants of southern Africa: an annotated checklist. Strelitzia 14. South African National Biodiversity Institute, Pretoria.

Henderson, L. 2001. Alien weeds and invasive plants: A complete guide to declared weeds and invaders in South Africa. Agricultural Research Council, Paarl Printer, Cape Town.

Hennekens, S. T. and J. H. J. Schaminée. 2001. "TURBOVEG, a comprehensive data base management system for vegetation data." Journal of Vegetation Science 12: 589-591.

Hill, D. and R. Arnold. 2012. Building the evidence base for ecological impact assessment and mitigation. Journal of Applied Ecology 49(1): 6-9.

Hoffman, T. & Ashwell, A. 2001. Nature divided: Land degradation in South Africa. University of Cape Town Press, Cape Town.

Kremen, C. 2005. Managing ecosystem services: what do we need to know about their ecology? Ecology Letters 8: 468-479.

Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. & Kloepfer, D. (eds). 2004. Atlas and Red Data book of the frogs of South Africa, Lesotho and Swaziland. SI/MAB Series no. 9. Smithsonian Institution, Washington, D.C.

McCune, B. and M. J. Mefford. 2006. PC-ORD. Multivariate Analysis of Ecological Data. Version 5.19 MjM Software, Gleneden Beach, Oregon, U.S.A.

Mucina, L, & Rutherford, M.C. (Eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Mucina, L., Bredenkamp, G.J., Hoare, D.B. & McDonald, D.J. 2000. A National vegetation database for South Africa. South Africa Journal of Science 96:497-498.

Mueller-Dombois, D. & Ellenberg, H. 1974. Aims and methods of vegetation ecology. Wiley, New York.

Perlman, D.L., and Milder, J.C. 2005. Practical ecology for planners, developers and citizens. Island Press, Washington.

Raimondo, D., Von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C. Kamundi, D.A. & Manyama, P.A. (Eds.). 2009. Red list of South African plants 2009. Strelitzia 25:1-668.

Reinecke, J., Ntisana, A., Poni, S.N.L. 2013. Renewable Energy EIA Application Mapping Report Version 1. Centre for Renewable and Sustainable Energy Studies (CRSES), Council for Scientific and Industrial Research (CSIR), Pretoria.

Skinner, J.D. & Chimimba, C.T. 2006. The Mammals of the Southern African Sub-Region, 3rd edition. Cambridge.

Strohbach, M. 2012. Mitigation of ecological impacts of renewable energy facilities in South Africa. The Sustainable Energy Resource Handbook (Renewable Energy) South Africa 4: 41 – 47.

Strohbach, M. 2013. Ecological Scoping Report: Boundary Solar Energy Facility. Savannah Environmental, Sandton, RSA.

Tichý, L. 2002. JUICE, software for vegetation classification. *Journal of Vegetation Science* 13:451-453.

Tsoutsos, T., Frantzeskaki, N. & Gekas, V. 2005. Environmental impacts from the solar energy technologies. Energy Policy 33 (3): 289-296.

Turney, D. & Fthenakis, V. 2011. Environmental impacts from the installation and operation of large-scale solar power plants. Renewable and Sustainable Energy Reviews, 15: 3261-3270.

UNCCD: United Nations Convention to Combat Desertification, 1995.

Westhoff, V. & Van der Maarel, E. 1978. The Braun-Blanquet approach. In: Whittaker, R.H. (ed.) Classification of plant communities. W. Junk, The Hague.

Wynberg, R. 2002. A decade of biodiversity conservation and use in South Africa: tracking progress from the Rio Earth Summit to the Johannesburg World Summit on Sustainable Development. South African Journal of Science 98: 233 – 243.

**Legislation:**

The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)

The Environment Conservation Act, 1989 (Act No. 73 of 1989)

The National Environment Management Act, 1998 (Act No. 107 of 1998)

The National Environmental Management Biodiversity Act, 2004. (Act 10 0f 2004). Government Gazette RSA Vol. 467, 26436, Cape Town, June 2004.

The National Environmental Management Biodiversity Act, 2004. (Act 10 0f 2004). National List of Ecosystems that are threatened and in need of protection. Government Gazette RSA Vol. 1002, 348093, Cape Town, 9 Dec 2011.

The Natural Scientific Professions Act (Act 27 of 2003)

The Nature Conservation Ordinance (NCO) 8 of 1969 and subsequent amendments

The Free State Conservation Bill (Provincial Act 23 of 2010)

**Websites:**

AGIS, 2007. Agricultural Geo-Referenced Information System, accessed from www.agis.agric.za on [29 March 2013]

ADU, 2012. Animal Demography Unit, Department of Zoology, University of Cape Town. : http://vmus.adu.org.za

BGIS: http://bgis.sanbi.org/website.asp

SANBI databases: http://posa.sanbi.org/searchspp.php

http://SIBIS.sanbi.org

Climate : http://en.climate-data.org/location/636/

http://www.meteoblue.com/en_ZA/weather/charts/yearclimate/kimberley_za_43860

http://www.worldweatheronline.com/Kimberley-weather-averages/Northern-Cape/ZA.aspx

**Heritage Study**

Beaumont, P.B. & Morris, D. Guide to archaeological sites in the Northern Cape. Kimberley: McGregor Museum.

Beaumont, P.B. 1990. Rosebery Plains. In Beaumont, P.B. & Morris, D. Guide to archaeological sites in the Northern Cape. Kimberley: McGregor Museum.

Butzer, K.W. 1976. A settlement archaeology project in the Alexandersfontein Basin (Kimberley). Palaeoecology of Africa 9:144-145. Beaumont, P.B. & Morris, D. 1990. Archaeological sites in the Northern Cape. Kimberley: McGregor Museum.

Butzer, K.W., Fock, G.J., Stuckenrath, R. & Zilch, A. 1973. Palaeohydrology of Late Pleistocene Lake, Alexandersfontein, Kimberley, South Africa. Nature 243:328-330.

Deacon, J. nd. Archaeological Impact Assessment - specialist input to planning and design. Unpublished notes compiled for the National Monuments Council.

Fock, G.J. & Fock, D.M.L. 1989. Felsbilder in Südafrika Teil III: Die Felsbilder im Vaal Oranje Becken. Köln: Böhlau Verlag.

Morris, D. 1988. Engraved in place and time: a review of variability in the rock art of the Northern Cape and Karoo. South African Archaeological Bulletin 43:109 121.

Morris, D. 1999. A phase 1 archaeological impact assessment: proposed Combined Treatment Plant and associated Haul Roads, Kimberley. Unpublished Report to De Beers Consolidated Mines Ltd.

Morris, D. 2000. Gamsberg Zinc Project environmental impact assessment specialist report: archaeology.

Morris, D. 2002. Palaeoenvironmental, archaeological and historical aspects of Benfontein and Alexandersfontein Pan. Report for De Beers.

Morris, D. 2011. Wag'nBiekiespan Solar Energy Facility: Specialist Input for the Environmental Management Programme for the Proposed Wag'nBiekiespan Solar Energy Facility near Boshof, Free State Province: Archaeology. Report prepared for Savannah Environmental.

Sampson, C.G. (1985). Atlas of Stone Age settlement in the central and upper Seacow Valley. Memoirs of the National Museum 20.

Whitelaw, G. 1997. Archaeological monuments in KwaZulu-Natal: a procedure for the identification of value. Natal Museum Journal of Humanities. 9:99-109.

**Paleontological Study**

Cainozoic Sak River terraces, near Brandvlei, Bushmanland, South Africa. *Palaeontologiaafricana*, 30, pp. 71-80.

Cornell, D.H., Thomas, R.J., Moen, H.F.G., Reid, D.L. Moore, J.M., and Gibson, R.L.(2006). *The Namaqua-Natal Province*. In Johnson, M.R., Anhaeusser, C.R. and Thomas,R.J. (eds) *The Geology of South Africa*, Johannesburg: Council for Geoscience, Pretoria:Geological Society of South Africa, pp. 325-379

Full Palaeontological Impact Assessment Report – Gestamp Asetym Solar South Africa (Pty)

Ltd's proposed solar energy facilities near Grootdrink, Northern Cape Province

De Wit, M.C.J. (1990). Palaeoenvironmental interpretation of Tertiary sediments at Bosluispan, Namaqualand. *Palaeoecology of Africa and the Surrounding Islands*, 21, pp.101-118.

Geological Survey of South Africa (1979). 1: 250 000 geological map series 2820 Upington.

Kent, L.E. and Gribnitz, K.H. (1985). Freshwater shell deposits in the northwestern Cape Province: further evidence for a widespread wet phase during the Late Pleistocene in Southern Africa. South African Journal of Science, 61, pp. 361-370.

Macey, P.H., Siegfried, H.P., Minnaar, H., Almond, J. And Botha, P.M.W. (2011). The geology of the Loerisfontein Area. Explanation of 1: 250 000 Geology Sheet 3018. Council for Geoscience, 139 pp.

Moen, H.F.G. (1980, Unpublished). *Petrology and geological setting of the Wilgenhoutsdrif Formation, northern Cape Province*. M.Sc thesis, University of the Orange Free State, Bloemfontein, 287 pp.

Moen, H.F.G. (2007). *The geology of the Upington area*. Explanation: Sheet 2820 Scale 1: 250 000. Council for Geoscience. 160 pp.

Moore, A.E. and Dingle, R.V. (1998). Evidence of fluvial sediment transport of Kalahari sands in central Botswana. *South African Journal of Geology*, 101, pp: 143-153.

Mucina, L. and Rutherford, M.C. (Eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelizia* 19. South African National Biodiversity Institute, Pretoria.

Partridge, T.S., Botha, G.A., and Haddin, I.G. (2006). *Cenozoic deposits of the interior*.In Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J. (eds) *The Geology of South Africa*, Johannesburg: Council for Geoscience, Pretoria: Geological Society of South Africa, pp. 585-604.

Republic of South Africa (1998). National Environmental Management Act (No 107 of1998). Pretoria: The Government Printer.

Republic of South Africa (1999). National Heritage Resources Act (No 25 of 1999). Pretoria: the Government Printer.

Senut, B. and Pickford, M. (1995). Fossil eggs and Cenozoic continental biostratigraphy of Namibia. Palaeontologia africana, 32, pp. 33-37.

Senut, B., Pickford, M., Ward, J., De Wit, M., Spaggiari., R. and Morales, J. (1996). Biochronology of the Cainozoic sediments at Bosluis Pan, Northern Cape Province, South Africa. South African Journal of Science, 92, pp. 249-251.

**Soil Study**

Agricultural Research Council. Undated. AGIS Agricultural Geo-Referenced Information System available at http://www.agis.agric.za/.

Water Research Commission. Undated. South African Rain Atlas available at http://134.76.173.220/rainfall/index.html.

**Social Study**

Burdge, Rabel J. and Frank Vanclay. (1995). *Social Impact Assessment: State of the Art.*

DEA&DP Guideline for involving Economic Specialists in the EIA processes (2005)

D. Pierce, et al. (1989).*Blueprint for a Green Economy*. Earthscan Publications Limited.

Guidelines for Social Assessment Specialists in EIA Processes. Department of Environmental Affairs and Development Planning, Western Cape Province (2006).

Integrated Resource Plan (IRP) for South Africa (2010-2030).

Kheis Municipality Integrated Development Plan (2012-2017).

Northern Cape Provincial Development and Resource Management Plan/PSDF (July 2012).

The Employment Equity Act no. 55 of 1998.

The National Energy Act, 2008.

The National Environmental Management Act 107 of 1998 (NEMA).

The White Paper on Renewable Energy, November 2003.

ZF Mgcawu District Municipality Integrated Development Plan (2010/2011).

StatsSA Community Survey. (2007).

Velasquez, M. G.(1985). *Ethics: Theory and Practice*.

Vanclay, F. (2002). *Conceptualising Social Impacts.* Environmental Impact Assessment Review.

Van Zyl, H.W., de Wit, M.P. &Leiman, A. 2005*. Guidelines for DEA&DP for involving Economic Specialists in EIA processes.*

**Internet Sources**

www.grootdrink.co.za

www.kheis.co.za

http://www.nwu.ac.za

http://www.nra.co.za/content/Siyanda

**Interviews (Attempted and concluded)**

FrankieTaljaard – Land Owner

Teresa Scheepers – Kheis LM Municipal Manager

Pieter Kriel – FM Safari's

**Visual Impact Study**

Chief Directorate National Geo-Spatial Information, varying dates. 1:50 000 Topo-cadastral Maps and Data.

CSIR/ARC, 2000. National Land-cover Database 2000 (NLC 2000).

DEADP, Provincial Government of the Western Cape, 2011. Guideline on Generic Terms of Reference for EAPS and Project Schedules

Department of Environmental Affairs and Tourism (DEA&T), 2001. Environmental Potential Atlas (ENPAT) for the Northern Cape Province

Google Inc. (Varying dates). Google Earth Satellite Images.

National Botanical Institute (NBI), 2004. Vegetation Map of South Africa, Lesotho and Swaziland (Unpublished Beta Version 3.0)

Oberholzer, B. (2005). Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1.

The Environmental Impact Assessment Regulations. Government Gazette Nr 33306, 18 June 2010.