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Environmental Impact Assessment for the Proposed Two Phase Photovoltaic Solar Power Park on Portion 0 of the Farm Rooipunt 617, Gordonia RD, near Upington in the Northern Cape

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PROJECT 25699BPWE - ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED TWO PHASE PHOTOVOLTAIC SOLAR POWER PARK ON PORTION 0 OF THE FARM ROOIPUNT 617, GORDONIA RD, NEAR UPINGTON IN THE NORTHERN CAPE

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for internal review	C Retief	JC Pretorius	J Harris	2014-06-06	N/A	

CONTENTS

Appendices

ACRONYMS

ARC-ISCW	Agricultural Research Council Institute for Soil, Climate and Water
ARI	Acute Respiratory Infections
BID	Background Information Document
CAGR	Compounded Annual Growth Rate
CAR	Co-ordinated Avifaunal Road-count
COPD	Chronic Obstructive Pulmonary Disease
CSP	Concentrated Solar Power
CWAC	Co-ordinated Waterbird Count
DEA	Department of Environmental Affairs
DNI	Direct Normal Irradiance
DTEEA	Department of Economic Development, Tourism and Environmental Affairs
EC	Electrical Conductivity
ECO	Environmental Control Officer
EDI	Electro-deionization
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment

EIAR	Environmental Impact Assessment Report
EMP	Environmental Management Programme
ERM	Environmental Resources Management
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GHG	Green House Gas
GN	Government Notice
GRU	Groundwater Resource Units
I&APs	Interested & Affected Parties
IDP	Integrated Development Plan
IPP	Independent Power Producer
NEMA	National Environmental Management Act
NERSA	National Energy Regulator of South Africa
NGOs	Nongovernmental Organizations
NGDB	National Groundwater Database
QDGS	Quarter Degree Square
RO	Reverse Osmosis

SAHRA	South African Heritage Resources Agency
SANBI	South African Biodiversity Institute
SDF	Spatial Development Framework

ABBREVIATIONS

%	Percentage
cm	Centimetres
CO2	Carbon Dioxide
GWh	Giga Watt Hour
ha	Hectares
kg	Kilograms
km	Kilometres
km2	Square kilometres
kV	Kilovolt
m	Metres
mamsl	Meters above mean sea level
mbgl	Meters below ground level
MW	Mega Watts
m2	Square meters
R	South African Rand
$	US Dollar

DEFINITIONS AND TERMINOLOGY

Alternative:

A possible course of action, in place of another, that would meet the same purpose and need (of the proposal). Alternatives can refer to any of the following but are not limited to: alternative sites for development, alternative projects for a particular site, alternative site layouts, alternative designs, alternative processes and alternative materials.

Cumulative Impacts:

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

Direct impacts:

Impacts that are caused directly by the activity and generally occur at the same time and at the same 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.

Environment:

The surroundings within which humans exist and that are made up of:

- the land, water and atmosphere of the earth;
- micro-organisms, plant and animal life;
- any part or combination of (i) and (ii) and the interrelationships among and between them; and

- The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being. This includes the economic, social, cultural, historical and political circumstances, conditions and objects that affect the existence and development of an individual, organism or group.

Environmental Assessment:

The generic term for all forms of environmental assessment for projects, plans, programmes or policies. This includes methods/tools such as environmental impact assessment, strategic environmental assessment, sustainability assessment and risk assessment.

Impact:

The positive or negative effects on human well-being and / or on the environment.

Environmental Management:

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

Environmental Management Programme:

An operational programme that organizes and coordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its on-going maintenance after implementation.

Extraterrestrial Radiation

Extraterrestrial radiation is the intensity (power) of the sun at the top of the Earth's atmosphere. It is usually expressed in irradiance units (Watts per square meter) on a plane normal to the sun. It varies throughout the year because of the Earth's elliptical orbit, which results in the Earth-Sun distance varying during the year in a predictable way

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 supplies water to a reservoir that supplies water to that activity). These types if impacts include all of 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 Parties (I&APs):

Individuals, communities or groups, other than the Applicant or the authorities, whose interests may be positively or negatively affected by the proposal or activity and/or who are concerned with a proposal or activity and its consequences.

Competent (Lead) Authority:

The environmental authority at the national, provincial or local level entrusted in terms of legislation, with the responsibility for granting approval to a proposal or allocating resources and for directing or coordinating the assessment of a proposal that affects a number of authorities.

Mitigate:

The implementation of practical measures to reduce adverse impacts or enhance beneficial impacts of an action.

Scoping:

The process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addresses in an environmental assessment. The main purpose of scoping is to focus the environmental assessment on a manageable number of important questions. Scoping should also ensure that only significant issues and reasonable alternatives are examined.

Significance:

Significance can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change (i.e. magnitude, intensity, duration and likelihood). Impact significance is the value placed on the change by different affected parties (i.e. level of significance and acceptability). It is an anthropocentric concept, which makes use of value judgments and science-based criteria (i.e. biophysical, social and economic).

Stakeholder engagement:

The process of engagement between stakeholders (the Applicant, authorities and I&APs) during the planning, assessment, implementation and/or management of proposals or activities.

1. EXECUTIVE SUMMARY

SolarReserve SA (Pty) Ltd (hereafter referred to as SRSA) proposes to construct and operate the planned Rooipunt Solar Power Park in the proximity of Upington in the Northern Cape Province. As such, SRSA has appointed WorleyParsons RSA as independent Environmental Assessment Practitioners (EAP) to conduct the Scoping and the Environmental Impact Assessment (EIA) for the proposed project. The general project details are contained in Table 1 below.

With respect to the various technologies proposed for the Rooipunt Solar Power Park, both an Integrated Environmental Impact Assessment (EIA) application will submitted to Department of Environmental Affairs (DEA) in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), the National Environmental Management: Waste Act (Act 56 of 2006) (NEM:WA) and the EIA Regulations with respect to the proposed Concentrated Solar Power technology.

However the Photovoltaic (PV) technology proposed does not entail the undertaking of a listed waste activity, as classified under the NEM: WA, thus prompting that a separate EIA Application was submitted to the DEA with respect to the PV Technology developments. The application was submitted in terms of NEMA and the associated EIA Regulations as promulgated in 2010. The PV Application was accepted on 10 January 2012. The Scoping Report for the project has received approval from DEA but during the Draft EIA phase of the project it has become apparent that an amendment of the layout of the facility was required. The required amended application forms were submitted to DEA to amend the projects as follow:

PHASE 1: 75MW PV (DEA REF 12/12/20/2488/01)

The original project consisted of a PV development of 150 ha which was intended to have generated 75 MW to be fed into the national grid.

Amendment

Phase 1 will now consist of a PV development of 300 ha which will a generation capacity of up to 100 MW to be fed in to the national grid.

PHASE 2 : 75MW PV (DEA REF 12/12/20/2488/02)

The original application was made for a PV development of 150 ha which was intended to have generated 75 MW to be fed into the national grid.

Amendment

Phase 2 will now consist of a PV development of 300 ha which will have a generation capacity of up to 100 MW to be fed in to the national grid.

PHASE 3 : 75MW PV (DEA REF 12/12/20/2488/03)

The original application was made for a PV development of 150 ha which was intended to have generated 75 MW to be fed into the national grid.

Amendment

This application was formally retracted.

This Draft EIA for the aforementioned PV projects will be provided to all Interested and Affected Parties (I&AP's) for comment during the public review period. The availability of this Draft EIA for comment will be corresponded to all I&AP's in due course.

SPECIALIST STUDIES AMENDMENT

As a result of the aforementioned amendments, the specialist studies were amended accordingly where required.

The site will cater for multiple solar projects, namely Photovoltaic (PV) and CSP. This report however provides a description of both the PV and CSP developments, but is focused on the PV developments – the CSP description is merely for reference purposes.

Table 1: Project Overview

Requirement	Details
General Solar Power Park Information	
Description of all affected farm Portions	Portion 0 of the Farm Rooipunt 617 Gordonia RD
Geographical Co-ordinates	S28°28'32.6" E21°01'22.1"

Requirement	Details
Photos of areas that give a visual perspective of all parts of the site	Site photographs contained in Appendix B **of the EIAR (Final Scoping Report: Appendix A)**
Generation capacity of the facility as a whole at delivery points	The facility will be 225-325 MW
Solar Power Generation Technology	The Solar Power Park will incorporate both Photovoltaic (PV) and Concentrated Solar Power (CSP) technology. However for the purpose of this Environmental Impact Assessment only PV technology will be reviewed and assessed.
Solar Park Development	The project as a whole will be developed in three phases as follow : – Phase 1: PV Development 1: – Phase 2: PV Development 2: This Application – Phase 4: CSP Development 100-200MW **The phases will not be developed in chronological order. This report only pertains to the PV development.**
Photovoltaic (PV) Developments	
PV design specifications	Two (2) 75-100 MW PV blocks (phases) is proposed. Each development will cover a surface area of approximately 300 ha (dependent on panel design technology used). The PV panels converts sunlight into electrical DC currant. The DC currant will be distributed to an inverter and transformer, which will feed power into the grid network.
Type of technology	PV technology will be determined during the final design phase.
Structure heights	PV panels are estimated to be roughly 3 m high.
Surface area to be covered	Each PV block (phase) requires 300 ha of surface area – thus a total of 600 ha will be required for all two (2) PV block (phases).
Structure orientation	Two (2) 75 - 100 MW PV power blocks with inverter and transformer collection.
Laydown area dimensions	81 ha

Requirement	Details
PV Generation capacity	The total generation capacity for the PV facility will be an estimated to be between 150 and 200 MW. The final capacity figures will only be available once grid connection has been concluded, the plant designs have been finalised and IPP status has been awarded.

The EIA process will determine the potential impact of the facility and whether it can be sustainably constructed and operated by negating potential negative impacts through the identification and implementation of suitable mitigation measures.

The proposed project aims to utilise the abundant and renewable solar resource to generate electricity and effectively create Green House Gas emission saving, whilst creating employment, skills development opportunities and stimulating the local and national economies. The experience and expertise of the Applicant and the successes with similar projects worldwide will introduce new technology and create knowledge and develop new skills in the country.

This Scoping Report (SR) (contained in Appendix B) provided the background to the project, describing the site, introducing the proposed technology and alternatives and identifying the possible impacts on the environment. It also outlines the Public Participation Process (PPP) that was followed, presented the Plan of Study (PoS) for the EIA which was adopted during the EIA phase and made recommendations to be considered during the EIA process.

This EIAR follows on the approved SR and addresses the impacts identified in the SR. This includes the required amendments and additional information as requested by the DEA – refer to Appendix A. Discussions with the DEA defined the detailed scope of work required to undertake the EIA.

SRSA made a conscious decision based on the recommendations and guidelines by the DEA to undertake 13 independent specialist assessments in order to assess both significant and less significant environmental impacts proposed by the development. The anticipated impacts were assessed in detail by a range of independent specialists and mitigation measures proposed to reduce any significant impacts. These mitigation measures are included in the EMP contained in Appendix Q.

The following detailed independent specialist studies were conducted:

- Heritage;
- Visual;
- Biodiversity;

- Avi-fauna;
- Surface hydrology;
- Wetland;
- Socio-economic;
- Air quality;
- Noise;
- Soils and Agriculture Potential;
- Geotechnical Assessment;
- Traffic
- Geohydrology; and
- Tourism.

In addition to the aforementioned independent specialist assessments, an independent sensitivity mapping analysis was undertaken. This analysis characterised the development site with regards to the significant environmental aspects in order to reflect the sites suitable and unsuitable (no-go) development footprint areas. This action guided the final footprint of the PV Plant(s).

The proper procedures were conducted in the performing of the public participation process. All commenting authorities, stakeholders and registered Interested and Affected parties (I&AP's) will be involved throughout the PPP – their inputs, issues and concerns will be considered by the EAP and addressed adequately.

The impacts identified and assessed by the specialist impact assessments and the sensitivity analysis conducted, allowed for the development of effective mitigation measures (Environmental Management Plant) (EMP)). The findings of these specialist impact assessments, which through the application of the proposed mitigation measures (EMP) is anticipated to decrease the impacts to such an extent that none of the impacts poses a significant threat to the environment and as such is recommended to be authorised.

2. INTRODUCTION

The ever increasing and growing demand for energy as well the need to find more sustainable and environmentally friendly energy resources have prompted developers to explore new energy generation options.

In an effort to utilise renewable energy resources, SolarReserve SA (Pty) Ltd (hereafter referred to as SRSA) is proposing to construct a 225 - 325 MegaWatt (MW) Solar Power Park on Portion 0 of the Farm Rooipunt 617 Gordonia RD, ZF Mgcawu District Municipal Region, comprising of both Photovoltaic (PV) and Concentrated Solar Power (CSP) Technology.

This report only assesses and defines the ***PV technology*** proposed for the development. The proposed development site is situated an approximate 20 km outside of the town Upington (refer to Figure 2), within the institutional boundaries of the Kai !Garib Local Municipality and ZF Mgcawu District Municipality. Because of the distance of the site to Upington, the //Khara Hais Municipality is also included to address any trans-boundary impacts

In terms of the Environmental Impact Assessment (EIA) Regulations (August 2010) promulgated under Sections 24 and 24D of the National Environmental Management Act (Act No. 107 of 1998) (NEMA) various aspects of the intended development are considered listed activities which may have an impact on the environment, therefore requiring authorisation from the National Department of Environmental Affairs (DEA) prior to the commencement of such activities.

SRSA (the Applicant) has appointed Worley Parsons RSA as independent Environmental Assessment Practitioners (EAP) to the project in fulfilment of legislative requirements in support of an application for Environmental Authorisation (EA).

2.1 PROJECT OVERVIEW

SRSA intends to construct and operate a Photovoltaic (PV) Solar Power Plant in the Kai !Garib Local Municipality, in the Northern Cape. The proposed Rooipunt Solar Power Park entails the construction and operation of one (1) CSP development, two (2) PV developments, associated infrastructure and services for the provision of renewable electricity to the national power grid. This EIAR pertains specifically to the PV Phases 1 – 2 development.

This Greenfields project entails the transformation of agricultural land to accommodate the proposed Solar Power Park, associated infrastructure and services. The infrastructure proposed for the entire Solar Power Park (project) includes but is not limited to inter alia:

2.1.1 PV Technology Specific Infrastructure

The proposed PV developments will entail the following infrastructure –

- Two (2) PV Developments with a generation capacity of between 150 – 200 MW comprising of 300 ha each;
- DC-AC current inverters and transformers.

2.1.2 CSP Technology Specific Infrastructure

As a CSP Project is also proposed for the site, it was deemed necessary to include an overview of these technology infrastructure requirements for completeness sake.

The technology infrastructure requirements of this technology include –

- A collector field (heliostat field) consisting of approximately between 10 000 and 17 500 dual-axis tracking heliostats, each approximately between 64 m^2 - 116 ^{m2}, providing approximately 1 200 000 m^2 of reflective surface area;
- An approximately200 meter tall slip-form concrete tower and thermal receiver rated at approximately 565 MW thermal (MWt);
- A thermal to electric power block with an approximately 115 MW reheat and multiple extractions high temperature subcritical steam turbine and generator;
- Two molten salt thermal storage tanks;
- An air-cooled condenser and/or a cooling tower for the steam cycle in order to minimise the consumption of water;
- An evaporation pond consisting of three (3) compartments with a combined area of approximately 8.0 ha, to completely contain all rejected water from the water treatment system and the steam cycle;
- Two (2) liquid gas auxiliary burners for start-up;
- Two (2) emergency diesel generators.

2.1.3 Other Associated Infrastructure

In order for the applicant to operate the proposed Facility/Solar Power Park, it is necessary that auxiliary infrastructure also be assessed and reviewed in this report. Auxiliary infrastructure that will be defined as part of the PV development includes, but is not limited to the following items –

- Water reticulation and purification works. This includes water reticulation from the Orange River for industrial water use, and a water treatment and purification system to provide water for both domestic and process use;
- Sewer reticulation and treatment works;
- Roads and storm water infrastructure;
- Substation/Switching station of approximately 100 m x 100 m and overhead power lines (OHL) for the evacuation of the power (please note the authorisation of the overhead distribution lines will be applied for separately from this EIA);
- Construction camp - accommodation and sanitation facilities for approximately 600 people (both CSP and PV allocation), with respect to the PV development it is estimated that approximately 350 people will have to be accommodated in the proposed man-camp ;
- Administrative and office buildings;
- Visitors centre;
- Equipment and materials lay down area;
- Assembly Plant;
- Concrete batching plant;
- Vehicle workshops and wash bays;
- Fuel storage area;
- Temporary general waste storage facility; and
- Hazardous material storage facility.

Prior to the commencement of any construction activities it is required that all required EA be obtained in relation to all the relevant national legislation.

2.2 PURPOSE OF THIS ENVIRONMENTAL IMPACT ASSESSMENT REPORT

This EIAR follows on the Scope of Work delineated in the detailed Scoping Report (SR) and Plan of Study (PoS). The SR outlined the scope of the project in great detail and set the scene for the detailed assessment that was conducted during the EIA phase. Existing information and input from specialists, commenting authorities, Interested and Affected Parties (I&AP's) was used to identify and evaluate potential environmental impacts (both social and biophysical) associated with the proposed project. No environmental fatal flaws associated with the proposed project were identified through the SR. A conscious decision was made based on the recommendations and guidelines by the DEA to undertake 13 independent specialist assessments in order to assess both significant and less significant environmental impacts proposed by the development.

The detailed assessment of the anticipated impacts were undertaken with the purpose of highlighting any areas of concern regarding the proposed project during its construction and operation and proposes necessary mitigation measures of the significant impacts.

In addition to the aforementioned independent specialist assessments, an independent sensitivity mapping analysis was undertaken. This analysis characterised the development site with regards to the significant environmental aspects in order to reflect the sites suitable and unsuitable (no-go) development footprint areas. This action guided the final footprint of the PV Plant(s).

This EIAR will also be used to motivate and define the previously identified, project alternatives (i.e. site, technology and layout) based on the findings of the environmental specialist reports and the suitability of the site to the type of development.

This EIAR has been compiled in accordance with the regulatory requirements stipulated in the EIA Regulations (2010), promulgated in terms of Section 24(5) of the National Environmental Management Act (NEMA) (Act No. 107 of 1998). The EIAR aims to:

- Provide an overall assessment of the social, physical and biophysical environments of the area affected by the proposed establishment of a PV Plant and associated infrastructure;
- Undertake a detailed assessment of the portion of the Portion 0 of the Farm Rooipunt 617, Gordonia Registration Division, considered for the proposed Solar Power Park developments, in terms of environmental criteria and impacts (direct, indirect and cumulative), and recommend a preferred location for the proposed plant (based on environmental sensitivity);

- Identify and assess any cumulative impacts associated with the simultaneous development and operation of the CSP and PV Plant on portion 0 of the farm Rooipunt 617 Gordonia RD; as well as other similar technology that is proposed for the locality,
- Identify and recommend appropriate mitigation measures for potentially significant environmental impacts; and
- Undertake a fully inclusive Public Participation Process (PPP) to ensure that all comments and concerns raised by I&AP's are recorded.

Fifteen (15) specialist assessments were conducted specifically, for the EIAR to identify potential impacts, propose mitigation and inform the sensitivity analysis.

2.3 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations underpin the approach to this EIA study:

- The information received from the stakeholders, specialist assessments are current and valid at the time of the study;
- A precautionary approach was adopted in instances where baseline information was insufficient or unavailable;
- Mandatory timeframes will apply to the review and adjudication of the reports by the competent authority and other government departments; and
- No land claims have been registered for the proposed site at the onset and registration of the study.

2.4 PROJECT APPLICANT

SolarReserve LLC is a Santa Monica, California-based developer and owner of utility-scale Concentrated Solar Power (CSP) projects utilizing exclusive, best-in-class technology with inherent storage capability. SolarReserve's primary focus is securing sites, transmission access, permitting, and power purchase agreements; engineering, procurement, and construction services; and securing financing for utility-scale CSP power projects.

The Company has developed a diverse portfolio of CSP projects and development opportunities that encompass 3 000 MW of project potential and approximately 25 individual sites of approximately 140 000 acres (56 000 ha), including some sites with multiple tower potential. SolarReserve holds an exclusive global license to the Molten Salt Power Tower technology developed by "Rocketdyne", with the initial license term extending until 2027. SolarReserve has a development pipeline of more than 1 100 MW in Solar PV and a geographically diverse portfolio of more than 3 000 MW of CSP projects.

2.5 EIA APPROACH & METHODOLOGY

The proposed Project entails the conducting of a mandatory EIA as required by the relevant environmental legislation and requires four (4) primary activities to be undertaken to ensure the successful completion of the process. These four (4) activities form the Scope of Work for the study and are described as below in Section 2.5.1 EIA Methodology:

2.5.1 EIA Methodology

2.5.1.1 Activity 1 : EIA Process Development and Initiation

It is required that proper planning be done in order to ensure that the EIA is conducted according to the legislative requirements and that the process is sound. In order to develop a sound EIA process it is required that an extensive legal gap analysis is conducted and a proper program developed, scheduling all the required activities. The initiation of the EIA process must involve consultation with institutional stakeholders in order to identify potential impacts, alternatives and key burning points relating to the project early in the process. During the initiation of the EIA it is important that the project alternatives are identify and assessed.

2.5.1.2 Activity 2 : The Scoping Report

The Scoping process must involve the identification of key issues, concerns, alternatives and impacts, over and above what was identified and assessed during the initiation phase. The vehicle for this process is the public participation process (PPP), whereby I&AP's has to be identified and engaged with to exchange information and to establish a platform of engagement. The information needs to form the basis from which to prepare the SR as well as the various terms of reference for the required Specialist Studies. The environmental baseline needs to be determined from which to assess the likely impacts of the proposed development. Issues raised in the course of scoping must be presented in both the SR and the Comments and Response Report (C&RR).

2.5.1.3 Activity 3 : Detailed Impact Assessment

The impacts, alternatives and issues identified during the scoping needs to be assessed during this phase of the process by means of the identified specialist assessments. Mitigation measures must be proposed and the likely residual impacts highlighted in the EIAR. It is crucial that the PPP be continued throughout this phase as well in order to involve I&APs and ensure transparency in the reporting.

2.5.1.4 Activity 4 : Environmental Management Plan

A crucial aspect of the EIA process is the formulation of the Environmental Management Programme (EMP). This programme must be contained within the EIAR and is a concurrent activity to the Detailed Impact Assessment phase of the project. It must state the actions to be implemented during the construction, operation and decommissioning phases of the proposed project in order to achieve the mitigation targets.

2.5.2 Approach to the study

A systematic approach will be adopted for the successful completion of the EIA in line with the regulated process. The diagram in **Figure 1** below indicates the sequential process that will be followed for this study.

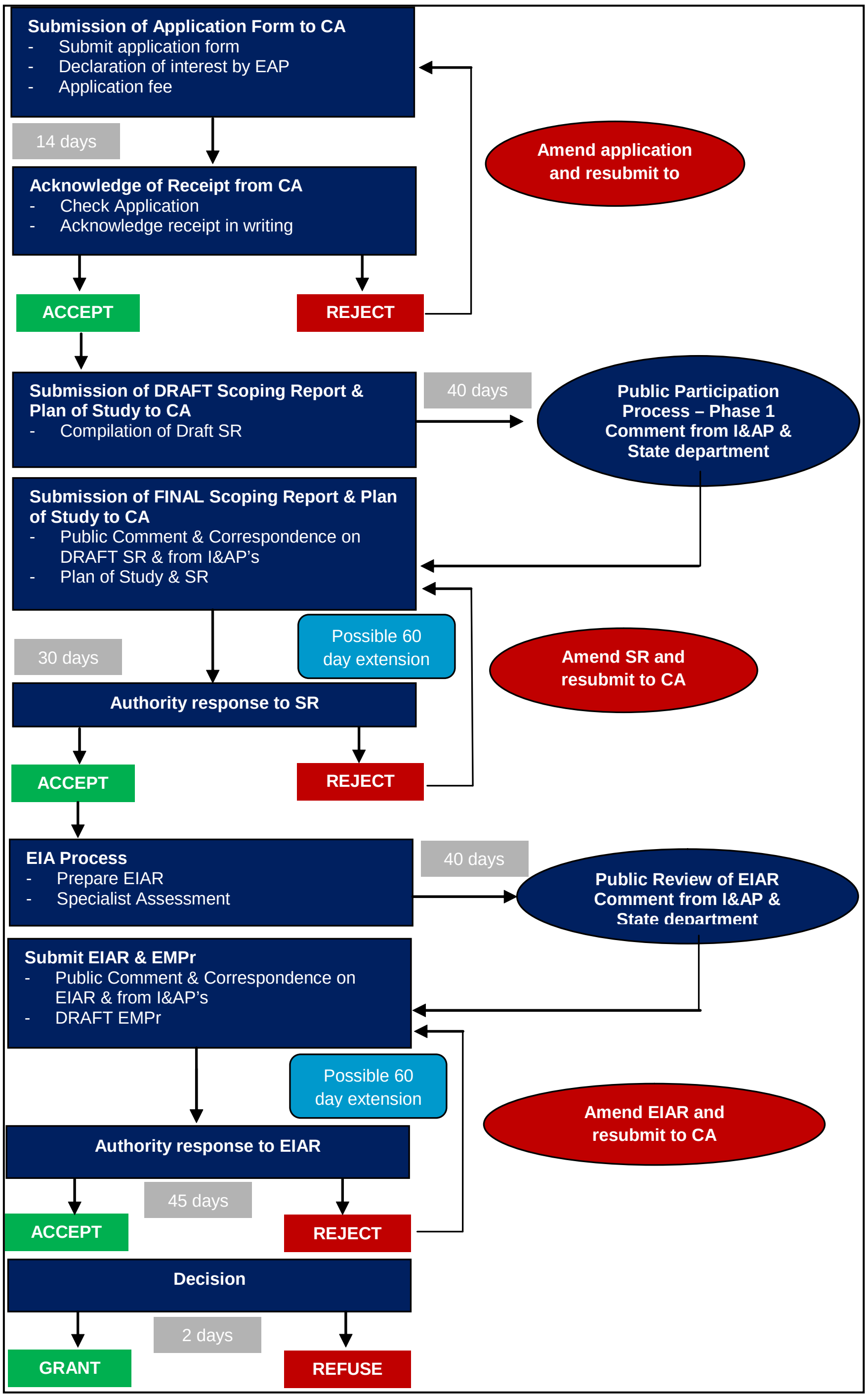

Figure 1: EIA Process

3. PROJECT DESCRIPTION

The proposed development of Renewable Energy (RE) projects aims to introduce both PV and CSP technology to the study area. The proposed Solar Power Plant will entail the installation and operation of two (2) 75 MW (megawatts) photovoltaic (PV) projects with a combined projected output of between 100 - 200 MW, whereas, the proposed CSP plant, will entail the construction and operation of a central receiver tower plant with a projected output of up to 200 MW.

This report only relates to the PV Phase 1 - 2 Plant although the potential development is described.

The site for the proposed project is Portion 0 of the Farm Rooipunt 617 Gordonia RD, approximately 25 km southwest of the town of Upington, as indicated in Figure 2 and falls within the jurisdiction of the Kai !Garib Local Municipality of the ZF Macawu District. The project will be capable of producing in total approximately 325 MW of Solar Power Park. With respect to the PV development it is proposed that the development be constructed in two (2) phases as follows, where after the CSP development will be developed (and addressed) separately as Phase 3:

- Phase 1: PV Development 1: 75-100 MW
- Phase 2: PV Development 2: 75 – 100 MW
- Phase 4: CSP Development 100 – 200 MW

The above phases will not be developed in chronological order but will be developed as determined by the applicant.

It is anticipated that the the PV developments are expected to be constructed in 15 – 18 months, and that more than half of the total capital project costs could potentially be spent in South Africa on procurement of local materials, services, and labour. It is envisaged that the project will make a notable contribution towards the achievement of the job creation targets set in the New Growth Path by creating employment opportunities throughout the country during the peak of construction and sustainable employment opportunities during operations.

SolarReserve's PV systems produce energy by converting solar irradiation into electricity. PV facilities use PV panels comprising many individual cells which absorb solar energy. The PV cells are commonly constructed from silicon and linked together behind a glass sheet (for protection) and they operate as a single combined PV panel.

The solar energy excites electrons inside the cells and produces DC electricity no emissions. In fact they are just larger versions of the cells used in solar calculators. The front surface of the solar panel is toughened glass with an anti-reflective coating to maximise the light captured by the solar cells. From the front, the panels look predominantly black in appearance, though from close-up a grid of silver contacts is visible. Panels are framed with anodised aluminium, and will be mounted as sub-arrays on frames of anodised aluminium and hot-dipped galvanised steel.

For completeness sake all technologies proposed for the site will be discussed, however only the PV technology, which is applied for in this EIA will be discussed in detail. Please refer to Section 0 below for the detailed description of how the PV technology produces electricity and the Technical Report Appendix C**.**

The CSP Technology proposed for the Solar Power Park entails the use of a central receiver tower which is equipped with an integrated thermal storage system. The proprietary receiver and storage components are provided through an exclusive license with United Technologies Corporation's subsidiary Hamilton Sundstrand Rocketdyne ("UTC" or "Rocketdyne"). The integrated molten salt storage technology proposed was demonstrated successfully at the SolarReserve LLC's Solar Two facility in Barstow, CA (built and operated jointly by the US Department of Energy and Rocketdyne) in the late 1990's.

SolarReserve's CSP technology generates power from sunlight by focusing the sun's thermal energy as collected by the heliostat field i.e. sun tracking mirrors onto a central receiver tower. The molten salt is circulated through tubes in the receiver, collecting the energy of the sun. Once the molten salt has been heated to a temperature of 560 degrees Celsius it is routed to an insulated storage tank i.e. the "hot" tank, where it can be stored with minimal energy losses. The heated, molten salt is routed from the "Hot" tank to a heat exchanger for the production of energy. Steam is produced by the heat exchanger and expanded through the standard Rankin cycle steam turbine which rotates a generator to produce electricity.

The molten salt is hereafter circulated back to the "cold" storage tank and the cycle repeated. Due to the energy storage ability of the proposed technology, a CSP plant of this nature, has a generation capacity of between 100 - 200 MW, can generate electricity for up to 24 hours a day during the summer months and between 12 to 16 hours a day in the spring, autumn and winter months. The proposed plant will utilise dry cooling technology to condense the water used during the steam cycle. Implementing this cooling technology allows for the use of considerably less water compared to that of a wet cooled solar thermal power plant.

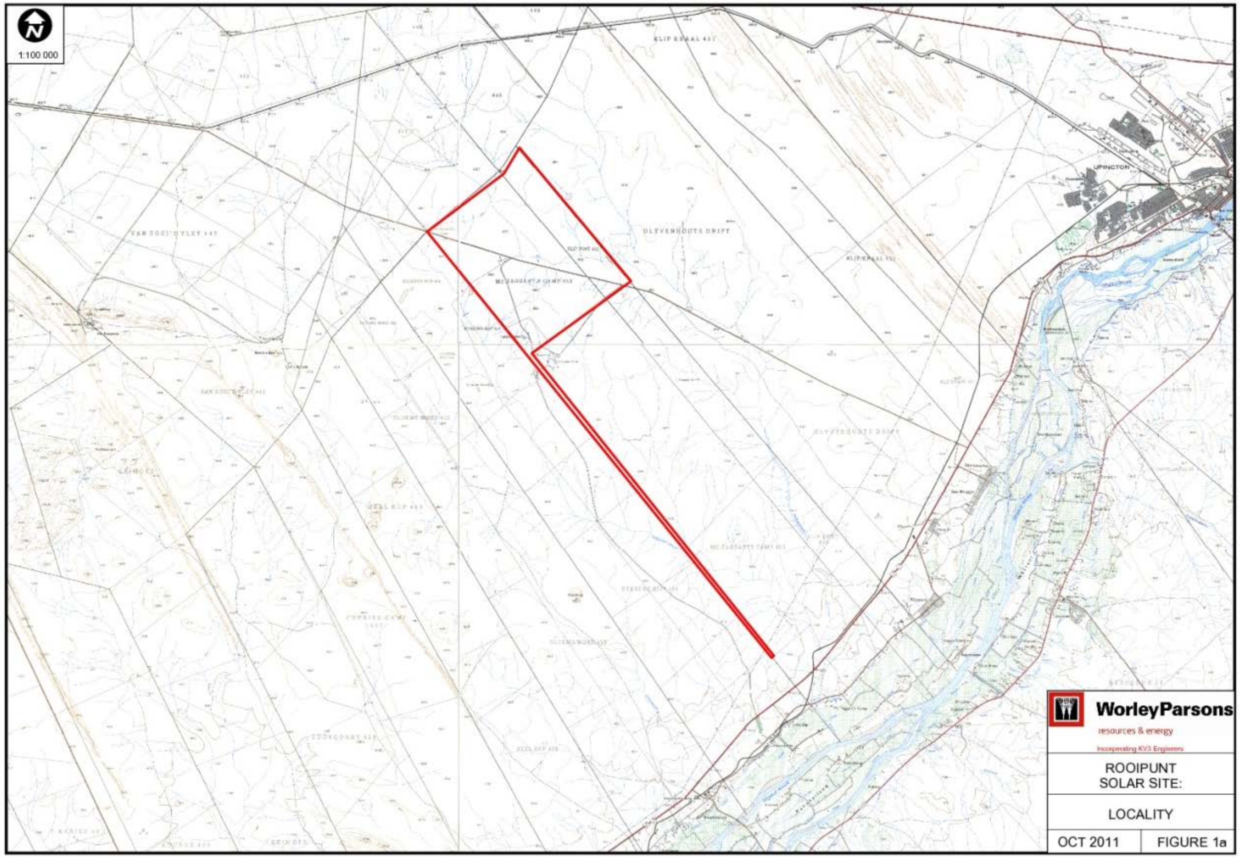

Figure 2: Locality Map

3.1 PROPERTY DESCRIPTION

The proposed development will be located on Portion 0 of The Farm Rooipunt 617 Gordonia RD . The site is situated approximately 20 km from the town of Upington, and falls within the jurisdiction of the Kai !Garib Local Municipality of the ZF Mgcawu District Municipality, in the Northern Cape Province.

The farm owner is Mr. P Van Scalkwyk, who is the registered title deed holder. The property is registered as follows:

Table 2: Registered Land Owner

Ownership	Property Description	Size (ha)	Title Deed Nr.
VAALDOORN BOERDERY CC	Portion 0 of the Farm Rooipunt 617 Gordonia RD	2201.6686	T2263/1994

3.2 THE PHOTOVOLTAIC SYSTEMS

PV systems produce energy by converting solar irradiation into electricity. A PV system consists of PV panels that encase the solar cells. Solar cells are solid-state semiconductor devices that convert light into direct-current electricity. The top layer of the silicon portion of a solar panel is made from a mixture of this silicon and a small amount of phosphorous, which gives it a negative charge. The inner layer, which constitutes the majority of the panel, is a mix of silicon and a little bit of boron, giving it a positive charge.

The place where these two layers meet creates an electric field called a junction. When light (or photons) hits the solar cell, before it gets to the silicon crystal to make electricity it passes through a glass cover on the panel and an anti-reflective coating, which stops photons from reflecting off of the panel and being lost. The photons are absorbed into the junction, which pushes electrons in the silicon out of the way (See **Figure 3**). If enough photons are absorbed, the electrons are pushed past the junction and flow freely to an external circuit.

To convert the Direct Currant (DC) to Alternating Current (AC) an inverter will be used. The AC energy can then be used to power anything that uses electricity. In fact, they are just larger versions of the cells used in solar calculators. The front surface of the solar panel is toughened glass with an anti-reflective coating to maximise the light captured by the solar cells and reduce glare back towards the atmosphere. The PV panels are predominantly black in appearance – when viewed directly from the front; however, from close-up, a grid of silver contacts is clearly visible.

Panels are framed with anodised aluminium, and will be mounted as sub-arrays on frames of anodised aluminium and hot-dipped galvanised steel. **Figure 4** is a diagram of typical PV development.

In simplified terms it can be stated that the operation of a PV Plant entails the production of power through the conversion of solar energy to electricity. The PV power generation process is primarily self-sufficient and is not in need of constant supervision or management attention. The inputs requirements for PV power generation include:

- Solar radiation;
- Water;
- Consumables, including but not limited to:
  - spare parts and equipment; and
  - detergents.

The products/outputs to be produced by the PV plant during operaitons includes inter alia:

- Power;
- Solid waste (hazardous and non-hazardous); and
- Liquid waste or effluent (non-hazardous).
- Waste water from washing of PV panels.

Operation of the facility will entail the regular maintenance of the site and infrastructure, management of waste facilities and the replacement of consumable items and/or damaged equipment to ensure that the plant operates optimally. This maintenance will as far as possible be scheduled to times that the plant is not operational to improve productivity. Unscheduled repairs and maintenance will likely occur as a result of breakdowns and emergency situations.

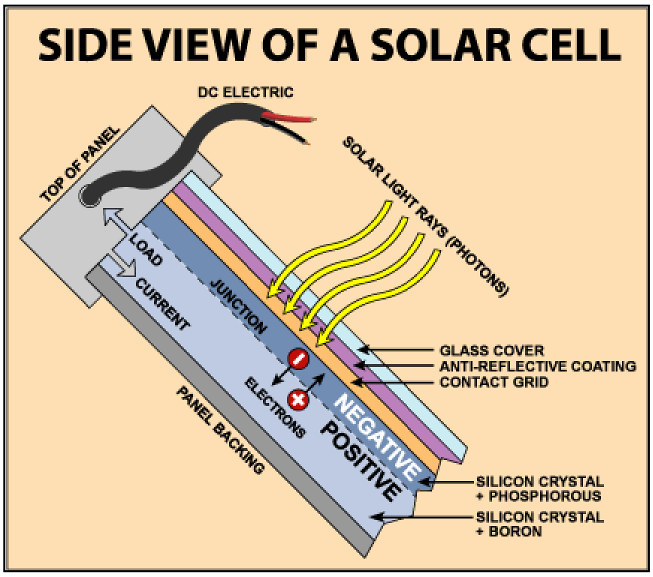

Figure 3: Illustration of a Typical PV Cell

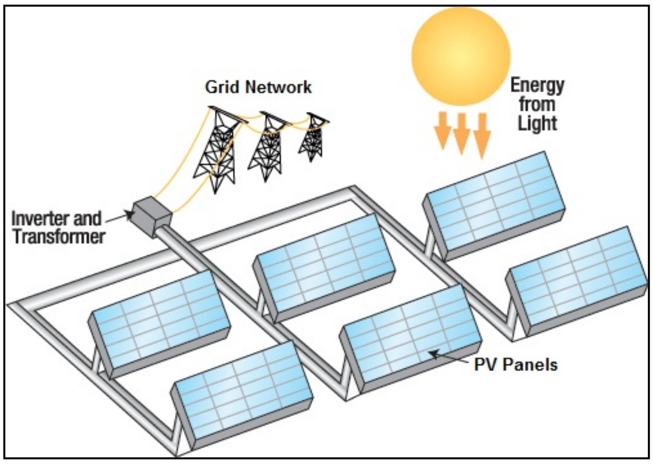

Figure 4: Diagram Typical PV Development

In large solar parks, the solar panels are configured in banks of sub-arrays. These blocks are spaced both to allow access and to ensure that one sub-array does not cast a shadow over the arrays behind. The electricity generated is connected to the national grid through various switchgear, and protection devices.

3.2.1 Principal PV Components

The PV development will consist of two (2) 300 ha PV blocks (phases) that will occupy a total of 600 ha of the Project Site. Each PV block (phase) will have the ability to generate between 75 and 100 MW of power. The panels will be situated in long rows extending across the site. It is anticipated that as each phase of the facility is completed, it will feed electricity into the national power grid. Once all two (2) phases are constructed, the PV development will have an installed capacity of between 150 - 200 MW.

The key components of the proposed Solar Power Park include the following:

- PV solar panels and arrays;
- PV panel mountings;
- DC-AC current inverters and transformers; and
- Underground cabling/overhead power lines.

PV panels are typically up to 6 m^2 in size and the rows will be approximately 1 km in length, made up of approximately 100 m sections depending on the optimal final design and layout of the development. The panels will be mounted on metal frames with a maximum height of approximately 3 m above the ground, supported by rammed, concrete or screw pile foundations, and they will face north in order to capture the optimum amount of sunlight.

Figure 5: PV Panel Foundation Construction

The facility will either be a fixed PV plant where the solar panels are stationary; or a tracking PV plant where the solar panels rotate to track the sun's movement (the exact type of PV plant system will be determined following on-site solar resource modelling and detailed development design). This will only be determined once the project has reached final engineering design stages. Figure 7 presents a typical array of PV panels.

Figure 6: Completed PV Panel Mounting

Figure 7: Completed PV Panel Structures

The inverters, switchgear and other electrical equipment are standard items as used for a wide range of industrial applications.

The other major operating component of the system is the inverter, which converts the DC power produced by the solar modules into AC power before the power is sent to the grid. Each PV phase will have approximately 40 separate inverters, each handling a part of the overall solar array.

Figure 8: PV Panel Inverters

During the construcion phase of the proposed Solar Power Park the primarily activities will include (but is not limted) to the following –

- Site establishment and the construction of access roads and services;
- Site clearing and heavy earthworks; and
- Construction and assembly of the tower, buildings, heliostats and infrastructure;
- Construction and assembly of the PV Systems, inverters and transformers.

3.3 THE CONCENTRATED SOLAR THERMAL POWER PLANT

The CSP plant (Figure 9) primarily comprises of four subsystems as summarised below:

- Solar Field - consists of all services and infrastructure related to the management and operation of the heliostats;
- Molten Salt Circuit - includes the thermal storage tanks for storing the hot and cold liquid salt, a concentration tower, pipelines and heat exchangers;

- The Power Block – consists of inter alia the steam turbine is where the electricity is generated; and
- Auxiliary facilities and infrastructure - includes the condenser-cooling system, electricity transmission lines, a grid connection, access routes, water supplies and facility start-up energy plant (gas or diesel generators).

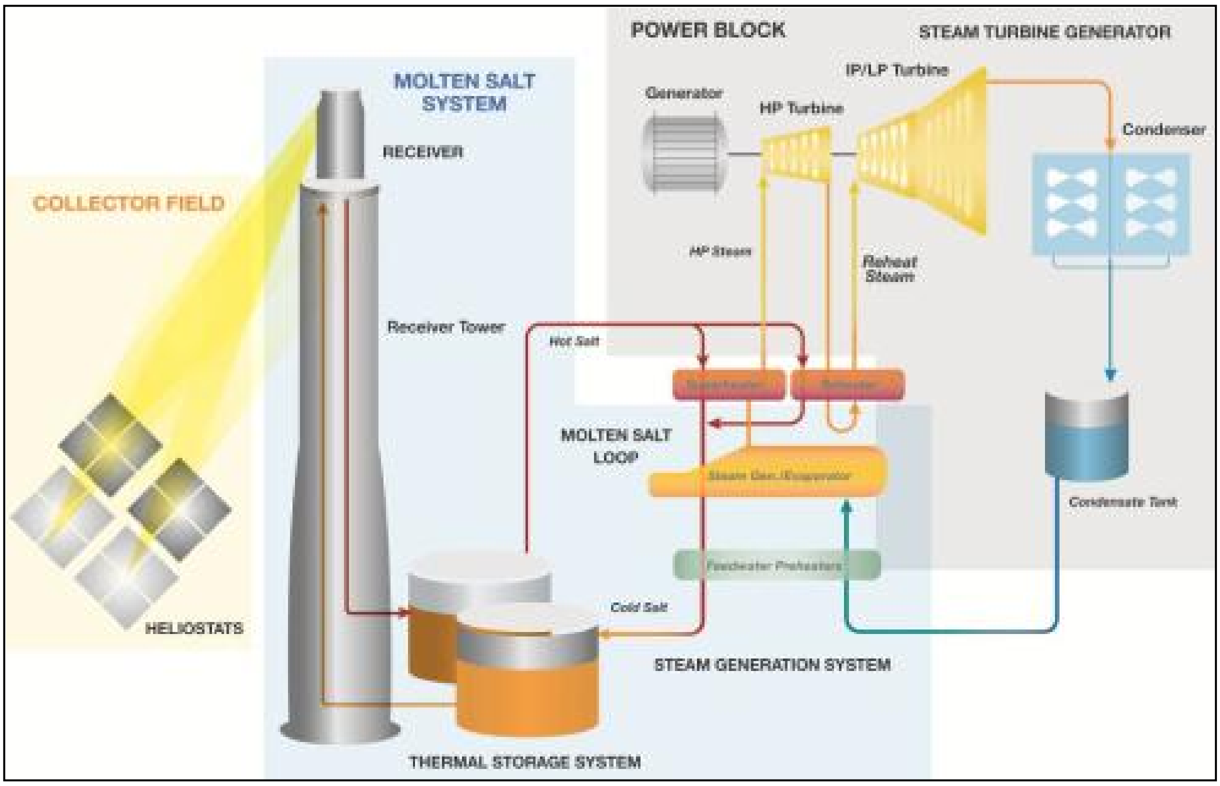

Figure 9: Process flow of a typical Solar Thermal Energy Power Plant operation

3.4 ANCILLARY INFRASTRUCTURE

Additional infrastructure will be required for the construction and operation of the proposed Solar Power Park in support of the two (2) technologies that are to be implemented. The Section below will aim to delineate the various other infrastructure requirments and resources needed for the operation and construction of the proposed Solar Power Park.

3.4.1 A Meteorological Station (Met Station)

Prior to construcion of the proposed development a MET station will be constructed by the project Applicant in order to capture and collect data on the solar resource.

3.4.2 Site Security

For health, safety and security reasons the PV Plant(s) will be enclosed by means of fencing from the surrouding community during both construction and operations. This will keep both the community safe from possible accidents and keep the project Applicants' investment safe. It is furhtermore recommendedc that closed circuit video-surveillance system will be fitted around the plant(s) also for safety reasons.

3.4.3 Construction Man Camp

It is anticipated that a temporary contractor's housing facility will be utilised for the duration of both the PV and CSP construction period. It is estimated that in total, approximately 356 persons will be employed and housed by the facility – over the estimated 15-18 month construction period. The camp will be either on a single location or split between more than one option on the site. The selection of the option or combination of options to be utilised will be finalised in conjunction with the appointed construction contractor to ensure that the options are practical as well as environmentally sound.

Habitation will be staggered over this period and the maximum number of persons housed at any given time will not accrue to 600. It is proposed that temporary/portable housing, ablution and sewer treatment facilities be procured from external service providers. Sewage will be removed from site by an authorised and licensed service provider on a weekly basis.

3.4.4 Access Road

An access road for SolarReserve will be constructed from the N14 running in the panhandle of the property and entering in the western corner of the property.

- Width of roads < 6 m
- Length approximately 14 km
- Access points (to be confirmed in following design phases)

Roads to be constructed wihin the site boundaries will be equipped with adequate drainage infrastructure i.e. stormwater trenches, these will also be fitted with silt traps if deemed necessary.

The public road D3276 runs through the middel of the site and will be rerouted to run around the development. Application for realigment will have to be made to the Northern Cape Province. The site is approximately 20 km west of Upington.Please refer to **Figure 10: Access Roads** bellow for map detailing the planned accses roads.

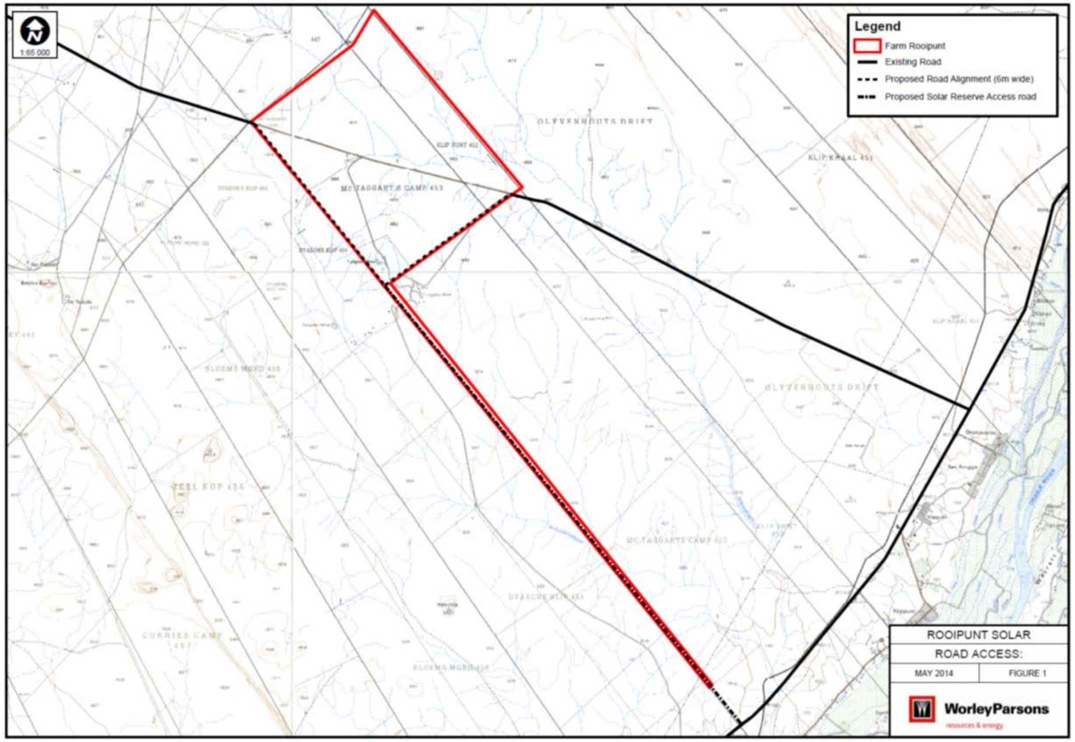

Figure 10: Access Roads

3.4.5 Lay Down Area

A laydown area of approximately 8 ha within the property boundaries was set aside for the temporary storage of materials during the construction activities as well as the assembly of PV modules. This area will be of a temporary nature and it is to be decommisioned once construction is finished. In addition to these laydown areas, temporary construction offices are also proposed. These offices will most likely be mobile offices and also of a temporary nature.

3.4.6 Building Infrastructure

The proposed Solar Power Park will require several onsite buildings to be constructed for the operational requirements. During the operational phase of the Solar Power Park an administrative building (offices) will be required and possilbly storage space. The administrative infrastructure will be used for regular administrative duties.

3.4.7 Network Connections & Electrical Integration Infrastructure

Each PV array is connected to the on-site network by means of strings – which are connected to the DC – AC Converters. Each string is connected to the inverters by means of a low voltage DC cable – whereafter the power is collected in a medium voltage transformer by means of the AC cables. The AC-DC cables can be either pole mounted or trenced dependent on the voltage requirements and the site topography.

It is furthermore proposed that a switching and substation be constructed within close proximity of each PV Block (Phase) as well in reaching distance of the proposed overhead distribution system to be utilised for the evacuation of power. Each substation is estimated to be 100 m x 100 m in size and will include transformer bays which will contain and make use of transformer oils.

The Facility will connect to Overhead lines at the southern boundary of the site.

Please refer to the Technical Report Appendix C for a more in depth review of the electrical connection and integration system.

3.4.8 Management of Hazardous Materials and Waste

SRSA has assessed and recorded all possible hazardous materials and wastes for both the CSP and PV developments. There will be a variety of chemicals stored and used during construction and operation of the Solar Power Park. Chemicals will be stored in appropriate chemical storage facilities. Bulk chemicals will be stored in storage tanks, and most other chemicals will be stored in returnable delivery containers. Chemical storage and chemical feed areas will be designed to contain leaks and spills. Concrete containment pits and drain piping design will allow a full tank capacity spill without overflowing the containment. For multiple tanks located within the same containment area, the capacity of the largest single tank will determine the volume of the containment area and drain piping. Drain piping for reactive chemicals will be trapped and isolated from other drains to eliminate noxious or toxic vapours.

Safety showers and eyewash stations will be provided adjacent to, or in the vicinity of, chemical storage and use areas. Plant personnel will use approved personal protective equipment (PPE) during chemical spill containment and cleanup activities. Personnel will be properly trained in the handling of these chemicals and instructed in the procedures to follow in case of a chemical spill or accidental release. Adequate supplies of absorbent material will be stored onsite for spill cleanup.

3.4.9 Water Supply Use

Potable water for domestic use at the facility will be sourced from Orange River. Wastewater and sewage will be treated with the use of a modular sewer treatment plant with capacities to be confirmed during the detail design phase.

SRSA has investigated various options in securing water for its power plant. The sources of the water supply and water treatment requirements are outlined in this EIAR. SRSA is lookaing at the option of applying for forapproval to recive a water supply from the Orange river an allocation of 380 000m3 per annum was awarded for use in both CSP and PV related technology.

Water will be delivered to a large raw water storage tank, also used to provide site fire protection water, and water for the potable water system. Raw water is pumped from the storage tank to the water treatment system for demineralized water production. The entire Solar Power Park will require approximately 380 000 m^3 per annum of raw water which will be divided between the PV and CSP technologies and all auxilary services.

The water treatment process includes two multi-stage Reverse Osmosis (RO) units, and electro-deionization (EDI) equipment. Pure demineralized water from the process is pumped into a separate demineralized water storage tank. Demineralized water is added to the de-aerator for steam plant makeup, for steam cycle blowdown quench water, and for heliostat washing. Wastewater from water treatment system, including 1st pass RO reject and EDI, as well as a portion of the steam cycle blowdown are discharged to the evaporation ponds.

The plant will have a raw water tank with an anticipated capacity of approximately 10 000 m^3. The major portion of the raw water is for plant use while a smaller portion of the raw water (2 500 m^3) will be reserved for fire water. The project will operate (generate electricity) an average of about 10 - 18 hours per day, seven (7) days a week throughout the year, with the exception of scheduled shutdowns for maintenance. However, the water treatment plant will operate an average of approximately 60% of each day, in order to minimize water treatment system size and capital cost, and to use off-peak energy at night.

3.4.10 Waste Management

Waste management is the process whereby all wastes produced at the proposed Solar Power Plant are minimised or reduced, properly collected, treated (if necessary), re-used and disposed of as a final resort. Wastes expected to be generated as a result of the PV power generation process include process and sanitary wastewater, nonhazardous waste and hazardous waste, both liquid and solid.

3.4.10.1 Liquid Waste

Wastewater Collection, Treatment, and Disposal

The PV developments will create a minimal amount of waste water. The source of waste water would be the water used for washing the PV panels at set intervals and surface runoff. To the extent practicable, process wastewater will be recycled and reused to reduce the amount of effluent generated and disposed of. The aggregate discharge from this waste stream will be sent to double-lined evaporation ponds where the water will be retained on site to evaporate, leaving solid waste constituents behind.

Sanitary Waste

Both the CSP and PV will create sanitary waste streams at both the administrative building and at the operations building and maintenance areas. Each area will have a kitchen as well as the requisite quantity of toilets and or showers to support the crew size. At these locations, a moduler treatment plant will be used to capture and treat the flows.This activity will adhere to the plant safety program as administered by plant personnel.

With respect to the handling and treatment design and operations of the proposed effluent treatment plant the following philosophy will be put in place –

- A closed loop system will be introduced and implemented with regards to the handling, treatment and reuse of treated water. It is proposed that all treated effluent be removed of site and disposed of at the //Kai Garib Municipality WWTW.
- Effluent treatment of sewage/sanitation water will be done in such a manner that the treated effluent will adhere to the general limit effluent standards.

As the proposed design of the Solar Power Park is dependent on EPC contractor designs and subject to the tender system, no definite design is yet available regarding sewage handling and treatment, for the purpose of this EIAR it is however deemed accurate that all sewage will be removed via an external service provider.

Stormwater Management System

A Stormwater management system will be implemented to separate clean and dirty surface water. All clean water will be directed away from the site, where as the contaminated water will be directed and collected within a stormwater management system. The aim of this system is to –

- Protect the health, welfare and safety of the public, and to protect property from flood hazards by safely routing and discharging stormwater away from and within the development.
- To conserve water and allow clean water to be re-absorbed in the natural environment for downstream benefit.
- To preserve the natural environment;
- To promote sustainable development within the natural environment while pursuing economic development; and
- To control runoff as to prevent pollution and contamination.

A stormwater management plan will be submitted subject to the EPC contractor site design and layout as well as the tender process.

3.4.10.2 Solid Waste

Both the PV and CSP will produce maintenance and plant wastes. All waste to be generated on site will be subject to the pricinpal of “Reduce, reuse and recylce” as far as possible before disposal is regarded as an option. Solid wastes will be temporarily kept on site and trucked offsite for recycling or disposal at a licensed recycling facility or licensed landfill site in the vicinity.

The following principles will be applied to the temporary storage of solid waste at the source –

- A service provider will be appointed to adequately address the temporary storage of solid waste. This service provider will provide adequate and appropriate containers for the storage of solid waste.

- Waste should be sorted and stored within appropriate containers to allow for the implementeaiton of “Reduce, Reuse and Recylce” as per the waste management plan.
- The site design will allow for designated waste storage areas. Each of these areas will be designed as to ensure environmental degradation does not occur – will be clearly marked and constructed appropriately.
- Waste will be collected on a daily basis.
- Waste will be stored in such a manner that it can be easily loaded and transported.
- Waste stored in containers need to adhere to the following –
    - Waste types will not be mixed;
    - Waste will be kept in a container that is of good condition – under no circumstances may waste containers be worn, corroded or have the potential to allow for environemtnal contamination.
    - All waste containers need to be positioned withing the designated waste areas and has to be labelled correctly.
    - Skips/waste containers may at no point in time overflow.
    - Skips/waste containers need to be adequately positioned and enclosed for rainy events.
- No waste product shall be burned on site or disposed of on site.
- Waste containers will be protected as to prevent scavanging.
- The waste management plan must allow for timely scheduled collection of wastes. Detailed records of these activities need to be kept.

4. PROJECT ALTERNATIVES

4.1 SITE LOCATIONAL ALTERNATIVES

An integrated site selection study was done in order to identify a suitable site for the proposed Solar Power Park.

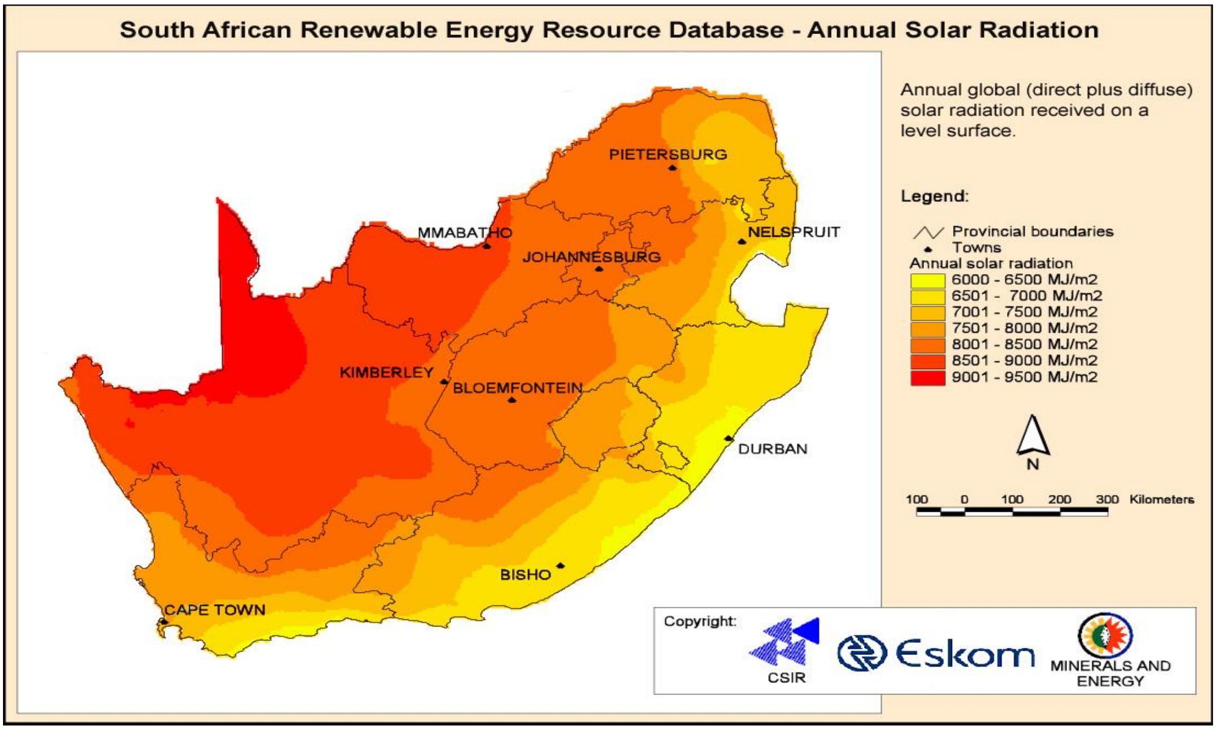

Figure 11: Annual incoming short wave radiation for South Africa

The proposed solar energy site on the farm Rooipunt is considered highly desirable due to the following considerations:

- Solar resource: Analysis of available data from existing weather stations suggests that the site has sufficient solar resource to make a solar energy facility viable (Figure 11).
- Site extent: Sufficient land was secured under long-term lease agreements with the land owner to enable sufficient power supply and to allow for a number of heliostats to make the project feasible.
- Land suitability:

  - Sites that facilitate easy construction conditions (relatively flat land with few rock outcrops or water-bodies) were favoured during site selection.
  - The site position will strategically strengthen the national grid.
  - Avoidance of obvious environmentally sensitive areas.
- Landowner support: The selection of sites where the land owners are supportive of the development of renewable energy is essential for ensuring the success of the project.
- Consideration of the above criteria resulted in the selection of the preferred site. No further site location alternatives are considered in the EIA process.

4.2 SITE LAYOUT ALTERNATIVES

The PV layout and project component underwent a number of iterations based on technical aspects and the environmental and social considerations assessed during the EIA process.

From a layout perspective, the position of the proposed PV developments and site infrastructure was determined by the consideration of the following aspects:

- Local topographical conditions;
- The position of environmentally sensitive features as assessed by the specialists depicted in the sensitivity analysis.
- The position of the CSP

The detailed sensitivity analysis (contained in Appendix P) was utilised to position the infrastructure in areas which would be impacted least yet be technically feasible. The assessment of the environmental attributes (specialist areas) that informed the sensitivity analysis essentially determined the site layout. The attributes that were included in the sensitivity analysis are:

- Biodiversity;
- Wetlands;
- Surface Hydrology;

The PV layout is dependent on the location of the CSP therefore the layout options of the CSP is discussed below:

The following alternatives have been identified :

- Northern Option
- Western Option
- Southern Option (Preferred Option)

The above alternatives will be further discussed below.

Selection of the preferred alternative would however require a number of mitigation measures aimed at addressing the impacts of habitat loss and fragmentation caused by locating the CSP facility across the riparian habitat of the Helbrandleegte. Measures that will require consideration, and which will be discussed in the following sections, include:

- Biodiversity/Wetland offset
- Diversion

4.2.1 Northern Option

In this alternative, the CSP is located in the northern reaches of the site and the PV in the southern corner of the site as showen in Figure 12

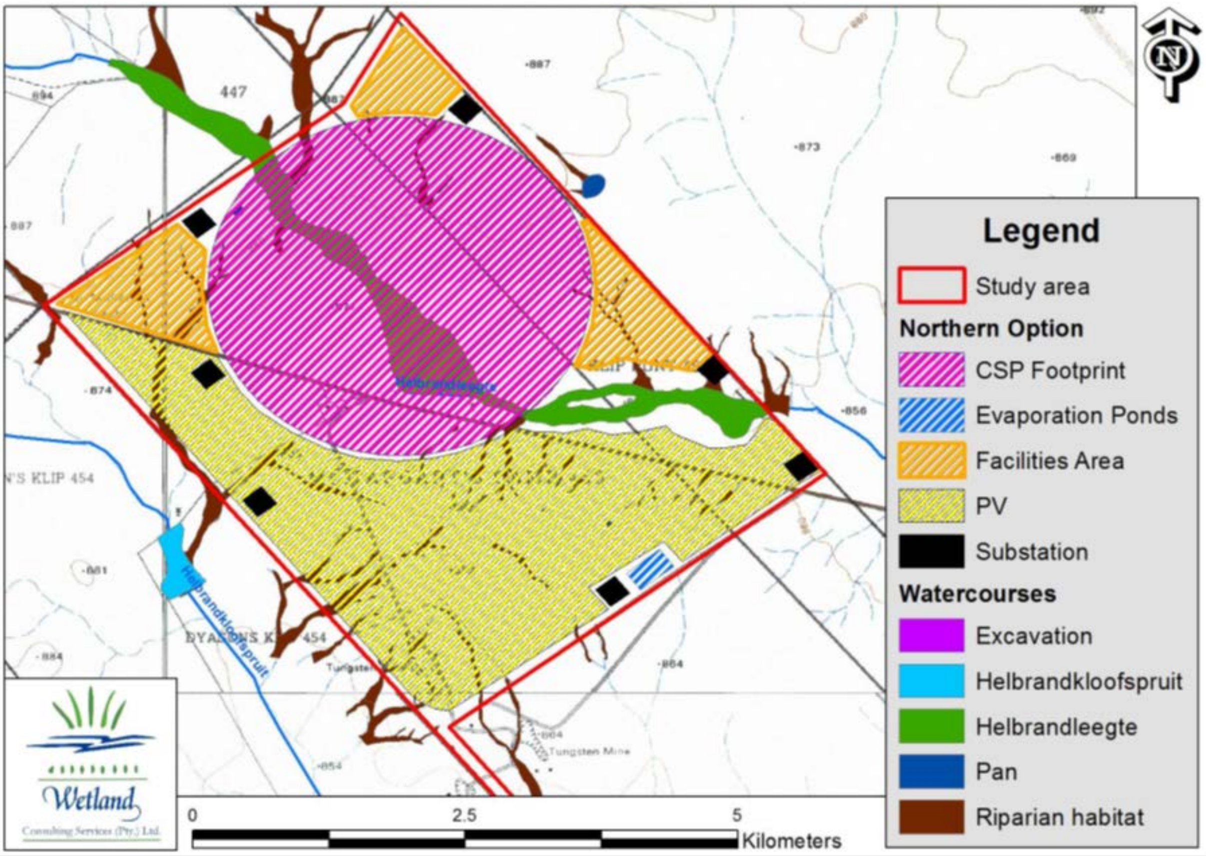

Figure 12: Layout map for the Northern Option

4.2.1.1 Wetland Assessment of Layout Alternative

In this alternative, the CSP is located in the northern reaches of the site. The CSP footprint extends right across the Helbrandleegte riparian habitat. This alternative has the largest direct footprint and is the least preferred.

Table 3: Table showing the extent of habitat directly impacted by the proposed alternative

Habitat	Area (ha) in footprint	% of habitat on site
Helbrandleegte	82.71	64.97%
Riparian habitat	70.86	70.29%
Pan	1.02	97.14%
TOTAL	**154.60**	**67.06%**

4.2.1.2 Biodiversity Alternative Layout Assessment

The placement of the CSP footprint implies significant impacts on the wetland habitat of the site. Similarly, an extensive PV footprint will result in significant losses of terrestrial habitat. Should this option be approved, a biodiversity offset will be required in addition to significant mitigation of potential and expected impacts on the terrestrial and wetland environs.

A significant diversion of the stream, which flows through the central part of the CSP footprint, will be required. The significance of expected impacts on the wetland environment, compared to the other layout alternatives, is expected to be the highest for this option, albeit marginally.

4.2.1.3 Hydrological Alternative Layout Assessment

The location of the CSP facility for the northern option will likely require diverting the Helbrandleegte stream into the adjacent eastern or western catchments which fall outside the Rooipunt site. The proposed diversion will compromise the lower Helbrandleegte steam and should not be considered. Any diversion of the Helbrandleegte steam is likely to impact (overlap) a proposed solar site upstream of the Rooipunt site.

4.2.2 Western Option

In this alternative, the CSP is located in the western reaches of the site and the PV in the southern and eastern parts of the site as showen in Figure 13

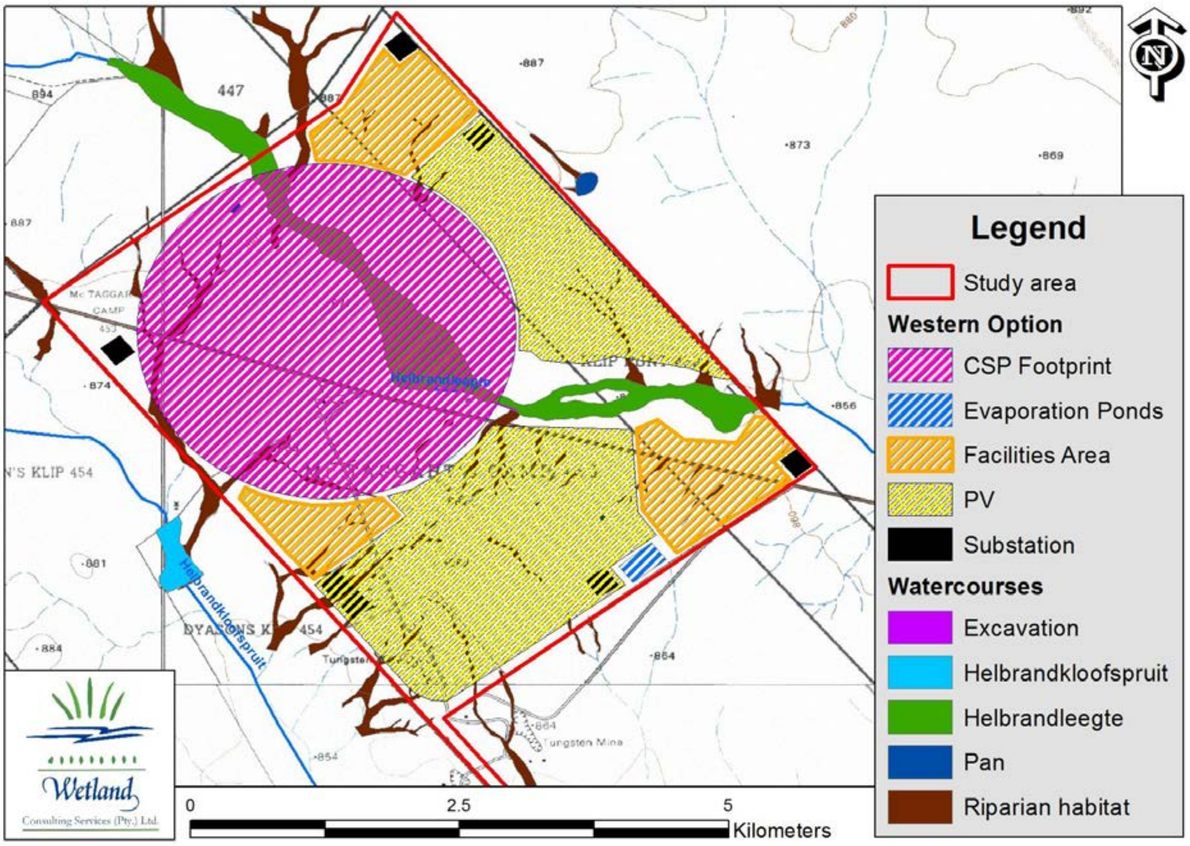

Figure 13: Layout map for the Western Option

4.2.2.1 Wetland Assessment of Layout Alternative

In this alternative, the CSP is located in the western reaches of the site and the PV developments on the eastern and southern reaches of the site. The CSP footprint extends right across the Helbrandleegte riparian habitat. This alternative has the second largest direct footprint and is the second least preferred.

Table 4: Table showing the extent of habitat directly impacted by the proposed alternative

Habitat	Area (ha) in footprint	% of habitat on site
Helbrandleegte	79.44	62.40%
Riparian habitat	64.64	64.12%
Pan	1.02	97.17%
TOTAL	**145.10**	**62.94%**

4.2.2.2 Biodiversity Alternative Layout Assessment

The CSP footprint is placed in the northwestern corner of the site. The extent of habitat loss remains significant. The potential loss of habitat is of a similar extent compared to Layout Alternative 1 and would therefore require a significant stream diversion and other mitigation measures. The extent of the stream diversion will however not be as significant compared to Layout Alternative 1. A biodiversity offset will nonetheless be required in addition to significant mitigation of potential and expected impacts on the terrestrial and wetland environs.

4.2.2.3 Hydrological Alternative Layout Assessment

The location of the CSP facility for western option may well require the diversion of both streams flowing through the site and should not be considered.

4.2.3 Southern Option (Proffered Option)

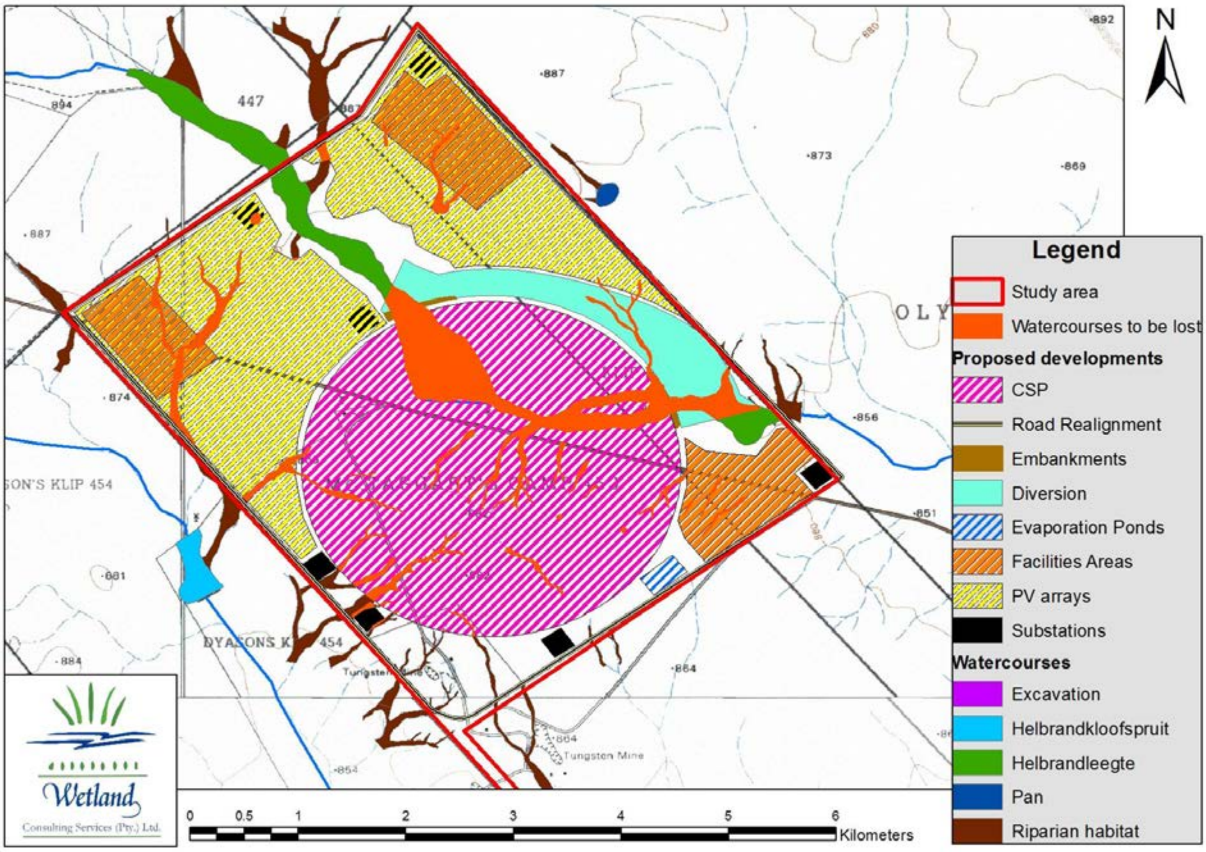

Figure 14: Layout map for the Southern Option (Preferred Option)

4.2.3.1 Wetland Assessment of Layout Alternative

In this alternative, the CSP is located in the southern reaches of the site. The CSP footprint extends right across the Helbrandleegte riparian habitat. Of the three alternatives this option has the smallest direct footprint and is the preferred alternative.

Table 5: Table showing the extent of habitat directly impacted by the proposed alternative

Habitat	Area (ha) in footprint	% of habitat on site
Helbrandleegte	70.86	55.66%
Riparian habitat	60.29	59.80%
Pan	1.02	97.14%
TOTAL	**132.17**	**57.33%**

4.2.3.2 Biodiversity Alternative Layout Assessment

The CSP footprint is placed in the northwestern corner of the site. The extent of habitat loss remains significant. The potential loss of habitat is of a similar extent compared to Layout Alternative 1 and would therefore require a significant stream diversion and other mitigation measures. The extent of the stream diversion will however not be as significant compared to Layout Alternative 1. A biodiversity offset will nonetheless be required in addition to significant mitigation of potential and expected impacts on the terrestrial and wetland environs.

4.2.3.3 Hydrological Alternative Layout Assessment

Of the layouts proposed the layout with the CSP southe and the PV north is the only layout that will contain any proposed diversion both within the Rooipunt project site and catchment area of the Helbrandleegte stream

The layout included in Appendix R of the EIAR depicts the most feasible layout alternative from an environmental and technical point of view.

4.2.4 Mitigation Measures Required for Preferred Alternative

4.2.4.1 Helbrandleegte Diversion

The recommendation of a suitable stream diversion will be determined by the layout of the development footprint. From the various alternatives, it appears that most of the options will result in unavoidable impacts of the wetland environs and will therefore require a suitable diversion in order to allow for artificial functionality of the habitat type. The efficacy of such a diversion would however be strongly informed by the nature of nearby developments that will affect these systems up- and downstream of the Project Site; diverting a portion of the system in isolation when no similar approaches up- and downstream are implemented, would be nonsensical. In such an event, the obligation and contribution to a suitable offset strategy will increase significantly.

The safe and effective conveyance of water around the facility could be easily engineered into a diversion structure designed based on modeled flow volumes and velocities. However, one of the important functions performed by the riparian habitat is the support of biodiversity, and the role that the riparian habitat plays as an ecological corridor. This function of a corridor becomes of elevated importance when surrounding developments are considered which are likely to lead to extensive habitat transformation on a local scale.

The required river diversion will therefore need to incorporate aspects that allow the diversion to continue to function as an ecological corridor. The diversion will need to resemble the natural stream and riparian habitat and the following recommendations are made in this regard:

- The diversion should be broad and largely un-channelled, potentially incorporating one or two depressions in which water could accumulate and be retained for brief periods after flood events;
- Ensuring the diversion is sufficiently wide will allow the diversion to more effectively act as a corridor as species moving along the diversion will be less likely to be affected by noise and movement disturbances on site. Recommendations of the biodiversity specialist should be considered in this regard, but a diversion width of at least 50 - 100m is recommended.
- The diversion must be vegetated using species currently occurring in the riparian habitat. Revegetation of the diversion is critical from a number of perspectives, including biodiversity support and soil stabilization.
- Establishing vegetation along the diversion might be a challenge given the low rainfall of the area, as well as the likely need to excavate the diversion. The removal of the shallow topsoil might leave little suitable growing medium in place. It is therefore recommended that topsoil be stripped and stockpiled for placement in the diversion following completion of construction activities.
- The use of berms, rather than deep excavation of the diversion, should be considered. Such berms could also act as noise and sight barriers to wildlife using the diversion as corridor or habitat.

The diversion of the stream should therefore be viewed as a last resort, based on development criteria and requirements (CSP) and should take cognisance of cumulative aspects.

4.2.4.2 Biodiversity Offsets

Anticipated impacts were assessed during the EIA in terms of the estimated significance in a context where unavoidable impacts will result on biological attributes during the life of the proposed development. Most impacts are regarded significant and long-term, but mostly restricted to a local milieu. It should be noted that none of the impacts represents a 'Red Flag' to the development when viewed in isolation, hence the 'No-Go' option is not regarded a requirement.

The nature of potential and likely impacts in the ecological environment is such that the implementation of mitigation measures is likely to reduce the significance of impacts to a more acceptable nature, but unavoidable loss will occur, irrespective of the level of mitigation. While an offset strategy will not result in any amelioration of potential and likely impacts, the contribution of the offset programme towards local and regional conservation of sensitive habitat places, the loss of portions of sensitive habitat in a context of a need for the proposed development, rendering the biodiversity losses that will inevitably result, more acceptable. It is important to note that an Offset Strategy is not recommended instead of mitigation measures; the implementation of sensible mitigation measures is not negotiable. An Offset Strategy should therefore be viewed as a last resort in light of significant impacts on the ecological environment.

Significant adverse impacts resulting from the proposed development on sensitive ecological attributes of the proposed site are most likely to be restricted to the wetland regimes of the site. While some significant impacts will inevitable result in the terrestrial environment, these impacts are generally of an acceptable nature (in a regional context) and can be effectively ameliorated. The loss of terrestrial habitat is unlikely to result in unacceptable ecological losses. One of the most important impacts in this regard is represented by the potential effects on conservation sensitive fauna that persist in the local environment. The mobility of most of these species enables them to evacuate areas of high impacts and relocating to nearby suitable habitat, which were found to be abundantly present in the surrounding areas. These statements, however, need to be interpreted with caution as severe cumulative impacts of numerous similar developments in the immediate surrounds are indicated, including the Abengoa, Sasol & Eskom projects (inter alia). The possibility of a collaborative effort between all local role players (developers) should be investigated.

Due to the nature of significant impacts in the wetland regime, the Offset Strategy will therefore mostly be guided by the wetland assessment (Wetland Consulting Services), while the biodiversity component will be augmentative in recommendations.

The following sections are presented in order to highlight aspects of an offset strategy that should be taken into account in order to present a suitable opinion on the size, location and management aspects of such a strategy.

a) Cost to Biodiversity

In order to determine whether a proposed offset will adequately compensate for immediate and residual impacts, the biodiversity loss to be caused, and the significance of this loss need to be determined through a synthesis of impacts prior and subsequent to the implementation of mitigation measures that include a biodiversity offset.

Indications are that loss of natural habitat and impacts on conservation important plants and animals will represent the most significant aspects to consider in this regard. Cumulative impacts, considering the nature of planned developments in the immediate surrounds, are likely to exacerbate these impacts on a local and regional context.

b) Offset Measurement

There are two (2) main approaches for offset measurement, namely the use of ecological proxies (such as hectares or habitat functions) and the use of economic values of biodiversity. In both cases, no uniform standard and simple solution is available, hence the preference of the area-based policy in this instance. Although in theory a like-for-like offset compensates for the biodiversity lost in a ratio of 1:1, the significance of two ecosystems may not be similar as to the economic or ecological services they provide. This calls for a precautionary approach with offset having to be like-for-better. In view of the Least Threatened status of the regional ecological types (Kalahari Karroid Shrubland & Bushmanland Arid Grassland), a 'like for like' approach will most likely suffice in terms of losses expected in the terrestrial environment; recommendations provided by the wetland ecologist need to be taken into account in this regard. Suitable offset alternatives will mostly be informed by wetland offset recommendations and a definite measure of collaboration is therefore needed between specialists. Two options are nonetheless possible, namely:

- No suitable terrestrial offset options are available in collaboration with the wetland offsets. This typically occurs when degraded wetland types that are recommended for rehabilitation, occur within a highly transformed and degraded environment. Independent terrestrial offset sites will in this event be recommended, typically considering existing local or regional conservation areas; and
- Suitable terrestrial offset options are available in collaboration with wetland offsets. The nature and extent of available terrestrial ecosystems will be taken into account, but will be heavily informed by wetland offset guidelines.

c) Compensation

Although the current proposed biodiversity offset system is focussed on physical area-based compensation, it does not necessarily exclude other forms of ecological compensation or monetary compensation schemes.

d) Offset Design

Key factors that should be addressed as part of the final offset programme include:

- Clear and valid purpose for offset in broader conservation planning;
- Consistency with development and conservation planning in the area;
- Clear designation of offset areas;
- Duration of the offset;
- Security of development and offset rights;
- Ecological effectiveness of the offset;
- Administrative costs of the offset; and
- Management responsibilities.

e) Offset Agreements

Before the development of a final offset management plan, the developer needs to reach agreement with a suitable land-owner. Such an agreement would include issues on ownership, management and the monitoring and evaluation of the proposed offset. At this stage of the process, only a vague indication of suitable offset is presented. Since suitable areas may still fall under an ownership not primarily concerned with biodiversity conservation, a consultation process needs to be driven by either the EAP or the Applicant.

f) Roles & Responsibilities

The three main parties in a biodiversity offset project include:

- • developer (acting on behalf of private shareholders);
- • authority (acting on behalf of the public); and

- • biodiversity representative (acting on behalf of biodiversity conservation).

The developer may receive authorisation for the development from the authority on certain conditions, such as the need for a sustainable biodiversity offset. The developer is required to follow the processes and rules laid down by the authorities to protect the interests of third parties and the diversity of life in the natural environment. The developer may need to appoint an independent environmental assessment practitioner (EAP) to exercise this responsibility.

The authority is responsible for defining the processes and rules for the biodiversity offset system, and may finally grant the right for development when all rules and regulations governing the offset system have been satisfied. The authority acts on behalf of third parties and ecosystems affected by development and would seek a solution that maximises social welfare.

The biodiversity representative includes all institutions, landowners or specialists acting in the interest of biodiversity. The existence of biodiversity impacts positively on a sustained flow of ecosystems services to the benefit of the public or as an intrinsic ecological value. A biodiversity representative may also be asked to assist the authority in evaluating the impacts of a development on biodiversity and the feasibility of a proposed offset (such as the biodiversity specialist or an independent statutory body concerned with biodiversity conservation and restoration).

4.2.4.3 Wetland Offsets

Where a direct loss of habitat and habitat functionality occurs as a result of proposed developments and the loss of such habitat cannot be mitigated on site, an offset strategy should be considered. Recently a lot of effort has been expended by SANBI on developing offset guidelines for wetlands in South Africa. The Draft SANBI Wetland Offset Guidelines (SANBI, 2012) provide a detailed methodology for determining the required offset areas and developing an offset strategy. Although the mentioned document has been specifically designed to deal with wetland offsets, and the habitat in question on the Project Site is riparian habitat, the methodology is still considered broadly applicable. Any offset strategy for the proposed development on site should thus be developed with the recently revised draft SANBI Offset Guidelines and offset calculator as guiding documents, but should also be strongly informed and guided by the biodiversity specialists involved in the project. Some further details on such an offset strategy, as well as an early indication of likely required offset targets are detailed below. However, all of these calculations should be revised once the compilation of the offset strategy commences. To calculate hectare equivalents and the required offset targets, the revised SANBI wetland offset calculator was used, as detailed in the document:

Towards a best-practice guideline for wetland offsets in South Africa: Final Report. SANBI. 2012.

"These guidelines are currently (2012) undergoing a review process by the Department of Water Affairs, other government departments and expert stakeholders. The process should result in the formal endorsement of these guidelines as a Department of Water Affairs guideline document in early 2013. SANBI is releasing the current version for use by the wetland community as we feel that it will both be useful to the wetland community, and also allow the identification of any problems in the document before formal endorsement. However, these guidelines currently have no formal status and cannot be considered to be formally endorsed by any government department." (SANBI 2012). The SANBI offset guideline document is available from sholness@nmmu.ac.za

a) Determining hectare equivalents

In order to allow for the quantification of wetland losses due to development and the gains due to wetland offsets and rehabilitation, as well as the comparison between the two, a unit of measure is required to use as a common currency for evaluating impacts and assessing the adequacy of offset proposals. This is achieved through use of the 'hectare equivalent'.

A hectare equivalent is a quantitative expression of the ecological integrity of a wetland hydro-geomorphic (HGM) unit under a given land use. It represents the common currency that enables the wetland functional area restored to the landscape by restoration, rehabilitation and artificial creation to be compared to that removed from the landscape by a development. Most environmental authorities advocate a no-net-loss of resources approach, be it to biodiversity or wetland functioning, and the hectare equivalent provides the conceptual means of judging whether these rehabilitation objectives have been satisfied.

'Hectare equivalent' is a measure of wetland functional area obtained through a conversion of the wetland health (PES) rating and the wetland aerial extent (hectares). This is done by converting the overall health (PES) score to an intactness score and then multiplying by the wetland area (in hectares) to obtain a measure of functional area:

(10-PES score) X wetland area = hectare equivalent

As an example, a 10 ha wetland with a PES score of 3 (category C – moderately modified) would be equal to:

(10-3) X 10 = 7 hectare equivalents

In essence, this reflects that a wetland which is moderately modified (PES category C) is only expected to be performing 70 % of the function that the wetland could have performed under pristine conditions.

b) Wetland Offset Targets

The broad wetland offset policy goals proposed by the SANBI offset guidelines (SANBI, 2012) are as follows:

- Formally protecting wetland systems in a good condition so as to contribute to meeting national conservation targets for the representation and persistence of different wetland and wetland vegetation types.
- No net loss in the overall wetland functional area by providing gains in wetland area and / or condition equal to or greater than the losses due residual impacts;
- Providing appropriate and adequate compensation for residual impacts on key\ ecosystem services
- Adequately compensating for residual impacts on threatened or otherwise important (e.g. wetland-dependent) species through appropriate offset activities that support and improve the survival and persistence of these species.

In order to achieve these goals, there are two aspects to the implementation of wetland offsets and which are determined through application of the wetland offsets calculator:

- **Functional Offset Targets** – these targets aim to secure the no net loss of overall wetland functional area and require that the total hectare equivalents lost as a result of the proposed development are gained through rehabilitation activities within remaining wetlands. No multipliers are applicable to these offset targets.
- **Ecosystem Conservation Targets** – also referred to as the protection-based offset. These targets aim to ensure the formal protection of wetland systems in a good condition so as to meet conservation targets. Depending on various factors, including vegetation threat status, offset multipliers are applicable.

Hectare equivalents were determined using the above formula for the Helbrandleegte riparian habitat affected by the proposed development. The results are summarised in Table 6 below.

Table 6 Results of the hectare equivalents calculation showing the likely offset target values.

Habitat	Functional Offset (hectare equivalents)	Ecosystem Conservation Target (hectare equivalents)
Helbrandleegte riparian zone	70.00	41.20

The required functional offset target would be 70 hectare equivalents. This target would need to be achieved through rehabilitation activities within remaining habitats on site (and if required, offsite) that result in a total hectare equivalent gain of at least 70 hectare equivalents.

Ideally the rehabilitation aspect of the functional offset target should take place as close as possible to where the wetland functional area is being lost, i.e. within the Helbrandleegte sub-catchment.

Using the revised wetland offset calculator, individual multipliers are determined for each hydro-geomorphic wetland unit. The exact total will depend on the outcome of these calculations once they are undertaken as part of the development of the wetland offset strategy, but is likely to be approximately equal to the 41.2 hectare equivalents indicated above. This figure is derived from the 70 hectare equivalents lost, multiplied by an offset multiplier of 0.6. The reason for such a low multiplier being used is the location of the Helbrandleegte riparian habitat with a vegetation type that is not yet considered threatened

The protection-based offset should ideally be located within the same quarternary catchment as the habitat that is being lost, and should be undertaken on a like-for-like basis as far as possible, i.e. the loss of riparian habitat should be offset through the protection of riparian habitat rather than say pan wetlands. If suitable sites cannot be found within the same quarternary catchment, alternative sites further afield will need to be sought, ideally though within the same broad ecosystem type.

It is recommended that the above offset calculations are reviewed by the project team once the development layout plans have been finalised. Given that the SANBI offset guidelines were developed specifically for wetland areas and the habitat in question is a riparian habitat, an alternative approach might be more suitable. Potentially a simple offset multiplier of 2:1 applied in a protection-based offset might be most suitable.

4.3 TECHNOLOGY ALTERNATIVES

4.3.1 Photovoltaic Power (PV) Systems

Two (2) PV technologies were considered for the proposed project, which are the most prominent technologies used worldwide. The technology options are described below:

4.3.1.1 Crystalline Technologies

By far, the most prevalent bulk material for solar cells is crystalline silicon (C-SI). Bulk silicon is separated into multiple categories according to crystallinity and crystal size in the resulting ingot, ribbon, or wafer.

- Monocrystalline silicon (c-Si): often made using the Czochralski process. Single-crystal wafer cells tend to be expensive, and because they are cut from cylindrical ingots, do not completely cover a square solar cell module without a substantial waste of refined silicon. Hence most c-Si panels have uncovered gaps at the four corners of the cells.

- Poly- or Multicrystalline silicon (poly-Si or mc-Si): made from cast square ingotslarge blocks of molten silicon carefully cooled and solidified. Poly-Si cells are less expensive to produce than single crystal silicon cells, but are less efficient.

- Ribbon silicon is a type of multicrystalline silicon: it is formed by drawing fiat thin films from molten silicon and results in a multicrystalline structure. These cells have lower efficiencies than poly-Si, but save on production costs due to a great reduction in silicon waste, as this approach does not require sawing from ingots.

Prices of polycrystalline silicon have gradually dropped as companies build additional polysilicon capacity quicker than the industry's projected demand. Manufacturers of wafer-based cells have responded to high silicon prices in 2004 - 2008 prices with rapid reductions in silicon consumption.

4.3.1.2 Thin Film Technologies

Thin-film technologies reduce the amount of material required in creating a solar cell. Though this reduces material cost, it also reduces energy conversion efficiency. Thin-film solar technologies have enjoyed large investment due to the success of First Solar and the promise of lower cost and flexibility compared to wafer silicon cells, but they have not become mainstream solar products due to their lower efficiency and corresponding larger area consumption per watt production.

Cadmium telluride (CdTe), copper indium gallium selenide (CIGS) and amorphous silicon (A-Si) are three thin-film technologies often used as outdoor photovoltaic solar power production.

4.4 NO-GO ALTERNATIVES

The current low environmental impact associated with long term sustainable farming practices will be maintained and no change in land use or zoning would be required. The status quo needs to be measured against the proposed facility to determine whether the environmental and socio-economic benefits warrant the approval thereof or whether the status quo should be maintained.

This development alternative entails that the proposed PV developments not be constructed on the Farm Rooipunt, thus result in the site being left as is. With South Africa's new focus on renewable energy and the targets set the NO-GO option will result in a zero contribution to these targets and no alleviation with regards to the current demand pressures on electricity.

The non-development of the proposed PV plant will furthermore impede economic development and socio-economic progress for the surrounding communities and the Kai! Garib Municipality region.

Due to the numerous socio economic and economic benefits, the enviornemtnal advancement and the fact that the identified environmental impacts can be suitably mitigated it has been determined that the No Go option can be been eliminated.

Should the Competent Authorities (CA)refuse the authorisation of the proposed Solar Power Park, the 'No Go' option will be "implemented" and the status quo of the site will remain in tact - leaving the site in its present state.

The site is currently being used for Agricultural purposes – livestock grazing. Although these activities are seemingly well managed at this point in time – this development option still has the potential for erosioand environmental degradation, as no control mechanisms will be in place to ensure that environmental consequences are kept at aminimum and grazing may be left unattended or unmanaged.

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5. PUBLIC PARTICIPATION PROCESS

5.1 OVERVIEW OF PUBLIC PARTICIPATION PROCESS UNDERTAKEN DURING THE EIA PHASE

The Public Participation Process (PPP) for the project is conducted in accordance with Chapter 6 of the EIA Regulations. The primary aims of the PPP during the Scoping Phase were:

- To inform Interested and Affected Parties (I&APs) of the proposed project;
- To identify issues, comments and concerns as raised by I&APs;
- To promote transparency and an understanding of the project and its consequences;
- To serve as a structure for liaison and communication with I&APs; and
- To provide local knowledge and input in identifying potential environmental (biophysical and social) impacts and "hotspots" associated with the proposed development.

5.2 INTERACTION WITH KEY STAKEHOLDERS

During the EIA Phase comments and issues raised by key stakeholders, identified during the preceding Scoping Phase, were addressed in the EIAR, kept informed of the process and were requested to give inputs on the Draft EIAR. These stakeholders included:

- National and Provincial Government Representatives:
    - Department of Environmental Affairs (DEA);
    - Department of Water Affairs (DWA);
    - Department of Agriculture, Forestry and Fisheries (DAFF);
    - South African Heritage Resources Agency (SAHRA); and
    - Relevant Northern Cape Provincial Authorities (ex. Environment & Conservation, Agriculture).
    - Relevant Local and District Municipalities:
    - Siyanda District Municipality;

  - Kai !Gharib Local Municipality; and
  - Khara Hais Local Municipality.
- Parastatals – Eskom, Civil Aviation Authority;
- Affected and surrounding landowners;
- Environmental Non-Governmental Organizations (e.g. Wildlife Society of South Africa, BirdLifeSA);
- Community based organisations; and
- Other (i.e. Air Traffic and Navigation Systems)

All I&AP information (including contact details), together with dates and details of consultations and a record of all issues raised is recorded within a comprehensive project database. This database will be updated on an on-going basis throughout the project, and will act as a record of the communication/public consultation process. It will be included in the updated C&RR of the Final EIA Report.

5.3 REVIEW OF DRAFT EIA REPORT

The Draft EIAR wil be available for public review at the following locations in close proximity to the study area, which were identified as readily accessible to I&APs:

- Khara Hais Local Municipal offices;
- Khara Hais Public Library
- Kai !Garib Public Library
- Kai !Garib Local Municipal Offices
- Forum Public Library
- Paballelo Public Library
- The following website: WorleyParsons RSA :

A 30-calendar day period is allowed for this review process from 12 June 2014 to 12 July 2014.Registered stakeholders and I&APs on the project database will be notified of the availability of this report via post or e-mail. The report will also be distributed to all the commenting authorities for review and comment in electronic or hard copy format.The availability of this draft report will be advertised through the following media:

5.4 MEDIA ADVERTISING

As per the statutory requirements of the 2010 EIA Regulations, the availability of the Draft EIA Report for public review will be advertised in the following local newspapers on 12 June 2014:

- *Sowetan (English); and*
- *Die Gemsbok (Afrikaans).*

Copies of the Newspaper Advertisements will be included in the updated C&RR in the final EIA Report.

5.5 MEDIA ADVERTISING

Site notices will be prepared according to the requirement set out in the EIA Regulations. The site notices will advertise the availability of the Draft EIAR for public review as well as the invitation to the public meeting. Site notices were placed at the entrance of the development site and at the Main road (N14) turnoff to the site.

5.6 PUBLIC NOTICES

Due to the proximity of project to Kai !Garib and Khara Hais Local Municipality the PPP focused on this Municipal area. Sets of A3 public notices will be placed on notice boards at the following amenities frequented by I&APs in Upington, Keimoes and Kakamas:

- Khara Hais Public Library
- Forum Public Library
- Kai !Garib Public Library
- Kai !Garib Local Municipal Offices
- Paballelo Public Library
- Khara Hais Local Municipality;

- Upington Agrimark;
- River City SPAR; and

Photographs of the notices placed in and around the affected area will be included in the updated C&RR in the Final EIAR

5.7 CONSULTATION AND PUBLIC INVOLVEMENT

During the Scoping process I&APs were invited to the public meeting.The turnout to the meeting was very low. As a result no public meeting will be held for the EIA phase unless the public reaction ot the printed medial and notices warrents one. The minutes of the public meeting will be compiled, distributed to attendees of the meetings and included in the C&RR of the Final EIA Report.

Consultation with I&APs, will further continue throughout the duration of the project.

5.8 SOCIAL ISSUES TRAIL

Issues and concerns raised during the Scoping Phase were included in the C&RR appended to the Scoping Report. The issues and concerns that were not addressed and resolved in the Scoping Report was included and addressed in the EIAR. All issues raised during the EIAR Phase Public Participation Process will be recorded and resolved. The C&RR will be updated and included in the Final EIAR updated with this information.

6. ASSESSMENT OF IMPACTS IDENTIFIED DURING THE EIA PHASE

During the EIA Phase, the preliminary identification and consideration of issues and concerns that may impact (positively and/or negatively) the biophysical and socio-economic environments was conducted. The issues that were identified as potentially significant during the EIA Phase formed the basis on which the more detailed specialist studies were conducted during the EIA Phase.In addition the less significant environmental impacts were also assessed providing a holistic assessment of the site.A screening process was conducted based on the inputs from the specialist baseline investigations to determine the most significant impacts that required further specialist assessment. Each of these potential issues identified in the Scoping Phase was assessed by the respective specialists and will be addressed in this section.

The standard impact rating methodology that was providedto the different independent specialist during this EIA for the calculation of the impact significance for each identified impact is described below.

6.1 SIGNIFICANCE RATING METHODOLOGY

All specialists were requested to provide their feedback, recommendations, impact ratings and possible mitigation measures in a uniform format. To ensure the various specialist studies present an accurate depiction of the proposed environmental status, six (6) standard rating scales are defined, applied in order to assess and quantify the identified impacts. The rating system used for assessing impacts (or when specific impacts cannot be identified, the broader term issue should apply) is based on five (5) criteria, namely:

- The relationship between impacts/issues and impact status (Box 1);
- The relationship between impacts/issues and spatial scale (Box 2);
- The relationship between impacts/issues and temporal scale (Box 3);
- The relationship between impacts/issues and probability (Box 4);
- The relationship between impacts/issues and severity (Box 5);

These five(5) criteria are combined to describe the overall importance rating, namely the significance (Box 6).

Box 1: Status of impacts

Rating	Description	Quantitative Rating
Positive	A benefit to the receiving environment.	+
Neutral	No cost or benefit to the receiving environment.	N
Negative	A cost to the receiving environment.	-

Box 2: Spatial scale of impacts

Rating	Description	Quantitative Rating
None	No impact	0
Low	Site Specific; Occurs within the site boundary.	1
Medium	Local; Extends beyond the site boundary; Affects the immediate surrounding environment (i.e. up to 5 km from Project Site boundary).	2
High	Regional; Extends far beyond the site boundary; Widespread effect (i.e. 5 km and more from Project Site boundary).	3
Very High	National and/or international; Extends far beyond the site boundary; Widespread effect.	4

Box 3: Temporal scale of impacts

Rating	Description	Quantitative Rating
None	No impact	0
Low	Short term; Quickly reversible; 0 – 5 years.	1
Medium	Medium term; Reversible over time; 5 – 15 years.	2
High	Long term; Approximate lifespan of the project: 16 -30 years.	3
Very High	Permanent; over 30 years and resulting in a permanent and lasting change that will remain.	4

Box 4: Probability of impacts

Rating	Description	Quantitative Rating
None	No impact	0
Improbable	Possibility of the impact materialising is negligible; Chance of occurrence <10%.	1
Probable	Possibility that the impact will materialise is likely; Chance of occurrence 10 – 49.9%.	2
Highly Probable	It is expected that the impact will occur; Chance of occurrence 50 – 90%.	3
Definite	Impact will occur regardless of any prevention measures; Chance of occurrence >90%.	4

Box 5: Severity of impacts

Rating	Description	Quantitative Rating
None	No impact	0
Negligible / Minor	The system(s) or party (ies) is marginally affected by the proposed development.	1
Average	Medium or short term impacts on the affected system(s) or party (ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example, a temporary fluctuation in the water table due to water abstraction.	2
Severe	Medium to long term impacts on the affected system(s) or party (ies) that could be mitigated. For example constructing a narrow road through vegetation with a low conservation value.	3
Very Severe	An irreversible and permanent change to the affected system(s) or party (ies) which cannot be mitigated. For example, the permanent change to topography resulting from a quarry.	4

Box 6: Significance of impacts

Impact	Rating	Description	Quantitative Rating
Positive	High	Of the highest positive order possible within the bounds of impacts that could occur.	+ 12 – 16
	Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. Other means of achieving this benefit are approximately equal in time, cost and effort.	+ 6 – 11
	Low	Impacts is of a low order and therefore likely to have a limited effect. Alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less time-consuming.	+ 1 – 5
No Impact	No Impact	Zero impact.	0
Negative	Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Social, cultural, and economic activities of communities can continue unchanged.	- 1 – 5
	Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and fairly possible. Social cultural and economic activities of communities are changed but can be continued (albeit in a different form). Modification of the project design or alternative action may be required.	- 6 – 11
	High	Of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is no possible mitigation that could offset the impact, or mitigation is difficult, expensive, time-consuming or a combination of these. Social, cultural and economic activities of communities are disrupted to such an extent that these come to a halt.	- 12 - 16

6.2 DESCRIPTION OF IDENTIFIED IMPACTS

The identified impacts on environmental and social receptors arising from the proposed development include direct and indirect impacts. Impacts are also linked to the different stages of the project development i.e. construction, operation and decommissioning. The potentially significant impacts that were highlighted during Scoping are as follow:

- Loss to archaeological and cultural heritage;
- Visual and landscape impacts;
- Impact on natural vegetation and ecology;
- Avifaunal;
- Waste impacts;
- Surface hydrology;
- Wetland impacts; and
- Socio-economic impacts.

The impacts listed above were earmarked for further specialist assessment in order to assess their impacts more accurately and determine possible mitigation measures to be included in the Environmental Management Programme (EMP). In addition to the potentially significant impacts, specialist assessments were also conducted for a number of the potentially less significant impacts. This was done in order to discount any possibility of a potentially significant impact occurring as a result of the proposed project and it being left unaccounted and unmitigated causing potentially serious harm to the environment. These specialist assessments included the following:

- Air quality;
- Geotechnical;
- Soils and Agriculture Potential;
- Noise;
- Geohydrology; and

- Tourism.

Through the implementation of standard environmental management measures the impacts on traffic, loss of agricultural land, and health and safety will also be addressed sufficiently in the impact assessment and controlled by the EMP.

6.3 POTENTIAL ENVIRONMENTAL IMPACTS

A key part of the Scoping Process is the preliminary identification and consideration of issues and concerns that may impact (positively and/or negatively) with the biophysical and socio-economic environments. The issues that are identified as potentially significant during the Scoping Phase forms the basis on which the more detailed specialist studies are conducted during the EIA Phase. Each of the potential issues identified in the Scoping Phase will be briefly described in this section.

6.3.1 Description of potential impacts

The potential impacts on environmental and social resources arising from the proposed development include direct and indirect impacts. Potential impacts will also be linked to the different stages of the project which are identified as construction, operation and decommissioning.Table 7 provides an overview of likely aspects arising from each of the key project activities and considers their likely interaction with socio-economic and environmental resources and receptors.

Table 7: Interaction between Project Activities and Receiving Environment

Project Activities	Receptor/Resource										
	Fauna	Flora	Soils	Hydrology	Wetland	Traffic and Transport	Air Quality	Land Use and Agricultural Potential	Landscape and Visual Amenity	Heritage/Archaeology/ Palaeontology	Socio-economics
Pre-construction and Construction											
Vegetation Clearance											
Construction of Access Roads											
Construction of Temp. Hard Standing											
Site Levelling and Grading											
Preparation of Solar Panel Foundations											

Project Activities	Receptor/Resource										
	Fauna	Flora	Soils	Hydrology	Wetland	Traffic and Transport	Air Quality	Land Use and Agricultural Potential	Landscape and Visual Amenity	Heritage/Archaeology/ Palaeontology	Socio-economics
Underground Cables/Overhead lines											
Substation Construction											
Solar Panel Delivery and Erection											
Construction of Service Building											
Hard Standing Area Rehabilitation											
Waste											
Operation											
Solar Panel Operation											
Use of Access Tracks											
Use of Buildings											
Site Maintenance											
Waste											
Decommissioning											
Removal of Solar Panels											
Removal of Foundations											
Removal of Access Roads											
Removal of Underground Cables											
Waste											
Site Restoration & Rehabilitation											

Note: This interactions matrix will be continually developed throughout the EIA process.

Key: Shaded box indicates potential interaction between the project and resource or receptor.

6.3.2 Potentially Significant Impacts

The following section describes potentially significant issues both the PV and CSP based on the initial site visit, discussions with the project team, issues and concerns raised by I&AP's during the PPP and available information about and from experience regarding the environmental effects of similar solar energy developments. These potential impacts will be separately discussed in detail for the PV and CSP in the EIAR.

It is likely that many of these impacts can be adequately addressed through the implementation of appropriate mitigation and management measures, however, some require further specialist investigation as part of the EIAR as indicated. The aspects that are potentially significant include the following:

6.3.3 Air Quality : Potential Impacts

6.3.3.1 Impacts proposed during construction

During the construction phase it is expected that, the main sources of impact will result due to the construction of access roads, and the plant area. These predicted impacts cannot be quantified, primarily due to the lack of detailed information related to scheduling and positioning of construction related activities. Instead a qualitative description of the impacts will be provided. This will involve the identification of possible sources of emissions and the provision of details related to their impacts.

Construction is commonly of a temporary nature with a definite beginning and end date. Construction usually consists of a series of different operations, each with its own duration and potential for dust generation. Dust emission will vary from day to day depending on the phase of construction, the level of activity, and the prevailing meteorological conditions (USEPA, 1996).

The following possible sources of fugitive dust have been identified as activities which could potentially generate dust during construction operations at the site:

- Product Transport
- Scraping;
- Debris handling;
- Debris stockpiles;
- Truck transport and dumping of debris.

- Clearing of site for infrastructure;

a) Creation and Grading of Access Roads

Access roads are constructed by the removal of overlying topsoil, whereby the exposed surface is graded to provide a smooth compacted surface for vehicles to drive on. Material removed is often stored in temporary piles close to the road edge, which allows for easy access once the road is no longer in use, whereby the material stored in these piles can be re-covered for rehabilitation purposes. Often however, these unused roads are left as is in the event that sections of them could be reused at a later stage.

A large amount of dust emissions are generated by vehicle traffic over these temporary unpaved roads (USEPA, 1996). Substantial secondary emissions may be emitted from material moved out from the site during grading and deposited adjacent to roads (USEPA, 1996). Passing traffic can thus re-suspend the deposited material.

To avoid these impacts material storage piles deposited adjacent to the road edge should be vegetated, with watering of the pile prior to the establishment of sufficient vegetation cover. Piles deposited on the verges during continued grading along these routes should also be treated using wet or chemical suppressants depending on the nature and extent of their impacts.

A positive correlation exists between the amount of dust generated (during vehicle entrainment) and the silt content of the soil as well as the speed and size of construction vehicles. Additionally, the higher the moisture content of the soil the lower the amount of dust generated. The periodic watering of these road sections will aid in the reduction of dust generated from these sources. Cognisance should be taken to increase the watering rate during high wind days and during the summer months when the rate of evaporation increases.

b) Preparation of areas identified for the construction of the plant and supporting infrastructure

Removal of material usually takes place with a bulldozer, extracted material is then stored in piles for later use during rehabilitation procedures. Fugitive dust is generated during the extraction and removal of overlying material, as well as from windblown dust generated from cleared land and exposed material stockpiles. Dust problems can also be generated during the transportation of the extracted material, usually by truck, to the stock piles. This dust can take the form of entrainment from the vehicle itself or due to dust blown from the back of the trucks during transportation.To avoid the generation of unnecessary dust, material drop height should be reduced and material storage piles should be protected from wind erosion. This can take the form of wind breaks, water sprays or vegetation of piles. All stockpiles should be damped down, especially during dry weather.

It should be noted that emissions generated by wind are also dependent on the frequency of disturbance of the erodible surface. Each time material is added to or removed from a storage pile or surface, the potential for erosion by wind is restored. Any crusting of the surface binds the erodible material (USEPA, 1996). Dust created during the transportation can be limited by watering the road sections that are being used and by either wetting the material being transported or covering the back of the trucks, to limit the windblown dust from the load.The removed topsoil will have to be transported to a designated collection point from where it can be recovered later during site rehabilitation. The removal of this material for storage should be done along designated roads which are properly maintained (watering), to reduce the amount of vehicle entrained dust which can be kicked up during these activities. In addition to the use of dedicated, treated roads, the material transported can be wet or covered to limit the windblown dust being released from the load.

It can thus be concluded that thefollowing components of the environment may be impacted upon during the construction phase of the proposed development:

- Ambient air quality;
- Local residents and neighbouring communities;
- Employees;
- The aesthetic environment; and
- Possibly fauna and flora.

The impact on air quality and air pollution of fugitive dust is dependent on the quantity and drift potential of the dust particles (USEPA, 1996). Large particles settle out near the source causing a local nuisance problem. Fine particles can be dispersed over much greater distances. Fugitive dust may have significant adverse impacts such as reduced visibility, soiling of buildings and materials, reduced growth and production in vegetation and may affect sensitive areas and aesthetics. Fugitive dust can also adversely affect human health. It is important to note that impacts will be of a temporary nature, only occurring during the construction period.

Given the short duration and low level of activity expected during construction, but bearing in mind that no quantitative emission figures exist, no long adverse impacts are anticipated on these receptors. Impact of fugitive dust emissions on employees on site could however be significant during the construction phase, but will vary between phases, with level of activity and meteorological conditions.

6.3.3.2 Impacts proposed during operation

This section aims to deal with the predicted air quality impacts which result due to the proposed operations. Details regarding the source characteristics will be obtained from site layout plans and process specific information provided and a questionnaire filled in by the client. The sources to be included in this assessment can be categorised as follows:

- Material handling;
- Plant Installation; and
- Equipment Transport.

6.3.3.3 Impacts proposed during decommissioning phase

The decommissioning phase is associated with activities related to the demolition of infrastructure and the rehabilitation of disturbed areas. The total rehabilitation will ensure that the total area will be free draining, covered with topsoil and revegetated. The following activities can beassociated with the decommissioning phase (US-EPA, 1996):

- Existing buildings and structures demolished, rubble removed and the area levelled;
- Remaining exposed excavated areas filled and levelled using overburden recovered from stockpiles;
- Stockpiles and tailings impoundments to be smoothed and contoured;
- Topsoil replaced using topsoil recovered from stockpiles; and
- Land and permanent waste piles prepared for revegetation.
- Possible sources of fugitive dust emission during the closure and post-closure phase include:
- Smoothing of stockpiles by bulldozer;
- Grading of sites;
- Transport and dumping of overburden for filling;
- Infrastructure demolition;
- Infrastructure rubble piles;

- Transport and dumping of building rubble;
- Transport and dumping of topsoil; and
- Preparation of soil for revegetation – ploughing and addition of fertiliser, compost etc.

Exposed soil is often prone to erosion by water. The erodability of soil depends on the amount of rainfall and its intensity, soil type and structure, slope of the terrain and the amount of vegetation cover (Brady, 1974). Revegetation of exposed areas for long-term dust and water erosion control is commonly used and is the most cost-effective option.

Plant roots bind the soil, and vegetation cover breaks the impact of falling raindrops, thus preventing wind and water erosion. Plants used for revegetation should be indigenous to the area, hardy, fast-growing, nitrogen-fixing, provide high plant cover, be adapted to growing on exposed and disturbed soil (pioneer plants) and should easily be propagated by seed or cuttings.

6.3.4 Avifauna : Potential Impacts

6.3.4.1 Impacts proposed during construction

a) Disturbance of birds and barrier effects

The disturbance of avifauna during the construction of the facility and associated infrastructure is likely to occur. Disturbance could also contribute to a habitat fragmentation effect during the operational phase of this project, since certain bird species will be displaced from the site, and forced to find alternative territories.

b) Habitat destruction associated with the construction of the facility

During the construction of this project, a certain amount of habitat destruction and disturbance will take place. The nature of the proposed facility means that the majority of the site will be transformed.

c) New roads

Disturbance of avifauna is likely to occur to some extent, but not likely to be too significant as there is already a gravel district road (along the rail line to the west of the site) as well as various tracks through the farm and it is unlikely that extensive new roads would be, again depending on the exact layout of the PV (and CSP) Projects on the Project Site.

Habitat destruction caused by road construction will have some impact on avifauna, but as discussed elsewhere the habitat in this landscape is relatively uniform and so this impact is unlikely to be too significant.

d) New pipe lines

This infrastructure is likely to have very similar impacts to the roads discussed above, except on a smaller scale. Should new pipelines be required for water supply to the CSP and PV plant impacts of this on avifauna will be minor habitat destruction and minor disturbance.

6.3.4.2 Impacts proposed during operation

a) Disturbance of birds and barrier effects

The disturbance of avifauna during the maintenance and operation of the facility and associated infrastructure is likely to occur. Disturbance could also contribute to a habitat fragmentation effect during the operational phase of this project, since certain bird species will be displaced from the site, and forced to find alternative territories.

b) Habitat destruction associated with the construction of the facility

During the maintenance phases of this project, a certain amount of habitat destruction and disturbance will take place. The nature of the proposed facility means that the majority of the site will be transformed.

c) Collision of birds with panels and other infrastructure

There is a chance that birds will collide with the PV panels and CSP heliostats, as they do with the windows of buildings. This could be during the normal course of their daily activities or when they are attracted to the panels, perhaps mistaking them for water sources. It is important to stress that this impact will probably only become significant when large numbers of birds are in the vicinity of the facility. For this reason, the more sensitive species in terms of this impact are likely to be the gregarious, flocking species which are mostly not threatened species in this study area. This is a new impact, the likes of which has not been seen in South Africa to date.

d) Nesting and other use of infrastructure by birds

Certain species, in particular Sociable Weaver, are likely to use some of the facility infrastructure for nesting, perching ad roosting. Nesting is particularly problematic, as it may make maintenance difficult for staff, and also poses a fire risk since nests present abundant fuel for fires.

e) Altered run off patterns

Depending on how the vegetation beneath the photovoltaic array and heliostat fieldis managed, this could create a new micro habitat for birds. It is likely that water used to wash the panels will fall to the ground and will effectively increase the amount of moisture, thereby stimulating plant growth. This could attract certain bird species to the site, particularly in winter when green vegetation is scarce in the area. Alternatively, erosion of the site by water runoff could be a concern. It is likely that these aspects would be discussed in more detail in the botanical specialist study. A better understanding of this aspect can be acquired through detailed on site avifaunal monitoring, as proposed elsewhere in this report

f) Water treatment works

Although not an impact in itself, the way in which water is treated and managed on site is a potential aggravating factor for other impacts.

Most of the direct impacts described above rely on birds congregating in numbers or regularly frequenting the site in order for the impact to have a high likelihood of occurring. In this arid environment, it is likely that any new surface water sources will do exactly that, attract and concentrate various bird species on site, thereby increasing the risk of direct impacts.

g) New power lines

Collision of large terrestrial birds with overhead distribution power lines is likely to occur and is anticipated to be the most significant threat posed by associated infrastructure. Species most likely to be affected are korhaans and other large terrestrial species. The significance of this impact depends on the length of new line to be built. In this case it appears that new line will be required from the Solar Power Park to a substation connecting with the High Voltage (HV) line running to the south-west of the site.

Electrocution of birds on pylons will depend entirely upon the exact pylon structure that for the new line – detail of which was not available at the time of this study. Electrocution risk is determined by the phase-phase and phase-earth clearances on a pole structure which differ greatly between different structures. Again, if the structure used is dangerous to birds, the significance of this impact will vary with the length of the line.

Nesting of birds on pylons is in fact a positive impact on avifauna, but may impact negatively on the quality of electrical supply by causing electrical faults. In the case of Sociable Weaver nests, the nest material may pose problems to the pylons structural integrity through added weight, and there is an increased fire risk due to the fuel load of these massive nests. Disturbance of avifauna through construction and maintenance activities associated with the power line is not likely to be significant. Habitat destruction by construction activities is likely to occur, but not likely to be significant.

h) New roads

Disturbance of avifauna is likely to occur to some extent, but not likely to be too significant as there is already a gravel district road (along the rail line to the west of the site) as well as various tracks through the farm and it is unlikely that extensive new roads would be, again depending on the exact layout of the CSP and PV within the farm. Habitat destruction caused by road construction will have some impact on avifauna, but as discussed elsewhere the habitat in this landscape is relatively uniform and so this impact is unlikely to be too significant.

i) New pipe lines

This infrastructure is likely to have very similar impacts to the roads discussed above, except on a smaller scale. Should new pipelines be required for water supply to the CSP and PV impacts of this on avifauna will be minor habitat destruction and minor disturbance.

6.3.5 Fauna and Flora (Biodiversity) : Potential Impacts

No impacts were identified that could lead to a beneficial effect on the ecological environment since the proposed development is largely destructive as it involves the alteration of natural habitat. A list of expected impacts were compiled from a generic list of possible impacts derived from previous projects of this nature and from a literature review of the potential impacts of similar facilities on the ecological environment. The major expected negative impact will be due to loss of habitat that may have direct or indirect impacts on individual organisms and communities.

Impacts resulting from the construction and operation of Solar Power Parks are largely restricted to the physical impacts on biota or the habitat in which they occur. Direct impacts, such as habitat destruction and modifications, are regarded immediate, long-term and of high significance. These impacts are mostly measurable and easy to assess since the effects are immediately visible and can be determined to an acceptable level of certainty. In contrast, indirect impacts (operation, waste handling & potential spillages, leaching, long-term changes in surrounds) are not immediately evident and can consequently not be measured immediately or accurately. A measure of estimation is therefore necessary in order to evaluate these impacts.

Lastly, impacts of a cumulative nature places direct and indirect impacts of this projects into a regional and national context, particularly in view of similar or resultant developments and activities. The following impacts were identified that are of relevance to the proposed development. Not all of these impacts might occur, or the extent of impact might be limited.

6.3.5.1 Impacts proposed during construction and operation

a) Impacts on Threatened & Protected Flora & Fauna Species& Habitat

This impact is regarded a direct impact as it results in the physical damage or destruction of Red Data or Threatened species or areas that are suitable for these species, representing a significant impact on the biodiversity of a region. Threatened species, in most cases, do not contribute significantly to the biodiversity of an area in terms of sheer numbers as there are generally few of them, but a high ecological value is placed on the presence of such species in an area as they generally only occur in pristine habitat. Conversely, the presence of pristine habitat conditions can frequently be accepted as an indication of the potential presence of species of conservation importance, particularly in moist habitat conditions.

Red Data species are particularly sensitive to changes in their environment, having adapted to a narrow range of specific habitat requirements. Habitat changes, mostly a result of human interferences and activities, are the greatest reasons for these species having a threatened status. Surface transformation/ degradation activities within habitat types that are occupied by species of conservation importance will ultimately result in significant impacts on these species and their population dynamics. Effects of this impact are usually permanent and recovery or mitigation is generally not perceived as possible.

One of the greatest drawbacks in terms of limiting this particular impact is that extremely little information is available in terms of the presence, distribution patterns, population dynamics and habitat requirements of Red Data flora species in the study area. In order to assess this impact, it is necessary to assess the presence/ distribution of habitats frequently associated with these species. In addition, by applying ecosystem conservation principles in this assessment and subsequent planning and development phases, resultant impacts will be limited largely. The likelihood that this impact will occur is high and will be of high significance.

b) Destruction of Sensitive/ Pristine Habitat Types

The loss of pristine habitat types or habitat that are regarded sensitive as a result of restricted presence in the larger region (atypical habitat) represents a potential loss of habitat and biodiversity on a regional scale. Sensitive habitat types include mountains, ridges, koppies, wetlands, rivers, streams and localised habitat types of significant physiognomic variation and unique species composition. It also includes forest, fynbos and wetland vegetation that leads to direct or indirect loss of such habitat. These areas represent centres of atypical habitat and contain biological attributes that are not frequently encountered in the greater surrounds. A high conservation value is generally ascribed to floristic communities and faunal assemblages that occupy these areas as they contribute significantly to the biodiversity of a region.

Furthermore, these habitat types are generally isolated and are frequently linear in nature, such as rivers and ridges. Any impact that disrupts this continuous linear nature will risk fragmentation and isolation of existing ecological units, affecting the migration potential of some fauna species adversely, pollinator species in particular.

Microhabitat conditions are changed because of the removal of the vegetation layer, affecting shade conditions, habitat competition, germination success of the herbaceous layer, etc. This is likely to result in the establishment of a species composition that is entirely different from original conditions and the immediate surrounds, in many cases also comprising species of an invasive nature, particularly shrubs. The likelihood that this impact will occur is high and will be of medium-high significance.

c) Direct Impacts on Common Flora & Fauna Species& Regional Habitat

The extent and location of a development generally determines the significance of this impact. Larger developments situated within areas of natural or undisturbed habitat is likely to have a much higher effect on the commonly occurring flora and fauna species of an area.

This impact results from the disruption of migration movements, loss of foraging and breeding habitat and, in the case of vegetation, fragmentation and isolation of remaining areas of natural vegetation. Continued impacts on species could potentially result in a change in the conservation status of certain species. While plant species are unable to avoid the point of impact, most fauna species are able to migrate away from unfavourable areas. The tolerance levels of some animal species are also of such a nature that surrounding areas will suffice in habitat requirements of species forced to move from areas of impact.

Conversely, the location of a development within areas of low biodiversity sensitivity or where few biodiversity attributes of importance are likely to occur, will largely limit the significance of this impact. The likelihood that this impact will occur is high and will be of high significance.

d) Changes to Surrounding Habitat/ Sensitive Features

This impact represents an indirect impact. The transformation of natural habitat during the construction process will inevitably result in the establishment of habitat types that are not considered representative of the region, in this case on the fringes of the development. This impact is generally regarded to be of low severity, impacted areas are frequently invaded by species not normally associated with the region (exotic and invasive species), but are easily mitigated.

In addition, many species that are not necessarily abundant in the region will increase in abundance because of more favourable habitat conditions being created because of habitat manipulation activities (encroacher species). This effect is more pronounced in the floristic component, but changed habitat conditions in the habitat will inevitably imply minor changes in the faunal component that occupies the habitat.

If left unmitigated, this risk could result in decreased habitat on a local or regional scale, increased competition and lower numbers of endemic biota, the genetic pool of species might eventually be influenced by the introduction of non-endemic species. Different faunal assemblages and plant communities have developed separate gene structures as a result of habitat selection and geographical separation and the introduction of individuals of the same species that might be genetically dissimilar to the endemic species might lead to different genetic selection structures, eventually affecting the genetic structure of current populations and assemblages. The likelihood that this impact will occur is high and will be of moderate significance

e) Impacts on Surrounding Flora & Fauna Species

Surrounding species of importance present in the direct vicinity of the study area could be affected by indirect impacts resulting from construction and operation activities. This indirect impact could potentially include all of the above impacts, depending on the sensitivity and status of surrounding habitat and species as well as the extent of impact activities. This impact becomes particularly significant in the event where sensitive species are known to occur near the development. The likelihood that this impact will occur is high and will be of moderate significance.

f) Faunal Interactions with Structures, Servitudes & Personnel

It should be noted that animals generally avoid contact with human structures, but do grow accustomed to structures after a period. While the structures are usually visible, injuries and death of animals do occur sporadically because of accidental contact. An aspect that is of concern is the presence of vehicles on access and infrastructure roads, leading to road kills, particularly amongst nocturnal animals that abound in the study area. This impact was frequently observed in the study area during the site investigation period. Alteration of habitat conditions within the development areas does not necessarily imply a decrease in faunal habitation. These areas are frequently preferred by certain fauna species.

The presence of personnel within the development area during construction and maintenance periods will inevitably result in some, but normally limited, contact with animals. While most of the larger animal species are likely to move away from human contact, dangerous encounters with snakes, scorpions and possibly scavengers always remain likely. Similarly, the presence of humans within areas of natural habitat could potentially result in killing of animals by means of snaring, poaching, poisoning, trapping, etc. The likelihood that this impact will occur is high and will be of medium-high significance.

g) Impacts on SA's Conservation Obligations & Targets

This impact is regarded a cumulative impact since it affects the status of conservation strategies and targets on a local as well as national level and is viewed in conjunction with other types of local and regional impacts that affects conservation areas. The importance of regional habitat types is based on the conservation status ascribed to vegetation types. The loss of any area of natural habitat, however insignificant, implies that the conservation status of this vegetation type can be further affected. It is therefore imperative to ensure that the conservation of pristine grassland habitat be prioritised. The likelihood that this impact will occur is high and will be of moderate significance.

h) Increase in Local & Regional Fragmentation/ Isolation of Habitat

Uninterrupted habitat is a precious commodity for biological attributes in modern times, particularly in areas that are characterised by moderate and high levels of transformation. The loss of natural habitat, even small areas, implies that biological attributes have permanently lost that ability of occupying that space, effectively meaning that a higher premium is placed on available food, water and habitat resources in the immediate surrounds. This, in some instances might mean that the viable population of plants or animals in a region will decrease proportionally with the loss of habitat, eventually decreasing beyond a viable population size.

The danger in this type of cumulative impact is that effects are not immediately visible and normally when these effects become visible, they are beyond repair since the development represents a destructive activity. The likelihood that this impact will occur is high and will be of moderate significance.

i) Increase in Environmental Degradation

Cumulative impacts associated with this type of development could lead to initial, incremental or augmentation of existing types of environmental degradation, including impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases are these effects are not bound and is dispersed, or diluted over an area that is much larger than the actual footprint of the causal factor.

Similarly, developments in untransformed and pristine areas are usually not characterised by visibly significant environmental degradation and these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced. The likelihood that this impact will occur is high and will be of moderate significance.

6.3.6 Noise : Potential Impacts

6.3.6.1 Impacts proposed during construction

During the construction phase construction vehicles including excavation equipment and trucks may produce a noticeable increase in noise disturbance. Construction vehicles may create some noise and vibration along access routes.

6.3.6.2 Impacts proposed during operation

Noise levels during operation are anticipated to be low. Noise associated with maintenance activities may create some disturbance but this will be low level and localised.

6.3.7 Loss of Agricultural Land : Potential Impacts

6.3.7.1 Impacts proposed during construction

The major impact on the natural resources of the study area would be the loss of arable land due to the construction of the various types of infrastructure. However, this impact would in all probability be of limited significance (due to the low potential soils and the fact that construction of the infrastructure will not involve deep excavations or large-scale topsoil removal) and would be local in extent.

6.3.7.2 Impacts proposed during operation

At the end of the project life, it is anticipated that removal of the structures would enable the land to be returned to more or less a natural state, with little impact, especially given the low prevailing agricultural potential.

The impact can be summarized as follows:

Table 8: Impact significance

Nature of impact	Loss of agricultural land	Land that is no longer able to be utilized due to construction of infrastructure
Status of impact	Neutral (N)	No cost or benefit to receiving environment
Spatial Scale of impact	Low (1)	Confined to site boundary
Time Scale of impact	High (4)	Lifespan of project
Probability of impact	Probable (4)	Likely to materialise
Severity of impact	Average (4)	Mitigation & rehabilitation will be possible

Nature of impact	Loss of agricultural land	Land that is no longer able to be utilized due to construction of infrastructure
Significance of impact	Medium (36)	
Mitigation factors	Mainly due to low potential of area, as well as nature of infrastructure.	

It does not appear, from a soils aspect, that there are any especially sensitive areas ("fatal flaws") within the site that should be avoided. In conclusion, due mainly to the low potential soils and prevailing climatic limitations for agriculture, it is extremely unlikely that any sort of detailed soil investigation will be necessary.

6.3.8 Heritage and Archaeology : Potential Impacts

6.3.8.1 Impacts proposed during construction and operation

a) Loss of, or Damage to Archaeological or Cultural Resources

Impact on archaeological sites - As concluded from the archival research, the possibility of archaeological finds have been identified as being high and thus further field work is required to develop a comprehensive Heritage Management Plan. Unidentified archaeological sites and the discovery of such sites during construction can seriously hamper construction timelines.

Field work can thus provide valuable information on such site in the study area and provide timeous management of such site through realignment of development or mitigation of such sites where needed; Excavations required for the installation of heliostats, building and road construction, laying of cables etc and land clearing could disturb or destroy features of cultural heritage interest.

6.3.9 Visual and Aesthetic Landscape : Potential Impacts

6.3.9.1 Impacts proposed during construction

Dust generation may occur during vegetation clearance, site grading, transportation of materials for construction, and the construction of the solar power facility.

Dust will be a temporary impact associated with the construction phase of the project. Sensitive local receptors may need to be protected from dust through the implementation of certain management measures by the contractors responsible for the construction of the facility.

6.3.9.2 Impacts proposed during operation

Visual resource impacts would result from the construction, operation, and maintenance of the proposed Solar Power Park. Specifically, impacts would result from project components being seen from sensitive viewpoints and from effects to the scenic values of the landscape. Impacts to views would be the highest when viewers are identified as being sensitive to change in the landscape, and when their views are focused on and dominated by the change. Visual impacts would occur when changes in the landscape are noticeable to viewers observing the landscape from their homes or from tourism / conservation areas, travel routes, and important cultural features and historic sites, especially when the project occurs in foreground a middle ground views. The visual impacts that could result from the project would most likely be direct, adverse, and long-term and must be addressed in the assessment phase of the project.

6.3.10 Traffic : Potential Impacts

6.3.10.1 Impacts proposed during construction

There may be a minor increase in traffic during the construction of in the facility as some trucks and earth-moving vehicles will bring infrastructure, equipment and construction materials onto site and undertake construction activities.

6.3.11 Waste Generation : Potential Impacts

a) Impacts proposed during construction

Waste from the construction activities may arise from a range of sources producing the following:

- Construction waste;
- Sanitary waste;
- Excavated material (e.g. rock and soil), and
- Domestic waste from construction workers and offices.

b) Impacts proposed during operation

Following the construction phase, there will be limited waste production during the operational phase. The anticipated wastes during operation will include:

- Domestic waste;

- Industrial waste (oil, oily rags, scrap metal replaced machine components etc.)
- Sanitary waste from the septic tanks, and

6.3.12 Soils and Geology : Potential Impacts

6.3.12.1 Impacts proposed during construction

The potential effects on soils and geology from construction and decommissioning include:

- The potential for soil properties at the site to be permanently altered due to site preparation (e.g. compaction of soil);
- Alteration of topography on a local scale through clearing and grading; and
- Site preparation and vegetation clearance activities which could cause instability and increased erosion potential.

6.3.12.2 Impacts proposed during operation

However, removal of vegetation and the development on access roads, areas and non-permeable hard standing surfaces may impact surface water flow and run off within the site area and near surrounds during both the construction and operation phases.

6.3.13 Surface Water and Groundwater : Potential Impacts

a) Impacts proposed during construction and operation

The potential for surface water contamination is an important consideration in relation to the construction of the facility since increased sediment load in surface water runoff could impact on watercourses and drainage channels in the local area. The potential for groundwater contamination is associated with uncontrolled spills of hydrocarbons from construction vehicles during the construction phase. The extent and impact of potential groundwater or surface water contamination is largely dependent on the nature of the subsurface soil conditions, their transmissivity and susceptibility to erosion. The substrate in the area generally has low permeability although groundwater contamination could occur through joints, fractures and contact zones which are associated with the inter-granular and fractured aquifer of the area.

6.3.14 Wetland and Riparian Habitats : Potential Impacts

The impacts expected due to the proposed developments are summarised below. All of the expected impacts have been grouped into the stage of the project in which they are expected to occur, though some of the impacts are likely to occur across several stages.

The impacts expected due to the proposed developments are summarised below. All of the expected impacts have been grouped into the stage of the project in which they are expected to occur, though some of the impacts are likely to occur across several stages.

Construction Phase:

- Loss and disturbance of riparian habitat and watercourses;
- Increased sediment movement into the watercourses on site;
- Water quality deterioration;
- Increased flows and erosion within the drainage line;
- Habitat fragmentation.

Operational Phase:

- Water quality deterioration

6.3.15 Socio-Economic : Potential Impacts

Based on the information presented above and the current knowledge about the project and activities taking place on site, the potential socio-economic impacts that could be predicted include -

6.3.15.1 Strategic macro-economic impacts

- Assistance in achieving government objectives;
- Impact on balance of payment due to the possibility that certain equipment and machinery will be imported;
- Provision of electricity without putting additional pressure on water resources;
- Potential to reduce carbon footprint in generating electricity; and

- Potential to establish new manufacturing industries.

6.3.15.2 Impacts proposed during construction

- Temporary increase in production and GDP-R in industries that provide services and materials to enable construction;
- Temporary employment creation in affected industries;
- Temporary increase in government revenue due to the establishment of the solar park;
- Temporary increase in households' income levels;
- Permanent loss of agricultural production created by the current agricultural activities taking place on site (stock farming);
- Permanent loss of jobs associated with the existing agricultural activities on site;
- Influx of job seekers and associated crime concerns;
- Pressure on housing provision; and
- Possible negative health impacts associated with migrants.

6.3.15.3 Impacts proposed during operation

- Increase in production and GDP-R due to the solar park's operations;
- Creation of sustainable employment opportunities at the plant and supporting industries;
- Increase in government revenue;
- Skills development;
- Improvement of living standards of positively affected households (through employment);
- Increase in households' income levels; and
- Change in standards of living of the directly affected households.

Any other socio-economic effects that will be raised by the I&APs, as well as effects that might result from impacts determined by other specialists, including visual, noise, and tourism

6.3.16 Human Health and Safety : Potential Impacts

As with any construction project, there is potential for impacts on human health and safety to occur as a result of accidents and unplanned events that may occur during the construction of the Solar Power Park.

The risk of injury associated with the construction of the facility will be mainly limited to the subcontractors (as the site will be secured to avoid public incursion into the active development area), but there remains some risk of injury to other site users (i.e. farm workers). Basic safety precautions and protective measures will be specified in the EMP which, in turn, will be incorporated into sub-contractor health and safety plans.

6.3.17 Tourism Industry : Potential Impacts

6.3.17.1 Impacts proposed during construction and operation

Based on the findings of our scoping phase as well as the tourism demand and economic impact assessments completed above, we identified the following possible impacts of the Rooipunt Solar Power Park on the surrounding tourism industry of Upington.

- Increase growth in tourist numbers to the study area
- Changes in growth of the accommodation product supply in the area
- Increase in tourism spend in the area
- Increase in employment opportunities in the area
- Impact on the tourism revenue of the Spitskop Nature Reserve
- Impact on the tourism revenue of the Kalahari Monate Lodge
- Impact on the tourism revenue of the Riverside Guesthouse
- Impact on the tourism revenue of the Orange River Hotel
- Impact on the tourism revenue of the Bezalel Wine and Brandy Estate
- Impact on the tourism revenue of the Naftali River House
- Increase tourism traffic along the N14

7. SPECIALIST ASSESSMENTS FOR POTENTIALLY SIGNIFICANT IMPACTS

This section of the EIAR will provide the findings of the various Specialist Investigation with regards to the identification of potential impacts as well as providing an impact rating and possible mitigation measures for the various impacts.

7.1 AVIFAUNAL IMPACT ASSESSMENT

7.1.1 Terms of Reference

The terms of reference received from WorleyParsons are as follows: Jon Smallie will undertake an avifaunal assessment, providing input to the Scoping EIA Process and assessing the potential impacts (direct, indirect and cumulative) associated with the proposed construction of the Rooipunt Solar I Power Park on avifauna. The study will further include a comparative assessment of the environmental impacts related to alternatives proposed by SolarReserve South Africa, and recommendations and mitigation measures to minimise identified impacts during all phases of the project life-cycle (planning, construction, operation and decommissioning). More specifically:

- The bird sensitive sections of the study area will be mapped and attached as an annexure to the main document
- The existing environment will describe and the bird communities most likely to be impacted will be identified. Different bird micro-habitats will be described as well as the species associated with those habitats.
- Typical impacts that could be expected from the development will be listed as well as the expected impact on the bird communities. Impacts will be quantified (if possible) and a full description of predicted impacts (direct and indirect) will be provided.
- Gaps in baseline data will be highlighted and discussed. An indication of the confidence levels will be given.
- The best available data sources will be used to predict the impacts, and extensive use will be made of local knowledge.
- The potential impact on the birds will be assessed and evaluated according to the magnitude, spatial scale, timing, duration, reversibility, probability and significance.

7.1.2 Sensitivity Analysis

The Project Site is of general low sensitivity in terms of avifauna, being extremely uniform habitat, and having no surface water sources evident. The diversity of bird species on site is therefore relatively low. As explained elsewhere in this report, destruction of habitat on this site is unlikely to have a significant effect on bird populations. Having said that, the larger drainage lines on site are probably of slightly higher sensitivity for birds, and have been identified as such in the figure below. In addition to drainage lines, there is also an area which is far more lush than the rest of the site, due to the presence of two windmills, reservoirs, and drinking troughs. Importantly, whilst these medium sensitivity areas do stand out from the rest of the study area, they are not of such a sensitive nature that construction may not take place there if necessary.

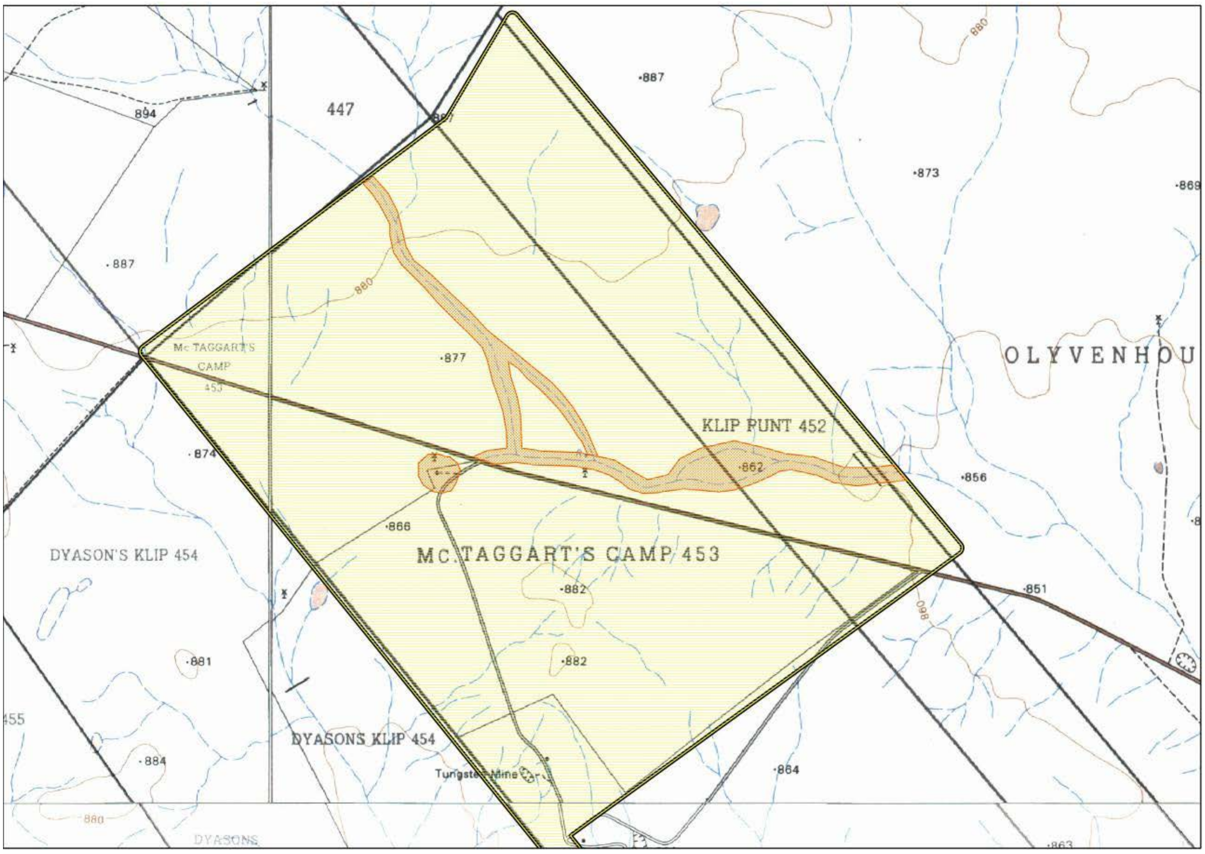


Figure 15: Avifaunal Sensitivity Map

7.1.3 Impact Assessment and Identification

7.1.3.1 Direct impacts on species

a) Disturbance of birds and barrier effect

The disturbance of avifauna during the construction (and thereafter during maintenance and operation) of the facility and associated infrastructure is likely to occur. Disturbance could also contribute to a habitat fragmentation effect during the operational phase of this project, since certain bird species will be displaced from the site, and forced to find alternative territories. This impact has been rated as low to moderate significance

Table 9: Impact Evaluation – Disturbance of birds and barrier effect

Nature of Impact: ***Disturbance of birds and barrier effects as a result of the facility***		
	Without mitigation	With mitigation
Scale	2	2
Duration	4	4
Magnitude	4	4
Probability	3	3
Significance	**30**	30
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Possibly – particularly for breeding sensitive species, breeding attempts may fail thereby losing recruitment to population	Possibly – particularly for breeding sensitive species, breeding attempts may fail thereby losing recruitment to population
Can impacts be mitigated during operational phase?	Only partially, to a large extent impacts are inevitable	

Cumulative impacts: The area is currently relatively unaltered by infrastructure the scale of proposed facility. The cumulative impact of adding this facility to the landscape should therefore be low. However the author is aware that the greater Upington area is the target of numerous solar energy facilities. If all of these are considered, the cumulative impact of solar energy on birds in the broader area could be far more significant that this one project in isolation. Since all of the proposed projects are not public knowledge and are in varying stages of assessment, it is beyond the scope of this study to examine this issue further.
Residual impacts: Medium – if the facility were decommissioned and the site rehabilitated many bird species would recover quickly and resume normal activities

b) Collision of birds with panels and other infrastructure

As described earlier in this report, there is a chance that birds will collide with the PV panels and heliostats, as they do with the windows of buildings. This could be during the normal course of their daily activities or when they are attracted to the panels, perhaps mistaking them for water sources. It is important to stress that this impact will probably only become significant when large numbers of birds are in the vicinity of the facility. For this reason, the more sensitive species in terms of this impact are likely to be the gregarious, flocking species which are mostly not threatened species in this study area. This is a new impact, the likes of which has not been seen in South Africa to date. This impact has been rated as low significance

Table 10: Impact Evaluation – Collision of birds with panels and other infrastructure

Nature of Impact: ***Disturbance of birds and barrier effects as a result of the facility***		
	Without mitigation	With mitigation
Scale	1	1
Duration	4	4
Magnitude	4	4
Probability	3	3
Significance	**27 (Low)**	27 (Low)
Status (positive or negative)	Negative	Negative

Reversibility	Low	Low
Irreplaceable loss of resources?	Yes – birds are killed	
Can impacts be mitigated during operational phase?	No - unknown measures at this stage	
Cumulative impacts: See above in **Table 9**– Disturbance.		
Residual impacts: Low – if the facility were decommissioned the impact would cease.		

c) Nesting and other use of infrastructure by birds

Certain species, in particular Sociable Weaver, are likely to use some of the facility infrastructure for nesting, perching and roosting. Nesting is particularly problematic, as it may make maintenance difficult for staff, and also poses a fire risk since nests present abundant fuel for fires. This will require management on site, preferably through the operational Environmental Management Plan (EMP). This impact has been rated as low significance

Table 11: Impact Evaluation – Nesting of birds on facility infrastructure

Nature of Impact: ***Nesting of birds on facility infrastructure. This could impact on birds positively through providing nesting substrate where it was not available previously, but could also raise operational issues for the plant as nesting may interfere with equipment and maintenance activities.***		
	Without mitigation	With mitigation
Scale	3	3
Duration	4	4
Magnitude	3	3
Probability	2	3
Significance	**20 (Low)**	20 (Low)
Status (positive or negative)	Negative	Negative
Reversibility	High – if facility decommissioned issue	High–if facility decommissioned

	would cease	issue would cease
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	Yes – partially, reactively	Yes – partially, reactively
Cumulative impacts: Cumulative impacts: Low		
Residual impacts: Low – if the facility were decommissioned the issue would cease.		

7.1.3.2 Impacts on habitat and ecological processes

a) Habitat destruction associated with the construction of the facility

During the construction and maintenance phases of this project, a certain amount of habitat destruction and disturbance will take place. The nature of the proposed facility means that the majority of the site will be transformed. This impact has been rated as low to moderate significance.

Table 12: Impact Evaluation – Habitat destruction associated with construction of facility

Nature of Impact: Habitat destruction associated with construction of facility		
	Without mitigation	With mitigation
Scale	2	2
Duration	4	4
Magnitude	4	4
Probability	3	3
Significance	**30 (Medium)**	30 (Medium)
Status (positive or negative)	Negative	Negative
Reversibility	Medium, site could probably be rehabilitated	
Irreplaceable loss of resources?	Yes – at least until site is rehabilitated	

Can impacts be mitigated during operational phase?	Not really – a certain amount of habitat destruction will take place regardless	
Cumulative impacts: See above in **Table 9**– Disturbance.		
Residual impacts: Low provided that the site is rehabilitated – if the facility were decommissioned many bird species would recover quickly and resume normal activities		

b) Altered run off patterns

Depending on how the vegetation beneath the PV panels and heliostats is managed, this could create a new micro habitat for birds. It is likely that water used to wash the panels/heliostats will fall to the ground and will effectively increase the amount of moisture, thereby stimulating plant growth. This could attract certain bird species to the site, particularly in winter when green vegetation is scarce in the area. Alternatively, erosion of the site by water runoff could be a concern. It is likely that these aspects would be discussed in more detail in Section 7.2 botanical specialist study. A better understanding of this aspect can be acquired through detailed on site avifaunal monitoring, as proposed elsewhere in this report. This impact has been rated as low to moderate significance

Table 13: Impact Evaluation – Altered runoff patterns

Nature of Impact: ***Altered runoff patterns***		
	Without mitigation	With mitigation
Scale	2	2
Duration	4	4
Magnitude	2	2
Probability	2	2
Significance	**16 (Low)**	16 (Low)
Status (positive or negative)	Negative	Negative
Reversibility	High – if site is restored	
Irreplaceable loss of resources?	Possibly, at this stage just speculating	

Can impacts be mitigated during operational phase?	Yes – partially through surface water management	
Cumulative impacts: See above in **Table 9**– Disturbance.		
Residual impacts: Low – if the facility were decommissioned the original run off patterns could be restored.		

c) Nesting and other use of infrastructure by birds

Certain species, in particular Sociable Weaver, are likely to use some of the facility infrastructure for nesting, perching and roosting. Nesting is particularly problematic, as it may make maintenance difficult for staff, and also poses a fire risk since nests present abundant fuel for fires. This will require management on site, preferably through the operational Environmental Management Plan (EMP). This impact has been rated as low significance

Table 14: Impact Evaluation – Nesting of birds on facility infrastructure

Nature of Impact: ***Nesting of birds on facility infrastructure. This could impact on birds positively through providing nesting substrate where it was not available previously, but could also raise operational issues for the plant as nesting may interfere with equipment and maintenance activities.***		
	Without mitigation	With mitigation
Scale	3	3
Duration	4	4
Magnitude	3	3
Probability	2	3
Significance	**20 (Low)**	20 (Low)
Status (positive or negative)	Negative	Negative
Reversibility	High – if facility decommissioned issue would cease	High–if facility decommissioned issue would cease
Irreplaceable loss of resources?	No	No

Can impacts be mitigated during operational phase?	Yes – partially, reactively	Yes – partially, reactively
Cumulative impacts: Cumulative impacts: Low		
Residual impacts: Low – if the facility were decommissioned the issue would cease.		

7.1.4 Conclusions and Recommendations

The proposed facility has the potential to impact on avifauna in the area. Since our experience of these facilities and associated impacts is so limited in South Africa, a precautionary approach has been taken in the identification of impacts. However due to the relatively low importance of the site for many bird species, most impacts have been rated as low significance. It is recommended that a pre and post construction monitoring programme be conducted at the site, and the data from this programme will contribute significantly towards eliminating uncertainty associated with the impacts. A draft outline of the monitoring programme has been described in this report, but this will be fully developed in the site specific EMP.

7.1.5 Recommended mitigation measures

Table 15: Avifaunal Mitigation Measures

Nature of Impact:	*Reomended Mitigation Measures*
Disturbance of birds and barrier effect	All activities should be designed to ensure as little impact through disturbance as possible. For example, existing roads must be used wherever possible, sensitive habitats must be avoided with machinery and vehicles, and labour teams must be strictly managed. Equipment batching plants and construction camps must also be situated away from sensitive areas, preferably in habitats that are already impacted on or in town. If any sensitive species are identified (during the site specific avifaunal EMP or monitoring programme) to be nesting in close proximity to the

	construction site, case specific recommendations on managing the situation will be made, and could include minor changes to construction timing in order to minimize interference during breeding season.
Collision of birds with panels and other infrastructure	Since we have no experience of this impact it is not possible to identify mitigation options at this stage. If the impact occurs mitigation measures will need to be developed based on how and when the impact occurs. An example of a possible mitigation measure is to alter the time at which heliostats 'start up' each day in order to avoid times of high bird activity. At this stage however this is just speculation. If a thorough on site bird monitoring programme is undertaken, the necessary information will be obtained to enable the development of management measures.
Nesting of birds on facility infrastructure	If nesting becomes an issue once the plant is operational, case and species specific recommendations will be made on how to manage the situation. For sensitive species nest removal will not necessarily be the preferred option, but for common species it may be possible.
Altered runoff patterns	Recommend that this is addressed in site specific EMP when more detail on exact layout is available. If issues are detected post construction then appropriate management measures will need to be developed.

The full Avifaunal Study is included in Appendix D

7.2 FLORISTIC BIODIVERSITY IMPACT ASSESSMENT

Vegmap (2006) describes the vegetation as Kalahari Karroid Shrubland in the northern part of the study area and Bushmanland Arid Grassland in the south.

A total of 54 plant species were recorded during the field investigations (refer Appendix E). The species composition recorded in the study area is regarded representative of the regional vegetation, indicating the prominence of grassland vegetation and scattered woody individuals. The grassland physiognomy (refer Table 16) of the region is represented by 21 forbs (38.9 %), 5 grass species (9.3 %) and 9 succulent species (16.7 %). The woody stratum is represented by 7 tree species (13.0 %) and 12 shrub species (22.2 %). The floristic diversity comprises 24 plant families, dominated by Asteraceae (7 species, 13.0 %), Fabaceae (6 species, 11.1 %) and Poaceae (5 species, 9.3 %).

Table 16: Growth Forms recorded in the study area

Growth Form	Number	Percentage
Forbs	21	38.9%
Grasses	5	9.3%
Shrubs	12	22.2%
Succulents	9	16.7%
Trees	7	13.0%
Total	**54**	

According the National Forests Act (Act no 84 of 1998), the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions state 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 license granted by the Minister’.

The following protected tree species occur in the study area (Table 17).

Table 17: Protected Tree species recorded in the study area

Taxon	Family	Abundance	Status
Acacia erioloba	Fabaceae	Less than 50	Declining, confirmed presence
Boscia albitrunca	Capparaceae	Less than 50	Declining, confirmed presence

An application for permits for the removal/ damage/ cutting or pruning of protected tree species as per National Forest Act, 1998 (No 84 of 1998) need to be submitted to the relevant authority prior to the commencement of construction activities.

The tree *Acacia erioloba* occurs in dry woodland along watercourses in arid areas where underground water is present, as well as on deep Kalahari sands. *Boscia albitrunca* occurs in semi desert-areas and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils.

The remaining natural (untransformed) vegetation of the study area and the surrounds is representative of the regional vegetation types, exhibiting limited divergence from the species composition, diversity and vegetation structure described by Mucina (Vegmap, 2006). Zonality of natural habitat of the study area is represented by the interplay of terrestrial and wetland related habitat types.

- Degraded Habitat, including;
    - Impoundments;
    - Road Infrastructure;
    - Degraded Areas (Piospheres);
- Natural Terrestrial Habitat, including
    - (Stipagrostis ciliata) Grassland Plains;
    - (Rhigozum trichotomum) Shrubveld Plains;
    - (Aloe claviflora – Salsola species) Quartz Gravel Plain;
    - (Stipagrostis obtusa – Aptosimum spinescens) Calcareous Gravel Plains;
- Wetland Habitat, including:
    - Drainage Lines and
    - Floodplains.

The extent of habitat variations of the study area is presented in Table 18.

Table 18: Extent of habitat variations in the study area

Habiatat Variation	Extent	Percentage
Degraded Areas	11.8 Ha	0.5%
Drainage Lines	54.0 Ha	2.5%
Floodplains	129.0 Ha	5.9%
Impoundments	2.0 Ha	0.1%
Natural Terrestrial Habitat (Open Plains/ Shrubveld)	1969.4 Ha	90.3%
Road Infrastructure	14.2 Ha	0.7%

7.2.1 Terms of Reference

The objective of this Biodiversity Impact Assessment is to establish the presence/absence of ecologically sensitive areas or species within the proposed project area. In order to assist with the planning of the proposed development it is necessary to assess potential impacts of the development on the biological environment (terrestrial biodiversity), comment on the suitability of the area for the proposed project and to provide development guidance to limit impacts as far as possible.

The Terms of Reference for the floristic assessment are as follows:

- Obtain all relevant Précis and Red Data flora information;
- Conduct a photo analysis of the proposed area;
- Identify floristic variations;
- Survey habitat types to obtain a broad understanding of the floristic diversity;
- Assess the potential presence of Red List flora species according to information obtained from SANBI;
- Incorporate existing knowledge of the region into the assessment;
- Describe broad habitat variations present in the study area in terms of biophysical attributes and phytosociological characteristics;
- Compile a floristic sensitivity analysis;

- Incorporate results into the Biodiversity Impact Evaluation;
- Map all relevant aspects;
- Provide pertinent recommendations; and
- Present all results in a suitable format.

7.2.2 Floristic Sensitivity Rating

Floristic sensitivity values are presented in Table 19. These estimations are used to ascribe a sensitivity index value to units of the respective variations. Habitat sensitivity is categorised as follows:

Low No natural habitat remaining; this category is usually represented by developed areas, nodal and linear infrastructure, areas of agriculture or cultivation, areas where exotic species dominate exclusively, mining land (particularly surface mining), etc. The possibility of these areas reverting to a natural state is regarded impossible, even with the application of detailed and expensive rehabilitation activities. Similarly, the likelihood of plant species of conservation importance occurring in these areas is regarded negligent.

Medium – low All areas where the natural habitat has been degraded, with the important distinction that the vegetation has not been decimated and a measure of the original vegetation remain, albeit dominated by secondary climax species. The likelihood of plant species of conservation importance occurring in these areas is regarded low. These areas also occur as highly fragmented and isolated patches, typical to cultivated fields, areas that have been subjected to clearing activities and areas subjected to severe grazing pressure. The species composition of these areas is typically low and is frequently dominated by a low number of species, or invasive plants.

Medium Indigenous natural habitat that comprehend habitat with a high diversity, but characterised by moderate to high levels of degradation, fragmentation and habitat isolation;

Also include areas where flora species of conservation importance could potentially occur, but habitat is regarded marginal;

Medium – high Indigenous natural vegetation that comprehend a combination of the following attributes:

- The presence of habitat that is suitable for the presence of these species;
- Areas that are characterised by a high/ moderate-high intrinsic floristic diversity;
- Areas characterised by moderate to low levels of habitat fragmentation and isolation;
- Regional vegetation types that are included in the lower conservation categories, particularly prime examples of these vegetation types;
- Low to moderate levels of habitat transformation;
- A moderate to high ability to respond to disturbance factors;

It may also include areas that are classified as protected habitat, but that are of a moderate status;

High Indigenous natural vegetation that comprehend for a combination of the following attributes:

- The presence of plant species of conservation importance, particularly threatened categories (Critically Endangered, Endangered, Vulnerable);
- Areas where 'threatened' plants are known to occur, or habitat that is highly suitable for the presence of these species;
- Regional vegetation types that are included in the 'threatened' categories (Critically Endangered, Endangered, Vulnerable), particularly prime examples of these vegetation types;
- Habitat types are protected by national or provincial legislation (Lake Areas Act, National Forest Act, draft Ecosystem List of NEM:BA, Mountain Catchment Areas Act, Ridges Development Guideline, Integrated Coastal Zone Management Act, etc.);
- Areas that have an intrinsic high floristic diversity (species richness, unique ecosystems), with particular reference to Centres of Endemism;

These areas are also characterised by low transformation and habitat isolation levels and contribute significantly on a local and regional scale in the ecological functionality of nearby and dependent ecosystems, with particular reference to catchment areas, pollination and migration corridors, genetic resources. A major reason for the high conservation status of these areas is the low ability to respond to disturbances (low plasticity and elasticity characteristics).

Table 19: Floristic sensitivity for the respective habitat types

Floristic sensitivity estimations for the respective habitat types								
Criteria	**RD species**	**Landscape sensitivity**	**Status**	**Species diversity**	**Functionality/ fragmentation**	**TOTAL**	**SENSITIVITY INDEX**	**SENSITIVITY CLASS**
Community	**Criteria Ranking**							
Degraded Habitat	1	3	2	3	4	73	23%	Medium-low
Drainage Lines	7	10	8	7	10	263	82%	high
Floodplains	7	8	7	7	10	241	75%	medium-high
Impoundments	1	10	3	3	10	153	48%	medium
Grassland/ Shrubveld/ Gravel Plains	5	4	8	7	7	186	58%	medium
Road Infrastructure	0	0	1	1	1	14	4%	low

7.2.3 Impact Assessment and Identification

7.2.3.1 Direct Impacts on Flora Species of Conservation Importance

This is a direct impact since it results in the physical damage or destruction of Red Data species/ communities, areas where these species are known to occur or areas that are considered particularly suitable for these species. Plant species of conservation importance, in most cases, do not contribute significantly to the biodiversity of an area in terms of sheer numbers, as there are generally few of them, but a high ecological value is placed on the presence of such species in an area as they represent an indication of pristine habitat conditions. Conversely, the presence of pristine habitat conditions can frequently be accepted as an indication of the potential presence of species of conservation importance, particularly in moist habitat conditions.

Red Data species are particularly sensitive to changes in their environment, having adapted to a narrow range of specific habitat requirements. Changes in habitat conditions resulting from human activities is one of the greatest reasons for these species having a threatened status. Surface transformation/ degradation activities within habitat types that are occupied by flora species of conservation importance will ultimately result in significant impacts on these species and their population dynamics. Effects of this type of impact are usually permanent and recovery or mitigation is generally not perceived as possible.

One of the greatest limitations in terms of mitigating or preventing this particular impact, is the paucity of species specific information that describe their presence, distribution patterns, population dynamics and habitat requirements. To allow for an accurate assessment, it is usually necessary to assess the presence/ distribution, habitats requirements, etc. associated with these species in detail and over prolonged periods; something that is generally not possible during EIA investigation such as this. However, by applying ecosystem conservation principles to this impact assessment and subsequent planning and development phases, potential impacts will be limited largely.

The likelihood of Red Data flora species occurring within the study area is moderate, but protected trees (National Forest Act) are present within the study area, albeit at low densities. Furthermore, other species of conservation importance were indicated to be present, although none was observed during the survey period.

7.2.3.2 Loss or Degradation of Natural Vegetation/ Sensitive or Protected Habitat

The loss or degradation of natural vegetation or habitat that are regarded sensitive as a result of restricted presence in the larger region (atypical habitat) represents a potential loss of habitat and biodiversity on a local and regional scale. Sensitive habitat types might include mountains, ridges, koppies, wetlands, rivers, streams and localised habitat types of significant physiognomic variation and unique species composition. These areas represent centres of atypical habitat and contain biological attributes that are not frequently encountered in the greater surrounds. A high conservation value is generally ascribed to floristic communities and faunal assemblages that occupy these areas as they contribute significantly to the biodiversity of a region.

7.2.3.3 Impacts on Surrounding Habitat/ Species & Ecosystem Functioning

Surrounding areas and species present in the direct vicinity of the study area could potentially be affected by indirect impacts resulting from construction and operational activities. This indirect impact also includes adverse effects on any processes or factors that maintain ecosystem health and character, including the following:

Disruption of nutrient-flow dynamics;

- Introduction of chemicals into the ground- and surface water through leaching;
- Impedance of movement of material or water;
- Habitat fragmentation;
- Changes to abiotic environmental conditions;
- Changes to disturbance regimes, e.g. increased or decreased incidence of fire;
- Changes to successional processes;
- Effects on pollinators; and
- Increased invasion by plants and animals not endemic to the area.

Changes to factors such as these may lead to a reduction in the resilience of ecological communities and ecosystems or loss or changes in ecosystem function. Furthermore, regional ecological processes, particularly aquatic processes that is dependent on the status and proper functioning of the drainage line, is regarded important. It is well known that the status of a catchment is largely determined by the status of the upper reaches of the rivers. Small drainage lines, such as the one on this property, might be insignificant on a regional scale, but the combined status of numerous such small drainage lines will determine the quality of larger rivers further downstream.

7.2.3.4 Impacts on SA's Conservation Obligations & Targets

This impact is regarded a cumulative impact since it affects the status of conservation strategies and targets on a local as well as national level and is viewed in conjunction with other types of local and regional impacts that affects conservation areas or threatened areas. The importance of vegetation types is based on the conservation status ascribed to regional vegetation types (Vegmap, 2006) and because impacts that result in irreversible transformation of natural habitat is regarded significant. However, only a moderate disruption of ecosystem functioning is assumed in the 'Least Threatened' vegetation types that occupy the study area.

7.2.3.5 Increase in Local & Regional Fragmentation/ Isolation of Habitat

Uninterrupted habitat is a precious commodity for biological attributes in modern times, particularly in areas that are characterised by moderate and high levels of transformation. The loss of natural habitat, even small areas, implies that biological attributes have permanently lost that ability of occupying that space, effectively meaning that a higher premium is placed on available food, water and habitat resources in the immediate surrounds. This, in some instances might mean that the viable population of plants or animals in a region will decrease proportionally with the loss of habitat, eventually decreasing beyond a viable population size.

The danger in this type of cumulative impact is that effects are not known or is not visible with immediate effect and normally when these effects become visible, they are usually beyond repair. Impacts on linear areas of natural habitat affect the migratory success of animals in particular.

The general region is characterised by low levels of transformation and habitat fragmentation. However, it is known that numerous other similar developments are planned in this particular region. The level of fragmentation and habitat isolation is therefore likely to increase significantly within the next few years.

7.2.3.6 Increase in Environmental Degradation, Pollution (soils, surface water)

Cumulative impacts associated with this type of development could lead to initial, incremental or augmentation of existing types of environmental degradation, including impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases, these effects are not bound and is dispersed, or diluted over an area that is much larger than the actual footprint of the causal factor. Similarly, developments in untransformed and pristine areas are usually not characterised by visibly significant environmental degradation and these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced.

The nature of the development is such that pollution and degradation of the surrounding areas are expected to some extent. **Table 20**, **Table 21** and **Table 22** provide the significance for each of the impacts during the construction, operation and decommissioning phase of the project.

Table 20: Floristic Impact Evaluation – Construction Phase

POTENTIAL ENVIRONMENTAL IMPACT	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	M	D	S	P	TOTAL	SP	M	D	S	P	TOTAL	SP
Construction Phase: Clearance of Land												
Direct impacts on flora species of conservation importance	8	5	3	4	64	H	6	5	2	4	52	M
Loss or degradation of natural vegetation, sensitive or protected habitat	6	5	3	4	56	M	4	5	2	4	44	M
Loss/ degradation of surrounding habitat	6	4	2	3	36	M	6	4	2	2	24	L
Impacts on SA's conservation obligations & targets	4	5	3	3	36	M	4	5	3	3	36	M
Increase in local and regional fragmentation/ isolation of habitat	4	5	2	5	55	M	4	5	2	5	55	M
Increase in environmental degradation, pollution (soils, surface water)	6	4	2	3	36	M	6	4	2	2	24	L
Construction Phase: Construction of Required Solar Infrastructure												
Direct impacts on flora species of conservation importance	8	5	4	2	34	M	8	5	2	2	30	L
Loss or degradation of natural vegetation, sensitive or protected habitat	6	5	2	2	26	L	6	5	2	2	26	L
Loss/ degradation of surrounding habitat	6	4	2	3	36	M	4	4	2	2	20	L
Increase in environmental degradation, pollution (soils, surface water)	6	4	2	3	36	M	4	4	2	2	20	L
Construction Phase: Construction of Access Roads												
Direct impacts on flora species of conservation importance	8	5	3	2	32	M	4	5	2	2	22	L
Loss or degradation of natural vegetation, sensitive or protected habitat	8	5	2	2	30	L	6	5	2	2	26	L
Loss/ degradation of surrounding habitat	6	4	2	3	36	M	4	4	2	2	20	L

POTENTIAL ENVIRONMENTAL IMPACT	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	M	D	S	P	TOTAL	SP	M	D	S	P	TOTAL	SP
Impacts on SA's conservation obligations & targets	4	5	3	2	24	L	4	5	3	2	24	L
Increase in local and regional fragmentation/ isolation of habitat	6	4	3	2	26	L	6	4	2	2	24	L
Increase in environmental degradation, pollution (soils, surface water)	4	4	3	2	22	L	4	4	2	2	20	L
Construction Phase: Presence of Personnel within a Natural Environment												
Direct impacts on flora species of conservation importance	8	5	3	3	48	M	8	5	2	2	30	L
Loss or degradation of natural vegetation, sensitive or protected habitat	8	5	2	3	45	M	8	5	2	2	30	L
Loss/ degradation of surrounding habitat	6	4	2	3	36	M	6	4	2	2	24	L
Increase in environmental degradation, pollution (soils, surface water)	4	4	2	3	30	L	4	4	2	2	20	L
Construction Phase: Placement of Power Lines, Cables, Water Pipelines, etc.												
Direct impacts on flora species of conservation importance	8	5	3	2	32	M	6	5	2	2	26	L
Loss or degradation of natural vegetation, sensitive or protected habitat	8	5	2	3	45	M	6	5	2	2	26	L
Loss/ degradation of surrounding habitat	6	5	2	3	39	M	6	5	2	2	26	L
Impacts on SA's conservation obligations & targets	4	5	3	2	24	L	4	5	2	2	22	L
Increase in local and regional fragmentation/ isolation of habitat	4	5	2	2	22	L	4	5	2	2	22	L
Increase in environmental degradation, pollution (soils, surface water)	4	4	2	3	30	L	4	4	2	2	20	L
Construction Phase: Chemical Contamination												
Loss or degradation of natural vegetation, sensitive or protected habitat	6	4	2	3	36	M	6	4	2	2	24	L

POTENTIAL ENVIRONMENTAL IMPACT	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	M	D	S	P	TOTAL	SP	M	D	S	P	TOTAL	SP
Loss/ degradation of surrounding habitat	6	4	2	3	36	M	6	4	2	2	24	L
Increase in environmental degradation, pollution (soils, surface water)	6	4	2	3	36	M	6	4	2	2	24	L
Construction Phase: Storage of Materials												
Loss or degradation of natural vegetation, sensitive or protected habitat	6	4	2	3	36	M	6	4	2	2	24	L
Loss/ degradation of surrounding habitat	6	4	2	3	36	M	6	4	2	2	24	L
Increase in environmental degradation, pollution (soils, surface water)	4	4	2	3	30	L	4	4	2	2	20	L
Construction Phase: Generation & Handling of Waste												
Direct impacts on flora species of conservation importance	6	4	2	2	24	L	6	4	2	2	24	L
Loss or degradation of natural vegetation, sensitive or protected habitat	6	4	2	2	24	L	6	4	2	2	24	L
Loss/ degradation of surrounding habitat	4	4	2	2	20	L	4	4	2	2	20	L
Increase in environmental degradation, pollution (soils, surface water)	4	4	2	2	20	L	4	4	2	2	20	L

Table 21: Floristic Impact Evaluation – Operational Phase

POTENTIAL ENVIRONMENTAL IMPACT	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	M	D	S	P	TOTAL	SP	M	D	S	P	TOTAL	SP
Operational Phase: Presence of Personnel within a Natural Environment												
Direct impacts on flora species of conservation importance	8	5	3	3	48	M	8	5	2	2	30	L
Loss or degradation of natural vegetation, sensitive or protected habitat	8	5	2	3	45	M	8	5	2	2	30	L
Loss/ degradation of surrounding habitat	6	4	2	3	36	M	6	4	2	2	24	L
Increase in environmental degradation, pollution (soils, surface water)	4	4	2	3	30	L	4	4	2	2	20	L
Operational Phase: Chemical Contamination												
Loss or degradation of natural vegetation, sensitive or protected habitat	6	4	2	3	36	M	6	4	2	2	24	L
Loss/ degradation of surrounding habitat	6	4	2	3	36	M	6	4	2	2	24	L
Increase in environmental degradation, pollution (soils, surface water)	6	4	2	3	36	M	6	4	2	2	24	L
Operational Phase: Storage of Materials for Maintenance												
Loss or degradation of natural vegetation, sensitive or protected habitat	6	4	2	3	36	M	6	4	2	2	24	L
Loss/ degradation of surrounding habitat	6	4	2	3	36	M	6	4	2	2	24	L
Increase in environmental degradation, pollution (soils, surface water)	4	4	2	3	30	L	4	4	2	2	20	L
Operational Phase: Generation & Handling of Waste												
Direct impacts on flora species of conservation importance	6	4	2	2	24	L	6	4	1	2	22	L
Loss or degradation of natural vegetation, sensitive or protected habitat	6	4	2	2	24	L	6	4	1	2	22	L
Loss/ degradation of surrounding habitat	4	4	2	2	20	L	4	4	2	2	20	L
Increase in environmental degradation, pollution (soils, surface water)	4	4	2	2	20	L	4	4	2	2	20	L

Table 22: Floristic Impact Evaluation – Decommissioning Phase

POTENTIAL ENVIRONMENTAL IMPACT	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	M	D	S	P	TOTAL	SP	M	D	S	P	TOTAL	SP
Closure & Decommissioning: Removal of Infrastructure												
Direct impacts on flora species of conservation importance	4	5	1	2	20	L	2	5	1	2	16	L
Loss or degradation of natural vegetation, sensitive or protected habitat	4	4	1	2	18	L	2	4	1	2	14	L
Increase in environmental degradation, pollution (soils, surface water)	4	4	1	2	18	L	2	4	1	2	14	L
Closure & Decommissioning: Rehabilitation Activities												
Direct impacts on flora species of conservation importance	4	5	1	2	20	L	2	5	1	2	16	L
Loss/ degradation of surrounding habitat	4	5	2	3	33	M	2	4	2	2	16	L
Increase in environmental degradation, pollution (soils, surface water)	4	5	2	3	33	M	2	4	2	2	16	L
Closure & Decommissioning: Presence of Personnel within a Natural Environment												
Direct impacts on flora species of conservation importance	4	5	2	2	22	L	2	5	2	2	18	L
Loss or degradation of natural vegetation, sensitive or protected habitat	4	4	2	2	20	L	2	4	2	2	16	L
Loss/ degradation of surrounding habitat	4	4	2	2	20	L	2	4	2	2	16	L
Increase in environmental degradation, pollution (soils, surface water)	4	4	2	2	20	L	2	4	2	2	16	L

7.2.4 Conclusion

Extensive parts of the study area comprehend untransformed and relative pristine habitat that exhibits inherent floristic attributes of moderate sensitivity; only wetland related habitat are regarded sensitive, occurring as small non-perennial drainage lines. The association of the protected tree *Acacia erioloba* with this habitat type and the intrinsic contribution to diversity on a local scale, contributed to the high sensitivity. While this habitat type is well-represented in the surrounding region, cumulative impacts from similar developments are likely to result in moderate to severe impacts on the extent and availability of this particular habitat. Furthermore, the nature of this habitat type dictates that impacts within the site is likely to be transferred downstream, particular reference is made to the presence of the Orange River, into which these streams eventually empty. Wetland habitat types are generally also accepted as sensitive for reasons other than only vegetation, or biodiversity.

Considering the low levels of habitat transformation on a local (study area) as well as regional scale, the moderate environmental importance ascribed to most of the study area is mostly a reflection of the regional (Vegmap, 2006) conservation status.

Impacts on the floristic environment assessed above have highlighted that effect associated with the proposed development are likely to result in limited significance. Direct impacts are mostly restricted to the loss of habitat that results from clearance activities. It is estimated that the flora on a regional scale is unlikely to be affected as large expanses of similar vegetation surround the study area. However, cumulative impacts from numerous similar developments in the immediate region could potentially result in some impact on the conservation status of the regional vegetation types. Other aspects of moderate significance include the presence of protected tree species, the potential presence of flora species of conservation importance, and peripheral effects on surrounding areas. These impacts could be mitigated to an acceptable level with the implementation of generic mitigation measures.

Mitigation of direct impacts resulting from development activities is largely restricted to the exclusion of sensitive areas (as far as technically feasible). Direct impacts on vegetation are irreversible, even with the application of detailed rehabilitation procedures. Furthermore, the inherent dependence of various habitat types (upland/ lowland interface) on each other limits the blanket approach of excluding only sensitive areas from a development of this nature. The creation of buffer zones and connective corridors is critical to avert peripheral (indirect) impacts from affecting the status of grassland and wetland habitat types on the long term. Generic mitigation measures, which are detailed in a later section of this report, will form the basis of protection from indirect, direct and peripheral impacts, but must be strongly controlled and monitored.

Biodiversity offset programmes is also recommended for this development, particularly in view of cumulative regional impacts. The inclusion of sensitive areas in local conservation and management strategies will benefit the diversity on a regional scale.

7.2.5 Recommended mitigation measures

7.2.5.1 Site Specific Mitigation Measures

Mitigation Measure 1 - Exclude as much as technically feasible of sensitive habitat from the proposed development;

Mitigation Measure 2 - Implement a suitable buffer zone (at least 30m) between the edge of these areas habitat and any type of development or surface disturbance;

Mitigation Measure 3 - Prevent all and any influx of water into wetland habitat;

Mitigation Measure 4 - Prevent contamination of natural habitat, wetland and endorheic pans from any source of pollution;

Mitigation Measure 5 - Locate, remove and relocate all plant species of conservation importance that are present areas that will be affected directly. Specific reference is made to protected trees (*Boscia albitrunca* and *Acacia erioloba*), Lithops species and *Hoodia gordonii* individuals. A site assessment is recommended whereby the study area is scrutinised for the presence of any of these individuals. All individuals will be georeferenced and applications for the removal/ relocation will be submitted to relevant authorities.

7.2.5.2 General Aspects

Mitigation Measure 6 - Appoint an Environmental Control Officer (ECO) prior to commencement of construction. Responsibilities should include, but not necessarily be limited to, ensuring adherence to EMP guidelines, guidance of activities, planning, reporting;

Mitigation Measure 7 - Compile and implement environmental monitoring programme, the aim of which should be ensuring long-term success of rehabilitation and prevention of environmental degradation. Biodiversity monitoring should be conducted at least twice per year (Summer, Winter) in order to assess the status of natural habitat and effects of the development on the natural environment;

7.2.5.3 Environmental Control Officer

Mitigation Measure 8 - Have overall responsibility for the implementation of the EMP;

Mitigation Measure 9 - Ensure that the developer and all contractors are aware of specifications, legal constraints and general standards and procedures pertaining to the project specifically with regards to the environment;

Mitigation Measure 10 - Ensure that all stipulations within the EMP are communicated and adhered to by the developer and contractors;

Mitigation Measure 11 - Monitor the implementation of the EMP throughout the project by means of site inspections and meetings. This will be documented as part of the site meeting minutes;

Mitigation Measure 12 - Be fully conversant with the EIA for the project, the conditions of theEA, all relevant environmental legislation and with the EMP;

Mitigation Measure 13 - Ensure that periodic environmental performance audits are undertaken on the project implementation;

Mitigation Measure 14 - Convey the contents of the EMP to the site staff and discuss the contents in detail with the Project Manager and Contractors;

Mitigation Measure 15 - Take appropriate action if the specifications contained in the EMP are not followed;

Mitigation Measure 16 - Monitor and verify that environmental impacts are kept to a minimum, as far as possible;

Mitigation Measure 17 - Compile progress reports on a regular basis, with input from the Site Manager, for submission to the Project Manager, including a final post-construction audit carried out by an independent auditor/consultant.

7.2.5.4 Fences & Demarcation

Mitigation Measure 18 - Demarcate construction areas by semi-permanent means/ material, in order to control movement of personnel, vehicles, providing boundaries for construction sites in order to limit spread of impacts;

Mitigation Measure 19 - No painting or marking of rocks or vegetation to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required;

7.2.5.5 Fire

Mitigation Measure 20 - The Project team will compile a Fire Management Plan (FMP) and Contractors directed by the ECO will submit a FMP. The Project FMP shall be approved by local Fire Protection Association, and shall include inter alia aspects such as relevant training, equipment on site, prevention, response, rehabilitation and compliance to the National Veld and Forest Fire Act, Act No. 101 1998;

Mitigation Measure 21 - Prevent all open fires;

Mitigation Measure 22 - Provide demarcated fire-safe zones, facilities and suitable fire control measures;

Mitigation Measure 23 - Use of branches of trees, shrubs or any vegetation for fire making purposes is strictly prohibited;

Mitigation Measure 24 - The irresponsible use of welding equipment, oxy-acetylene torches and other naked flames, which could result in veld fires, or constitute a hazard and should be guided by safe practice guidelines; and

Mitigation Measure 25 - The use of fire as a management tool should be guided and instructed by a qualified ecologist.

7.2.5.6 Roads & Access

Mitigation Measure 26 - Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted;

Mitigation Measure 27 - A road management plan should be compiled prior to the commencement of construction activities;

Mitigation Measure 28 - Dust control on all roads should be prioritised;

Mitigation Measure 29 - No roads should be allowed within ecologically sensitive areas.

7.2.5.7 Workers & Personnel

Mitigation Measure 30 - Provide temporary on-site ablution, sanitation, litter and waste management and hazardous materials management facilities;

Mitigation Measure 31 - Abluting anywhere other than in provided toilets shall not be permitted. Under no circumstances shall use of the veld be permitted;

7.15.5 Vegetation Clearance & Operations

Mitigation Measure 32 - All individuals/ stands of Protected Trees must be identified and clearly marked prior to the start of construction or maintenance procedures;

Mitigation Measure 33 - The landowner must immediately take steps to remove alien vegetation as per Conservation of Agricultural Resource Act (No. 43 of 1983), namely:

- Uprooting, felling or cutting;
- Treatment with a weed killer that is registered for use in connection with such plants in accordance with the directions for the use of such a weed killer;
- The application of control measures regarding the utilisation and protection of veld in terms of regulation 9 of the Act;
- The application of control measures regarding livestock reduction or removal of animals in terms of regulations 10 and 11of the Act;
- Any other method or strategy that may be applicable and that is specified by the executive officer by means of a directive.
- According to the Conservation of Agricultural Resource Act (No. 43 of 1983) as amended, the person applying herbicide must be adequately qualified and certified as well as registered with the appropriate authority to apply herbicides.

Mitigation Measure 34 - The size of areas subjected to land clearance will be kept to a minimum;

Mitigation Measure 35 - Only areas as instructed by the Site Manager must be cleared and grubbed;

Mitigation Measure 36 - Cleared vegetation and debris that has not been utilised will be collected and disposed of to a suitable waste disposal site. It will not be burned on site;

Mitigation Measure 37 - All vegetation not required to be removed will be protected against damage;

Mitigation Measure 38 - Removal of vegetation/ plants shall be avoided until such time as soil stripping is required and similarly exposed surfaces must be re-vegetated or stabilised as soon as is practically possible;

Mitigation Measure 39 - Monitoring the potential spread of declared weeds and invasive alien vegetation to neighbouring land and vice versa and protecting the agricultural resources and soil conservation works are regulated by the Conservation of Agricultural Resources Act (No 43 of 1983) and must be addressed on a continual basis, through an alien vegetation control and monitoring programme;

Mitigation Measure 40 - Remove and store topsoil separately in areas where excavation/ degradation takes place. Topsoil should be used for rehabilitation purposes in order to facilitate regrowth of species that occur naturally in the area;

Mitigation Measure 41 - Stored topsoil will be free of deleterious matter such as large roots, stones, refuse, stiff or heavy clay and noxious weeds, which would adversely affect its suitability for planting;

Mitigation Measure 42 - No spoil material will be dumped outside the defined site;

Mitigation Measure 43 - Disturbance of vegetation must be limited to areas of construction;

Mitigation Measure 44 - The removal or picking of any protected or unprotected plants shall not be permitted and no horticultural specimens (even within the demarcated working area) shall be removed, damaged or tampered with unless agreed to by the ECO);

Mitigation Measure 45 - Ensure proper surface restoration and resloping in order to prevent erosion, taking cognisance of local contours and landscaping;

Mitigation Measure 46 - Exposed areas with slopes less than 1:3 should be rehabilitated with a grass mix that blends in with the surrounding vegetation;

Mitigation Measure 47 - The grass mix should consist of indigenous grasses adapted to the local environmental conditions;

Mitigation Measure 48 - The revegetated areas should be temporarily fenced to prevent damage by grazing animals;

Mitigation Measure 49 - Re-vegetated areas showing inadequate surface coverage (less than 30% within eight months after re-vegetation) should be prepared and re-vegetated from scratch;

Mitigation Measure 50 - Damage to re-vegetated areas should be repaired promptly;

Mitigation Measure 51 - Exotic weeds and invaders that might establish on the re-vegetated areas should be controlled to allow the grasses to properly establish;

7.2.5.8 Waste

Mitigation Measure 52 - As far as possible, waste should be avoided, reduced, re-used and/or recycled. Where this is not feasible, all waste (general and hazardous) generated during the construction of the power station may only be disposed of at appropriately licensed waste disposal sites (in terms of Section 20 of the Environment Conservation Act, No 73 of 1989 and in accordance with the new waste act: National Environmental Waste Management Act 2008);

Mitigation Measure 53 - Prevent and advocate against the indiscriminate disposal of rubbish, litter or rubble;

Mitigation Measure 54 - The burning of general waste material under any circumstances is not to be allowed;

Mitigation Measure 55 - The use of small on-site incinerators for waste burning should be investigated, and if found feasible, be implemented;

Mitigation Measure 56 - Waste will be sorted at source (i.e. the separation of tins, glass, paper etc); recycled waste of this sort will be collected by an accredited waste removal contractor;

Mitigation Measure 57 - A stormwater management plan will be compiled that will address, inter alia, capturing and storage of stormwater;

Mitigation Measure 58 - All runoff water from fuel deposits, workshops, vehicles washing areas and other equipment must be collected and directed through oil traps to settlement ponds. These ponds must be suitably lined and should be cleaned as soon as practicable, and the sludge disposed off at a suitable waste site;

Mitigation Measure 59 - No wastewater or water containing any chemical or pollutant should be released from, or escape as effluent, from the site.

The full Biodiversity Impact Assessment is included in Appendix E

7.3 FAUNAL BIODIVERSITY IMPACT ASSESSMENT

The study area comprehends two regional vegetation types, namely Kalahari Karroid Shrubland in the north (Least Threatened, 99.2% untransformed) and Bushmanland Arid Grassland in the south (Least Threatened, 99.4% untransformed). Both vegetation types are included in the Bushmanland Bioregion of the country (Nama-Karoo Biome). The Nama Karoo Bioregion (or Biome) is a large landlocked region (25 % of the land surface area of South Africa) stretching across the Eastern and Western Cape Province interior to the Free State and Northern Cape Provinces.

The Karoo region, because of its aridity and low shrubby vegetation, has never supported the diverse array of herbivorous large mammals found in the other African savanna types. Plant-eating animals of the Karoo are generally small and confined to protected habitats, or are highly mobile, being able to move vast distances across different regions. Termites are responsible for much of the nutrient cycling in the Nama Karoo, also forming the staple food of many other species. There are a number of specialized insectivorous mammals and birds found in this region, including some of the smallest and largest species in South Africa. The reptile fauna is rich and there is a high diversity of invertebrates. Threats to fauna include overgrazing (desertification) and land transformation by mining, agriculture and development. The Nama Karoo has a rich faunal diversity and relatively high levels of endemism:

- • Mammals: 75 species (16 endemics, 12 threatened)
- • Birds: 271 species (21 endemics, 10 threatened)
- • Reptiles: 64 species (6 endemics, 1 threatened)
- • Amphibians: 13 species (5 endemics)
- • Invertebrates: unknown # species (unknown # endemics, 14 threatened)

During the field investigation, 80% of the species observed (56 species) were recorded during the first 67% of the time spend (527 minutes) Within the first half of the survey time (390 minutes), 67 % of the total number of species (47 species) has been observed using general observation methods.

A total of 77 animal species was recorded during the site investigation by means of visual sightings, tracks, scats, burrows and species-specific calls. This diversity includes:

- 1 spider;
- 10 butterflies;
- 8 reptiles;
- 40 birds; and
- 18 mammals.

Eighty-nine Red Data animals are known to occur in the Northern Cape Province (butterflies, frogs, reptiles and mammals) and in the Q-grids 2820BD, 2821AC and 2821CA (birds). This includes 18 listed as Data Deficient (DD), 28 as Near Threatened (NT), 31 as Vulnerable (VU), 6 as Endangered

(EN), 5 as Critically Endangered (CR) and one as Regionally Extinct (RE). It is estimated that 66 of the 89 animals listed have a low probability of occurring in the study area, 6 have a moderate low probability, 11 a moderate probability and 1 a moderate-high probability of occurring in the study area. Five red data species were confirmed to be present in the study area

- Secretarybird;
- Lanner Falcon(Near Threatened);
- The Reddish-grey Musk Shrew(DD);
- Kori Bustard; and (Vulnerable)
- Black-footed Cat (Vulnerable). Although the species' presence was not confirmed during the field investigation (shy, difficult to census), the landowner and farmworkers confirmed the presence of the "Anthill Tiger" on the farm. Following the precautionary principle, the species is considered a confirmed inhabitant of the study area until proof of its presence/absence can be investigated in more detail

7.3.1 Terms of Reference

The objective of this Biodiversity Impact Assessment is to establish the presence/absence of ecologically sensitive areas or species within the proposed project area. In order to assist with the planning of the proposed development it is necessary to assess potential impacts of the development on the biological environment (terrestrial biodiversity), comment on the suitability of the area for the proposed project and to provide development guidance to limit impacts as far as possible.

- The Terms of Reference for the faunal assessment are as follows:
- Obtain available faunal distribution records and Red Data faunal information
- Survey the site to obtain a broad overview of available faunal habitat types;
- Assess the potential presence of Red Data fauna species;
- Incorporate existing knowledge of the region;
- Describe the status of available habitat in terms of faunal attributes, preferences and conservation potential;
- Compile a faunal sensitivity analysis;

- Incorporate results into the Biodiversity Impact Evaluation;
- Map all relevant aspects; and
- Present all results in a suitable format.

7.3.2 Faunal Habitat Sensitivity Rating

The close relationship between vegetation units and specific faunal composition has been noted in several scientific studies. For the purpose of this investigation, floristic units are therefore considered representative of the faunal habitat types

Table 23: Faunal Habitat sensitivity for the study site

Faunal habitat sensitivity for the study site							
Criteria	Status	Diversity	Linkage	Red Data	Sens	Ave	Sens Class
Degraded areas	3	4	6	4	2	38%	Medium-low
Drainage Lines	8	8	9	8	8	82%	high
Floodplains	7	7	7	8	7	72%	medium-high
Impoundments	5	7	5	5	6	56%	medium
Open Plains/ Shrubveld	5	5	7	7	5	58%	medium
Road Infrastructure	1	1	1	1	1	10%	low

7.3.2.1 Impact Assessment and Identification

The following impacts resulting from the proposed development are expected to affect the faunal attributes of the study area:

- Direct impacts on Red Data fauna species;
- Loss or Degradation of natural faunal habitat & in surrounding areas;
- The disruption of ecological connectivity and migration routes of larger, flightless animals as well as territorial infringement; and
- Direct impacts on common fauna species & interactions with structures & personnel.

7.3.2.2 Direct impacts on Red Data Fauna Species

Threatened animals contribute significantly to the ecological diversity of a region since their presence usually provides an indication of a relatively pristine environment. Although regarded as a direct and significant impact, developments such as this are unlikely to affect these animals directly since they are generally mobile and will ultimately be able to migrate away from impacts that result from the proposed development. Significantly, however, the loss of suitable habitat that is available to them represents a significant impact on the status of these animals. Aspects of these animals that will also be affected include migration patterns and suitable habitat for breeding and foraging purposes. Since these requirements are frequently stricter than most generalist species, impacts on their habitat are likely to be more significant than for most other, common fauna species.

A relative high number of Red Data species was observed during the survey period, the Red Data assessment of this report indicates that several Red Data fauna species are furthermore likely to occupy suitable areas within the study area. The status of these areas is relative pristine and the possibility that some fauna species simply were not observed during the limited time available cannot be excluded (due to customary limitations in the search of these species).

Potential Mitigation: Conduct a verification assessment that will establish the presence/ absence of particularly Black-footed cat from the study area. A relocation programme should be implemented in the event of these species being present. Other Red Data species occur in specific habitat types that should be excluded from the development. Implement a biodiversity-offset programme that will ensure conservation of similar, nearby habitat. Contamination of surrounding areas should be prevented at all cost.

7.3.2.3 Loss/ Degradation of Natural Faunal Habitat

Natural habitat of the study area as well as surrounding areas will be affected adversely by direct impacts resulting from construction and operational activities. Particular reference is made to the loss of habitat resulting from surface clearing activities, the construction of infrastructure as well as less obvious impacts such as leaching of chemicals into the groundwater and surface water, generation of huge amounts of dust and spillages of particularly hydrocarbon substances. Also of importance is the loss of habitat that are not necessarily considered suitable for Red Data species, but where a high diversity of animals are likely to occupy the area. Extensive areas exhibiting low habitat fragmentation and isolation levels are included in this category. This impact also includes adverse effects on any processes or factors that maintain ecosystem health and character, including the following:

- Disruption of nutrient-flow dynamics;
- Introduction of chemicals into the ground- and surface water through leaching;

- Impedance of movement of material or water;
- Habitat fragmentation;
- Changes to abiotic environmental conditions;
- Changes to disturbance regimes, e.g. increased or decreased incidence of fire;
- Changes to successional processes;
- Effects on pollinators; and
- Increased invasion by plants and animals not endemic to the area.

Changes to the natural habitat may lead to a reduction in the resilience of ecological communities and ecosystems and changes in ecosystem function. Furthermore, regional ecological processes, particularly aquatic processes that is dependent on the status and proper functioning of the wetland habitat types, is particularly important. A high conservation value is generally ascribed to floristic faunal assemblages that occupy these areas as they contribute significantly to the biodiversity of a region.

Potential Mitigation: Implement a biodiversity offset programme that will target nearby habitat and of which the aim would be to improve the status of these areas. Ensure that the loss of faunal habitat is restricted to the development site itself. Infrastructure and related activities must be confined to the development site and not allowed to spread to nearby sensitive areas. Fences must be erected prior to construction and all personnel and contractors should be instructed as to the physical boundaries pertaining to their respective disciplines and measures set in place to ensure that they keep to these boundaries. In addition, erosion control measures must be put in place from the commencement of construction to ensure that artificial erosion associated with the activities of the project (construction, operation and decommissioning) does not degrade the natural ecological state of the faunal habitats bordering the study area and the various areas of activity.

7.3.2.4 Disruption of Ecological Connectivity & Migration Routes

The region is characterised by low transformation and fragmentation levels. It is therefore reasonable to assume that animals that utilises the existing areas of natural habitat will migrate extensively across the region. Foraging, available water, food sources, breeding patterns and seasonal/ climate changes include some of the more obvious explanations for migration patterns of animals.

While most of the larger mammal species (ungulates) are restricted in their movement by fences, small and medium sized animals, that include predators, burrowing species, small mammals, invertebrate species, reptiles, amphibians, etc. utilises all available natural habitat as either corridors, 'stepping stones' or habitat. Loss of current migration routes or connectivity areas (stepping stones) within the study area will likely affect the migration pattern of some species. While larger animals are not likely to be affected significantly, smaller animals might not be able to cross or avoid certain types of development/ infrastructures. Particular reference is made to the disruption of migration patterns of flightless animals.

Potential Mitigation: All impacts must be limited to the site only; no land use changes or otherwise disturbances of animals outside of the study area should be allowed; vehicles should yield to larger\ animals on access roads. Wherever linear structures (roads and pipelines) bisect natural areas of untransformed faunal habitat measures should be put in place to ensure continued movement of all faunal groups needing to cross these manmade barriers.

7.3.2.5 Impacts on Common Fauna & Interactions with Structures & Personnel

Activities that are known to transpire from human–animal conflicts are likely to affect animals that utilize surrounding areas. Unwanted activities might include poaching, snaring, killing by accidental contact, capturing, effects of domestic cats and dogs, roadkills, etc. While the tolerance levels of common animal species is generally of such a nature that surrounding areas will suffice in habitat requirements of species forced to move from the area of impact, some species would not able to relocate, such as ground living and small species.

It should be noted that animals generally avoid contact with human structures, but do grow accustomed to structures after a period. An aspect that is of concern is the presence of vehicles on access and infrastructure roads, leading to accidental death of animals, particularly amongst nocturnal animals.

The presence of personnel within the development area during construction and operational phases will inevitably result in some contact with animals. Therefore, encounters with dangerous animals (such as snakes) remain likely. In addition, the presence of domestic dogs and cats is generally associated with humans. These animals are frequently accountable for killing of natural fauna. It is also regarded moderately likely that the natural faunal component might be attracted to the artificial habitat that is created by the development. The establishment of human abodes generally result in the presence of foraging rodents, which is likely to attract smaller predators, raptors, owls, and snakes. The lack of understanding from personnel frequently results in the unnecessary killing of these animals.

Potential Mitigation: Frequent policing of fences and areas bordering the mining area must be implemented with severe penalties to offenders that kill animals. Sensitizing personnel to the presence and handling of animals must form part of the induction. The construction of fences around all areas related to the project where personnel have daily access (construction, operation and decommission) is of the utmost importance. Regular inspection of these fences to ensure the fences' integrity and patrol of the borders and surrounding areas next to the site for the presence of snares etc. will limit the impact of poaching and snaring. Communication with farmers whose properties border the operational areas to create awareness of potential poaching problems in the area is important.

Table 24: Faunal Impact Evaluation – Construction Phase

POTENTIAL ENVIRONMENTAL IMPACT	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	M	D	S	P	TOTAL	SP	M	D	S	P	TOTAL	SP
Construction Phase: Footprint Clearance												
Impacts on RD fauna species - Reddish-grey Musk Shrew	8	5	3	4	64	H	8	5	3	2	32	M
Impacts on RD fauna species - Black-footed Cat	8	5	3	4	64	H	8	5	3	2	32	M
Impacts on RD fauna species - Brown Hyaena	5	5	2	4	60	H	8	5	2	2	30	L
Degradation of natural faunal habitat	4	5	2	5	55	M	4	5	2	4	44	M
Disruption of ecological connectivity	4	4	2	5	50	M	4	4	2	5	40	M
Direct impacts & interactions with structures & personnel	4	4	2	3	50	M	4	4	2	3	30	L
Construction Phase: Establishment of Infrastructure												
Impacts on RD fauna species - Reddish-grey Musk Shrew	8	4	2	4	56	M	8	4	2	4	56	M
Impacts on RD fauna species - Black-footed Cat	8	4	2	4	56	M	8	4	2	4	56	M
Impacts on RD fauna species - Brown Hyaena	8	4	2	4	56	M	8	4	2	4	56	M
Loss/ Degradation of faunal habitat & in surrounding areas	4	5	2	3	33	M	4	5	2	3	33	M
Disruption of ecological connectivity & migration routes	4	4	2	3	30	L	4	4	2	3	30	L
Direct impacts & interactions with structures & personnel Construction Phase: Establishment of Linear Infrastructure	4	4	2	5	50	M	4	4	2	5	50	M

POTENTIAL ENVIRONMENTAL IMPACT	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	M	D	S	P	TOTAL	SP	M	D	S	P	TOTAL	SP
Construction Phase: Establishment of Linear Infrastructure (Roads, Pipelines, Powerlines, etc.)												
Impacts on RD fauna species - Reddish-grey Musk Shrew	8	4	2	3	42	M	8	4	2	3	42	M
Impacts on RD fauna species - Black-footed Cat	8	4	2	3	42	M	8	4	2	3	42	M
Impacts on RD fauna species - Brown Hyaena	8	4	2	2	28	L	8	4	2	2	28	L
Loss/ Degradation of faunal habitat & in surrounding areas	4	5	2	2	22	L	4	5	2	2	22	L
Disruption of ecological connectivity & migration routes	4	4	3	3	33	M	4	4	3	3	33	M
Direct impacts & interactions with structures & personnel	4	4	3	3	55	M	4	4	3	5	55	M
Construction Phase: Generation and Handling of Waste												
Loss/ Degradation of faunal habitat & in surrounding areas	4	4	2	4	40	M	4	4	2	2	40	M

M = Magnitude, D = Duration, S = Scale, P = Probability

Table 25: Faunal Impact Evaluation – Operational Phase

POTENTIAL ENVIRONMENTAL IMPACT	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	M	D	S	P	TOTAL	SP	M	D	S	P	TOTAL	SP
Operational Phase: Maintenance and Generation Activities												
Impacts on RD fauna species - Reddish-grey Musk Shrew	8	5	4	3	51	M	8	5	2	2	30	L
Impacts on RD fauna species - Black-footed Cat	8	5	4	3	51	M	8	5	2	2	30	L
Impacts on RD fauna species - Brown Hyaena	8	5	4	3	51	M	8	5	2	2	24	L
Loss/ Degradation of faunal habitat & in surrounding areas	4	4	2	3	30	L	4	4	2	2	20	L
Disruption of ecological connectivity & migration routes	4	4	2	5	50	M	4	4	2	2	20	L
Direct impacts & interactions with structures & personnel	4	4	2	5	50	M	4	4	2	2	20	L
Operational Phase: Transportation												
Loss/ Degradation of faunal habitat & in surrounding areas	4	4	2	3	30	L	4	4	2	3	30	L
Disruption of ecological connectivity & migration routes	4	4	2	3	30	L	4	4	2	3	30	L
Direct impacts & interactions with structures & personnel	4	4	4	5	60	H	4	4	2	4	40	M
Operational Phase: Generation and handling of waste												
Loss/ Degradation of faunal habitat & in surrounding areas	2	4	2	3	24	L	2	4	2	2	16	L
Disruption of ecological connectivity & migration routes	2	4	2	2	16	L	2	4	2	2	16	L

M = Magnitude, D = Duration, S = Scale, P = Probability

Table 26: Faunal Impact Evaluation – Decommissioning Phase

POTENTIAL ENVIRONMENTAL IMPACT	Environmental Significance Before Mitigation						Environmental Significance After Mitigation					
	M	D	S	P	TOTAL	SP	M	D	S	P	TOTAL	SP
Closure & Decommissioning: Removal of Infrastructure												
Loss/ Degradation of faunal habitat & in surrounding areas	4	4	2	3	30	L	2	4	2	2	16	L
Disruption of ecological connectivity & migration routes	4	4	3	3	33	M	2	4	2	2	16	L
Direct impacts & interactions with structures & personnel	4	4	2	3	30	L	2	4	2	2	16	L
Closure & Decommissioning: Rehabilitation												
Loss/ Degradation of faunal habitat & in surrounding areas	2	4	2	2	16	L	2	4	2	2	16	L
Disruption of ecological connectivity & migration routes	2	4	2	2	16	L	2	4	2	2	16	L
Direct impacts & interactions with structures & personnel	4	4	2	3	33	L	2	4	2	2	16	L
Closure & Decommissioning: Presence of Personnel within a Natural Environment												
Loss/ Degradation of faunal habitat & in surrounding areas	4	5	2	2	22	L	2	5	2	2	18	L
Direct impacts & interactions with structures & personnel	4	4	2	3	33	M	2	5	2	2	18	L

M = Magnitude, D = Duration, S = Scale, P = Probability

7.3.3 Recommended mitigation measures

7.3.3.1 Site Specific Mitigation Measures

Mitigation Measure 1 - Exclude as much of the highly sensitive habitat from the development as possible. Cognisance of the wetland ecologist/ specialist is regarded imperative in this regard. This should be done during the planning phase;

Mitigation Measure 2 - Implement a suitable buffer zone (at least 30m) between the edge of sensitive habitat and any type of development or surface disturbance;

Mitigation Measure 3 - Implement a suitable buffer zone around wetland habitat, taking cognisance of recommendations from the wetland report;

Mitigation Measure 4 - Prevent contamination of surrounding areas of natural habitat, from stockpiling, conveyor lines, water treatment facilities or any other source of pollution;

7.3.3.2 Roads & Access

Mitigation Measure 5 - Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted;

Mitigation Measure 6 - A road management plan should be compiled prior to the commencement of construction activities;

Mitigation Measure 7 - No roads should be allowed within ecologically sensitive areas. The use of roads around ecologically sensitive areas for the purpose of buffers should be done with circumspect particularly in view of accidental killing of animals;

7.3.3.3 Animals

Mitigation Measure 8 - No animal may be hunted, trapped, snared or captured for any purpose whatsoever. Fences and boundaries should be patrolled weekly in order to locate and remove snares/ traps;

Mitigation Measure 9 - Vehicular traffic should not be allowed after dark in order to limit accidental killing of nocturnal animals;

Mitigation Measure 10 - Speed of vehicles should be limited to allow for sufficient safety margins;

Mitigation Measure 11 - Dangerous animals should be handled by a competent person;

Mitigation Measure 12 - Compile a graphic list of potentially dangerous animals and present this to all workers as part of site induction;

Mitigation Measure 13 - Sensitize all personnel to the presence, characteristics and behaviour of animals on the site;

Mitigation Measure 14 - Include suitable procedures in the event of encountering potentially dangerous animals on the site;

Mitigation Measure 15 - Ensure that a snake handler and/ or anti venom serum is available at all times, together with a competent person to administer this serum;

Mitigation Measure 16 - No domestic pets should be allowed on the site.

7.3.4 Conclusion

The study area is characterised by untransformed Bushmanland Arid Grassland and Kalahari Karroid Shrubland; untransformed habitat of the Bushmanland Bioregion dominates the study area; the fragments of transformed faunal habitat within the study area is scattered and insignificant. The faunal habitats of the study area is also well connected to other untransformed habitat in a region characterised by large areas of natural faunal habitat (99.2 % of Kalahari Karroid Shrubland and 99.4 % of Bushmanland Arid Grassland remain untransformed – Vegmap, 2006). Although limited effects of overgrazing (desertification) is noted in the study area, it is insignificant and the original Bushmanland Bioregion ecosystem processes and original faunal assemblages and species are still present.

Most of the animals observed in the study area are found widely in South Africa and only a few are limited to the arid regions of the country. Except for the livestock present in the study area, no introduced or alien animal species were observed during the field investigation.

Anticipated impacts were assessed during the EIA in terms of the estimated significance in a context where unavoidable impacts will result on biological attributes during the life of the proposed development. Most impacts are regarded significant and long-term, but mostly restricted to a local milieu. It should be noted that none of the impacts represents a ‘Red Flag’ to the development when viewed in isolation, hence the ‘No-Go’ option is not regarded a requirement

The nature of potential and likely impacts in the ecological environment is such that the implementation of mitigation measures is likely to reduce the significance of impacts to a more acceptable nature, but unavoidable loss will occur, irrespective of the level of mitigation

Significant adverse impacts resulting from the proposed development on sensitive ecological attributes of the proposed site are most likely to be restricted to the wetland regimes of the site. While some significant impacts will inevitable result in the terrestrial environment, these impacts are generally of an acceptable nature (in a regional context) and can be effectively ameliorated. The loss of terrestrial habitat is unlikely to result in unacceptable ecological losses. One of the most important impacts in this regard is represented by the potential effects on conservation sensitive fauna that persist in the local environment. The mobility of most of these species enables them to evacuate areas of high impacts and relocating to nearby suitable habitat, which were found to be abundantly present in the surrounding areas. These statements, however, need to be interpreted with caution as severe cumulative impacts of numerous similar developments in the immediate surrounds are indicated, including the Abengoa, Sasol & Eskom projects (inter alia).

Please refer to Appendix E for full Biodiversity Assessment.

7.4 HYDROLOGICAL IMPACT ASSESSMENT

The area is characterized with very low rainfall (MAP less than 250 mm). This scarcity of rain dictates that no meaningful surface water features are relevant. There are no visible watercourses within the project area, other than dried up pans and drainage lines and stream beds. All surface run-off drains in a southerly direction to the Orange River. There are no specific or sensitive environments downstream of the project site that can suffer any contamination from runoff from the site.

The drainage lines are seldom active, but they are geomorphologically important because they carry large loads of sediment during spate events. This process of mobilising and redistributing sediments shapes the landscape that characterises the gravel plains and the vegetation that occurs in the area have adapted to this process.

The proposed PV facility is likely to impede the geomorphical processes by rerouting the flow of stormwater and the sediments that they carry. This can have long-lasting impacts on the downstream landscape, with consequent implications for the abundance and species composition of plants and in extreme cases, may lead to problems of erosion and damage to infrastructure. The slightly undulating terrain present in the project area results in local low points or pans. These low points tend to collect stormwater runoff for short periods, where it evaporates or is consumed by livestock.

There are no potential perennial fresh water supply options from surface water sources on the site. Rain harvesting is an option together with utilising surface runoff when available. The quantity is unlikely to meet the total demands of the project. Fresh water will more than likely only be realized by obtaining water via the Orange River or from ground water options.

Ephemeral drainage lines are common throughout the study area. These systems are usually active for a few hours or days, and play important roles in the transport of water and sediments during storm events. They were not considered further in this study because they do not support aquatic flora or fauna, but they do need to be considered in stormwater management.

7.4.1 Terms of Reference

The approach used to assess impacts is similar to the approach adopted for mining projects throughout South Africa. The approach was to undertake a predominantly desktop assessment of the surface hydrology in the study area, where selected climatic data for the region was obtained, and baseline catchment data for the proposed project area was reviewed. A limited field survey confirmed the desktop findings.

Limited information was available on surface hydrology near the proposed project area. The most important sources of available data used in this report were the following:

- Google TM earth satellite images;
- Climatic data regarding temperature, rainfall, evaporation, humidity etc;
- Water resource software and legislation; and
- Rooipunt Scoping Report on the surface hydrology (Knight Piésold, 2011).

A field survey was undertaken in February 2012. The field survey was used to observe and collect baseline data on surface hydrology. The visit took place towards the end of the wet season which allowed for an investigation of the surface hydrological system. Selected photographs of the study area are shown in Appendix I.

The likely surface hydrology impacts of the proposed development were evaluated using the following criteria:

- P = Probability: 0=none; 1=improbable; 2=low probability; 3=medium probability; 4=highly probable; 5=definite or don't know.
- D = Duration: 1=immediate and/or unique impact; 2=short-term (0 to 5 years) and/or infrequent impact; 3=medium-term (5 to 15 years) and/or frequent impact; 4=long-term (impact ceases after operational life) and/or very frequent impact; 5=permanent and/or continuous impact.
- S = Scale: 1=site only; 2=local; 3=Regional; 4=National; 5=International.

- M = Magnitude: 0=none; 2=minor; 4=low; 6=moderate; 8=high; 10=very high or don't know.
- S = Significance: The overall significance of each impact was determined by combining the consequence of the impact and the probability of occurrence i.e.: Significance = Consequence (duration + scale + magnitude) x probability.

The scores were interpreted as follows:

Total Score	Significance
60 ≤	Score High Environmental Significance
30 ≤ Score < 60	Moderate Environmental Significance
Score < 30	Low Environmental Significance

7.4.2 Hydrological Sensitivity

The Helbrandleegte stream running through the proposed development area has been identified by the wetland specialist consultant as a sensitive habitat. It has been established that the PV can be constructed outside of the stream but part of the CSP facility will be located within the stream and that the location and extent of the CSP facility cannot be changed to avoid the stream. The proposed solution will be to divert the stream away from and around the facility. Ideally the diversion should be as natural (unlined) as possible, should remain within the project area and should rejoin the Helbrandleegte stream at a point downstream of the facility.

The diversion will come with its own challenges and will require sizing with a hydraulic model. Flow velocities and erodibilities will also have to be checked.

7.4.2.1 Impact Assessment and Identification

This section details the expected environmental impacts of the proposed development on surface water hydrology. Impacts are arranged in order of decreasing overall significance. Table 27 presents a concise summary of the various elements of the project and the associated potential impacts.

Table 27: Project Elements and Potential Impacts

Action	Possible Impacts
Development on watercourses	It has been confirmed that the solar footprint will encroach on some drainage lines introducing many impacts relating to flood risk, water quality and the need for responsible stormwater management.
Stormwater management infrastructure	Stormwater management may result in the realignment of natural streams. This may lead to reduced sediment volumes being transported downstream, thus affecting the downstream landscape.
Site stormwater control	Hardening of catchments with impermeable surfaces (in the plant area and associated infrastructure) will increase base and peak runoff. Erosion risks associated with stormwater disposal.
Potential transport of contaminants via stormwater	Drainage of the plant areas could result in contaminants entering the downstream environment.
Un-natural drainage of surface water	This may result in drainage of surface water features (e.g. ponds).
Fresh water supply	The natural unavailability of fresh water may result in significant measures introduced by the project to obtain fresh water from distant sources. These measures are likely to introduce a new range of impacts (e.g. construction of pipelines from distant sources).

a) Construction Phase Impact : Removal of Vegetation

Significant vegetation cover will be removed during the construction phase of the project. This will result increase runoff from the project area, which may in turn result in increased erosion.

The overall significance of this impact, in the absence of mitigation, is rated as **High** for the Construction Phase.

b) Construction Phase Impact : Risks of Erosion and Pollution

Construction of the Solar Power Park is certain to cause a localised, short-term deterioration in surface water quality. Construction activities are likely to increase the likelihood of accidental spills of hydrocarbons (oils, diesel etc), and other potentially hazardous chemicals. Furthermore, equipment maintenance and washing could affect surface water quality. Such spills and uncontrolled discharge of polluted water should be contained within the solar sites and not allowed to impact the downstream environment. Further recommended the containment structures such as evaporation ponds should be lined to prevent pollution of groundwater resources.

The overall significance of this impact, in the absence of mitigation, is rated as Medium for the Construction Phase.

c) Construction Phase Impact: Clean / Dirty Water Separation

Operation of the solar power project may lead to dirty plant runoff mixing with clean natural runoff. This may lead to contamination of clean surface and ground water. All storm water generated within the project site deemed to be “dirty” areas should be contained. Run off from “clean” areas should be diverted away from the “dirty” areas and into the natural watercourse.

The overall significance of this impact, in the absence of mitigation, is rated as Moderate for the Operational Phase.

d) Construction Phase Impact: Flood Inundation

There are one major stream (Helbrandleegte) that pass through the project area. These streams are generally dry but do flow after spate events. The floodlines associated with the streams will inundate sections of the project area, which may lead to contamination and pollution of surface water resources.

The overall significance of this impact, in the absence of mitigation, is rated as **Medium** for the Construction Phase.

e) Operational Phase Impact : Maintaining diversion channel

Over the period of the project maintenance of the diversion channel in terms of sedimentation, erosion, vegetation, impact on downstream reaches of river, etc., will be ongoing. A diversion management plan should be developed.

The overall significance of this impact, in the absence of mitigation, is rated as **High** for the Operational Phase.

f) Operational Phase Impact : Hardening of the Project Area

Operation of the Solar Power Park may cause an increase in the runoff volumes from the project areas. This may lead to increased levels of erosion in the areas surrounding the project area.

The overall significance of this impact, in the absence of mitigation, is rated as **Medium** for the Operational Phase

g) Operational Phase Impact : Risks of Pollution

The operational phase of the Solar Power Park may result in reduced water quality runoff from the project area. This runoff could extend, as far downstream as the Orange River. Other concerns include accidental spills. There is a likelihood of accidental spills of hydrocarbons (oils, diesel etc.), and other potentially toxic chemicals through surface runoff during operation. Furthermore, increased traffic is certain to increase the likelihood of accidental spills. These spills, if not mitigated, could have severe, localised, but short-duration impacts on local flora and fauna, particularly downstream of the project area. The control of process water, including cooling water is very important and if uncontrolled, may lead to polluting of the surface water resources.

The overall significance of this impact, in the absence of mitigation, is rated as **Medium** for the Operational Phase.

h) Operational Phase Impact : Altered Sediment Transport

The drainage lines running through the project area are seldom active, but may be considered geomorphologically important because they carry large loads of sediment during spate events. This process of mobilising and redistributing sediments shapes the landscape. The proposed diversion of the Helbrandleegte stream is likely to impact these processes within the project area but rerouting the flow of stormwater and sediments may also result in impacts on the downstream landscapes.

The overall significance of this impact is rated as **Medium**.

i) Operational Phase Impact : Flood Inundation

There are two streams that pass through the project area. These streams are generally dry but do flow after spate events. The floodlines associated with the streams will inundate sections of the project area, which may lead to contamination and pollution of surface water resources.

The overall significance of this impact, in the absence of mitigation, is rated as **Medium** for the Operational Phase.

j) Operational Phase Impact: Clean / Dirty Water Separation

Operation of the Solar Power Park may lead to dirty plant runoff mixing with clean natural runoff. This is will lead to contamination of clean surface and ground water.

The overall significance of this impact, in the absence of mitigation, is rated as **Medium** for the Operational Phase.

k) Closure Phase Impact : Risks of Erosion and Pollution

Closure of the Solar Power Park will mean removing storm water containments that may cause a localised, short-term deterioration in surface water quality.

The overall significance of this impact, in the absence of mitigation, is rated as **Medium** for the Closure Phase.

Table 28 bellow provides the significance rating for the potential Hydrological impacts.

Table 28: Potential Hydrology Impacts

Potential Environmental Impacts	Criteria					Score	Significance before Mitigation			Significance after Mitigation		
	N	P	D	S	M	TOTAL	LOW	MOD	HIGH	LOW	MOD	HIGH
Construction Phase												
Removal of Vegetation	-ve	5	2	1	10	65			H		M	
Risk of Erosion and Pollution	-ve	4	2	2	8	48		M		L		
Clean/Dirty Water Contamination	-ve	2	2	2	8	24		M		L		
Flood Inundation	-ve	3	2	1	8	33		M		L		
Operational Phase												
Maintain diversion	-ve	5	5	2	8	75			H		M	
Hardening of the project site	-ve	4	5	1	6	48		M			M	
Risk of pollution	-ve	3	4	1	6	33		M		L		
Altered Sediment transport	-ve	3	2	1	8	33		M		L		
Clean/Dirty Water Contamination	-ve	3	4	2	6	36		M		L		
Closure												
Rehabilitation of site	+ve	5	2	2	8	60			H		M	
Risk of Pollution	-ve	3	4	2	8	42		M		L		
Risk of Erosion	-ve	3	5	1	8	42		M			M	

N = Nature, P = Probability, D = Duration, S = Scale, M = Magnitude

7.4.3 Conclusion and Recommendations

The fact that the site is positioned well away from significant water courses such as the Orange River, largely limits the hydrological impacts to issues pertaining to site stormwater control. Storm water Controlee designs by a registered civil engineer will mitigate any impacts. The following mitigation measures are aimed at preventing sedimentation and pollution of existing watercourses:

- Activities on the banks of the streams should be avoided as far as possible;
- Watercourse crossings and stormwater management infrastructure should be implemented along access roads. The infrastructure should not alter the flow of water in the watercourses;
- Adequate measures must be implemented to reduce the contamination of clean runoff with dirty plant runoff;
- It is expected that the watercourses will encroach into the project area. Mitigation measures, such as diversion canals and berms, will have to be implemented to avoid soil erosion;
- Soil erosion control measures, such as protection berms, should be employed where necessary;
- Containment and stormwater management measures should be implemented by the contractor to prevent the loss of topsoil;
- Land clearing should be kept to a minimum and limited to development areas; and
- In general no development may be located within 100 m of a watercourse or within the 1:50 yr flood lines. This may not be appropriate to this project area.
- Any surface water storage will be subjected to significant rates of evaporation.
- Stored surface water should be used as it becomes available or should be stored in a covered reservoir.
- Appropriate pollution control measures should be incorporated into the design and costing of the proposed development. These include:
    - Containment of all stormwater from the facility into lined containment ponds;
    - Oil traps to minimise hydrocarbon pollution of surface water and groundwater;

- Bunding of all facilities that store hazardous materials, and
- Adequate washing and ablution facilities.

Site Specific Stormwater Management measures will have to be implemented to ensure the plant design will be sensitive to peak rainfall. These measures are listed in **Table 29** bellow.

Table 29: Site Spesific Stormwater Management Measures

Aspect	Measure
Construction Phase	
Zoning	Work areas and sensitive areas should be zoned and demarcated accordingly. By adequately zoning the project area, land clearing can be reduced to the minimum necessary for project development.
Control Pollution	Standard procedures to control and minimize surface and groundwater pollution should be implemented. These include: • Contain stormwater runoff from construction areas; • Maintain oil traps; • Maintain bunding of all facilities that store hazardous materials; • Maintain washing and ablution facilities; • Provide and maintain solid waste collection facilities; • Provide spill kits and monitor spills; and • Monitor vehicle oil leaks.
Operational Phase	
Control Pollution	Standard procedures to control and minimize surface and groundwater pollution should be implemented, as recommended for the construction phase (see above). The strategy to minimise contamination and pollution is to separate the clean and dirty runoff. The runoff entering the project area is considered clean together with possible sections within the project area while plant areas are considered dirty runoff.

Aspect	Measure
Water Conservation Programme	A water conservation programme should be developed and implemented. The programme should monitor water use and runoff. The project area experiences very low rainfall. As such measures should be taken to store rainfall and surface runoff from within the project area. This is already evident in the project area. This water can then be treated and reused in the plant. It is unlikely that rain harvesting will meet the demands of the project but it will assist in reducing the overall demand.
Closure	
Decommissioning of facilities	Softening of the project area and the removal of permanent infrastructure will mitigate increased runoff from the project area. The removal of infrastructure may lead to increased erosion. Measures should be implemented to return the project area to its original condition to limit further erosion. The diversion of the Helbrandleegte stream should remain after closure and the stream should be allowed to naturally follow the new route.

Mitigation, if correctly applied, can be highly effective in reducing some of the impacts identified, particularly:

- risk of pollution;
- reducing the amount of erosion; and
- increased runoff due to hardening of the project area.

Remaining impacts can be partially mitigated, except for minor inundation of project areas for which no direct mitigation measures are possible.

Please refer to Appendix I for full Hydrological Impact Assessment.

7.5 WETLAND IMPACT ASSESSMENT

Wetland Consulting Services (Pty.) Ltd. was appointed by Worley Parsons to undertake the specialist wetland and riparian habitat assessment for the proposed Rooipunt Solar Power Park, near Upington in the Northern Cape Province. The proposed project will be located on the Portion 0 of the Farm

Rooipunt 617 Gordonia RD, and will include a Concentrated Solar Power (CSP) Plant, as well as Photovoltaic (PV) plants.

The requirement to establish the existence and/or extent of watercourses on the property is based on the legal requirements contained in both NEMA as well as the National Water Act. Given the stringent legislation regarding developments within or near watercourses, it is important that these areas are identified and developments planned sensitively around them to minimize any potential impacts.

The only existing wetland information obtained for the Rooipunt Project Site was from the National Wetland Inventory (NWI) (SANBI, 2009) and the National Freshwater Ecosystem Priority Areas project which incorporates the NWI. A number of small pans are indicated as occurring within the general area, though none on site. The Helbrandleegte stream is indicated as flowing across the site from north west to south east,.

The recently published Atlas of Freshwater Ecosystem Priority Areas in South Africa (Nel et al, 2011) which represents the culmination of the National Freshwater Ecosystem Priority Areas project, a partnership between SANBI, CSIR, WRC, DEA, DWA, WWF, SAIAB and SANParks, provides a series of maps detailing strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. Freshwater Ecosystem Priority Areas (FEPA's) were identified through a systematic biodiversity planning approach that incorporated a range of biodiversity aspects such as ecoregion, current condition of habitat, presence of threatened vegetation, fish, frogs and birds, and importance in terms of maintaining downstream habitat. High water yield areas and high groundwater recharge areas were also identified as part of the project.

Based on Nel et al (2011), the three sub-quarternary catchments in which the Rooipunt Project Site is located are classified as an Upstream Management Areas. Upstream Management Areas are sub-quarternary catchments in which human activities need to be managed to prevent degradation of downstream river FEPA's and Fish Support Areas, in this case referring to the Orange River.

7.5.1 Terms of Reference

- Wetland Baseline Investigation:
    - Collate and review existing information;
    - Conduct a desktop and field investigation to accurately delineate all wetlands and riparian habitats on site as per the DWAF (2005) methodology;
    - Classify wetlands according to HGM (SANBI, 2009);
    - Undertake a functional assessment of all the wetlands and riparian habitats on site;

  - Determine the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of all wetlands and riparian habitats on site using the applicable tools; and
  - Compile a detailed wetland and riparian habitat delineation and assessment report, including a map of delineated wetlands and riparian habitats.

- Impact Identification and Assessment:
  - Review of proposed development layout plans;
  - Identification of expected and possible impacts, including cumulative impacts;
  - Recommendations of proposed mitigation and/or management measures for all identified impacts;
  - Recommendations for monitoring; and
  - Compile a report detailing all the above information

7.5.2 Impact Assessment and Identification

7.5.2.1 Delineation and Sensitivity

In total wetlands and watercourses were found to cover roughly 230.53 ha and make up 10.65 % of the study area.

The wetland and riparian habitats on site are dominated by the riparian habitat associated with the Helbrandleegte stream which drains across the study area from north west to south east. The Helbrandleegte riparian habitat makes up more than 55 % of the riparian and wetland habitat on site and covers 5.88 % of the study area.

The only wetland habitat identified and delineated on site is associated with 4 small pans covering a combined area of only 1 hectare. All 4 of these pans were dry at the time of the site visit and are considered to be highly ephemeral systems that only contain surface water for brief periods following larger rainfall events. All pans did however show signs of fairly recent inundation and saturation in the form of surface cracking and heavily trampled, dried mud. The pan basins were generally devoid of vegetation and fringed by a well-developed shrub fringe dominated by Rhigozum trichotomum (generally more robust than the shrubs growing away from the pans and watercourses), with the alien Prosopis glandulosa also occurring in places. Table 30 below shows the extent of various wetlands found on site.

Table 30: Extent of various wetlands recorded on site

Description	Area (ha)	% watercourse on site	% of study area
Riparian habitat/watercourse	100.82	43.73%	4.66%
Pan	1.05	0.46%	0.05%
Helbrandleegte	127.30	55.22%	5.88%
Helbrandkloofspruit	1.36	0.59%	0.06%
TOTAL	230.53	100%	10.65%

Figure 16 below provides an illustration of the delineated wetland and riparian areas within the main body of the study area

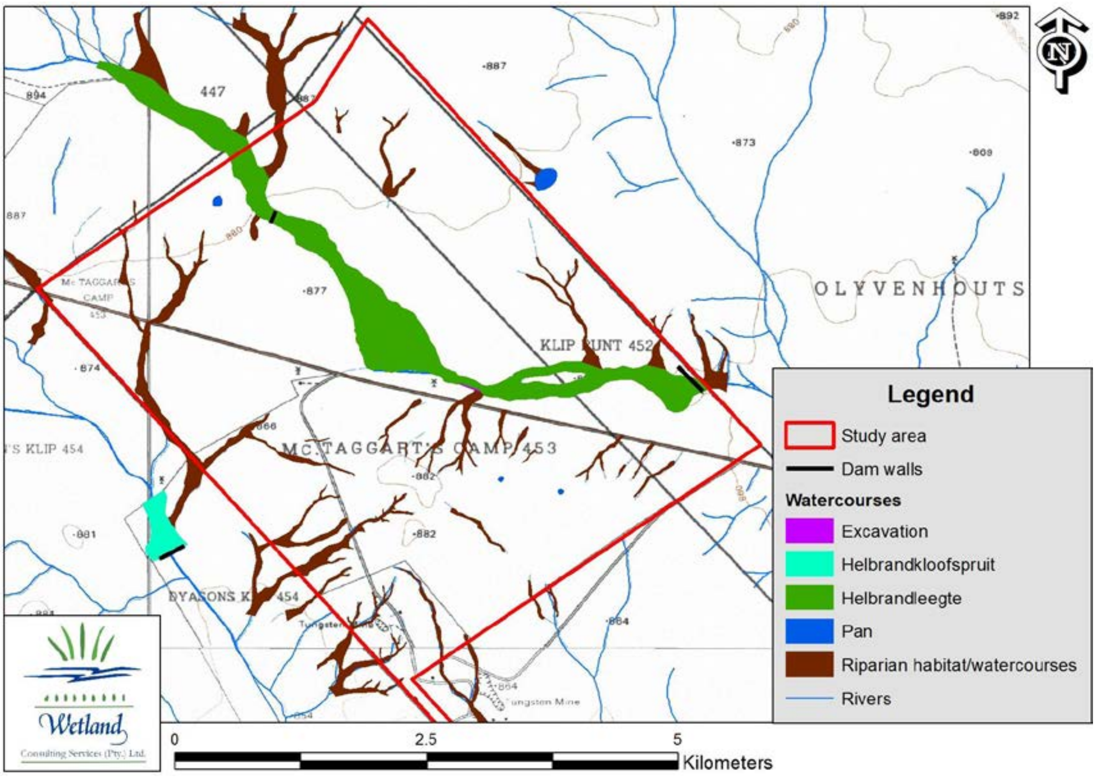


Figure 16: Delineated wetlands and riparian habitats within the main body of the study area.

The remaining riparian habitat on site is made of numerous smaller watercourses draining into the Helbrandleegte and Helbrandkloofspruit. A small section of the Helbrandkloofspruit riparian zone also falls within the panhandle section of the study area as shown in Figure 17 below.

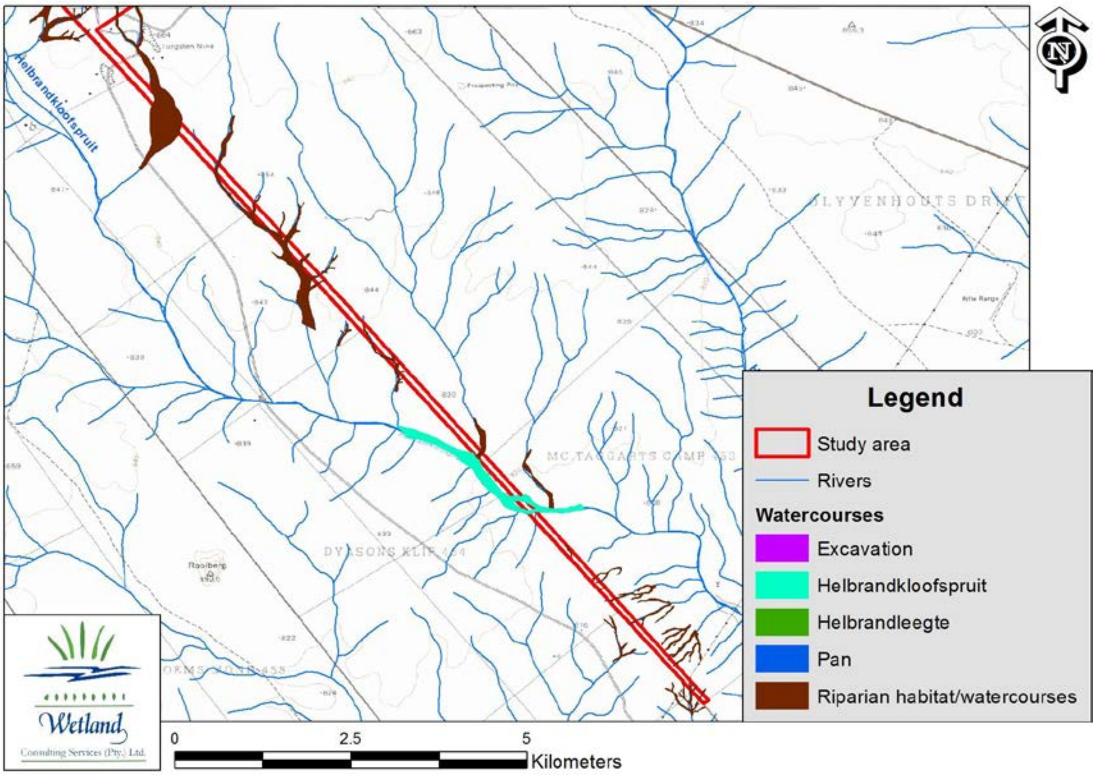


Figure 17: Map of the delineated wetlands and riparian habitats within the panhandle section of the study area.

Two (2) dams were also identified on site in the form of low berms constructed across the riparian habitat. At the time of the site visit no water was present in either of the dams and it would appear as if the dams only hold water for very short periods immediately after rainfall. A longitudinal excavation which contained a small pool of surface water was seen along the edge of the Helbrandleegte.

The study area falls within the Southern Kalahari Freshwater Ecoregion (Freshwater Ecoregions of the World, www.feow.org). The rivers of this ecoregion are often referred to as fossil rivers/paleorivers, as they are considered relicts of a wetter epoch. Although considered fossil rivers, river processes are still active within the rivers and watercourses, though these dryland fluvial processes have distinctive characteristics that differentiate them from more humid fluvial environments.

Precipitation within the arid and semi-arid west of the country, which includes the southern Kalahari in which the study area falls, is highly variable in space and time, and this plays an important role in the development and maintenance of the rivers and riparian habitats of the area. Average annual rainfall for the quarternary catchment D73F is only 158 mm, but interannual variability of rainfall is typically high in arid areas (increases as degree of aridity increases) and short term totals can often far exceed long term averages (Tooth, 2000). Rainfall, especially that which is associated with convective thunderstorms which are common in South Africa, is also often highly localized and the spatial variability of rainfall thus high. Flow within the watercourses on site is therefore likely to be highly variable and unpredictable in terms of both space and time, with all the watercourses considered to be highly ephemeral and flows that occur often take the form of flash floods – sudden, short duration high flows – followed by long periods of no flow.

Within arid and semi-arid environments, the erosional effectiveness of rainfall is generally also very high (Thornes, 1994), as rainfall occurs at high intensities and the ground is generally only sparsely covered by vegetation, interception of rainfall by plants is low. Runoff coefficients however tend to be high as a combination of the following factors, all of which apply within the study area:

- High intensity rainfall derived from thunderstorms
- Low interception losses due to sparse vegetation cover
- Large bare soil and rock areas that enhance surface runoff
- Low soil infiltration capacities

Given the above, rainfall results in rapid surface runoff, even from fairly small rainfall events, and is usually dominated by Hortonian overland flow (Tooth, 2000), with little throughflow, groundwater flow or saturation excess overland flow.

The generation of surface flow across the landscape, together with the limited erosion protection provided by the sparse vegetation cover and the concentration of surface flow by stones and vegetation, results in the formation of rills and gullies, which join to form into small drainage lines and watercourses. Drainage densities in these areas, as is the case within the study area and surroundings, is thus often high, but due to rapid evaporation of surface runoff and infiltration losses (especially within the beds of the watercourses which are generally characterised by more sandy and deeper soils than the surrounding areas), the watercourses are often poorly connected and poorly defined, especially towards the footslope. This is clearly seen on the map of delineated watercourses in Figure 16 above, with a number of the smaller watercourses being unconnected to the larger drainage lines of the area.

A further characteristic of dry land watercourses is that floods are generally subjected to downstream decreases rather than increases. The decrease in flow volumes is principally due to transmission losses resulting from infiltration losses of floodwaters, as well as losses due to overbank flooding and evaporation. Transmission losses along watercourses are in part offset by inputs from downstream tributaries. However, given the often localised nature of rainfall derived from thunderstorms, downstream tributaries might not have received any rainfall or sufficient rainfall to generate surface flows to offset transmission losses.

7.5.2.2 Functionality Assessment

Based on what has been mentioned above, the riparian habitats have specific biotic and abiotic characteristics which are important in terms of the functioning of the watercourses and in terms of other benefits it provides.

Thus the riparian habitat should not be considered, viewed or managed in isolation, but always with full recognition of its roles and functions in the total landscape (see Rogers, 1995). These functions provide certain benefits, not only from an ecological perspective, but also from a number of other perspectives including:

- The binding action of riparian plant roots on the soil would reduce erosion of the stream bed and banks during flooding;
- Similarly, the changes in flow characteristics caused by the vegetation results in increased deposition of both organic and inorganic suspended materials within the macro-channel which in turn results in a decrease in flood energy;
- Certain fauna may utilise the riparian zone during parts of their life cycles and others may be confined solely to the system;
- Despite the presence of some exotic plant species occurring in the riparian zone, it nevertheless forms a centre of species biodiversity within the surrounding landscape;
- More generally, the riparian zone provides an aesthetic quality to the overall landscape of the area; and
- The riparian zone is commonly considered a corridor for the movement of animals and it is also important for the dispersal of plants (Naiman and Decamps, 1997).

For the pan wetlands on site, a WET-EcoServices assessment was undertaken. However, given the small size of the pans and the fact that they are isolated from the drainage network of the area, the flood attenuation function of these systems is considered almost insignificant, though they do store some water.

7.5.2.3 Present Ecological Status (PES) Assessment

Although the study area is currently being used for livestock grazing, the study area and surrounding landscape is still characterised by mostly natural vegetation cover. The movement of water across the landscape, which drives and maintains the wetlands and riparian habitats on site, is therefore still largely intact and in largely natural condition.

A number of direct impacts to the wetlands and riparian habitats were however observed on site that has contributed to habitat degradation:

- Construction of dam walls/low berms across the Helbrandleegte
- Public gravel road crossing a number of watercourses
- Farm tracks crossing the watercourses on site
- Small scale opencast mining of tungsten and the associated dumping of overburden within and adjacent to watercourses
- Alien vegetation, mostly in the form of Prosopis glandulosa, within the riparian habitats on site
- Construction of a gravel access road to the Abengoa Khi Solar One facility along the panhandle section of the study area that involves numerous watercourse crossings

The NFEPA database classified the pan wetlands of the area as being generally of a natural to largely natural condition (PES category A/B) based on the fact that the pan catchments are characterised by more than 75 % natural vegetation cover. The hydrological driver of these pans is still intact. The pan basins at the time of the site visit were heavily trampled by livestock and mostly devoid of vegetation. Trampling would however also have occurred under natural conditions by larger herbivores attracted to the accumulation of surface water and the minerals within the pan sediments. The pan wetlands on site are thus considered to be in a largely natural condition (PES category B).

Figure 18 below provides an illustration of the PES assessment results

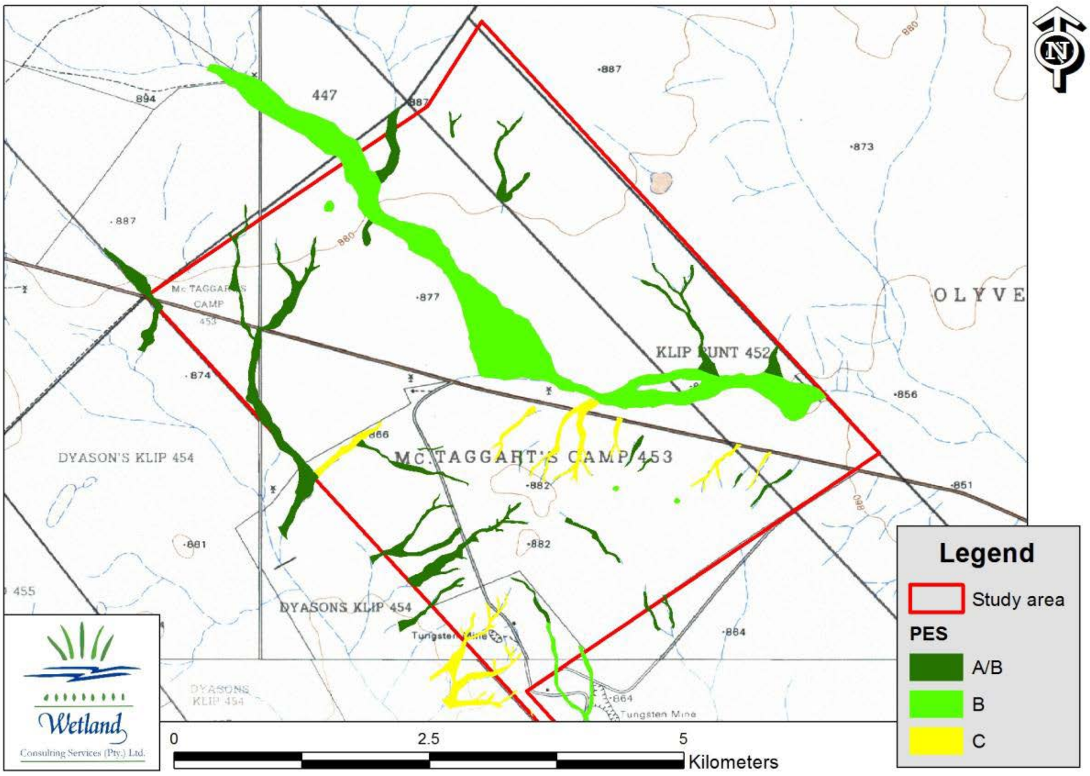


Figure 18: Results of the PES assessment

As in the case of the pans, the hydrological drivers of the majority of watercourses and riparian habitats on site are still intact. The NFEPA Rivers database considered the Helbrandleegte and Helbrandkloofspruit to be in an A/B category, while the 1999 DWA PES data rates them as moderately modified (PES category C) systems. As indicated above, there have been some direct impacts to some of the watercourses on site that have led to their degradation. The smaller watercourses on site are considered to range from natural/largely natural (PES category A/B) to moderately modified (PES category C). The Helbrandleegte is rated as largely natural (PES category B).

Table 31: Scoring system used in PES assessment

Description	Combined Impact Scoring	PES Catagory
Unmodified, natural.	0-0.9	A
Largely natural with few modifications. A slight change in ecosystem processes is discernable and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2-3.9	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	E
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 - 10	F

7.5.2.4 Ecological Importance and Sensitivity (EIS) Assessment

Ecological Importance and Sensitivity is a concept introduced in the reserve methodology to evaluate a wetland in terms of:

- Ecological Importance;
- Hydrological Functions; and
- Direct Human Benefits

These scoring assessments for these three aspects of wetland importance and sensitivity have been based on the requirements of the NWA, the original Ecological Importance and Sensitivity assessments developed for riverine assessments (DWAF, 1999), and the work conducted by Kotze et al (2008) on the assessment of wetland ecological goods and services (the WET-EcoServices tool).

The pan wetlands on site, given their small size and highly ephemeral nature, are considered to be of moderate ecological importance and sensitivity.

From a sensitivity point of view, the higher order watercourses, including the main watercourse (i.e. the Helbrandleegte which traverses the study area from north west to south east) are more sensitive and, therefore, more important to protect than the low order ephemeral streams. This assessment is based on the greater importance of these systems in terms of biodiversity through providing greater habitat diversity, higher species richness, supporting larger trees that can provide nesting habitat to a number of Red Data listed bird species, and providing surface water for longer periods than the smaller watercourses.

Table 32: Rating scale used in EIS assessment

Ecological Importance and Sensitivity categories	Range of Median	Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and <=2	C
Low/marginal Wetlands that is not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	>0 and <=1	D

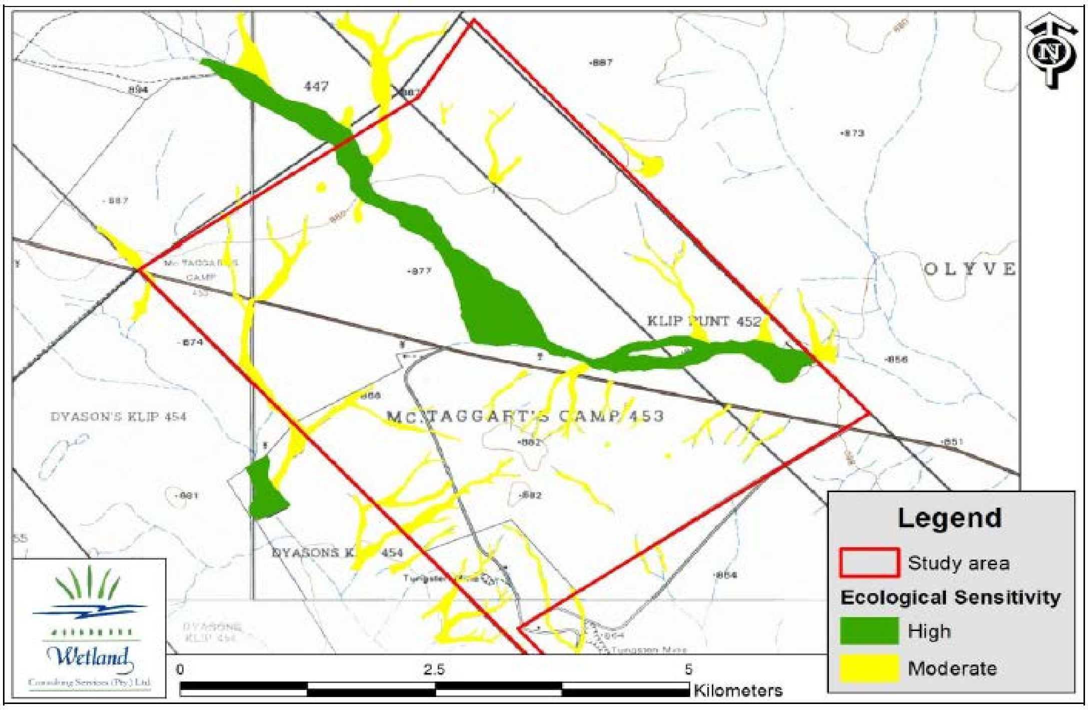


Figure 19: Sensitivity map of the study area, incorporating the results of the EIS assessment

7.5.2.5 Impact Assessment

The proposed developments, mostly the CSP Plant, associated heliostat field, will impact directly on a number of watercourses that fall within the proposed development footprints, most notably a significant section of the Helbrandleegte. In total roughly 154 ha, consisting of 88.5 ha of the Helbrandleegte riparian habitat, 64 ha of riparian habitat associated with the smaller watercourses on site and three (3) small pans (1.02 ha), will be lost due to the developments. Figure 20 below provides a illustration of the proposed development in relation to the delineated wetlands and riparian areas. Watercourses falling within the development footprint have been highlighted in orange.

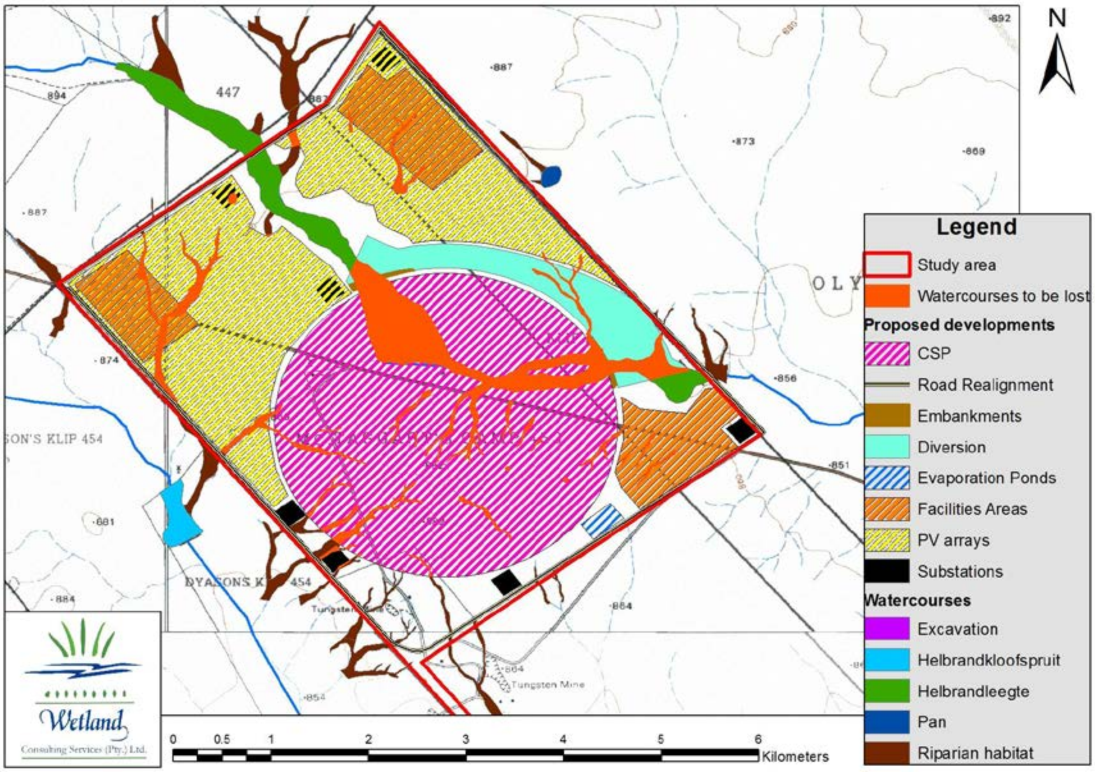


Figure 20 : Map of the proposed development in relation to the delineated wetlands and riparian areas.

The development of a power plant within an arid climate such as which characterizes the Northern Cape Province will also require that substantial quantities of water are imported to the area to support the proposed development. Water will be required during construction activities, for steam generation and cooling in the CSP Plant, for washing of heliostats and PV panels, as well as potable water for the power plant staff.

The impacts expected due to the proposed developments are summarised below. All of the expected impacts have been grouped into the stage of the project in which they are expected to occur, though some of the impacts are likely to occur across several stages.

- Construction Phase:
  - Loss and disturbance of riparian habitat and watercourses;
  - Increased sediment movement into the watercourses on site;

  - Water quality deterioration;
  - Increased flows and erosion within the drainage line;
  - Habitat fragmentation.

- Operational Phase:
  - Water quality deterioration
  - Increased flows within the water course
  - Stormwater discharge

The impact rating scale as supplied by Worley Parsons (Pty.) Ltd. Was utilised for this assessment. Refer to the full EIA documentation for a detailed description of the methodology.

7.5.2.6 Construction Phase Impact : Loss and disturbance of riparian habitat and watercourses

The proposed developments, mostly the CSP Plant, associated heliostat field and PV arrays, will impact directly on a number of watercourses that fall within the proposed development footprints, most notably a significant section of the Helbrandleegte. In total roughly 154 ha, consisting of 88.5 ha of the Helbrandleegte riparian habitat, 64 ha of riparian habitat associated with the smaller watercourses on site and three 3 small pans (1.02 ha), will be lost due to the developments. The proposed heliostat field extends right across the Helbrandleegte riparian habitat and the 1:100 year floodline. As such, a broad stream diversion is proposed around the northern edge of the heliostat field.

In addition it is likely that further riparian habitat will be disturbed by construction activities taking place on site, for example through placement of laydown areas or temporary stockpiling of materials in watercourses, injudicious driving on site etc.

Table 33: Significance Rating: Loss and disturbance of riparian habitat and watercourses

Criteria				Score	Significance		
P	D	S	M	TOTAL	Lo	Med	Hi
5	5	2	8	75			H

7.5.2.7 Construction Phase Impact : Increased sediment movement off site

During the construction phase it is expected that most of the direct development footprints will be cleared of vegetation and extensive earthworks will take place on site. These activities will expose the disturbed, bare soil to erosion by wind and water. As the construction phase is expected to run over approximately 15-18 months, this will include at least two (2) rainfall seasons. High intensity rainfall events which result in surface runoff could result in significant volumes of sediment being transported off the construction site and into downslope water courses.

Given the soil and vegetation characteristics of the study site, this area is naturally prone to a high percentage of surface runoff. However, unless managed, surface runoff and sediment transport is likely to increase.

Table 34: Significance Rating: Increased sediment movement off site

Criteria				Score	Significance		
P	D	S	M	TOTAL	Lo	Med	Hi
4	2	2	6	40		M	

7.5.2.8 Construction Phase Impact : Water quality deterioration

Numerous hazardous substances will be used and stored on site during the construction phase of the project. These substances will include: diesel, oil, cement, etc. Spillages or leaks of these substances could enter downslope water courses via surface run-off during high intensity storm events, leading to water quality deterioration within the receiving water courses and potentially the downstream Orange River.

Table 35: Significance Rating: Water quality deterioration

Criteria				Score	Significance		
P	D	S	M	TOTAL	Lo	Med	Hi
2	2	3	6	22	L		

7.5.2.9 Construction Phase Impact : Increased water inputs to riparian habitats and watercourses

Significant volumes of water will be imported to the study area during the construction of the facilities during the 15-18 month construction period. This water will be used mostly for dust suppression, heliostat cleaning and compaction purposes, as well as other uses. Large volumes of the water are thus likely to infiltrate into the soil of the area. This could lead to increased seepage of water through the soil profile and into adjacent watercourses. Increased water inputs would impact on riparian vegetation through increased growth vigour and potentially preferentially advantaging species with higher water requirements, e.g. the alien Prosopis glandulosa.

Table 36: Significance Rating: Increased water inputs to riparian habitats and watercourses

Criteria				Score	Significance		
P	D	S	M	TOTAL	Lo	Med	Hi
3	2	4	4	30		M	

7.5.2.10 Construction Phase Impact : Habitat fragmentation

The riparian habitat associated with the watercourses, especially with the larger Helbrandleegte, is considered a centre of diversity within the study area and plays an important role as an ecological corridor. The importance of this function will likely be elevated over time given the large number of solar power developments within the surrounding area. The riparian habitats remaining will then form ecological corridors through a largely transformed environment.

The loss of 88 ha of Helbrandleegte riparian habitat will result in fragmentation of habitat and interrupt the ecological corridor provided by the habitat.

Table 37: Significance Rating: Increased water inputs to riparian habitats and watercourses

Criteria				Score	Significance		
P	D	S	M	TOTAL	Lo	Med	Hi
5	2	4	6	30			H

7.5.2.11 Operational Phase Impact : Water Quality Deterioration

A number of activities will pose a potential water quality hazard during the operational phase:

- Diesel storage on site
- Water treatment facilities, specifically the discharge of treated or untreated water

This impact is expected to be Moderate, Long term, Local and Low probability, resulting in an impact significance of Low (24).

Table 38: Significance Rating: Water Quality Deterioration

Criteria				Score	Significance		
P	D	S	M	TOTAL	Lo	Med	Hi
2	2	4	6	24	L		

7.5.2.12 Operational Phase Impact : Increased flows within the watercourse

Significant volumes of water will be used during the operational phase of the project. Importing large volumes of water into an area characterised by a dry climate such as is found on site could have significant consequences if released into the environment. However, it has been indicated that no water will be discharged from site other than clean stormwater captured in the attenuation facilities.

Table 39: Significance Rating: Increased flows within the watercourse

Criteria				Score	Significance		
P	D	S	M	TOTAL	Lo	Med	Hi
3	4	2	4	30		M	

7.5.2.13 Operational Phase Impact : Discharge of Stormwater

Clean stormwater generated on site will be captured in an attenuation facility and discharged into the environment. The location or size of the attenuation facility is not known, nor the location or design of the discharge point. The discharge of stormwater is however likely to occur as a point source discharge and be of higher velocity and concentration that pre-development flows and thus poses a significant erosion risk at the point of discharge.

Table 40: Significance Rating: Discharge of Stormwater

Criteria				Score	Significance		
P	D	S	M	TOTAL	Lo	Med	Hi
3	4	2	6	36		M	

7.5.2.14 Decommissioning Phase Impact : Disturbance of riparian habitat and watercourses

During decommissioning activities it is likely that riparian habitat will be disturbed by decommissioning activities taking place on site, for example through placement of laydown areas or temporary stockpiling of materials in watercourses, injudicious driving on site etc.

Table 41: Significance Rating: Increased water inputs to riparian habitats and watercourses

Criteria				Score	Significance		
P	D	S	M	TOTAL	Lo	Med	Hi
5	5	2	8	75			H

7.5.2.15 Decommissioning Phase Impact : Increased sediment movement off site

During decommissioning activities extensive areas of soil and vegetation on site could be disturbed, resulting in increased surface runoff and erosion on site.

Given the soil and vegetation characteristics of the study site, this area is naturally prone to a high percentage of surface runoff. However, unless managed, surface runoff and sediment transport is likely to increase.

Table 42: Significance Rating: Increased sediment movement off site

Criteria				Score	Significance		
P	D	S	M	TOTAL	Lo	Med	Hi
4	2	2	6	40		M	

7.5.2.16 Decommissioning Phase Impact : Water quality deterioration

Decommissioning activities could lead to disturbance and exposure of contaminated soils underlying hazardous substance storage facilities, e.g. diesel storage tanks, evaporation dams etc. Mobilisation of these sediments during storm events could lead to mobilisation of pollutants and transport into adjacent watercourses and potentially the downstream Orange River.

Table 43: Significance Rating: Water quality deterioration

Criteria				Score	Significance		
P	D	S	M	TOTAL	Lo	Med	Hi
2	2	3	6	22	L		

7.5.3 Recommended Mitigation Measures

Table 44 below lists the mitigation measures for the impacts as described in the previous section.

Table 44: Wetland and Riperian areas Mitigation Measures

Impact	Recommended Mitigation Measures
Construction Phase	
Loss and disturbance of riparian habitat and watercourses	Various layout alternatives were investigated for the proposed development. However, should the proposed development proceed on site, there is little means to mitigate on site against the direct loss of riparian habitat. The following measures are however recommended: • The river diversion should be designed in an environmentally friendly manner to allow for the re-establishment of riparian vegetation within the diversion so that the diversion can act as an ecological corridor. • The diversion should be constructed as a broad, flat, unchannelled valley to approximate current conditions within the riparian habitat; • The diversion should be re-vegetated making use of trees indigenous to the area, e.g. Acacia mellifera and Acacia erioloba • An offset mitigation strategy should be considered • All staff and contractors on site should be informed about the location and sensitivity of the watercourses on site and no access to these areas should be allowed unless authorised and supervised by the Environmental Officer. • All watercourses on site should be demarcated and, if they fall outside the direct development footprint, should be fenced off if possible. • The required construction servitudes and laydown areas should be clearly demarcated in the field and all activities limited to the delineated servitudes. • Access roads to the construction sites should make use of existing roads and tracks on site. Where new roads are required, these should be aligned to fall outside the watercourses.

Impact	Recommended Mitigation Measures
	• No laydown areas, temporary stockpiles, contractor's camps etc. may be located within any of the delineated watercourses. • Fire should be controlled on site. If burning of watercourses is required, this should be undertaken in strict accordance with a fire management strategy compiled by a suitably qualified professional.
Increased sediment movement off site	• Limit the area of disturbance and vegetation clearing to the direct development footprints. • Phase vegetation clearing activities to limit the extent of exposed bare soils at any one time. • Develop and implement a construction stormwater management plan which incorporates sediment traps and erosion protection measures as required. • Install sediment barriers along the downslope edge of disturbed areas during periods where rainfall could be expected. • Rehabilitate and revegetate disturbed areas as soon as possible.
Water quality deterioration	• All potentially polluting and hazardous substances used and stored on site should be stored in clearly demarcated areas. • Storage areas for diesel, oil and other polluting substances must have adequate spillage containment measures to contain any spills within the direct area of the spill. Ideally, all potentially polluting substances should be stored in bunded areas of sufficient capacity to contain the full volume plus 10% of the storage containers. • All re-fuelling areas and workshops should make use of drip trays to capture fuel and oil spills during re-fuelling or during vehicle maintenance and repairs. • Stormwater should be diverted around the storage areas of polluting substances to prevent contamination of clean stormwater. • Sufficient quantities of spill clean-up materials (e.g. Drizit or Spillsorb) should always be available on site. Once used, absorbent material and contaminated soil should be disposed of at a registered hazardous waste disposal site. • The following guidelines apply to the use of polluting substances on site, and specifically to the use of cement and concrete: o Carefully control all on-site operations that involve the use of cement and concrete. o Limit cement and concrete mixing to single sites where possible. o Use plastic trays or liners when mixing cement and concrete:

Impact	Recommended Mitigation Measures
	Do not mix cement and concrete directly on the ground. o Dispose of all visible remains of excess cement and concrete after the completion of tasks. Dispose of in the approved manner (solid waste concrete may be treated as inert construction rubble, but wet cement and liquid slurry, as well as cement powder must be treated as hazardous waste)
Increased water inputs to riparian habitats and watercourses	• Water usage on site should be minimised and re-use of water should be maximised. No discharge of dirty water should be allowed.
Habitat fragmentation	• The river diversion should be designed in an environmentally friendly manner to allow for the re-establishment of riparian vegetation within the diversion so that the diversion can act as an ecological corridor. • The diversion should be broad and largely unchannelled, potentially incorporating one or two depressions in which water could accumulate and be retained for brief periods after flood events; • Ensuring the diversion is sufficiently wide will allow the diversion to more effectively act as a corridor as species moving along the diversion will be less likely to be affected by noise and movement disturbances on site. Recommendations of the biodiversity specialist should be considered in this regard, but a diversion width of at least 50 - 100m is recommended. • The diversion must be vegetated using species currently occurring in the riparian habitat. Revegetation of the diversion is critical from a number of perspectives, including biodiversity support and soil stabilization. • Establishing vegetation along the diversion might be a challenge given the low rainfall of the area, as well as the likely need to excavate the diversion. The removal of the shallow topsoil might leave little suitable growing medium in place. It is therefore recommended that topsoil be stripped and stockpiled for placement in the diversion following completion of construction activities. • The use of berms, rather than deep excavation of the diversion, should be considered. Such berms could also act as noise and sight barriers to wildlife using the diversion as corridor or habitat.
Operational Phase	
Water Quality Deterioration	• The diesel storage tanks on site should be housed in a designated area that will allow for easy containment and clean-up of any spills that could

Impact	Recommended Mitigation Measures
	occur on site, ideally in a bunded area. • Drip trays should be used at all refuelling sites to capture small spills during refuelling. • Emergency spill procedures must be clearly defined and all staff should be familiar with these procedures. Sufficient quantities of absorbent material should be easily available on site for containment of small spills. • No discharge of any treated or untreated water may take place on site unless authorised by the DWA.
Increased flows within the watercourse	• Water usage on site should be minimised and re-use of water should be maximised. No discharge of dirty water should be allowed.
Discharge of stormwater	• To ensure effective functioning of the stormwater system, the attenuation facility should be designed to successfully attenuate all regular return rainfall events, up to at least the 1:25 year event. Silt traps should be incorporated into the stormwater system upstream of the attenuation facility to prevent sedimentation of the attenuation dam. Silt traps should be regularly cleaned. • Discharge from the attenuation facility should take place via an erosion protected discharge point and should incorporate energy dissipaters to ensure low velocity discharge with low erosive energy. • Clean and dirty stormwater should at all times be kept separate. No dirty stormwater may be discharged.
Closure	
Disturbance of riparian habitat and watercourses	• All staff and contractors on site during decommissioning activities should be informed about the location and sensitivity of the watercourses on site and no access to these areas should be allowed unless authorised and supervised by the Environmental Officer. • All watercourses on site should be demarcated and, if possible, should remain fenced off until after decommissioning activities. • Access roads to the site during decommissioning should make use of existing roads and tracks on site. • No laydown areas, temporary stockpiles, contractor's camps etc. may be located within any of the delineated watercourses. • Disturbed areas should be rehabilitated as soon as possible following completion of decommissioning.
Increased sediment movement off site	• All staff and contractors on site during decommissioning activities should be informed about the location and sensitivity of the watercourses on site and no access to these areas should be allowed

Impact	Recommended Mitigation Measures
	unless authorised and supervised by the Environmental Officer. • All watercourses on site should be demarcated and, if possible, should remain fenced off until after decommissioning activities. • Access roads to the site during decommissioning should make use of existing roads and tracks on site.
Water quality deterioration	• All potentially contaminated soils should be analyzed and assessed. If found to pose a contamination risk these soils should, if possible, be remediated on site or otherwise removed off site and disposed off in a suitable facility. • All solid waste should be removed off site.

7.5.4 Conclusion

The wetland and riparian habitats on site are dominated by the riparian habitat associated with the Helbrandleegte stream which drains across the study area from north west to south east. The Helbrandleegte riparian habitat makes up more than 55% of the riparian and wetland habitat on site and covers 5.88% of the study area. The only wetland habitat identified and delineated on site is associated with four (4) small pans covering a combined area of only 1.02 hectare.

The NFEPA database classified the pan wetlands of the area as being generally of a natural to largely natural condition (PES category A/B) based on the fact that the pan catchments are characterised by more than 75% natural vegetation cover. The hydrological driver of these pans is still intact. The pan basins at the time of the site visit were heavily trampled by livestock and mostly devoid of vegetation. Trampling would however also have occurred under natural conditions by larger herbivores attracted to the accumulation of surface water and the minerals within the pan sediments. The pan wetlands on site are thus considered to be in a largely natural condition (PES category B).

As in the case of the pans, the hydrological drivers of the majority of watercourses and riparian habitats on site are still intact. The NFEPA Rivers database considered the Helbrandleegte and Helbrandkloofspruit to be in an A/B category, while the 1999 DWA PES data rates them as moderately modified (PES category C) systems. The smaller watercourses on site are considered to range from natural/largely natural (PES category A/B) to moderately modified (PES category C). The Helbrandleegte is rated as largely natural (PES category B).

From a sensitivity point of view, the higher order watercourses, including the main watercourse (i.e. the Helbrandleegte which traverses the study area from north west to south east) are more sensitive and, therefore, more important to protect than the low order ephemeral streams. This assessment is based on the greater importance of these systems in terms of biodiversity through providing greater habitat diversity, higher species richness, supporting larger trees that can provide nesting habitat to a number of Red Data listed bird species and providing surface water for longer periods than the smaller watercourses.

The proposed developments, mostly the CSP Plant, associated heliostat field and PV arrays, will impact directly on a number of watercourses that fall within the proposed development footprints, most notably a significant section of the Helbrandleegte. In total roughly 154ha, consisting of 88.5ha of the Helbrandleegte riparian habitat, 64ha of riparian habitat associated with the smaller watercourses on site and four (4) small pans (1.02ha), will be lost due to the developments. The proposed heliostat field extends right across the Helbrandleegte riparian habitat and the 1:100 year floodline. As such, a broad stream diversion is proposed around the northern edge of the heliostat field.

From a riparian habitat perspective, the most significant impacts are expected to be the direct loss of approximately 88ha of riparian habitat associated with the Helbrandleegte, as well as the impact on the functioning of this riparian habitat as an ecological corridor due to its fragmentation. In order to successfully mitigate against these impacts it is critical that the required river diversion be designed to ensure its continued functioning in terms of biodiversity support and to act as an ecological corridor.

It is important to point out that any activity which is contemplated and which will impact on the watercourses on site by either impeding or diverting flow in a watercourse, or through altering the beds, banks or characteristics of the watercourse will be subject to authorisation in terms of water uses (c) and (i) as detailed under Section 21 of the National Water Act.

Please refer to Appendix O for full Wetland Assessment.

7.6 SOILS & AGRICULTURE POTENTIAL IMPACT ASSESSMENT

Much of the area comprises red, sandy soils, many of which are shallow to very shallow and only a limited portion of deep soils, as can be seen from the information contained in Table 45. The very low rainfall in the area means that the only means of cultivation would be by irrigation and the Google Earth image of the area shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation, as is clearly evident along the Orange River.

The climatic restrictions mean that this part of the Northern Cape Province is suited at best for grazing and here the grazing capacity is very low, around 40-50 ha/large stock unit (ARC-ISCW, 2004).

7.6.1 Terms of Reference

To provide a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project

- a description and evaluation of environmental issues and potential impacts (including direct, indirect and cumulative impacts) that have been identified
- Direct, indirect and cumulative impacts of the identified issues must be evaluated within the Scoping Report in terms of the following criteria:
    - the nature, which shall include a description of what causes the effect, what will be affected and how it will be affected;
    - the extent, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international
- a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts
- a comparative evaluation of the identified feasible alternatives, and nomination of a preferred alternative for consideration in the EIA phase
- identification of potentially significant impacts to be assessed within the EIA phase and details of the methodology to be adopted in assessing these impacts.

The objectives of the study are;

- To obtain all existing soil information and to produce a soil map of the specified area as well as
- To assess broad agricultural potential.

7.6.2 Impact Assessment and Identification

A summary of the dominant soil characteristics of each land type is given in Table 45 below (the colours correspond to those used in Figure 21.

The distribution of soils with high, medium and low agricultural potential within each land type is also given, with the dominant class shown in bold type.

Table 45: Soil types in study area

Land Type	Dominant soils	Depth (mm)	Percent of land type	Characteristics	Agric. Potential (%)
Ae10	Hutton 33/34 Mispah 22	450 – 1000 100 - 250	42% 40%	Red, sandy soils, occasionally on hardpan calcrete Red-brown, sandy topsoils on hard rock and calcrete	High:0.0 Mod: 47 **Low: 53**
Ae108	Hutton 40/43 Hutton 30/33	300-600 300-750	50% 19%	Red-brown, sandy, calcareous soils on hard rock and calcrete Red-brown, sandy soils on hard rock and calcrete	High:0.0 **Mod: 87.3** Low: 12.8
Ag1	Hutton 30/33/34 Mispah 10/12/20/22	200 – 450 100 - 250	36% 20%	Red, sandy topsoils on hard rock and calcrete Red-brown, sandy topsoils on hard rock and calcrete	High:0.0 Mod: 15.0 **Low: 85.0**

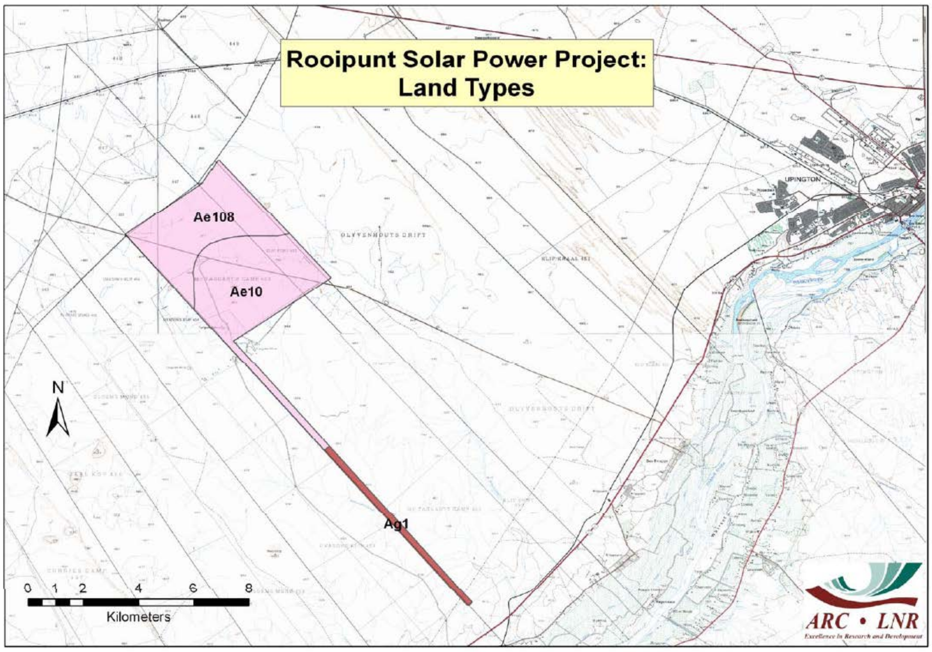


Figure 21: Land Types

The major impact on the natural resources of the study area would be the loss of potentially arable land due to the construction of the various types of infrastructure. However, due to the extremely dry and hot climate of the region, this impact would in all probability be of limited significance and would be local in extent. At the end of the project life, it is anticipated that removal of the structures would enable the land to be returned to more or less a natural state following rehabilitation, with little impact, especially given the low prevailing agricultural potential.

The impact can be summarized as follows:

Table 46: Impact Significance: Soil and Agricultural Potential

Natureof impact	Loss of agricultural land	Land that is no longer able to be utilized due to construction of infrastructure
Status of impact	Neutral (N)	No cost or benefit to receiving environment
Spatial Scaleof impact	Low (1)	Confined to areas within the site where infrastructure will be located
Duration of impact	Long-term (4)	Will cease if operation of activity ceases
Probabilityof impact	Highly probable (4)	Likely to materialise
Magnitudeof impact	Low (4)	Mitigation & rehabilitation will be possible
Significance of impact	Medium (36)	Mainly due to low potential of area, as well as nature of infrastructure

It does not appear, from a soils aspect, that there are any especially sensitive areas ("fatal flaws") within the site that should be avoided. Due mainly to the low potential soils and prevailing climatic limitations for agriculture, it is extremely unlikely that any sort of detailed soil investigation will be necessary.

7.6.3 Recommended Mitigation Measures

The main mitigation would be to ensure that as little pollution or other non-physical disturbance occurs. In addition, there appears to be a stream channel system which, although dry for most of the time, should be avoided for infrastructure placement if at all possible.

7.6.4 Conclusion

Due mainly to the prevailing unfavourable climatic conditions for arable agriculture, as well as the prevalence of soils with limited depth, it is not envisaged that any more detailed soil investigation will be required.

7.7 AIR QUALITY ASSESSMENT

7.7.1 Terms of Reference

It was requested that the impact assessment include the following as part of the scope of work:

- Describe the baseline conditions that exist in the study area and identify any sensitive areas that will need special consideration;
- Predict and assess the potential air quality and health impacts associated with dust and fumes generated during the construction phase of the proposed project;
- Identify and list legislative and permit requirements applicable to the potential impacts of the proposed project;
- Recommend suitable mitigation measures.

7.7.2 Baseline Conditions

7.7.2.1 Existing Air Pollution Sources

The identification of existing sources of emission in the region, and the characterisation of ambient pollutant concentrations is fundamental to the assessment of the potential for cumulative impacts given the potential particulate emissions associated with the project during the construction phase. Furthermore, the impact of dust and other debris (referred to as soiling) on photovoltaic output can potentially also be significant. It is possible that the solar plant may operate satisfactorily without any array cleaning other than normal rainfall and wind; however the dust fallout during winter season (little to no rainfall) could potentially reduce the output. Becker et al. (1996) and Haeberling et al (1998) analysed the reduction of the annual efficiency of fixed PV facilities with a 30° inclination angle located near urban areas, thus close to pollution sources such as train stations or chimneys and biological pollution sources such as forests, farms, etc. The Becker et al. (1996) study reported that regular cleaning of the modules resulted on an energy improvement ranging from 2 to 6%. Haeberling et al (1998) determined that in four years, the generator power had decreased between 8 and 10% during the summer months due to pollution. García et al (2010) reported on their field measurements of dirt energy losses and irradiance incidence angle losses on a solar-tracking PV plant located south of Navarre (Spain). This location corresponds to a rural area surrounded mainly by dry crops and forestry areas. The daily optical energy losses ranged from 1 to 8% in the case of tracking surfaces and from 8 to 22% in the case of fixed horizontal surfaces. During dry periods, the losses increased about 0.1–0.2% per day. They also reported that energy losses due to dirt were notably higher on horizontal surfaces and also more uniform along the year. These losses ranged from 2 to 6% on the tracking surfaces and from 7 to 9% on the horizontal surfaces; showing that the cleaning effect of rainfall on horizontal surfaces is not as effective as it is on inclined ones. Garcia et al (2010) also found that daily rainfalls above 4 to 5 mm noticeably clean the modules. Vivara et al (2010) similarly found that bird droppings, pollution, and dust from traffic or farming activities can reduce output by as much as 26% over the course of a dry summer in an arid region.

An air pollution emissions inventory has not been completed for the region. The establishment of such an inventory was also not within the scope of the current study. The potential air pollutants in the area will therefore only be discussed qualitatively. The proposed site is surrounded by dry grazing areas. Given these activities, it is expected that fugitive dust may be present during dry, windy conditions. These would originate from farming activities, vehicles travelling on dirt roads and wind erosion of exposed areas.

Vehicles travelling on the nearby national, provincial and secondary roads release carbon dioxide, carbon monoxide, oxides of nitrogen, particulate matter, sulphur dioxide and volatile organic emission. These vehicles are also responsible for wheel-entrained dust.

Other potential sources of air pollution include

- Residential use of coal and wood for heating and cooking purposes;
- Biomass burning (veld fires);
- Windblown dust from exposed surfaces, and unpaved roads; and

These sources are mainly associated with the release of airborne particulates, although combustion sources would also emit carbon dioxide, carbon monoxide, oxides of nitrogen, sulphur dioxide and volatile organic compounds.

7.7.2.2 Baseline Air Pollution Concentrations

As far as is known, no ambient air quality monitoring at and in the vicinity of the proposed site has been carried out. Some information on background concentration of particulate matter in the Southern African region was provided by the SAFARI 2000 project, during which several over flights at 5 km altitude were made over the countries of the region. (Eatough et.al., 2003). The average concentration of particulate matter observed from five samples collected over South Africa early in August was 18.7±3 μg/m³ and from two samples collected after 22 August (and thus presumably more impacted by biomass burning) was 42.1±3.1 μg/m³. At that altitude, it can be accepted that good mixing has taken place and that this measurement is equivalent to PM10. Individual source contributions to this figure are difficult to determine; from the composition of the samples a large contribution from biomass burning is evident. The conclusion to be drawn is that background PM10 will make up a material portion of the total PM10 in the area and that the contribution of this background PM10 to cumulative impact is season-dependent.

7.7.2.3 Surrounding Receptors

Apart from a number of homesteads, the area is considered to have very few receptors that could potentially be impacted by the proposed facility.

7.7.2.4 Solar Radiation

Solar radiation measurements have historically not formed part of the meteorological network at Kanoneiland. As an alternative, Clemence (1992) used over 20 000 daily radiation observations from a wide geographic range of stations, and derived a relationship for southern Africa to estimate solar radiation from:

- Extraterrestrial radiation;
- Maximum daily temperature; and
- Temperature range.

Since there will be no combustion activities, material handling, storage of volatile liquids or any other activities, including significant vehicular movements, that could produce air pollution during the operational phase of the PV plant, the only air pollution impacts are anticipated to occur during the construction phase..

7.7.3 Impact Assessment and Identification

The UK"s Atmospheric Dispersion Modelling System (ADMS) was assumed to be applicable to the study area. The ADMS model was developed by the Cambridge Environmental Research Consultants (CERC). ADMS 4 is a New Generation air dispersion model which means that it differs in a number of aspects from the regulatory models traditionally used. The most important differences are (i) the description of atmospheric stability as a continuum rather than as discrete classes (the atmospheric boundary layer properties are described by two parameters; the boundary layer depth and the Monin-Obukhov length, rather than in terms of the single parameter Pasquill Class) and (ii) in allowing more realistic asymmetric vertical plume behaviour under unstable atmospheric conditions. Dispersion under convective meteorological conditions uses a skewed Gaussian concentration distribution (shown by validation studies to be a better representation than a symmetric Gaussian exp (i)

- Scenario 1: Construction activities are occurring for the CSP and phase 1 of the PV installation simultaneously over an area of 900 ha; vehicle movements and worst-month wind erosion assuming 50% vegetation cover are assumed.
- (Scenario 2: Construction is completed; worst-month wind erosion (50% vegetation cover assumed) occurs over the completed project area of 1050 ha). Two scenarios were modelled or a 20 x 20 km modelling domain on a 250 m grid:

7.7.4 Construction air quality impacts

All predicted PM10 concentrations (in µg/m³) and daily dust fall (in mg/m²/day) for the construction phase are within the respective standard/guideline limits.

7.7.4.1 Operational air quality impacts

All predicted PM10 concentrations (in µg/m³) and daily dust fall (in mg/m²/day) for the construction phase are within the respective standard/guideline limits.

7.7.4.2 Other Emissions

Some phases of construction could cause odours that are detectible to some people at a distance from the project site. This would be particularly true during asphalt paving operations. However, asphalt odours would be short-term in nature.

Burning waste may also include plastic containers and bags, which can give off odorous and in some instances poisonous gases.

The practise of burning waste vegetation from land-clearing and other waste products (e.g. cement bags) can result in significant airborne contaminants. As for the airborne dust particles, these emissions can cause soiling, health problems and visibility problems outside the project boundary

7.7.5 Recommended Mitigation Measures

It was identified in the previous section the most significant air pollution, with respect to health risk and soiling potential (i.e. dust fallout), would potentially occur during the construction phase. The main focus of this section is therefore on the management plans and emission reduction methods which are recommended to minimise the impact beyond the plant boundary.

It is essential to have effective dust and emission controls for every potentially dust generating activity to protect the health and safety of the workforce on site as well as reduce statutory nuisance and health risk to local residents and people in the vicinity.

7.7.5.1 Construction Emission Minimisation Plan

An emission minimisation plan is regarded essential in the situation where construction activities are conducted very close to residential and other sensitive receptors. Although the currently proposed project is relatively far removed from any large residential areas a management plan is still recommended since it construction would have the potential to impact at the nearby farmsteads. The plan should have, as a minimum, watering schedules of unpaved roads and other activities which could be mitigated with water sprays.

Dust and gaseous generating activities should be detailed to an extent that a risk matrix can be developed. This process would allow the developer to categorise the level of risk of their particular planned work and prioritise each activity. This categorisation could be in the form of the matrix, where for example, the probability of releasing dust or particles is given a value between 1 and 5 (corresponding to “improbable”, “unlikely”, “likely”, “very likely”, “almost certain”) and similarly, severity is given a value ranging from 1 to 5 corresponding to “negligible”, “slight”, “moderate”, “high” and “very high”. An activity that has a negligible severity of impact and low probability of releasing dust is categorised as low risk. This could include one that is far removed from sensitive receptors and very limited dust generation, e.g. casting concrete on the eastern side of the property. A high risk would be an activity that has the capability of generating significant amounts of dust and it is towards the western side. This may be scraping activity on a windy day.

Mitigation measures that the developer puts in place will help to reduce the impact of a high risk site to medium or low. A general checklist of activities associated with construction is contained in the Appendix.

Mitigation measures need to take into account seasonal variations, and specifically the occurrence of rainy and windy months. As shown in the Air Quality Impact Assessment, most rain at the Kanoneiland weather station occurs during December to April, with the least rain from June to September. Autumn has the most calm wind days with summer and spring displaying the lowest occurrence of calm wind periods. The strongest winds occur during spring.

As part of the management plan, a method statement should be completed. The contents should be built on the issues identified in the risk matrix, and should include the following

- Inventory of all dust generating activities and emission control methods to be used.

- Identification of an authorised on-site person responsible person for air pollution – most likely the appointment responsible for health and safety;
- Details and procedure on using a site log book (to record information including exceptional incidents causing dust episodes and action taken, identification and details of vehicle washing, site inspections); and
- Details of any fuel stored on site.

7.7.5.2 Predicted Impact Reduction of Construction Emissions

The predicted impacts from wheel entrainment constitute approximately a small fraction of the TSP and PM10 emissions. However, these emissions are likely to concentrate in small areas. It is therefore recommended to apply dust suppression on the access roads. Typical dust mitigation measures include regular watering of service roads, speed reduction, minimising material handling operations and early rehabilitation of disturbed surfaces. Untreated plain water is commonly used for roadway dust control. The study by Rosbury and Zimmer (1983a, 1983b) showed that watering once per hour resulted in a control efficiency of about 40%. Doubling the application rate increased the control effectiveness by about 15% to 55%. Thomson and Visser (2002), based on the context of South African coal mines, determined the degree of dust control achieved by watering as a function of the amount of water applied, the time between applications, traffic volumes, weather conditions, wearing-course material and the extent of water penetration into the wearing course. They determined that on average degree of dustiness, a 50% reapplication is required at three-hour intervals in the winter and every hour and a half in the summer.

Better success can normally be achieved with chemical dust suppressants (primarily salts and linings), in excess of 80% (Rosbury and Zimmer 1983a, 1983b).

However, even with chemical treatment of the road surfaces, re-entrainment of material spillage can become a problem if chemicals are applied with infrequent watering. Therefore, in situations where spillage cannot be controlled, watering alone is better for dust control.

7.7.5.3 Operational Emission Minimisation Plan

The potential exists for dust to be generated due to wind erosion of exposed areas at the site after construction. Although it was predicted not to be as significant as during the construction phase, these emissions can be mitigated quite effectively by covering the area with a ground cover (e.g. indigenous grass). It is recommended to cover the site as much as practically possible, but not less than 15%.

7.7.6 Conclusion

The impact assessment considered potential air pollution emissions during both the construction and operational phases of the proposed photovoltaic power plant. The main conclusion is that the most significant quantity of air emissions could potentially be generated during the construction period, and more specifically fugitive dust.

7.7.6.1 Construction Phase

The emissions expected during the construction phase include:

- Airborne particulate emissions
  - Land clearing, excavations and grading
  - Entrained dust from construction vehicles, including haul trucks, excavators, bulldozers, compactors, etc.
  - Vehicles travelling along unpaved roads
  - Wind erosion of exposed areas and stockpiles
  - Crushing plant and cement batching, if these were to be used
  - Tailpipe exhausts from vehicles and smaller equipment such as generators and compressors
- Gaseous emissions
  - Combustion products from - On-road and off-road vehicles and Power generators and compressors
  - Volatile organic emissions from asphalt preparation and paving operations, if these were to be used
  - Potential burning of waste

The impact would include both fallout dust and respirable particulates. Larger dust particles can cause a nuisance both within the construction site and outside its boundary, for example through deposition on cars, windows, properties, washing, swimming pools, etc. Respirable dust particulates can be carried further distances, causing health problems not just to construction workers but also to people living and working in the local neighbourhood.

7.7.6.2 Operational Phase

The emissions expected during normal operation of the PV Project(s) will be minimal, and may include:

- Airborne particulates
  - Vehicle activities (tailpipe emissions and wheel entrainment)
  - Windblown dust from cleared un-vegetated areas
- Gaseous emissions
  - Vehicles emissions (tailpipes and evaporative emissions)
  - Emissions potentially from paint and solvent usage

Of these, the only significant pollution would be due to wind erosion of exposed areas. Other air emissions were considered to be insignificant and were not investigated any further. The highest air concentration PM10 daily average levels predicted were less than the SANA AQS daily average limit value is 75 µg/m³.

7.7.7 Recommendations

Given that construction activities are expected to produce the most significant impact, it inessential to have effective dust and emission controls for every potentially dust generating activity to protect the health and safety of the workforce on site as well as reduce statutory nuisance and health risk to people in the vicinity.

Based on the predicted impacts, it is recommended that the construction dust emissions be reduced by 75% to ensure that air concentration (PM10) and fallout rates would be within acceptable limits.

Typical dust mitigation measures include regular watering of service roads, speed reduction, minimising material handling operations and early rehabilitation of disturbed surfaces. Untreated plain water is commonly used for roadway dust control. Chemical treatment of road surfaces could also be considered to reduce fugitive dust.

The degree of dust control achieved by watering is a function of the amount of water applied, the time between applications, traffic volumes, weather conditions, wearing-course material and the extent of water penetration into the wearing course. The amounts and frequency can only be determined once a more detailed construction plan is available. Generally, it has-been found that a 50% emission reduction can be achieved with three-hour watering intervals in the winter and every hour and a half in the summer (between rainy days). Doubling these rates can achieve emission controls of 75%.

Regular inspection and an appropriate maintenance plan must be in place to maintain the effectiveness of the emission control.

The practise of burning domestic and construction waste, including plastic containers and cement bags, must not be allowed since these can give off odorous and in some instances poisonous gases.

Skips must be kept covered. All waste leaving the site has to be covered appropriately. Any waste residues on the outside of the removal truck must be removed before leaving the site.

During operation, windblown dust can be mitigated quite effectively by covering the area with a ground cover (e.g. indigenous grass). It is recommended to cover the site as much as practically possible, but not less than 15%.

7.8 GEOTECHNICAL ASSESSMENT

Moore Spence Jones (Pty) Ltd (MSJ) completed the desktop Geotechnical Assessment. The fieldwork was completed on 24th January 2012 and comprised the excavation of 50 test pits with soil profiling and limited sampling. The intention of the report was to provide preliminary foundation and earthworks recommendations based on the visual and tactile assessment of site conditions, including laboratory test results.

Table 47: Geotechnical Conditions

Geotechnical Condition	Constraint and recommendations
Potential expansiveness/activity	Expansive soils not encountered
Collapsibility	Low to medium collapse at low to medium loads in the upper transported sands.
Erodibility	Significant in transported layers
Compressibility	No possibility of compressibility in all other layers.
Bearing capacity & subgrade	Weathered bedrock and hardpan calcrete to provide 250 kPa or more. Percussion Bored piles only.

Geotechnical Condition	Constraint and recommendations
Seepage	De-watering during construction will probably not be required. Subsoil drainage measures should only be required in deep cuts.
Construction materials	Most materials arising will most likely be suitable for construction purposes.
Excavatability	Soft (SANS 1200) to 0.60 m average in transported, pedogenic and residual material. 98% of IP refused at <1.5m below surface. Expect intermediate to hard excavation below this level.

7.8.1 Conclusions

- The site comprises approximately 2,201.7 ha of open veld and small scattered informal farm houses. The site is divided into two (2) by the existing access road which runs across the site and fenced on either sides
- Numerous excavations were noted on the south western portion of the site. This area is however fenced off.
- Topographically the site has a very gentle slope in a south-easterly direction. Restricted and minor bulk excavations to create construction platforms will not be extensive.
- The majority of bulk and restricted excavations should be provisionally classed as 'soft' excavation according to SABS 1200D to an average depth of 0.60 m (but can be shallower than 0.5 m below surface in localised areas). Thereafter, heavy ripping due to estimated intermediate to hard excavation classification.
- Suitable foundation horizons occur at an average nominal depth of 0.6 m but can be shallower than 0.5 m below surface and generally the transported layers are not suitable for founding, even for lightly-loaded structures.
- The popular European method of rammed piles for foundations is not recommended on this site due to the shallow bedrock profile. Ground beams or percussion bored piles are the preferred methods of founding for the PV panels and a deep mass ring beam or raft for the CSP tower.
- Groundwater seepage should not be a problem during bulk earthworks and restricted foundation excavations.
- The use of materials for construction purposes is generally favourable.

7.8.2 Recommendations

- Suitable allowable bearing capacity in excess of 250 kPa for conventional pad foundations for the structures exists at an average depth of 0.60 m below existing ground levels on calcrete ,weathered calcified granite and weathered granite bedrock

- Hard excavation and possible blasting should be expected below an average depth of 0.60 m below existing ground level. However, conditions < 0.60 m should be expected over the majority of the site.

- It is important to complete a detailed ground investigation comprising boreholes in the vicinity of the CSP, the tower and power block.

- Finally it is important to note that the information given in the report relates specifically to the positions of the inspection pits put down on site and also in conjunction with the proposed FFL and structural loads. It is possible that variations in the subsoil conditions may be encountered elsewhere on site during construction. These variations must be taken into consideration during on site supervision and construction.

Please refer to Appendix F for full Geotechnical Report

7.9 HERITAGE IMPACT ASSESSMENT

PGS Heritage & Grave Relocation Consultants was appointed to undertake a Heritage Impact Assessment (HIA) for the proposed Solar Power Park for SRSA, Portion 0 of the Farm Rooipunt 617 Gordonia RD.

Heritage resources are unique and non-renewable and as such any impact on such resources must be seen as significant. The Heritage Scoping Report has shown that the surrounding areas around the study area have a rich historical and archaeological history. The field work identified a total of 46 heritage sites with the following heritage classification, mitigation and impacted on by the proposed layouts:

- The field work identified numerous areas where low density scatters of Middel and Later Stone Age lithics were found. As no context and in situ preservation were identified these sites were grade as of low heritage significance. No further mitigation is envisaged at these find spots. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

- During the field work five (5) Stone Age Exposures were identified. These surface scatters do not exclude the possibility of subsurface material the site is rated as Generally Protected B.

- One possible herder site was identified during the survey. No other material or deposits were identified but does not exclude the possibility of subsurface material, the site is rated as Generally Protected B.

- The tungsten mine and building ruins present in the south-eastern section of the property dates from the early 1940 to 1970. As the site has been utilised over a period of 30 years from 1940 some of the mining structures are older than 60 years, and protected under Section 34 of the NHRA, the sites are rated as Generally Protected A and will require further mitigation.

- Due to the landscape's topography the solar park infrastructure will be prominent in the landscape and alter the rural appearance. Due to the remoteness of the area the impact on the experience of the cultural landscape is not foreseen to be significant.

7.9.1 Terms of Reference

The aim of the study is to identify possible heritage sites and finds that may occur in the proposed development area. The Heritage Impact Assessment (HIA) aims to inform the EIA in the development of a comprehensive EMP to assist the developer in managing the discovered heritage resources in a responsible manner, in order to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

7.9.2 Impact Assessment and Identification

Site significance classification standards prescribed by the South African Heritage Resources Agency (2006) and approved by the Association for Southern African Professional Archaeologists (ASAPA) for the Southern African Development Community (SADC) region, were used for the purpose of this report.

Table 48: Site significance classification standards as prescribed by SAHRA

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
National Significance (NS)	Grade 1	-	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High Significance	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High Significance	Mitigation (Part of site should be retained)

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
Grade 4A (GP.A)	Grade 4A	High / Medium Significance	Mitigation before destruction
Grade 4B (GP.B)	Grade 4B	Medium Significance	Recording before destruction
Grade 4C(GP.A)	Grade 4C	Low Significance	Destruction

7.9.3 Impact Assessment and Identification

7.9.3.1 Palaeontology

Significant negative impacts on local fossil heritage are therefore unlikely to result from the proposed solar park development and in the author's opinion no further specialist palaeontological studies for this project are necessary.

Should outcrop areas of potentially fossiliferous ancient Orange River alluvial gravels subsequently be identified (e.g. during geotechnical investigations) within the south-eastern sector of the study area, however, these should be assessed by a professional palaeontologist before construction commences. The purposes of the field assessment study would be (a) to identify the rock units actually present, (b) to carry out judicious sampling of any fossil heritage currently exposed, together with pertinent geological and palaeontological data, (c) to determine the likely impact of the proposed development on local fossil heritage based on the new field-based information, and finally (d) to make recommendations for any no-go areas, buffer zones or further palaeontological mitigation deemed necessary for this project (e.g. comprehensive pre-construction sampling of near-surface surface fossil material, palaeontological monitoring of excavations). Note that further mitigation may be most useful during the construction phase of the development while fresh, potentially fossiliferous bedrock is still exposed.

7.9.3.2 Archaeology

The possibility of archaeological finds in the study area has been indicated by previous research in the greater Upington area. This is confirmed by an initial site visit by an archaeologist from PGS to the study area. Concentrations of Stone Age artefact around the dry rivers were found as well as spot finds in the flat sandy areas.

Other sensitive area maybe the rocky outcrops occurring in some areas on the farm.

Figure 22 – Cores and flakes found in area during site visit

Figure 23 – Possible archaeological sensitive area in study area

Although the current owners indicated no knowledge of rock art it is recommended that special attention is given to rocky areas as such sites could be prevalent.

7.9.3.3 Historical

The tungsten mine and building ruins (Figure 24 and Figure 25) present in the south-eastern corner of the property is a possible heritage sensitive site will be research further during the EIA phase of the project.

Figure 24 – Structure that is part of ruins of tungsten mine

Figure 25 – Remains of tungsten mine

To be able to compile a heritage management plan to be incorporated into the EMP the following further work was required for the HIA for inclusion in the EIA.

Archaeological walk through the whole of the study area, with specific attention given to the areas around river beds, outcrops and historical structures will be required.

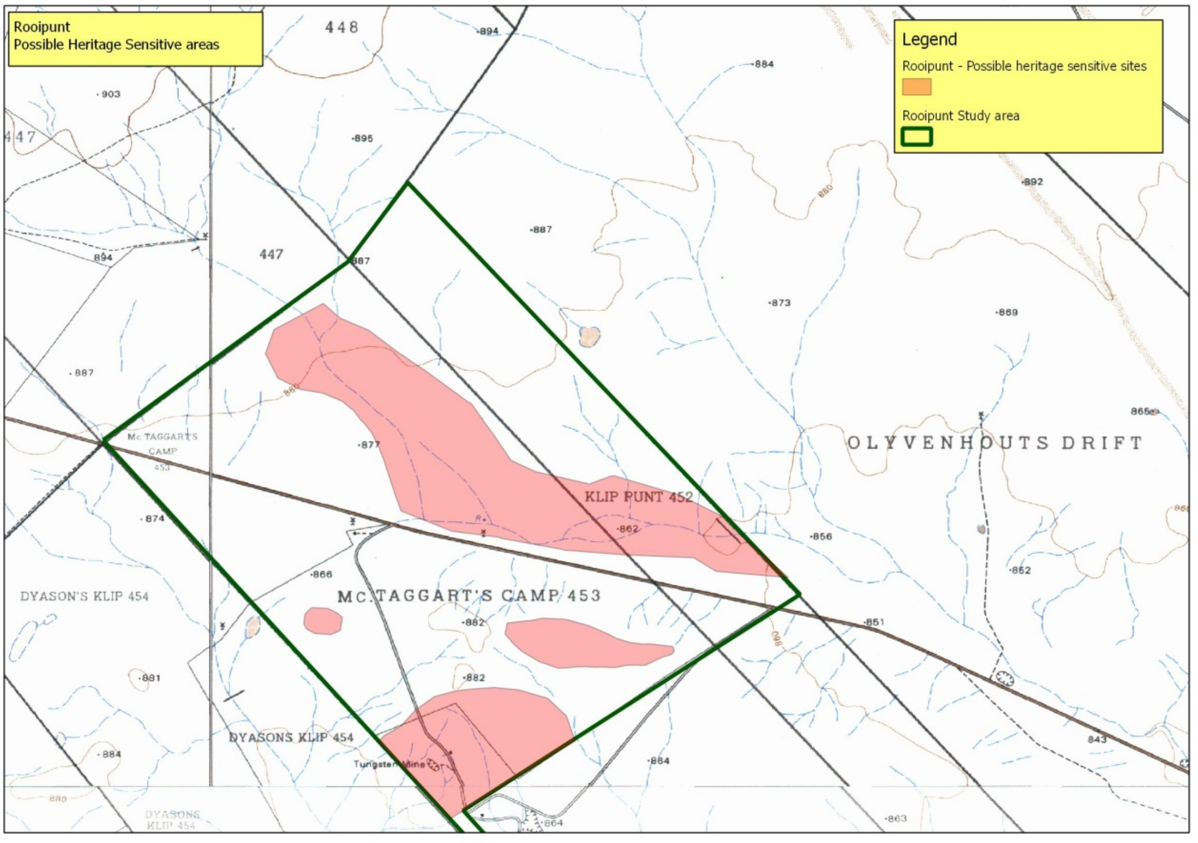


Figure 26 – Heritage Sensitivity Map

7.9.3.4 Findings of field work

A follow up visit to the study area was conducted in April 2012 with the aim of conducting an archaeological survey of the development area and giving particular attention to the areas identified during the Scoping phase as being potentially sensitive. The focus of the field work was on the identified sensitive areas and natural features in the landscape that is usually associated with human settlement.

The footprint area for this project covers approximately 2,000 hectares in total. Due to the nature of cultural remains, with the majority of artefacts occurring below surface, a controlled-exclusive surface survey was conducted over a period of five (5) days on foot and vehicle by an archaeologist of PGS.

The find during the field work can be divided into the following categories of heritage resources:

- Stone Age Find Spots
- Stone Age Exposures
- Possible herder sites
- Historical structures associated with mining and prospecting

a) Stone Age Find Spots

The field work identified numerous areas where low density scatters of Middel and Later Stone Age lithics were found (Figure 27). A few single occurrences of ESA lithics were also discovered during the field work. Most of these scatters were found where pebble layers were exposed or quarts outcrops in the area (Figure 28). This mostly occurred along dry river beds and pans that occur in the study area. As no context and in situ preservation were identified these sites were grade as of low heritage significance and rated as Generally Protected C. **Table 49** below provides the location of the Stone Age findings.

Table 49: Stone Age Find Spots

WP no	Coords	Description	Layout Option Impact
32	S28.47930 E21.00749	Single MSA/LSA flake	N, W, S
33	S28.48165 E21.00295	Single LSA flake	N, W, S
34	S28.48096 E21.00247	Single LSA flake	N, W, S
35	S28.47742 E21.00232	Two MSA/LSA Artefacts (Core & Flake)	N, W, S
36	S28.48464 E21.00679	Single MSA/LSA flake	N, W, S
37	S28.48496 E21.01018	Single MSA/LSA flake	N, W, S
38	S28.49166 E21.01486	Two MSA/LSA flakes	N, W, S

WP no	Coords	Description	Layout Option Impact
43	S28.49792 E21.02999	Single MSA/LSA flake	N, W, S
45	S28.48058 E21.02954	Single MSA/LSA flake	N, W, S
49	S28.46981 E21.01993	Single MSA/LSA flake	N, W, S
50	S28.45426 E21.02379	Three MSA/LSA artefacts. 1 broken blade, 1 large flake & 1 waste flake	N, W, S
51	S28.46611 E21.00835	Single MSA/LSA flake/core	N, W, S
52	S28.46446 E21.00598	Three ESA/MSA artefacts. 1 core, 1 large utilised flake & 1 possible quartz flake	N, W, S
53	S28.46338 E21.00125	Two MSA/LSA artefacts. 1 retouched flake (LSA) and 1 waste flake (LSA/MSA)	N, W, S
54	S28.46001 E21.00626	Three MSA/LSA artefacts. Two flakes and 1 broken blade	N, W, S
60	S28.46818 E21.03212	Single MSA/LSA fake/core	N, W, S
61	S28.46291 E21.01770	Single ESA flake	N, W, S

Figure 27 – MSA/LSA core and flake, typical of find spots

Figure 28 – Quartz outcrop in study area

Table 50 below provides the impact significance for the project on the Stone Age Finding Spots

Table 50: Impact Significance: Stone Age Find Spots

POTENTIAL ENVIRONMENTAL IMPACT	Environmental Significance Before Mitigation					
	P	D	S	M	TOTAL	SP
CONSTRUCTION	2	5	1	2	16	L
CONSTRUCTION MITIGATION	2	4	1	2	14	L
OPERATION	1	5	1	2	8	L
OPERATION MITIGATION	1	4	1	2	7	L
CLOSURE	2	5	1	2	16	L
CLOSURE MITIGATION	2	4	1	2	14	L

The overall impact on these finds spots is seen as **LOW** during the life of the project and no mitigation will be required.

b) Stone Age Exposures

During the field work five (5) Stone Age Exposures were identified. The exposures can be described as low density surface scatters with no associated structures or deposits visible and in most cases an ephemeral site. Figure 29, Figure 30 and Figure 31 provides illustrations of Stone Age exposures found on site. Table 51 below provides location of Stone Age exposures. These surface scatters do not exclude the possibility of subsurface material the site is rated as **Generally Protected B**.

Table 52 provides the impact significance for the Stone Age Exposures.

Table 51: Stone Age Exposures

Site no	Coords	Description	Layout Option Impact	Mitigation
47	S28.48032 E21.03280	Very low density surface scatter of MSA artefacts	N, W, S	Monitor
48	S28.49591 E21.01541	Anvil rock. Smooth rock used as an anvil, period unknown. Very close to Site 48 - might have been used during its construction.	N, W, S	

Site no	Coords	Description	Layout Option Impact	Mitigation
55, 57	S28.47804 E21.04925	Several MSA/LSA artefacts scattered around a quartz outcrop. Notably a hammer stone and a convergent flake/point	N, W, S	
58	S28.47602 E21.03511	Low density scatter of ESA artefacts next to a dry stream. Area of 50m2. Several flakes and cores.	S	Monitor
59	S28.47660 E21.03266	Low density scatter of ESA artefacts next to the same dry stream as 58. At least 2 Acheulean handaxes were noted as well as several very large flakes.	S	Monitor

Figure 29 – LSA lithics typical of exposures

Figure 30 – Quartz outcrop where Exposures 55 and 57 where identified

Figure 31 – Exposure 58 close to a dry river bed

Table 52: Impact Significance: Stone Age Exposures

POTENTIAL ENVIRONMENTAL IMPACT	Environmental Significance Before Mitigation					
	P	D	S	M	TOTAL	SP
CONSTRUCTION	2	5	1	2	16	L
CONSTRUCTION MITIGATION	2	4	1	2	14	L
OPERATON	1	5	1	2	8	L
OPERATION MITIGATION	1	4	1	2	7	L
CLOSURE	2	5	1	2	16	L
CLOSURE MITIGATION	2	5	1	2	16	L

The overall impact on these finds spots is seen as **LOW** during the life of the project and minimal mitigation will be required.

Of the three layout options **the option with the southern CSP and northern PV** impacts on all five (5) sites, while the Western and Northern option impacts on three (3) of the five (5) sites.

c) Possible herder sites

The site is situated on the eastern border of the property within the servitude allocated in the larger development area. The site consists of an elliptical stone wall constructed at the base of a quartz outcrop and resembles the small stone kraals constructed by herders. Table 53 provides the location of the herder sites. No other material or deposits were identified but does not exclude the possibility of subsurface material, the site is rated as Generally Protected B. Table 54 provides the impact significance on the herder sites.

Table 53: Location of Herder Sites

Site no	Coords	Description	Layout Option Impact	Mitigation
56	S28.47824 E21.04959	Elliptical stone wall enclosure at the base of a quartz outcrop. Approximately 7mx4m.	N,S,W	Monitor

Table 54: Impact Significance: Herder Sites

POTENTIAL ENVIRONMENTAL IMPACT	Environmental Significance Before Mitigation					
	P	D	S	M	TOTAL	SP
CONSTRUCTION	1	5	1	2	8	L
CONSTRUCTION MITIGATION	1	4	1	2	7	L
OPERATON	1	5	1	2	8	L
OPERATION MITIGATION	1	4	1	2	7	L
CLOSURE	1	5	1	2	8	L
CLOSURE MITIGATION	1	5	1	2	8	L

The overall impact on these finds spots is seen as LOW during the life of the project and minimal mitigation will be required.

The site is situated on the edge of proposed infrastructure for all three alternatives and no impact is foreseen if the site is excluded from the footprint area.

d) Historical structures associated with mining and prospecting

The tungsten mine and building ruins (Figure 24 and Figure 25) present in the south-eastern section of the property dates from the early 1940 to 1970. Tungsten prospecting on the Gordonia Region can be traced back to the mid 1930's when companies like the South African Tungsten (Proprietary) Limited lead by Messrs Berwick and Morcing. The most prominent tungsten deposits in the Northern Cape is situated on the farm

- Van Rooi's Vley –Boksputs tungsten-tin deposit; and
- Renosterkop tin-tungsten- zinc deposit, just to the west of the current study area

These deposits were discovered in1938 and the first tungsten produced in 1941. However most of these deposits are mined out.

The tungsten mine in the study area is described in the Northern Cape Provincial Growth and Development Strategy (2004),

"The Mc Taggart's Camp and Dyason's Klip Tungsten-tin deposits are located some 20 km southwest of Upington, in close proximity to Van Rooi's Vley. Mineralisation occurs in thin steeply dipping (50--60°) vein that have similar geologic al characteristics to those of the Van Rooi's Vley deposit, but the resources are much smaller. Drilling by Anglovaal showed that the ore zone had closed off before a depth of 80 m was reached on one of the deposits. Mining took place intermittently from the early 1940s to approximately 1970. These deposits could possibly be worked on a small scale with an increase in the price of Tungsten" (Northern Cape, 2004)

As the site has been utilised over a period of 30 years from 1940 some of the mining structures are older than 60 years, and protected under Section 34 of the NHRA, the sites are rated as Generally Protected A and will require further mitigation.

Table 55: Location of Histroical Sites

Site no	Coords	Description	Layout Option Impact	Mitigation
39	S28.49326 E21.02046	Remains of an unidentified, roundish structure. Outside chance that it is a grave. Some associated cultural material (rusted cans). Associated with mine infrastructure. Single upright cement slab were observed in the centre of the structure.	N,S,W	Document as part of larger distribution of mining activity. Test excavation to determine if the structure is a grave.
40	S28.49445 E21.02806	Mine quarry	N,S.W	Document as part of larger distribution of mining activity.
41	S28.49380 E21.02833		N,S,W	Document as part of larger distribution of mining activity.
42	S28.49522 E21.03005	Mine quarry	N,S,W	Document as part of larger distribution of mining activity.
44	S28.49289 E21.02099	Remains of a rectangular structure (7mx4m) and an associated round structure (4m diameter). Probably living quarters & kraal.	N,S,W	
46	S28.48547 E21.04029	Mine quarry	N,S,W	Document as part of larger distribution of mining activity.

Site no	Coords	Description	Layout Option Impact	Mitigation
48	S28.49521 E21.01537	Shed constructed of corrugated iron. Might have been a storage shed for explosives. Associated with mining infrastructure.	N,S,W	Document as part of larger distribution of mining activity.
62	S28.47536 E21.02525	Rectangular dam, age unknown but probably not older than 60 years	N,S,W	Document as part of larger distribution of mining activity.
63	S28.47678 E21.02494	Rectangular structure and associated round dam. Possibly a pump house. Age unknown but probably not older than 60 years	N,S,W	Document as part of larger distribution of mining activity.
64	S28.49324 E21.02073	Very faint remains of a small rectangular structure. Associated with mining infrastructure. Single upright stone were noted in the centre of the structure. Purpose unknown.	N,S,W	Document as part of larger distribution of mining activity.
65	S28.49423 E21.02195	Remains of stone building. Probably workers accommodation associated with mining infrastructure	N,S,W	Document as part of larger distribution of mining activity.
66	S28.49456 E21.02250	Remains of stone building. Probably workers accommodation associated with mining infrastructure	N,W	Document as part of larger distribution of mining activity.
67	S28.49474 E21.02297	Remains of stone building. Probably workers accommodation associated with mining infrastructure	N,S,W	Document as part of larger distribution of mining activity.
68	S28.49588 E21.02224	Remains of stone building. Probably workers accommodation associated with mining infrastructure	N,W	Document as part of larger distribution of mining activity.

Figure 32 – Stone built structure at point 65

Figure 33 – Rectangular dam

Figure 34 – Corrugated explosives magazine

Figure 35 – Mining quarry at Site 42

Table 56: Impact Significance: Herder Sites

POTENTIAL ENVIRONMENTAL IMPACT	Environmental Significance Before Mitigation					
	P	D	S	M	TOTAL	SP
CONSTRUCTION	4	5	1	6	44	M
CONSTRUCTION MITIGATION	4	5	1	2	32	M
OPERATON	1	5	1	2	8	L
OPERATION MITIGATION	1	4	1	2	7	L
CLOSURE	2	5	1	6	22	L
CLOSURE MITIGATION	2	5	1	2	16	L

The overall impact on these finds spots is seen as **MEDIUM NEGATIVE** during the construction phase and **LOW NEGATIVE** during operational and closure phases of the project and minimal mitigation will be required.

Of the three (3) layout options the **Southern CSP and northern PV Option** impacts on the least amount of historical mining infrastructure. However documentation of the mining landscape will have to include the two sites not impacted by the Southern Option.

e) Cultural Landscape

Heritage significance of the cultural landscape is derived from the interaction between the natural landscape, such as valleys, undulating plains and rivers courses usually framed by mountain ranges or accentuated by ridges and koppies, and access routes, human settlements and farmsteads. Also interacting with these physical entities are intangible and historic landscapes and events that is known to have added to the cultural fabric of a place or area.

The evaluation of the study area and surrounds as demarcated shown the area to be rich in heritage resources spanning the archaeological to historical timeframe.

The cultural landscape of the study area has a wilderness/rural appearance, no large industrial installations occur within the vicinity and the historical mining activity has been defunct for the past 40 years.

Due to the landscape's topography the solar park infrastructure will be prominent in the landscape and alter the rural appearance. Due to the remoteness of the area the impact on the experience of the cultural landscape is not fore seen to be significant and provisionally rate as follows:

Table 57: Impact Significance: Herder Sites

POTENTIAL ENVIRONMENTAL IMPACT	Environmental Significance Before Mitigation					
	P	D	S	M	TOTAL	SP
CONSTRUCTION	3	2	2	6	30	L
CONSTRUCTION MITIGATION	3	2	2	4	24	L
OPERATON	3	4	1	2	21	L
OPERATION MITIGATION	1	4	1	2	14	L
CLOSURE	3	2	1	4	14	L
CLOSURE MITIGATION	2	2	1	4	14	L

7.9.4 Conclusion

Heritage resources are unique and non-renewable and as such any impact on such resources must be seen as significant.

The Heritage Scoping Report has shown that the surrounding areas around the study area have a rich historical and archaeological history.

The field work that feeds into the Heritage Impact Assessment has utilised the findings of the Scoping Report to guide this work. The field work identified a total of **46 heritage sites** with the following heritage classification, mitigation and impacted on by the proposed layouts:

7.9.4.1 Stone Age Find Spots

The field work identified numerous areas where low density scatters of Middel and Later Stone Age lithics were found. As no context and in situ preservation were identified these sites were grade as of low heritage significance and rated as **Generally Protected C**.

All three layout options will impact directly on the 17 find spots identified. The impact significance is rated as Low.

No further mitigation is envisaged at these find spots. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

7.9.4.2 Stone Age Exposures

During the field work five (5) Stone Age Exposures were identified. These surface scatters do not exclude the possibility of subsurface material the site is rated as **Generally Protected B**.

Of the three layout options **the Southern Option impacts on all the sites**. **The Northern and Western Options** impacts on three (3) of the five (5) exposures identified. The impact significance is rated as Low-Medium significance

Mitigation required for these sites will be:

1. Monitoring during construction in at each of the exposures identified by a qualified archaeologist, managed through an agreed upon watching brief.

2. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

7.9.4.3 Possible herder sites

One possible herder site was identified during the survey. No other material or deposits were identified but does not exclude the possibility of subsurface material; the site is rated as Protected 4B.

The site is situated on the edge of proposed infrastructure for all three alternatives and no impact is foreseen if the site is excluded from the footprint area. The overall impact on this site is seen as LOW- MEDIUM during the life of the project and minimal mitigation will be required.

Mitigation required for this site will be:

1. Monitoring during construction, managed through an agreed upon watching brief.

2. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

7.9.4.4 Historical structures associated with mining and prospecting

The tungsten mine and building ruins (***Figure 24* and *Figure 25***) present in the south-eastern section of the property dates from the early 1940 to 1970.

As the site has been utilised over a period of 30 years from 1940 some of the mining structures are older than 60 years, and protected under Section 34 of the NHRA, the sites are rated as Generally Protected 4A and will require further mitigation.

Of the three (3) layout options the Southern Option impacts on the least amount of historical mining infrastructure. However documentation of the mining landscape will have to include the two sites not impacted by the Southern Option.
The overall impact on these sites is seen as Medium Negative during the construction phase and Low Negative during operational and closure phases of the project and minimal mitigation will be required.

Mitigation that will be required for these sites will be:

- Some of the structures associated with mining is older than 60 years and protected under Section 34 of the NHRA, and thus require permitting before such structures are to be demolished.
- It is recommended that the historical and mining structure be documented as part of a cultural landscape layout plan and where build structures are present these are to be documented by plan sketches and photographs before applying for destruction permits from the Provincial Heritage Authority - Ngwao Boswa Kapa Bokone, Heritage Northern Cape (Boswa).
- Investigate Site 39, as the possibility exist that it may be a grave, through test excavation to determine if the structure is a grave.
- Monitoring during construction, managed through an agreed upon watching brief.
- Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

7.9.4.5 Cultural Landscape

Due to the landscape's topography the Solar Power Park infrastructure will be prominent in the landscape and alter the rural appearance. Due to the remoteness of the area the impact on the experience of the cultural landscape is not foreseen to be significant. Mitigation as recommended in the Visual Assessment should be able to mitigate any impacts on the cultural landscape to an acceptable level.

The overall impact on the heritage resources is seen as acceptably low through the implementation of the recommended mitigation measures and general heritage management guidelines as listed in Section 5 of the HIA report (Appendix H).

7.9.4.6 Palaeontology

Almond (2012) (Appendix H) found that the "overall impact significance of the proposed solar park development is likely to be LOW because:

Most of the study area is underlain by unfossiliferous igneous and metamorphic basement rocks (granites, gneisses etc.) or mantled by superficial sediments (wind-blown sands, alluvium etc.) of low palaeontological sensitivity;

Extensive, deep excavations are unlikely to be involved in this sort of Solar Power Park.

Significant negative impacts on local fossil heritage are therefore unlikely to result from the proposed solar park development and in the author's opinion no further specialist palaeontological studies for this project are necessary."

7.9.4.7 Evaluation of Layout Options

Evaluation of the three (3) layout Options, has shown that the Southern and Eastern PV options impacts on the least amount of heritage site with a total count of 35 out of 37 sites:

Table 58: Impact Significance: Herder Sites

Layout Option	Heritage Site Count
Northern Option	35
Southern Option	36
Western Option	35

The cumulative impact by all three (3) options is however seen as equivalent for all three (3) and no one of the options carry a preference with regards to impact on heritage resources. Figure 36 below provides an illustration of the preferred layout with the different types of heritage sites identified

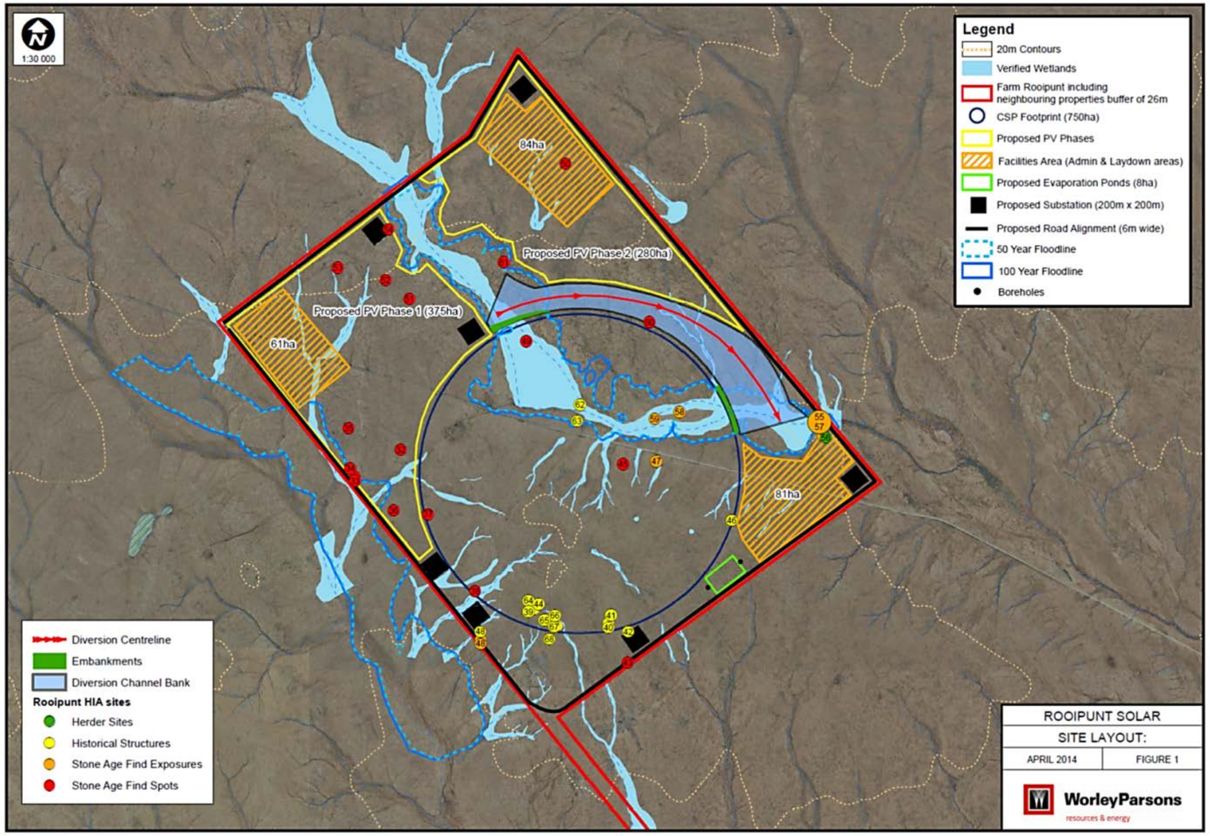


Figure 36 – Map of the Preferred Layout with Heritage sites

7.9.5 Recommended Mitigation Measures

7.9.5.1 General Management Guidelines

- The National Heritage Resources Act (Act 25 of 1999) states that, any person who intends to undertake a development categorised as-
  - the construction of a road, wall, transmission line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
  - the construction of a bridge or similar structure exceeding 50 m in length;
  - any development or other activity which will change the character of a site-
    - exceeding 5, 000 m^2 in extent; or
    - involving three or more existing erven or subdivisions thereof; or
    - involving three or more erven or divisions thereof which have been consolidated within the past five years; or
    - the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
- the re-zoning of a site exceeding 10,000 m^2 in extent; or
- any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

In the event that an area previously not included in an archaeological or cultural resources survey is to be disturbed, the South African Heritage Resources Agency (SAHRA) needs to be contacted. An enquiry must be lodged with them into the necessity for a Heritage Impact Assessment.

- In the event that a further heritage assessment is required it is advisable to utilise a qualified heritage practitioner preferably registered with the Cultural Resources Management Section (CRM) of the Association of Southern African Professional Archaeologists (ASAPA).
- This survey and evaluation must include:

  - The identification and mapping of all heritage resources in the area affected;
  - An assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6 (2) or prescribed under section 7 of the National Cultural Resources Act;
  - An assessment of the impact of the development on such heritage resources;
  - An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
  - The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;
  - If heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
  - Plans for mitigation of any adverse effects during and after the completion of the proposed development.

- It is advisable that an information section on cultural resources be included in the SHEQ training given to contractors involved in surface earthmoving activities. These sections must include basic information on:
  - Heritage;
  - Graves;
  - Archaeological finds; and
  - Historical Structures.
- This module must be tailor made to include all possible finds that could be expected in that area of construction.
- In the event that a possible find is discovered during construction, all activities must be halted in the area of the discovery and a qualified archaeologist contacted.
- The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures.

- If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA.
- After mitigation an application must be lodged with SAHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed.
- If during the initial survey sites of cultural significance is discovered, it will be necessary to develop a management plan for the preservation, documentation or destruction of such a site. Such a program must include an archaeological/palaeontological monitoring programme, timeframe and agreed upon schedule of actions between the company and the archaeologist.
- In the event that human remains are uncovered or previously unknown graves are discovered a qualified archaeologist needs to be contacted and an evaluation of the finds made.
- If the remains are to be exhumed and relocated, the relocation procedures as accepted by SAHRA needs to be followed. This includes an extensive social consultation process.
- The purpose of an archaeological/palaeontological monitoring programme is:
    - To allow, within the resources available, the preservation by record of archaeological/palaeontological deposits, the presence and nature of which could not be established (or established with sufficient accuracy) in advance of development or other potentially disruptive works
    - To provide an opportunity, if needed, for the watching archaeologist to signal to all interested parties, before the destruction of the material in question, that an archaeological/palaeontological find has been made for which the resources allocated to the watching brief itself are not sufficient to support treatment to a satisfactory and proper standard.
    - A monitoring is not intended to reduce the requirement for excavation or preservation of known or inferred deposits, and it is intended to guide, not replace, any requirement for contingent excavation or preservation of possible deposits.
    - The objective of the monitoring is to establish and make available information about the archaeological resource existing on a site.

Table 59: Roles and responsibilities of archaeological and heritage management

ROLE	RESPONSIBILITY	IMPLEMENTATION
A responsible specialist needs to be allocated and should sit in at all relevant meetings, especially when changes in design are discussed, and liaise with SAHRA.	The client	Archaeologist and a competent archaeology supportive team
If chance finds and/or graves or burial grounds are identified during construction or operational phases, a specialist must be contacted in due course for evaluation.	The client	Archaeologist and a competent archaeology supportive team
Comply with defined national and local cultural heritage regulations on management plans for identified sites.	The client	Environmental Consultancy and the Archaeologist
Consult the managers, local communities and other key stakeholders on mitigation of archaeological sites.	The client	Environmental Consultancy and the Archaeologist
Implement additional programs, as appropriate, to promote the safeguarding of our cultural heritage. (i.e. integrate the archaeological components into employee induction course).	The client	Environmental Consultancy and the Archaeologist,
If required, conservation or relocation of burial grounds and/or graves according to the applicable regulations and legislation.	The client	Archaeologist, and/or competent authority for relocation services
Ensure that recommendations made in the Heritage Report are adhered to.	The client	The client
Provision of services and activities related to the management and monitoring of significant archaeological sites.	The client	Environmental Consultancy and the Archaeologist
After the specialist/archaeologist has been appointed, comprehensive feedback reports should be submitted to relevant authorities during each phase of development.	Client and Archaeologist	Archaeologist

7.9.5.2 All phases of the project

a) Archaeology

Based on the findings of the HIA, all stakeholders and key personnel should undergo an archaeological induction course during this phase. Induction courses generally form part of the employees' overall training and the archaeological component can easily be integrated into these training sessions. Two courses should be organised – one aimed more at managers and supervisors, highlighting the value of this exercise and the appropriate communication channels that should be followed after chance finds, and the second targeting the actual workers and getting them to recognize artefacts, features and significant sites. This needs to be supervised by a qualified archaeologist. This course should be reinforced by posters reminding operators of the possibility of finding archaeological/palaeontological sites.

The project will encompass a range of activities during the construction phase, including ground clearance, establishment of construction camps area and small scale infrastructure development associated with the project.

It is possible that cultural material will be exposed during operations and may be recoverable, but this is the high-cost front of the operation, and so any delays should be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance, but construction trenches do offer a window into the past and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project and these must be catered for. Temporary infrastructure is often changed or added to the subsequent history of the project. In general these are low impact developments as they are superficial, resulting in little alteration of the land surface, but still need to be catered for.

During the construction phase, it is important to recognize any significant material being unearthed, making and to make the correct judgment on which actions should be taken. A responsible archaeologist/palaeontologist must be appointed for this commission. This person does not have to be a permanent employee, but needs to sit in at relevant meetings, for example when changes in design are discussed, and notify SAHRA of these changes. The archaeologist would inspect the site and any development recurrently, with more frequent visits to the actual workface and operational areas.

In addition, feedback reports can be submitted by the archaeologist to the client and SAHRA to ensure effective monitoring. This archaeological monitoring and feedback strategy should be incorporated into the Environmental Management Plan (EMP) of the project. Should an archaeological/palaeontological site or cultural material is discovered during construction (or operation), such as burials or grave sites, the project needs to be able to call on a qualified expert to make a decision on what is required and if it is necessary to carry out emergency recovery. SAHRA would need to be informed and may give advice on procedure. The developers therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the material and data are recovered. The project thus needs to have an archaeologist/palaeontologist available to do such work. This provision can be made in an archaeological/palaeontological monitoring programme.

b) Graves

In the case where a grave is identified during construction the following measures must be taken.

Mitigation of graves will require a fence around the cemetery with a buffer of at least 20 meters.

If graves are accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the remains a rescue permit must be applied for with SAHRA and the local South African Police Services must be notified of the find.

Where it is then recommended that the graves be relocated a full grave relocation process that includes comprehensive social consultation must be followed.

The grave relocation process must include:

- A detailed social consultation process, that will trace the next-of-kin and obtain their consent for the relocation of the graves, that will be at least 60 days in length;
- Site notices indicating the intent of the relocation
- Newspaper Notice indicating the intent of the relocation
- A permit from the local authority;
- A permit from the Provincial Department of health;
- A permit from the South African Heritage Resources Agency if the graves are older than 60 years or unidentified and thus presumed older than 60 years;
- An exhumation process that keeps the dignity of the remains intact;
- An exhumation process that will safeguard the legal implications towards the developing company;

- The whole process must be done by a reputable company that are well versed in relocations;
- The process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the developing company.

Figure 37 bellow provides a map illustrating the different mitigation actions required.

The full Heritage Impact Assessment is included in Appendix H

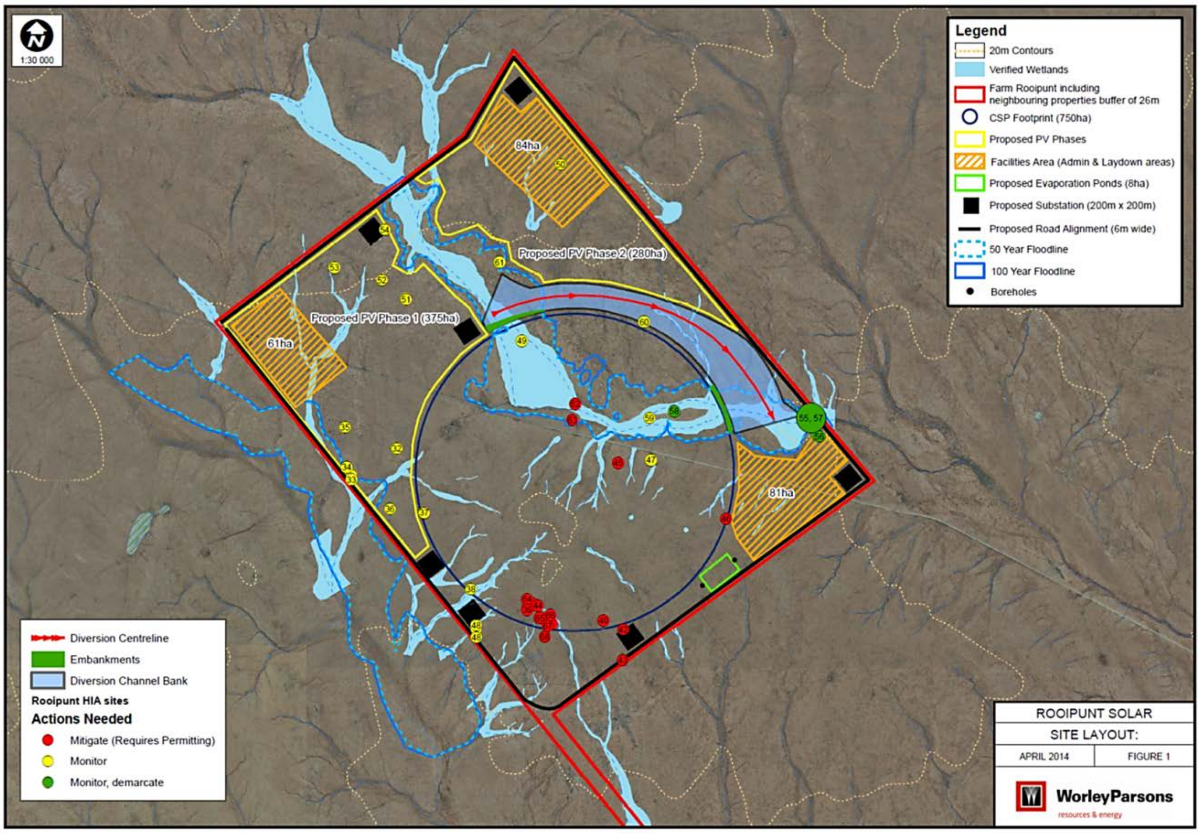


Figure 37 – Map of the Preferred Layout with Mitigation Actions Needed

7.10 NOISE IMPACT ASSESSMENT

The core study area of the noise impact assessment has been taken to be that within the potential noise area of influence of the planned Solar Thermal Energy Power Plant. Essentially the whole area within at least 10 kilometres of the site boundaries has been evaluated. Where necessary however, and particularly in regard to the project-generated traffic impact, a wider area of influence has been considered. Preliminary calculations for the CSP Plant of the Solar Thermal Energy Power Plant indicate that the offset of the 35dBA noise footprint will be at approximately 4800 metres from the powerblock , while that of the 45dBA contour will be at approximately 2150 metres. The PV parks (modules) will also generate some fairly significant noise, mainly from the power inverters. It is estimated that there will be 40 inverters per PV park (a total of 120 inverters for the whole installation. Dependent on the layout, noise sensitive sites within 2 500 metres of a 120 inverter cluster (worst case scenario) could be adversely affected.

7.10.1 Terms of Reference

The terms of reference (TOR) are as follows:

- A sufficiently detailed quantitative (by measurement) and qualitative assessment within the area of influence of the planned Rooipunt Solar Power Park was to be undertaken at the development site in order to enable a full appreciation of the nature, magnitude, extent and implications of the potential noise impact.
- The level of investigation was to that of an Environmental Impact Assessment (EIA).
- The evaluation covered the CSP and PV Projects and proximate appurtenant works.
- All aspects of the investigation were to conform to the requirements of relevant environmental legislation and noise standards.
- The potential impacts of the pre-construction, construction and operational phases of the project were to be assessed.
- Mitigation measures were to be identified. These were to be in concept only and not in detail.

7.10.2 Noise Sensitive Receptors

The main noise sensitive receptors in the area are (refer also to Figure 38):

- Various farmhouses and farm labourer residences.
- The residential sector in the eastern part of Upington.
- Residences in various settlements on the banks of the Orange River such as Oranjevallei, Ses Brugge and Klippunt.

- Educational. There are a number of schools in the western sector of Upington and in the settlements along the Orange River.

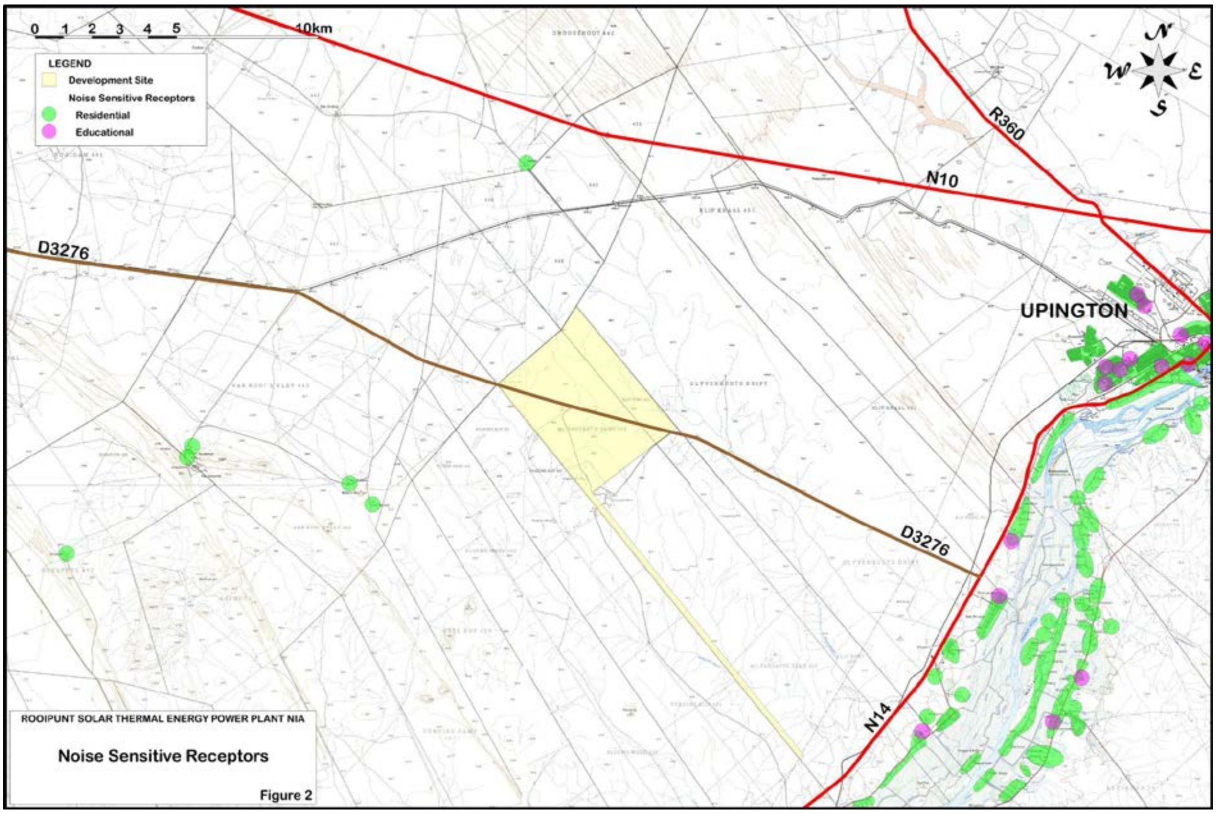


Figure 38 – Noise Sensitive Receptors

7.10.3 Impact Assessment and Identification

7.10.3.1 Noise Sources

The main noise sources presently affecting the study area and the additional sources that will affect the area once the Solar Power Park is commissioned are:

- Road traffic noise, mainly from the traffic on National Road N14 and National Road N10. The noise component from Road D3276 is negligible.

- Railway traffic on the lines through the north and south sectors of the study area.

- Factories in the northern sector of Upington.
- Mining operations to the north of the development site.
- Noise from general farming operations.
- Fans from refrigeration units at various wineries.

7.10.3.2 Noise Sensitive Receptors

The main noise sensitive receptors in the area are (refer also to Figure 38):

- Various farmhouses and farm labourer residences.
- The residential sector in the eastern part of Upington.
- Residences in various settlements on the banks of the Orange River such as Oranjevallei, Ses Brugge and Klippunt.
- Educational. There are a number of schools in the western sector of Upington and in the settlements along the Orange River.

7.10.3.3 The Residual (Existing) Noise Climate

The determination of the residual (existing) noise climate in the study area is based on the measurements and observations made in the area, and where relevant also from the calculation of the noise from the traffic on the main roads. The following were determined:

- The existing typical residual noise climate throughout most of the study area is typical of a rural/agricultural environment as defined in SANS 10103:2008, that is, areas where ambient noise levels generally do not exceed 45dBA during the day and generally do not exceed 35dBA during the night-time.
- Sites close to National Road N14 are adversely affected by traffic noise.
- The following residential areas have a typical suburban noise climate, that is areas where ambient noise levels generally do not exceed 50dBA during the day and generally do not exceed 40dBA during the night-time:
    - Residences in various settlements on the banks of the Orange River such as Oranjevallei, Ses Brugge and Klippunt.

- Residences in the eastern sector of the study area that fall into the urban area of Upington and are noisier than the rest of the study area

- The ambient noise levels alongside main roads exceed the acceptable levels as recommended in SANS 10103 with respect to rural, suburban and urban residential living and other noise sensitive land uses. The noise climates in these areas can be defined as being severely degraded for these land uses. The areas next to the main roads are in some areas degraded for up to the following distances (based on rural residential SANS 10103 standards):
  - National Road N14 - 3500 metres
  - National Road N10 - 700 metres
  - Road D3276 - very low traffic volumes

- The train noise is a minor factor along the Upington-Keimoes railway line due to the low rail traffic volumes. Along the Upington-Keetmanshoop railway line, there is more of an impact with the passing of each train.

7.10.3.4 Noise Impact Criteria and Standards

From these findings and observations on site it was considered appropriate to apply the following noise standards and impact criteria to the study area:

- Rural residential: the noise impact on the farmhouse sites in the area has been determined on the basis of rural residential district standards (SANS 10103), namely the daytime period ambient noise level should not exceed 45dBA and that for the night-time period should not exceed 35dBA. Measured levels indicate that parts of the (rural) study area are already severely degraded close to the main sources of noise.

- Suburban residential: the noise impact on the villages along the Orange River and the eastern suburbs of Upington has been determined on the basis of suburban residential district standards (SANS 10103), namely the daytime period ambient noise level should not exceed 50dBA and that for the night-time period should not exceed 40dBA.

- Educational: noise levels at the schools should not exceed 50dBA (outdoor condition) with the proviso that indoor classroom conditions do not exceed 40dBA.

The above indicates the ideal situation, where noise sensitive receptors are not already degraded by the existing (residual) noise climate. However, it is likely that the residual noise level at some of the noise sensitive receptors already exceeds the recommended maximum (e.g. next to major roads and railway line). In order to assess the actual noise impact at any particular site, therefore, the residual noise climate has to be taken into account. Where the noise level for a particular site is presently lower than the maximum ambient allowed (as indicated in SANS 10103) the recommended maximum shall not be exceeded by the introduction of the intruding noise. Where the noise level for the site is presently at or exceeds the maximum level allowed, the existing level shall not be increased by more than that indicated as acceptable in SANS 10103 (refer to Table A3 in Appendix A).

7.10.3.5 The Predicted Noise Climate

a) Pre-Construction Phase

Activities during the planning and design phase that normally have possible noise impact implications are those related to field surveys (such seismic testing and geological test borehole drilling for large building foundations). As these activities are usually of short duration and take place during the day, they are unlikely to cause any noise disturbance or nuisance in adjacent areas.

b) Construction Phase

This Section summarises the more detailed analysis, which is documented in Appendix J.

Construction will likely be carried out during the daytime only (05h00 to 18h00 or 20h00). It should however be noted that certain activities may occasionally extend into the late evening period, while others such as de-watering operations and continuous concrete pouring may need to take place over a 24-hour period. It is estimated that the development of the project will take place over a period of 15-18 months. A large construction camp will need to be established. Details of the anticipated main sources of construction noise and the noise levels generated are given in Appendix J

The nature of the noise impact from the construction sites is likely to be as follows:

- Source noise levels from many of the construction activities will be high. Noise levels from all work areas will vary constantly and in many instances significantly over short periods during any day working period.

- Exact daytime period and night-time period continuous equivalent sound pressure levels are not possible to calculate with certainty at this stage as the final construction site layout, work programme for the various components, work modus operandi and type of equipment have not been finalised. Working on a worst case scenario basis, it is estimated that the ambient noise level from general construction activities could negatively affect noise sensitive sites within a distance of 1,380 metres of the construction site. Appendix J. Night-time construction could have a significant impact on noise sensitive sites within a radius of 3,000 metres of the construction site.

- Slightly higher ambient noise levels than those normally considered as reasonable are acceptable during the construction period provided that the very noisy construction activities are limited to the daytime and that the contractor takes reasonable measures to limit noise from the work site.

- For all construction work, the construction workers working with or in close proximity to equipment will be exposed to high levels of noise as can be seen from Appendix J.

c) Operational Phase: Solar Power Park Generated Noise Footprint

This Section summarises the more detailed analysis, which is documented in Appendix J. Three (3) options for site lay-out were analysed.

d) PV Plants:

The main noise sources at the PV Projects will be from the inverter/transformer units. It is predicted that the noise from the Projects could be of the following order (under atmospheric temperature inversion conditions) at the given offsets from the plant:

Table 60: NOISE LEVELS FROM PV PLANTS UNDER INVERSION CONDITIONS (40 INVERTER/TRANSFORMER UNITS)

Noise Level (dBA)	Offset (m)
35	1500
40	1000
45	600
50	300

Refer to Noise Impact Assessment in Appendix J.

For daytime operations, noise sensitive sites (in a rural setting) within 2150 metres from the CSP Plant could be significantly impacted. For night-time operations (standby) noise sensitive sites within 2450 metres of the Plant will be impacted. Preliminary investigation shows that there are no noise sensitive receptors affected by noise from the development.

The noise levels given are the unmitigated values. A conservative approach has been taken in that a hard intervening ground condition has been modelled. There will be greater attenuation than shown with distance where there are houses, other buildings and terrain restraints in the intervening ground between the source and the receiver point. The sparse vegetation in the area will not assist the attenuation with distance.

e) Other Service Infrastructure

For a typical water purification or waste water treatment installation, the ambient noise level could be of the order of 40dBA at 300 metres offset.

f) Substation

The noise profile of a typical medium-sized substation (to be built on the development site) is as given in Appendix J. Preliminary investigation shows that there are no noise sensitive receptors in the vicinity of the substation sites in the three layout options; therefore noise levels generated should not have an impact. It should, however be noted that transformers typically emit a predominant pure tone of 100Hz, which, although not loud in volume, has the potential to induce vibrations in nearby structures, such as the offices for the complex.

g) Solar Power Park Generated Traffic

The total volume of traffic generated by the Solar Power Park will be very small in comparison to the total volume of traffic on the adjacent main roads. It is estimated that there could be of the order of 60 vehicle trips (two-way) per day generated by the development. These volumes are far too small to cause any significant noise impact on the main roads in the study area. Although there will be an increase in traffic volume on Road D3276 (from the current ADT of 25 vehicles per day to 85 vehicles per day), the order of this increase will not have significant noise impact.

Table 61: Impact Significance: Herder Sites

POTENTIAL ENVIRONMENTAL IMPACT	Environmental Significance Before Mitigation					
	P	D	S	M	TOTAL	SP
CONSTRUCTION	3	2	2	4	24	L
CONSTRUCTION MITIGATION	3	2	2	4	24	L
OPERATON	3	4	2	4	30	L
OPERATION MITIGATION	3	4	2	4	30	L
CLOSURE	3	2	2	4	24	L
CLOSURE MITIGATION	3	2	2	4	24	L

7.10.4 Conclusions

The following conclusions can be drawn from the preceding analysis:

- The residual noise climate area of the Solar Power Park development is typical of a rural environment.
- The following residential areas have a typical suburban noise climate:
  - Residences in various settlements on the banks of the Orange River such as Oranjevallei, Ses Brugge and Klippunt.
  - Residences in the eastern sector of the study area that fall into the urban area of Upington and are noisier than the rest of the study area
- The areas close to the main roads (N14 and N10) and the railway lines in the study area are degraded with regard to rural residential and in some areas suburban residential living.
- The Solar Power Park will introduce an uncharacteristic, loud noise source into the area.
- For daytime operation of the Solar Power Park, an area within a radius of 2,150 metres of the plant (45dBA contour) could potentially be adversely affected by the noise from the plant. The examination of the area indicates that the nearest noise sensitive receptors lies approximately 6 000 metres to the west and to the north of the boundary of the development site.
- Not one of the three alternative overall layout options is preferred over the others.
- There are mitigation measures that can be introduced to prevent or reduce the noise impacts.

In overview, it may be concluded that the noise impact of the proposed Solar Power Park will be neither extensive nor significant.

7.10.5 Mitigation

a) Pre-construction Phase

Local residents should be notified of any potentially noisy field survey works or other works during the planning and design phase and these activities should be undertaken at reasonable times of the day. These works should not take place at night or on weekends.

During this phase, consideration must be given to the noise mitigation measures required during the construction phase and which should be included in the tender document specifications and the design.

b) Construction Phase

The noise mitigation measures to be considered during the construction phase are as follows:

- Construction site yards, workshops, concrete batching plants, and other noisy fixed facilities should be located well away from noise sensitive areas.
- Use of low-noise generation construction machinery. Noise control measures on construction machinery must, however, be agreed with the manufacturer.
- Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers) should be encapsulated in acoustic covers, screens or sheds. Proper sound insulation can reduce noise by up to 20dBA. Portable acoustic shields should be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators).
- Curtailing the uses of reverse-warning signals on site vehicles in certain areas and at certain times. Consideration of alternative safety measures may be necessary when taking such a measure.
- All construction vehicles, plant and equipment are to be kept in good repair, for example, cover sheets should not vibrate or rattle; wheels, rollers and pulleys should not squeak.
- Truck traffic should be routed away from noise sensitive areas, where possible.
- Noisy operations should be combined so that they occur where possible at the same time.
- Instruction of employees on low-noise work methods, for example, the handling of structural steel and the use radiotelephony rather than shouting for communication.
- Blasting operations (if required) are to be strictly controlled with regard to the size of explosive charge in order to minimise noise and air blast, and timings of explosions. The number of blasts per day should be limited, blasting should be undertaken at the same times each day and no blasting should be allowed at night.
- Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum.

- Construction activities are to be contained to reasonable hours during the day and early evening. Night-time activities near noise sensitive areas should not be allowed. No construction should be allowed on weekends from 14h00 on Saturday afternoons to 06h00 the following Monday morning.

- With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor should liaise with local residents and owners on how best to minimise impact, and the local population should be kept informed of the nature and duration of intended activities.

- As construction workers operate in a very noisy environment, it must be ensured that their working conditions comply with the requirements of the Occupational Health and Safety Act (Act No 85 of 1993). Where necessary ear protection gear should be worn.

c) Operational Phase

The following noise mitigation measures, which will need to be considered where appropriate, are indicators of what needs to be done to reduce or control the noise generated by the operations at the Solar Power Park:

- The design of all major plant for the development is to incorporate all the necessary acoustic design aspects required in order that the overall generated noise level from the new installation does not exceed a maximum equivalent continuous day/night rating level (LRdn), namely a noise level of 70dBA (just inside the property projection plane, namely the property boundary of the Solar Power Park) as specified for industrial districts in SANS 10103. Refer to Appendix A. Notwithstanding this provision, the design is also to take into account the maximum allowable equivalent continuous day and night rating levels of the potentially impacted sites outside the Solar Power Park property. Where the noise level at such an external site is presently lower than the maximum allowed, the maximum shall not be exceeded. Where the noise level at the external site is presently at or exceeds the maximum, the existing level shall not be increased by more than indicated as acceptable in SANS 10103.

- The latest technology incorporating maximum noise mitigation measures for components of the complex should be designed into the system. Ideally, plant and equipment should meet the following specification: the sound power level (LW) should be such that the sound pressure level (SPL – i.e. the noise level) measured at 1 metre from the surface of the given plant/equipment should not exceed 85dBA. When ordering plant and machinery, manufacturers should be requested to provide details of the sound power level. Where possible, those with the lowest sound power level (most quiet) should be selected.

- The design process is to consider, inter alia, the following aspects:
    - The position and orientation of buildings on the site. .
    - The design of the buildings to minimise the transmission of noise from the inside to the outdoors.
    - The insulation of particularly noisy plant and equipment.
- All plant, equipment and vehicles are to be kept in good repair.
- Where possible, very noisy activities should not take place at night (between the hours of 20h00 to 06h00). It must be ensured with the washing of the heliostats and PV panels at night that noise levels from the high-pressure hose system (compressor) on the trucks are minimised.

It should be noted that any mitigation measures taken at the Solar Power Park will limit the impacts in the specific areas designed for, but will not necessarily contribute to improving the degraded noise climates in adjacent areas where there is already a problem.

7.10.6 Recommendations

The following are recommended:

- The National Noise Control Regulations and SANS 10103:2008 should be used as the main guidelines for addressing the potential noise impact on this project.
- Various measures to reduce the potential noise impact from the development are possible, and the mitigation measures indicated need to be considered.
- The power generation unit of the Solar Power Park should be constructed at an offset of at least 3,000 metres from the nearest noise sensitive receptor, depending on the intended periods of operation.
- The noise mitigation measures will need to be designed and/or checked by an acoustical engineer in order to optimise the design parameters and ensure that the cost/benefit of the measure is optimised.
- Once the layout of infrastructure of the components at the proposed Solar Power Park is finalised and the actual noise profile of plant and equipment is known, the position of the noise contours should be checked.

- At commissioning of the Solar Power Park, the noise footprint of each discrete element should be established by measurement in accordance with the relevant standards, namely SANS ISO 8297:1994 and SANS 10103. The character of the noise (qualitative aspect) should also be checked to ascertain whether there is any nuisance factor associated with the operations.
- Not all of the Noise Sensitive Receptors identified in this report are confirmed as such and should be verified by the Social Impact Team.

7.11 VISUAL IMPACT ASSESSMENT

The identified site for the proposed facility is situated approximately 12 km west of Upington on the Portion 0 of the Farm Rooipunt 617 Gordonia RD within the Kai !Garib Municipality. Distance by road is approximately 20 km from Upington on the N14, before turning onto the access road.

This farm is located west of, and abutting the possible future Eskom CSP facility. Eskom applied in 2006 for the construction of a CSP consisting of a central tower and 3000 to 4000 heliostats over an identified area of 230 ha.

Access to the proposed solar facility is afforded by means of a 13 km stretch of secondary (gravel) road that joins the N14 national road near the small town of Oranjevallei. Other small towns and settlements along the Orange River include Ses Brugge, Louisvale, Klippunt and Kanoneiland.

The N14, N10, R360 and R359 are the primary roads in the region and are the main link between Gauteng and Namibia, the Augrabies Falls National Park and the Kgalagadi Trans-frontier National Park. These roads are considered as primary tourist routes, linking Upington with the Kalahari, West Coast and Namibia as popular tourist destinations. A secondary road transects the site from north-west to south-east, carrying mostly local traffic.

The topography of the region is relatively homogenous and is described pre-dominantly as lowlands with hills, dune hills and irregular or slightly irregular plains. Relatively prominent hills occur towards the south-west of the study area. See the map in Figure 2 for the topography map of the study area.

The terrain surrounding the farm is predominantly flat with an even south-eastern slope towards the Orange River valley that forms a distinct hydrological feature in the region.

The Orange River has, to a large degree, dictated the settlement pattern in this arid region by providing a source of perennial water for the cultivation of grapes. This and the associated production of wine is the primary agricultural activity of this district.

Cattle and game farming practises also occur, although are less intensive. Other land-use activities include conservation and nature oriented tourism in the form of the Spitskop Nature Reserve located north-west of Upington (along the R360) and the Augrabies Falls National Park (approximately 120 km west of Upington).

The majority of the study area is sparsely populated (less than 10 people per km^2) and consists of a landscape of wide-open expanses and vast desolation. The scarcity of water and other natural resources has strongly influenced settlement within this region - the population distribution is concentrated along the Orange River.

Vegetation cover in this semi-desert region is restricted to thicket, bushland, shrubland, and grassland. Planted vegetation in the form of vineyards and cotton fields is found along the Orange River floodplain.

The Spitskop Nature Reserve is a provincial nature reserve. It is located in the north east of the Project Site and is the only statutory protected area within the study area. It should be noted that the Spitskop is not a well-developed tourist destination, and has little infrastructure at present.

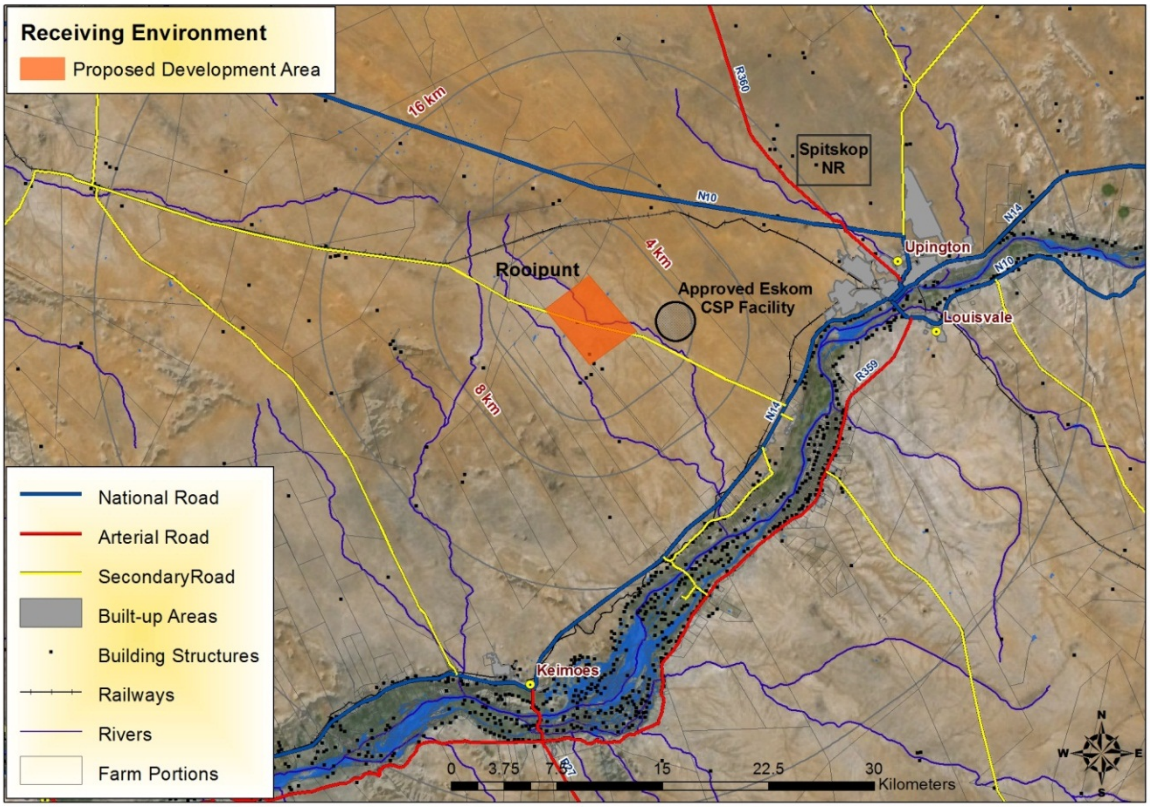


Figure 39: Satellite image of the broader study area (indicating the location of the proposed solar facility, the possible Eskom CSP facility and the topography.

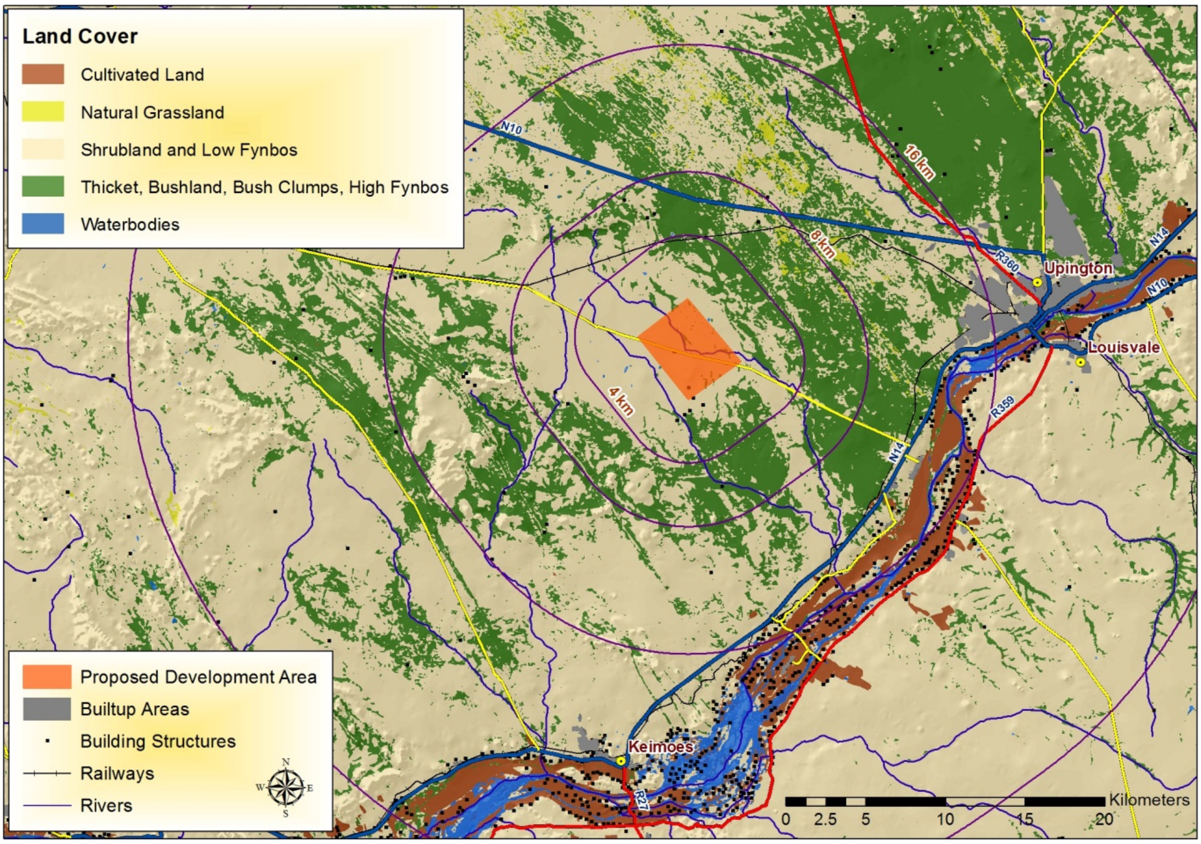


Figure 40: Land types and vegetation cover of the broader study area.

7.11.1 Terms of Reference

The study was undertaken using GIS based spatial analysis tools to generate viewshed and proximity analyses and to apply relevant spatial criteria to compile a spatial orientated visual impact index.

Site visits were undertaken to source information regarding land use, vegetation cover, topography and general visual quality of the affected environment. It further served the purpose of verifying the results of the spatial analyses and to identify other possible mitigating/aggravating circumstances related to the potential visual impact.

The approach utilised to identify issues related to the visual impact included the following activities:

- The sourcing of relevant baseline data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc.;
- The creation of a detailed digital terrain model (DTM) of the potentially affected environment;
- The identification of sensitive environments upon which the proposed facility could have a potential impact;
- Undertaking viewshed analyses from the proposed development area in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses take into account the dimensions of the proposed structures;
- Calculating and generating proximity buffers, and a hyperbolic proximity raster to simulate the effect of reduced visibility over distance;
- Integrating the relevant analyses into spatial impact indexes.

This visual impact assessment sets out to identify and quantify the possible visual impacts related to the proposed solar facility and related infrastructure mentioned above, as well as offer potential mitigation measures, where required.

7.11.2 Potential Visual Exposure

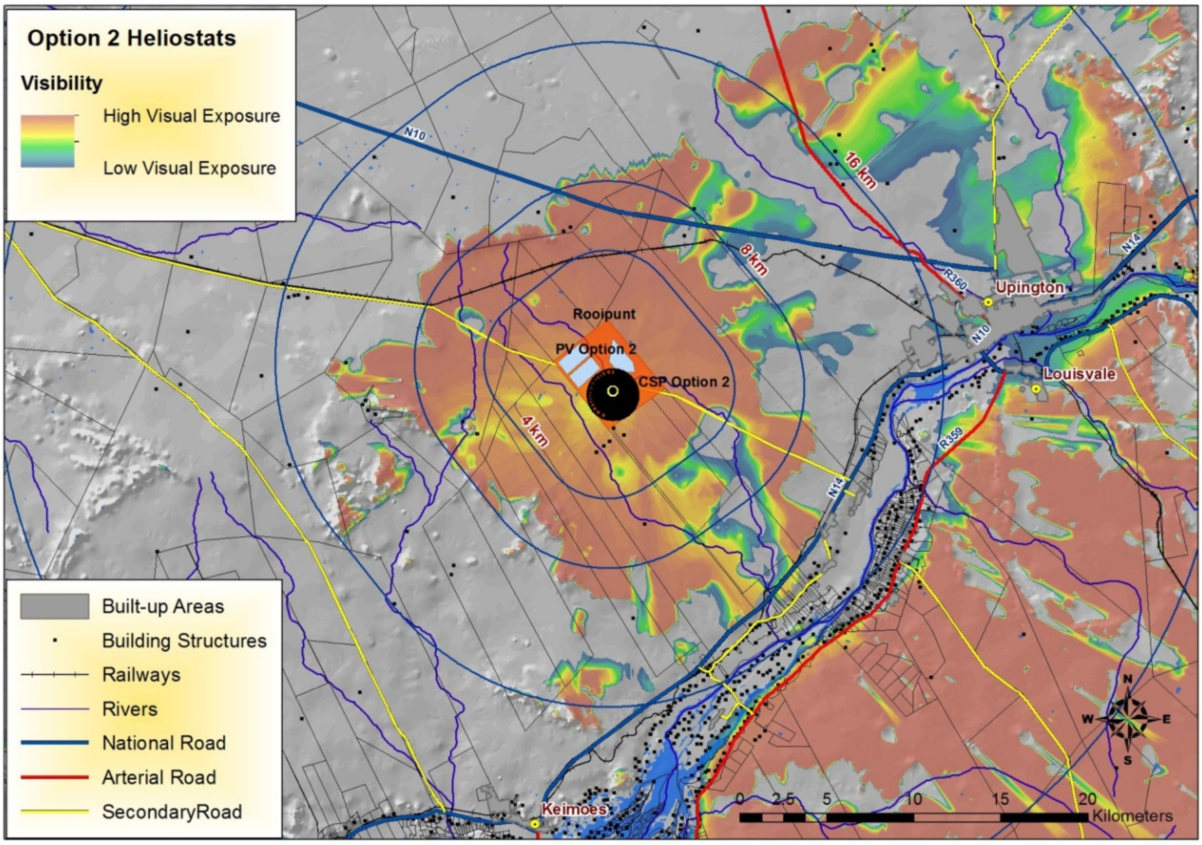
The potential visual exposure analysis was undertaken from actual positions as set out in the layout of the three (3) options for the CSP and PV plant. The heights of the central tower (200 m) and heliostats (14 m) were used to generate viewsheds (areas with a line of sight to the facility), as these represent the largest and potentially the most visibly and prominent infrastructure within the proposed facility. The potential visual exposure of the PV panels is also accommodated within the heliostat field viewshed.

The ancillary infrastructure (i.e. the generator building, the central tower, the substation, the reservoirs, the access roads and the workshops and offices) are all smaller than the central tower, and will thus fall within this structure's viewshed.

The visual exposure of the heliostats and the central tower are indicated on the maps in **Figure 41**. The red shading indicates areas from which the facilities would be fully exposed. The green and blue shading indicate areas from which only parts or sections would be visible.

Due to the height of the central tower and the heliostats, together with the relatively flat topography of the region, the level of visual exposure is virtually the same for each of the three options (compare the maps in **Figure 42**). It is therefore anticipated that, from a visual impact perspective, any position of infrastructure on the farm Rooipunt has the same advantage / disadvantage.

The viewshed analyses further indicate that the central tower would be exposed to a much larger geographical area than the heliostat field, due to its tall dimensions. Visibility of the tower virtually covers the whole study area, whereas the heliostat field will mostly be visible in a core zone of approximately 4 – 8 km from the sit. Although visibility is possible from areas south of the Orange river, visual impact will be low due to the far distance.



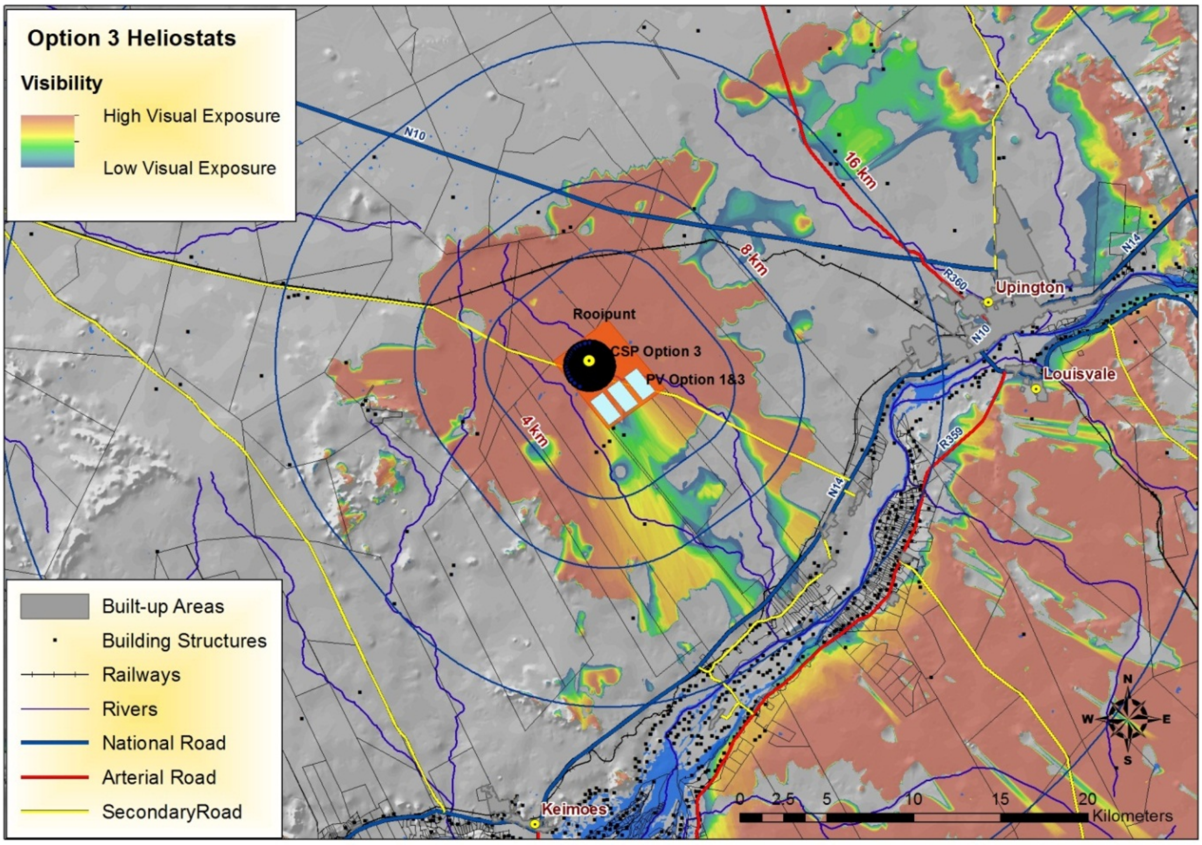


Figure 41: Viewshed Analysis of the Heliostats (Option 2 & 3).

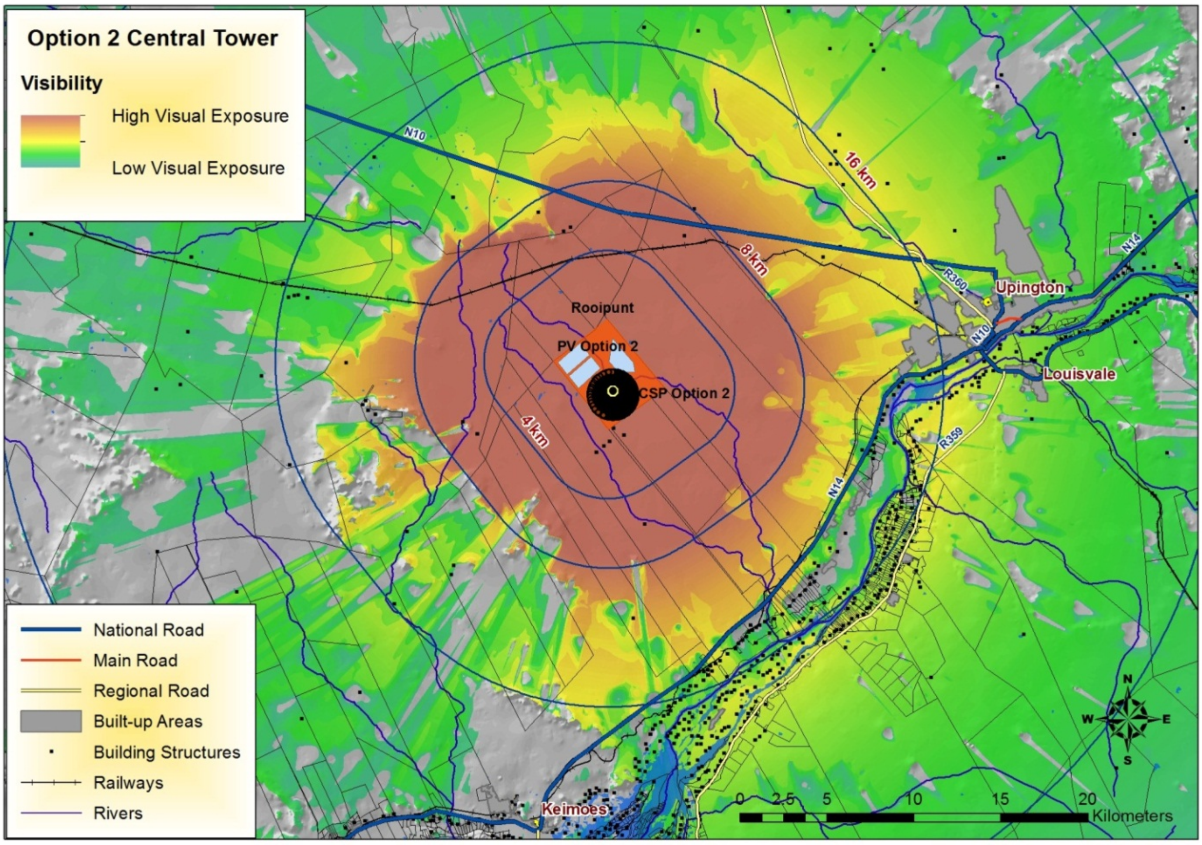


Figure 42: Viewshed Analysis of the Central Tower.

The central tower presents a core area of full exposure for an extent of 8 km around the site (see **Figure 42**). Visibility becomes diminished beyond 8 km as the topography will shield structures smaller than 15 m in height, thereby exposing upper lengths of the tower. This vertical intrusion of the skyline may be visible for distances up to 32 km from the site.

Affected areas include the western parts of Upington and Louisvale, as well as sections of the N10 and N14. Local roads, settlements (Oranjevallei, Ses Brugge, Louisvale, Klippunt, and Kanoneiland) and farmsteads / homesteads within close proximity (< 8 km) of the facility may also be affected.

The proposed solar facility is likely to be visible from parts of the Spitskop Nature Reserve, with the central tower visually exposed to the entire reserve. It should be noted that the Spitskop Nature Reserve is not a well-developed tourist destination, and has little infrastructure at present. It is renowned for a telescope on top of a rocky hill from where the environment can be observed.

It is envisaged that the proposed facility would be easily and comfortably visible, especially within a 16km radius of the site. The central tower in particular would constitute a high visual prominence, potentially resulting in a high visual impact. It should be noted, however that the nature of the impact is subjective.

7.11.3 Visual Distance/Observer Proximity to the facility

In addition to the visibility and exposure analyses as described above, a proximity analysis is required to incorporate the effect of reduced visibility over distance. The degree to which an object fills a person's central field of vision determines the visual impact it might cause.

The central field of vision for most people covers an angle of between 50° to 60°. Within this angle, both eyes observe an object simultaneously. This creates a central field of greater magnitude than that is possible by each eye separately. Within this field images are sharp, depth perception occurs and colour discrimination is possible (Figure 6).

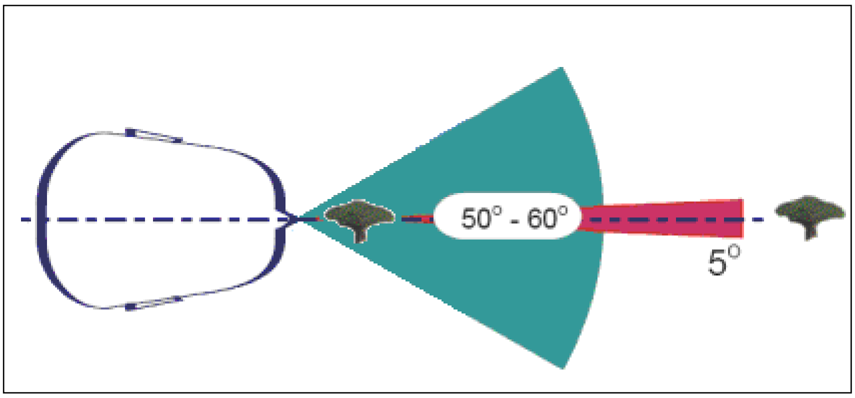


Figure 43: Illustration of a person's central field of vision and the relation between distance from an object and visual impact.

The visual impact of a development will vary according to the proportion in which an observed object impacts on the central field of vision. This in turn is determined by the distance from the object (e.g a tree as illustrated in **Figure 43**). Objects which take up less that 5% of the central field of vision are usually insignificant in most landscapes (Berry and Martin, 2003).

The degree to which visual impact might be reduced over distance is illustrated by the graph in **Figure 44** below. Expressed as a hyperbolic function, more than 50% of the degree of impact is reduced over a relative short distance from the immediate proximity of an object.

The interpretation of proximity as a parameter is conceptual, since the spatial dimensions of the object in view determine the degree of exposure within the central field of vision, which is difficult to quantify.

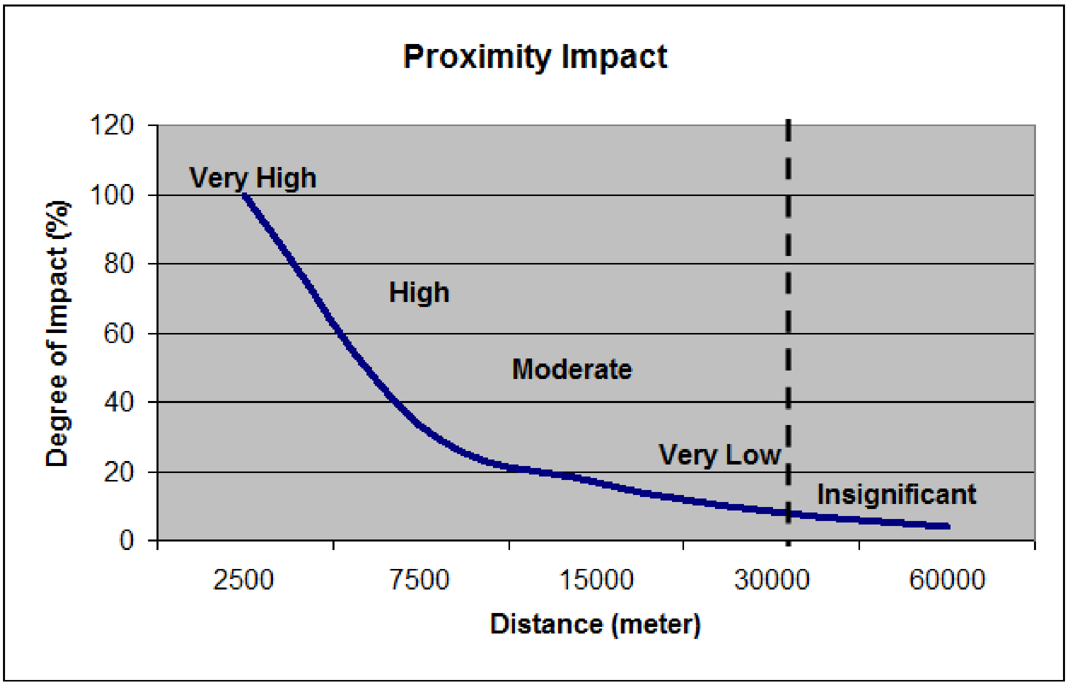


Figure 44: Reduced visibility over distance

MetroGIS determined the proximity radii based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger facilities and downwards for smaller facilities (i.e. depending on the size and nature of the proposed infrastructure. MetroGIS developed this methodology in the absence of any known and/or acceptable standards for South African solar energy facilities.

The proximity radii (calculated from the boundary lines of the farm selected for the solar facility) are shown on the map in Figure 8 and are as follows:

- 0 - 4 km - Short distance view where the solar facility would dominate the frame of vision and constitute a **high to very high** visual prominence.
- 4 - 8 km - Medium distance view where the solar facility would be easily and comfortably visible and constitute a **high** visual prominence.

- 8 - 16 km - Medium to longer distance view where the facility would become part of the visual environment, but would still be visible and recognisable, especially if the whole facility is exposed. This zone constitutes a **high to medium** visual prominence.

- Greater than 16 km **-** Long distance view of the facility where solar facility would still be visible though not as easily recognisable. This zone constitutes a **medium to low** visual prominence for the facility.

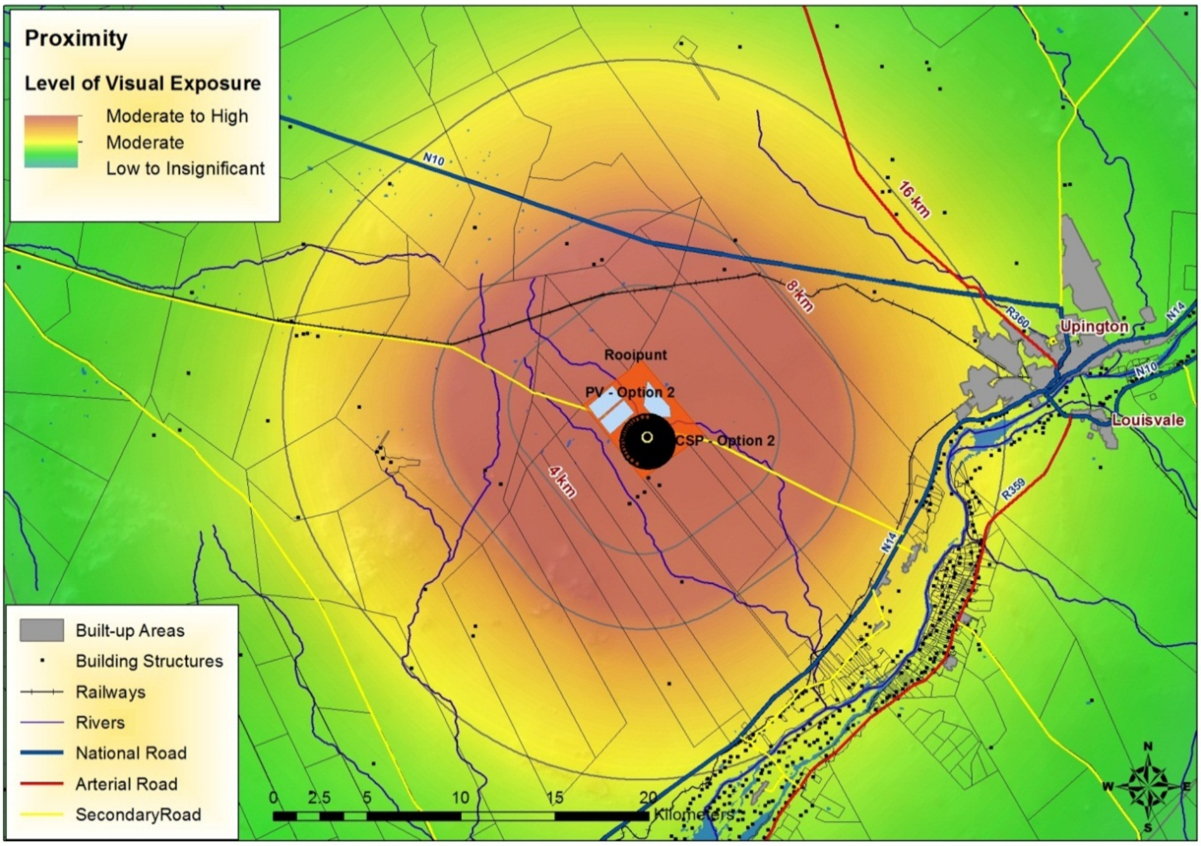


Figure 45: Proximity analysis, showing diminishing significance of visual exposure with distance.

7.11.4 Viewer Incidence/Viewer Perception

The viewer incidence analysis is based on the identification of places of residence, roads and tourists areas where a concentration of people normally occur. Extracted from the baseline data, this is integrated with data from the viewshed analyses for further interpretation. For the purpose of this study, five categories were identified as having differing observer incidences and/or perceptions. These are indicated on the map in Figure 9.

- The **first** category of high viewer incidence and potential negative perception includes the built-up areas within the study area. These include Upington, Louisvale Road, Oranjevallei, Ses Brugge, Louisvale, Klippunt, and Kanoneiland. Observers residing in these areas are accustomed to the wide natural expanses and vistas afforded by this rural region, although storage and chiller plants are visible intermittently. Visual exposure to the solar facility will be limited to partial views of the heliostat field and partial to full views of the central tower. Developments of the scale of the central tower may constitute a negative visual impact.

  The industrial areas surrounding Upington are not likely to be negatively impacted upon due to the nature of the activities and facilities already present here.

  It must be noted that no complaints pertaining to potential visual impact of the construction and operation of the proposed solar facility, as far as the author is aware, were received from individual landowners in the study area during the public participation process or otherwise.

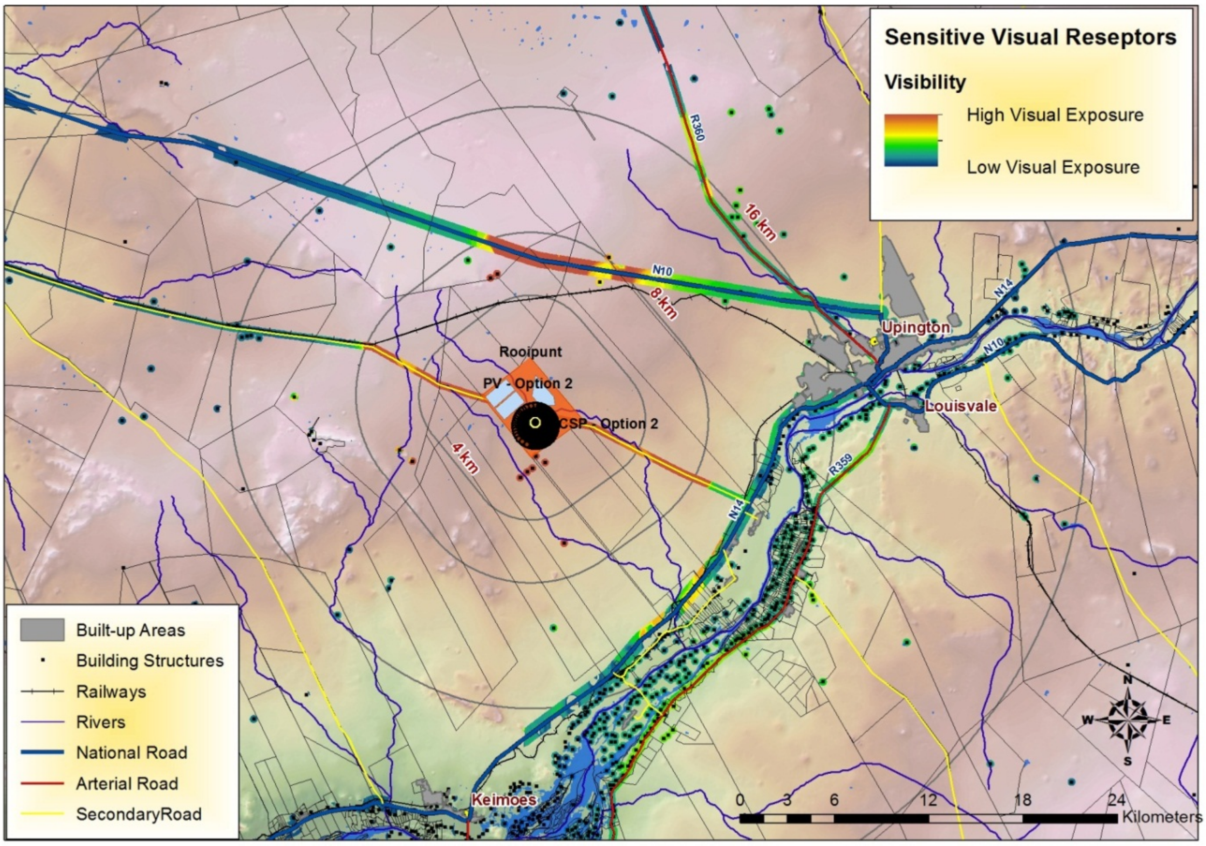


Figure 46: Possible sensitive receptor areas.

- The **second** category with medium observer incidence and potentially negative viewer perception encompasses the cultivated areas adjacent to the Orange River. This zone consists mainly of vineyards and activities related to the cultivation of grapes. It is perceived that it would have fewer observers but could still evoke potentially negative perceptions of the facility. This is due to the existing rural context to which the viewers are accustomed.

  The gentle slopes toward the river, as well as riverine and other vegetation, offer some visual protection from the smaller infrastructure (heliostats and PV panels), but not from the central tower.

- Areas that are greatly devoid of random observers make up the **third** category with low observer incidence and/or a predominantly neutral perception of the facility. This area includes large tracts of sparsely populated land (*thicket and bushland, shrubland* and *grassland*).

- The **fourth** category that could potentially experience a negative visual impact due to land use conflicts are the protected areas (Spitskop Provincial Nature Reserve) and nature based tourism destinations. It should be noted that the Spitskop Nature Reserve is not a well-developed tourist destination, and has little infrastructure at present. Situated some 16 km from the development area, any possible visual impact from the solar facility is expected to be of low significance

- The **fifth** and final category comprises corridors along the main roads in the area. These areas include a 500 m buffer zone along the national roads, and a 250 m buffer along arterial and secondary roads, and are expected to support a higher frequency of observers. These buffers represent the area with the highest potential sightings of the solar facility. Visual exposure and related visual impact will vary from high to low, depending on the distance between the observer and the solar facility, and the nature of the landscape surrounding the observer at a specific location.

7.11.5 Visual Absorption Capacity of the natural vegetation

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.

7.11.6 Visual impact index

The combined results of the visual exposure, viewer incidence and proximity to the proposed solar facility are displayed on the maps in Figure 10. Here the weighted impact and the likely areas of impact are indicated as a visual impact index. Values were assigned for each potential visual impact per data category and merged in order to calculate the visual impact index.

An area with short distance, high frequency of visual exposure to the proposed facility, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

Due to the differing nature of impact between the heliostat field and the central tower, two indexes were generated, to analyse each component separately. The joint index of the two facilities is represented by the central tower index map (refer to the maps in Figure 10).

***Category 1** – residential areas/built up areas*

Upington, as well as the towns of Oranjevallei, Louisvale, and Kanoneiland are expected to be exposed to medium to long distance views of the central tower. It is not anticipated that the other primary infrastructure or ancillary infrastructure will be visible from this distance.

It should be noted that the visual impact index does not take into account visual clutter and structures that obstruct long distance views within built-up areas. For this reason it can be assumed that the solar facility would not be visible from all areas within the towns, but have a higher visual incidence from the outskirts.

***Category 2** – cultivated areas along the Orange River*

Many homesteads and settlements occur along the extended banks of the Orange river. In addition to being somewhat shielded by topography and vegetation, most of these settlements lie beyond 8 km (medium to long distance view) from the proposed facility, and would thus potentially be exposed to a **moderate to high** visual impact as a result of the central tower.

It is not anticipated that the other primary infrastructure or ancillary infrastructure will be visible from this distance.

***Category 3** – sparsely populated areas*

Within a radius of 4km (short distance view) of the solar facility, observers will potentially be exposed to **very high** visual impact as a result of both the central tower, and the smaller infrastructure. Within this radius lies one settlement adjacent to the facility which will be exposed to **very high** visual impact.

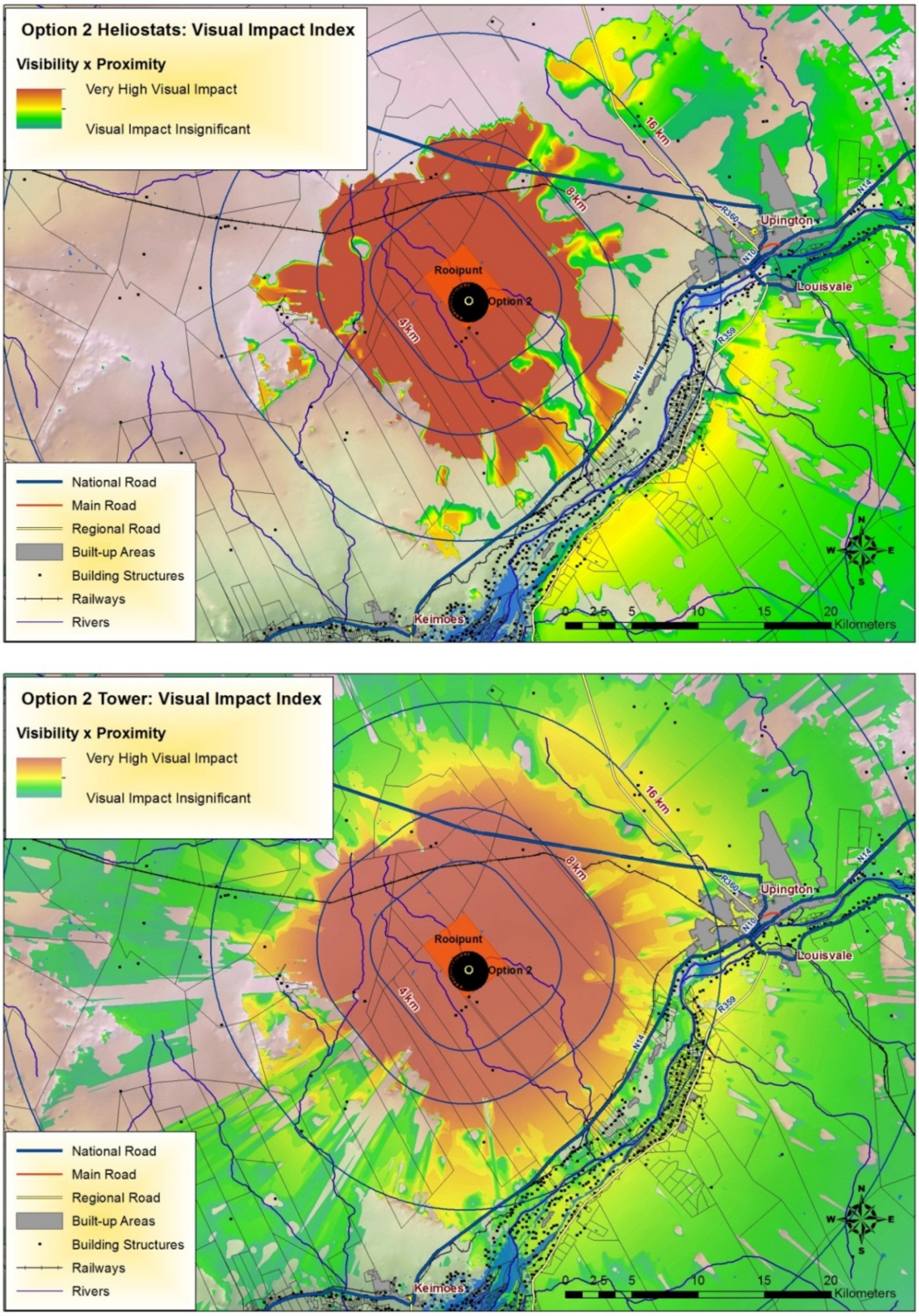


Figure 47: Visual impact index for the heliostat field (top) and central tower (bottom).

Settlements surrounding the Tungsten Mine are expected to experience negative visual impact. As these settlements are not formally occupied, and are currently in ruin, this potential impact is in fact negligible. Beyond the 8 km radius, settlements such as Van Rooisvlei are expected to be exposed to **moderate** and **low** visual impact as a result of the central tower.

It is not anticipated that the other primary infrastructure or ancillary infrastructure will be visible from this distance.

***Category 4** – protected areas*

The central tower would be visible from the Spitskop Nature Reserve, but these would be long distance views (> 16 km) and visual impact would be **moderate to low**.

It is not anticipated that the other primary infrastructure or ancillary infrastructure will be visible from this distance.

***Category 5:** – corridors/roads*

Observers in close proximity to the facility (i.e. within 4 km) would be exposed to a **very high** potential visual impact as a result of the central tower. This includes a section of secondary road transecting the development area. This road is not of great concern as it is generally devoid of random observers and does not carry a large number of motorists. The other primary infrastructure and the ancillary infrastructure may be discernable, but will not be apparent.

Both national and arterial roads between 4km and 16km of the site will be exposed to views of the central tower, and thus to **moderate to high** visual impact, dropping to **moderate** in places. A small section of the N14 will experience **high** visual impact as a result of the central tower.

It is not anticipated that the other primary infrastructure or ancillary infrastructure will be visible from this distance of significance is that these roads are the primary tourist routes in a region where Upington functions as a gateway and activity hub to a host of eco-tourism destinations (for example Augrabies National Park).

Roads with a **high** potential visual impact include sections of the N10 north, and N14 south east of the site and a section of the secondary road close to and transecting the site. At this distance (less than 8 km) the solar facility will be most prominent. It is anticipated that the central tower will be visible from this distance. The other primary infrastructure and the ancillary infrastructure may be discernable, but will not be apparent.

Beyond 16 km away from the development the potential visual impacts along all the roads and built-up areas becomes **low** to **very low** or **not visible.**

It is not anticipated that the other primary infrastructure or ancillary infrastructure will be visible from this distance.

7.11.7 Visual impact assessment

The previous section of the report identified specific areas where likely visual impacts would occur. This section will attempt to quantify these potential visual impacts in their respective geographical locations and in terms of the identified issues related to the visual impact.

The methodology for the assessment of potential visual impacts states the **nature** of the potential visual impact (e.g. the visual impact on users of major roads in the vicinity of the proposed solar facility) and includes a table quantifying the potential visual impact according to the following criteria:

- **Extent** - site only (very high = 5), local (high = 4), regional (medium = 3), national (low = 2) or international (very low = 1)
- **Duration** - very short (0-1 yrs = 1), short (2-5 yrs = 2), medium (5-15 yrs = 3), long (>15 yrs = 4), and permanent (= 5)
- **Magnitude** - None (= 0), minor (= 2), low (= 4), medium/moderate (= 6), high (= 8) and very high (= 10)
- **Probability** - none (= 0), improbable (= 1), low probability (= 2), medium probability (= 3), high probability (= 4) and definite (= 5)
- **Status** (positive, negative or neutral)
- **Reversibility** - reversible (= 1), recoverable (= 3) and irreversible (= 5)
- **Significance** - low, medium or high

The **significance** of the potential visual impact is equal to the **consequence** multiplied by the **probability** of the impact occurring, where the consequence is determined by the sum of the individual scores for magnitude, reversibility, duration and extent (i.e. **significance = consequence (magnitude + reversibility + duration + extent) x probability**).

The significance weighting for each potential visual impact (as calculated above) is as follows:

- <30 points: Low (where the impact would not have a direct influence on the decision to develop in the area)

- 31-60 points: Medium/moderate (where the impact could influence the decision to develop in the area)
- >60: High (where the impact must have an influence on the decision to develop in the area)

*Please note that due to the declining visual impact over distance, the **extent** (or spatial scale) rating is reversed (i.e. a localised visual impact has a higher value rating than a national or regional value rating). This implies that the visual impact is highly unlikely to have a national or international extent, but that the local or site-specific impact could be of high significance.*

No mitigation measures (e.g. painting the structures a sky blue colour) is proposed as the colour scheme and lighting fixtures are legally required by the Civil Aviation Authority, and cannot be altered.

7.11.7.1 The Solar Power Park

a) Potential visual impact on users of national, arterial and secondary roads in close proximity of the solar facility.

Potential visual impact on the major roads within close proximity to the proposed solar facility (i.e. within 8km) is expected to be **high**. The table below illustrates this impact assessment.

Table 62 Impact table summarising the significance of visual impacts on users of national, arterial and secondary roads in close proximity of the solar facility.

Nature of Impact: **Potential visual impact on users of arterial and secondary roads in close proximity of the solar facility**	
Extent	Local **(4)**
Duration	Long term **(4)**
Magnitude	High **(8)**
Probability	High **(4)**
Significance	High **(64)**
Status (positive or negative)	Negative
Reversibility	Recoverable **(3)**
Irreplaceable loss of resources?	No
Can impacts be	No

mitigated during operational phase?	
Mitigation: Decommissioning: removal of the solar facility structures and ancillary infrastructure after 30 years	
Cumulative impacts: If the construction of this facility is considered in addition to the possible future construction of the Eskom CSP plant, there is a potentially cumulative visual impact within the region as a result of the construction of the two facilities. The development of the primary infrastructure over 2 to 3 years may create the impression of a cumulative visual impact on uninformed observers (i.e. observers who are not aware of the total extent of the facility).	
Residual impacts: None. The visual impact will be removed after decommissioning	

b) Potential visual impact on residents of farmsteads in close proximity to the proposed solar facility.

The visual impact of the proposed solar facility on farmsteads within 8 km of the site is found to be **high**.

The table below illustrates this impact assessment.

Table 63 Impact table summarising the significance of visual impacts on farmsteads in close proximity to the proposed solar facility

Nature of Impact: Potential visual impact on residents of farmsteads in close proximity (<8km) to the proposed solar facility.	
Extent	Local **(4)**
Duration	Long term **(4)**
Magnitude	High **(8)**
Probability	High **(4)**
Significance	High **(64)**
Status (positive or	Negative

negative)	
Reversibility	Recoverable **(3)**
Irreplaceable loss of resources?	No
Can impacts be mitigated during operational phase?	No
Mitigation: Decommissioning: removal of the solar facility structures and ancillary infrastructure after 30 years	
Cumulative impacts: If the construction of this facility is considered in addition to the possible future construction of the Eskom CSP plant, there is a potentially cumulative visual impact within the region as a result of the construction of the two facilities. The development of the primary infrastructure over 2 to 3 years may create the impression of a cumulative visual impact on uninformed observers (i.e. observers who are not aware of the total extent of the facility).	
Residual impacts: None. The visual impact will be removed after decommissioning	

c) Potential visual impact on residents of towns and settlements within the region.

The visual impact of the proposed solar facility on built-up areas and settlements beyond 8km of the site is found to be **moderate**.

The table below illustrates this impact assessment.

Table 64 Impact table summarising the significance of visual impacts on residents of towns and settlements within the region

Nature of Impact: Potential visual impact on residents of towns and settlements within the region (<16km)	
Extent	Regional **(3)**
Duration	Long term **(4)**
Magnitude	Moderate **(6)**
Probability	High **(4)**
Significance	Moderate **(52)**
Status (positive or negative)	Negative
Reversibility	Recoverable **(3)**
Irreplaceable loss of resources?	No
Can impacts be mitigated during operational phase?	No
Mitigation: Decommissioning: removal of the solar facility structures and ancillary infrastructure after 30 years	
Cumulative impacts: If the construction of this facility is considered in addition to the possible future construction of the Eskom CSP plant, there is a potentially cumulative visual impact within the region as a result of the construction of the two facilities. The development of the primary infrastructure over 2 to 3 years may create the impression of a cumulative visual impact on uninformed observers (i.e. observers who are not aware of the total extent of the facility).	
Residual impacts: None. The visual impact will be removed after decommissioning	

d) Potential visual impact of the proposed solar facility on protected areas and eco-tourism

The potential visual impact of the proposed solar facility on the Spitskop Nature Reserve and on eco-tourism along the Orange River is expected to be **moderate.**

The table below illustrates this impact assessment.

Table 65 Impact table summarising the significance of visual impacts on protected areas and eco-tourism

Nature of Impact: Potential visual impact of the proposed solar facility on protected areas and eco-tourism	
Extent	regional **(3)**
Duration	Long term **(4)**
Magnitude	Low **(4)**
Probability	High **(4)**
Significance	Moderate **(44)**
Status (positive or negative)	Negative
Reversibility	Recoverable **(3)**
Irreplaceable loss of resources?	No
Can impacts be mitigated during operational phase?	No
Mitigation: Decommissioning: removal of the solar facility structures and ancillary infrastructure after 30 years	
Cumulative impacts: If the construction of this facility is considered in addition to the possible future construction of the Eskom CSP plant, there is a potentially cumulative visual impact within the region as a result of the construction of the two facilities. The development of the primary infrastructure over 2 to 3 years may create the impression of a cumulative visual impact on uninformed observers (i.e. observers who are not aware of the total extent of the facility).	

Residual impacts: None. The visual impact will be removed after decommissioning

7.11.7.2 Ancillary infrastructure

a) Potential visual impact of the external access road.

Although no dedicated viewshed has been generated for the external access road, it is expected that the area of potential visual exposure of this road will lie within that of the primary infrastructure (specifically the central tower, heliostats and PV panels). The potential visual impact of this access road is expected to be **low**.

The table below illustrates this impact assessment.

Table 66 Impact table summarising the significance of visual impact of the external access road.

Nature of Impact: Potential visual impact of the external access road	
Extent	Local **(4)**
Duration	Long term **(4)**
Magnitude	Low **(4)**
Probability	Low **(1)**
Significance	Low **(12)**
Status (positive or negative)	Negative
Reversibility	Recoverable **(3)**
Irreplaceable loss of resources?	No
Can impacts be mitigated during operational phase?	No
Mitigation: Decommissioning: removal of the solar facility structures and ancillary infrastructure after 30 years	

Cumulative impacts: None.
Residual impacts: None. The visual impact will be removed after decommissioning

b) Potential visual impact of other ancillary infrastructure.

Other ancillary infrastructure (i.e. the generator building, the substation, storage reservoirs, the internal roads, the office and the workshop) will be located within the development footprint, and will generally be overshadowed by the much taller central tower as well as the heliostats and PV panels.

Visual impacts related to the proposed pipe line relate to vegetation that will be removed during the construction phase. If left unrehabilitated, this servitude could remain as a visual scar in the landscape. In addition, unrehabilitated areas are vulnerable to erosion over time. The effects of erosion also represent a potential visual impact to observers.

Although no dedicated viewshed has been generated for these ancillary infrastructure, it is expected that the area of potential visual exposure will lie within that of the primary infrastructure (i.e. specifically the central tower). The potential visual impact of this ancillary infrastructure is expected to be **low**.

The table below illustrates this impact assessment.

Table 67 Impact table summarising the significance of visual impact of other ancillary infrastructure.

Nature of Impact: **Potential visual impact of other ancillary infrastructure**	
Extent	Local **(4)**
Duration	Long term **(4)**
Magnitude	Moderate **(6)**
Probability	Low **(2)**
Significance	Low **(28)**
Status (positive or negative)	Negative
Reversibility	Recoverable **(3)**

Irreplaceable loss of resources?	No
Can impacts be mitigated during operational phase?	No
Mitigation: Decommissioning: removal of the solar facility structures and ancillary infrastructure after 30 years	
Cumulative impacts: None.	
Residual impacts: None. The visual impact will be removed after decommissioning	

7.11.8 Secondary visual impacts

7.11.8.1 Lighting impacts

The area earmarked for the placement of the solar facility has a relatively small number of populated places (towns, settlements and farmsteads).

Light impacts are expected to occur from the central tower glowing white hot during the day, and security lighting during the night. The glowing effect of the tower receiver will be low, but noticeable due to its height above ground, which is negligible in the context of daylight. At night time security lighting may cause glare and sky glow.

Although these are not densely populated areas, the light trespass and glare from the security and after-hours operational lighting will have some significance. Furthermore, the sense of place and cultural ambiance of the local area increases its sensitivity to such lighting intrusions.

A second source of light pollution stemming from the solar facility will be in the form of 'glare light', which is not as intense as flood lighting. The source of this lighting is the aircraft warning lights mounted on top of the central tower. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impact is low. Only the central tower will require such lights, which means the impact of these should also be low.

Last is the potential lighting impact known as sky glow. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust, or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contributes to the increase in sky glow. The solar facility may contribute to the effect of sky glow in an otherwise dark environment.

This issue is also relevant in context of other nearby infrastructure (i.e. a crusher plant to the north west of the site just off the N10) which may already be causing sky glow. The addition of this facility could contribute to the accumulation of this impact.

7.11.8.2 Potential visual impacts associated with the construction phase

The construction phase of a project potentially causes the most disturbances within the receiving environment. During this time there will be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and land owners in the area.

7.11.8.3 The potential to mitigate visual impacts

- The primary visual impact, namely the appearance of the facility (including the primary and ancillary infrastructure), is not possible to mitigate. The largest structure, being the central tower, will be impossible to hide. The heliostats (with a footprint area of about 130m² each), as well as the PV panels, are also large and their functional design cannot be changed in order to reduce visual impacts. All other structures and infrastructure will fall within the viewshed of the larger structures.

  Considering the topography of the land and the VAC of the vegetation, very little can be done to mitigate the visual impacts caused by these structures. Furthermore, the functional design of these structures and the dimensions of the facility cannot be changed in order to reduce visual impacts. Therefore, the potential for mitigation is low.

  However, the visual impact of ancillary structures such as the pipe line can be successfully mitigated by placing the pipe underground, and rehabilitating the vegetation within the pipeline servitude. This has the further advantage of negating possible visual impacts associated with vegetation clearing and potential unsightly erosion scarring.

  The mitigation of secondary visual impacts caused by security and functional lighting, and construction activities may be mitigated through careful planning and management.

- A land use conflict exists with regard to the Spitskop Nature Reserve. This land use conflict extends to the Orange River itself, which holds potential for ecotourism development within the region. The visual impact represented by the solar facility will impose some limitation on conservation based development and tourism opportunities in the future. This impact is not possible to mitigate.

It should be noted, however that the current status of the Spitskop Reserve is such that it is not a well-known tourist destination, and very little if any tourism infrastructure exists.

- The secondary visual impact associated with the access road is not possible to mitigate.

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

    - Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
    - Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
    - Making use of downward directional fixtures;
    - 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.

- Visual impacts associated with the construction phase, albeit temporary, should be managed according to the following principles:

    - Reduce the construction period, if possible, through careful planning and productive implementation of resources.
    - Restrict the activities and movement of construction workers and vehicles to the immediate construction site.

- Ensure that the general appearance of construction activities, construction camps (if required) and lay-down areas are maintained by means of the timely removal of rubble and disused construction materials.
- Restrict construction activities to daylight hours, as per the requirements of the Environment Conservation Act, in order to negate or reduce the visual impacts associated with lighting.

7.11.9 Conclusions and Recommendations

The construction and operation of the proposed Rooipunt Solar Park (primarily the central tower) will have a visual impact on the natural scenic resources of this region.

However, the author is of the opinion that the solar facility has an advantage over other more conventional central generating plants (e.g. coal-fired central stations). The facility utilises a renewable source of energy (considered as an international priority) to generate central and is therefore generally perceived in a positive light. It does not emit any harmful by-products or pollutants and is therefore not negatively associated with possible health risks to observers.

The facility further has a novel and futuristic design that invokes a curiosity factor not generally present with other conventional central generating plants. The advantage being that the solar facility can become an attraction or a landmark within the region that people would actually want to come and see. As it is impossible to hide the facility, the only option would be to promote it.

This opinion should however not distract from the fact that the central tower would be visible for a large area that incorporates various sensitive visual receptors that should ideally not be exposed to industrial-type structures.

There are not many recommendations as to the mitigation of the visual impact of the facility (including the primary and ancillary infrastructure), but especially the central tower.

It is however recommended that all disturbed areas are properly rehabilitated, and that all infrastructure and the general surrounds are maintained in a neat and appealing way.

In addition, Alternative A should be favoured for both the central line and the external access road, as these both represent the lowest potential visual impact.

Furthermore, the visual impact of ancillary structures such as the pipe line can be successfully mitigated by placing the pipe underground, and rehabilitating the vegetation within the pipeline servitude.

The construction phase of the facility should be sensitive to potential observers near the construction site. The placement of lay-down areas and temporary construction camps should be carefully considered in order to not negatively influence the future perception of the facility.

Secondary visual impacts associated with the construction phase, such as the sight of construction vehicles, dust and construction litter must be managed to reduce visual impacts. The use of dust-suppression techniques on the access roads (where required), timely removal of rubble and litter, and the erection of temporary screening will assist in doing this.

The planning and proper placement of light fixtures will also reduce visual impacts associated with glare and light trespass.

The facility should be dismantled upon decommissioning and the site and surrounding area should be rehabilitated to its original (current) visual status.

7.11.10 Mitigation Measures

The management plan tables aim to summarise the key findings of the visual impact report and to suggest possible management actions in order to mitigate the potential visual impacts. The management plan primarily focuses on the mitigation and management of potential secondary visual impacts, due to the fact that the primary visual impact (i.e. the central tower and heliostats) has very low or limited mitigation potential.

Table 68: Management plan – Rooipunt Solar Power Park

OBJECTIVE: The mitigation and possible negation of the additional visual impacts associated with the construction of the Rooipunt Solar Energy Facility.		
Project component/s	Construction site, access road and central line	
Potential Impact	Potential scarring and erosion due to the unnecessary removal of vegetation	
Activity/risk source	The viewing of the above mentioned by observers on or near the site	
Mitigation: Target/Objective	Minimal disturbance to vegetation cover in close vicinity to the proposed roads	
Mitigation: Action/control	Responsibility	Timeframe
Adopt responsible construction practices aimed at containing the construction activities to specifically demarcated areas thereby limiting the removal of natural vegetation to the minimum.	SolarReserve, CSP /contractors	During construction
Limit access to the construction sites to existing access roads.	SolarReserve, CSP /contractors	Construction / operational phases

Rehabilitate all disturbed areas to acceptable visual standards.	SolarReserve, CSP /contractors	Construction / operational phases
Maintain the general appearance of the facility in an aesthetically pleasing way.	SolarReserve, CSP	Operational phase
Performance Indicator	Vegetation cover that remains intact with no erosion	
Monitoring	Monitoring of vegetation clearing during the construction phase	

Table 69: Management plan - Lighting impacts

OBJECTIVE: The mitigation and possible negation of the potential visual impact of lighting at the solar facility		
Project component/s	Solar facility lighting fixtures	
Potential Impact	The potential night time visual impact of lighting fixtures on observers in proximity to the site	
Activity/risk source	The effects of glare and light trespass on motorists and observers	
Mitigation: Target/Objective	The containment of light emitted in order to eliminate the risk of additional night time visual impacts Minimal usage of security and other lighting	
Mitigation: Action/control	Responsibility	Timeframe
Ensure that proper planning is undertaken regarding the placement of lighting structures and that light fixtures only illuminate areas inside the substation sites. Undertake regular maintenance of light fixtures.	SolarReserve, CSP /contractors	Construction/Operation
Performance Indicator	he monitoring of the condition and functioning of the light fixtures during the operational phase of the project	
Monitoring	The monitoring of the condition and functioning of the light fixtures during the operational phase of the project	

The full Visual Impact Assessment is included in Appendix N

7.12 SOCIO ECONOMIC IMPACT

Study area delineation depends on the type of economic activity that is being analysed and the perceived spread of economic impacts that are expected to be generated from the project during both construction and operation. The municipal area where the site is located is likely to experience some direct, indirect and induced impacts resulting from the activities on site. However, it is highly unlikely that the local economy can be sufficiently diversified to supply all materials and services and support construction and operational activities from start to finish. Thus economic impacts tend to extend beyond the municipal boundaries and spread throughout the entire national economy.

For the purpose of this study the following study areas will be delineated:

- The primary study area: This refers to the locality where direct economic impacts of the proposed activity are to be concentrated. It is defined considering the actual location of the proposed project, proximity to skilled and unskilled labour, juxtaposition relative to suppliers, and availability of data. The primary study area for the proposed Solar Power Park was chosen to be the the Kai !Garib and the //Khara Hais LMs due to the proximity of the site to the //Khara Hais LM's border and most importantly the town of Upington within this municipality.

- The secondary and tertiary study areas: They are the areas where the majority of indirect and induced effects will be concentrated and where the former forms part of the latter. The proposed project is to be located in the Northern Cape Province about 350 km from Kimberley - the main economic hub in the Province and the closest city with a relatively diversified economy. Thus, it is assumed that some of the inputs required for the establishment and operations would be sourced from the Province and most probably from Kimberley itself. The tertiary study are is chosen to be South Africa, as it will benefit from all domestic expenditure directly or indirectly related to the proposed project, as well as from procurement of numerous components for the project including steel structures, project management services, etc.

- Visually affected study area: The consultation with other specialists on the team revealed that the most significant environmental impact associated with the proposed activity is a visual impact. Thus, another area was delineated for this purpose and will be referred to as a visually affected study area. The delineation of this area is provided in **Figure 48**.

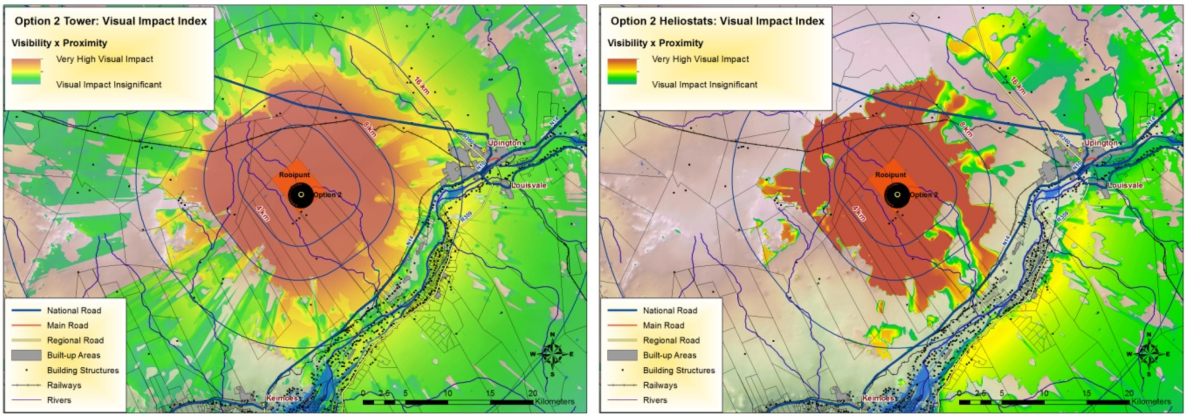


Figure 48 - 49: Visually affected area

7.12.1 Terms of Reference

The purpose of the Socio-Economic Impact Assessment is to determine the potential positive and negative effects of the proposed Solar Power Park, i.e. an impacting agent in the context of this study, on the local and regional economies and to compare their effects with the “no go” alternative to determine the net effect of the project. The “no go” alternative assumes that the proposed Solar Power Park is not established at the intended location, nor anywhere else in the country. The “no go” alternative represents the current status of the environment, including the socio-economic situation.

Socio-economic impacts generated by the impacting agent can be disaggregated in terms of the initial impacts, or direct impacts that are created. Such impacts trigger second and further flow-on rounds of impacts, thus creating a multiplier effect that can be either positive or negative. In pure economic terms these are expressed as indirect and induced effects, where:

- Indirect effects relate to the changes in economic indicators that are triggered along the upstream industries that supply goods and services to the impacting agent

- Induced effects refer to the changes in economic indicators that are stimulated by changes in consumption expenditure of households that were directly or indirectly affected by the impacting agent

In addition to the above, two other types of socio-economic impacts can be distinguished in the context of the environmental impact assessment studies and thus need to be investigated. These include, inter alia:

- Secondary impacts that are caused by the impacting agent, but that are further removed in distance or take place later in time and are still reasonable foreseeable. Secondary impacts largely relate to changes in the land use pattern, economic vitality, changes to community's character, and property values in the vicinity of the impacting agent's location.

- Cumulative effects are the results of incremental consequences of the impacting agent's activity when added with other past, present, and anticipated future interventions. They consider the manner in which the impacts of a project may affect or be affected by other projects. Such effects are generally difficult to identify as they require a complete knowledge of local conditions and developmental plans, and are sometimes even more difficult to quantify.

The specific objective aimed to be achieved by the socio-economic impact assessment study include, inter alia:

- Create profiles for the economies representing the study areas and the environmentally affected environment, which would then represent a "do nothing" alternative and would be used to assess the potential changes ensued from the proposed activity

- Identify positive and negative economic impacts that are expected to be stimulated by the proposed facility during both construction and operational phases

- Quantify socio-economic impacts, where possible, using an economic model developed on the basis of a Social Accounting Matrix

- Determine the significance of potential impacts using criteria determined by the environmental practitioner

- Compare various alternatives and advise on the most beneficial option

- Provide practical mitigation measures where possible and where necessary

The methodology employed in conducting the study comprised of five main steps. The following paragraphs briefly describe each of the steps.

Step 1: Data gathering

Impact assessment requires the knowledge of the socio-economic environment that will be affected by the proposed project and expenditure during both the construction and operational phases. Gathering of the above-mentioned data followed the next approach:

- **Status-quo data**: In order to create a comprehensive understanding of the socio-economic environment that might be affected by the Solar Park, a socio-economic profile of the study areas and visually affected area needed to be created. The following information sources were used in gathering the data:
    - Quantec database (1995-2010)
    - StatsSA Labour Force Survey (LFS)
    - Northern Cape Growth and Development Strategy
    - Siyanda DM: IDP 2010-2011 and IEDP 2006
    - Kai !Garib LM: IDP 2010
    - Khara Hais LM: IDP 2007-2012 and LED 2010
    - Telephonic interview of the owner of the farm where the proposed facility is to be located
    - Interviews with the local authorities and businesses in the Upington area
    - Information collected by Grant Thornton, the tourism specialist on the team, during the site visit
- **Information on project's expenditure** was sourced from SolarReserve. These figures present estimates and could change in the future, however for the purpose of the study they were deemed to be sufficient.

Step 2: Data analysis

Data analysis involved the processing of information gathered during the previous step and presenting its results in terms of selected economic variables. Socio-economic data describing the study areas were analysed and presented as the baseline data. Information regarding the project and economic activities that will be affected by the project (i.e. economic activity on site in the visually affected area) was reviewed, collated and presented as input into modelling exercises.

Step 3: Modelling

In order to estimate the direct and follow-on effects of the proposed project expenditure, as well as the potential losses associated with the sterilisation of agricultural land and visual impacts, an economic modelling technique was utilised. The modelling exercise made use of two economic models developed on the basis of the South Africa's Social Accounting Matrix (SAM) and the Northern Cape Province's SAM updated to 2011 figures. The SAM is a comprehensive, economy-wide database that contains information about the flow of resources that takes place between the different economic agents in this case in the provincial economy.

The selection of two models to be used in the assessment was attributed to the expected spatial distribution of procurement during both the construction and operational phases. It is expected that most of the local inputs required for the project will be sourced from outside the Northern Cape Province, which justifies the use of the national SAM. Some expenditure during construction and most of the spending during operations, though, are assumed to be retained in the Northern Cape Province. Gross operating surplus to be earned during operation is expected to be counted outside the Northern Cape Province, i.e. where SolarReserve quarters are located. Thus, the calculation of impacts during the operational phase made use of both SAMs – for South Africa and the Northern Cape.

The following assumptions were used with respect to the economic model and the modelling exercise:

- No structural changes in the economy are experienced during the analysed period (between 2004 and 2011).
- The model was closed by households to determine the consumptions induced effects in addition to direct and production induced impacts.
- When calculating the exogenous inputs, Gross Operating Surplus was excluded from the consumption induced effects thus assuming that all earnings will be retained and not paid out as dividends. Capital formation and interest payments were excluded from modelling, too.
- The model assumes that the economy is in equilibrium.
- The supply of each good and service is assumed to be perfectly elastic and absent of any capacity constraints. This means that industries and sectors can produce any quantities of goods and services and would not experience technological, budgetary, and/or human resource constraints.
- Employment is estimated in full-time equivalent (FTE) person-years for one year. This, however, does not directly translate into new employment positions. In the short-term, an increase in FTE could be absorbed by currently employed through working overtime or it could translate into the support of currently employed people.

The results of the modelling exercise were provided in constant 2011 prices to ensure the compatibility of this data with the baseline data, which is also presented in 2011 figures where applicable.

Step 4: Interpretation

The results of the modelling exercise and qualitative assessment of potential effects of the project on the socio-economic environment were translated in terms of various socio-economic impacts and were interpreted against the current status of the analysed economies. The analysis of impacts was disaggregated between various phases of the project life cycle, i.e. construction, operation and closure. Where possible, impacts were separated in terms of direct, indirect, and induced effects; as well as secondary and cumulative impacts.

Step 5: Impact rating

Impact rating is done for each type of impact identified during all the stages of the project's life cycle that is being analysed (i.e. construction, operation, and closure). In determination of the impact rating, the net was considered, if applicable. The significance rating of impacts was determining using probability, duration, scale, and magnitude ranges as outlined in **Table 70**.

Table 70: Impact Significance Ranking Scales

Probability:	Duration:	Scale:	Magnitude:
5 - Definite/don't know **4 - Highly probable** **3 - Medium probability** **2 - Low probability** **1 - Improbable** **0 - None**	5 - Permanent 4 - Long-term (impact ceases after the operational life of the activity) 3 - Medium-term (5-15 years) 2 - Short-term (0-5 years) 1 - Immediate	5 - International 4 - National 3 - Regional 2 - Local 1 - Site only	10 - Very high/don't know 8 - High 6 - Moderate 4 - Low 2 - Minor 0 - None

Once the above factors had been ranked for each impact, the overall significance of each impact was assessed using the following formula:

Potential Significance (PS) = (Magnitude + Duration + Scale) x Probability

All impacts were then ranked in terms of low, moderate and high following the scale:

- PS ≥ 60 = High Environmental Significance (Adverse Impact. Mitigation, if possible, is often difficult, expensive and time consuming)

- 60 < PS ≥ 30 = Medium Environmental Significance (Mitigation is both feasible and fairly easily possible)
- PS < 30 = Low Environmental Significance (Mitigation easily achieved or little is required)

7.12.2 Impact Assessment and Identification

The purpose of this chapter is to evaluate the socio-economic impacts of the proposed Rooipunt Solar Power Park on the regional and local economies. Impact evaluation is done for all types of effects identified earlier in the report and are grouped per the stage of the project's lifecycle, i.e. during construction, operations, and closure phases.

7.12.2.1 Construction phase assumption (impacts)

In this section the project assumptions that were used to determine the socio-economic impact of the proposed project are brought forth. The construction phase assumptions are presented first followed by the assumptions applicable to the operational and closure phases. All the assumptions provided are for the 100 – 200 MW nameplate capacity of the concentrated solar power (CSP) plant and two (2) sets of 75 -100 MW installed capacity of photovoltaic (PV) systems, which jointly provide an installed capacity of 225-325 MW.

The estimated cost of development of a CSP plant of the suggested size is R5 686 million. Of the total expenditure, approximately one-third (R 1 949 million) will be spent on materials, components, and services which cannot be sourced locally and will be imported, such as heliostats, salt and a receiver for the molten salt circuit, as well as a steam turbine generator. The nature and magnitude of the proposed development necessitates the use of some foreign labour with sufficient expertise and "know-how" in the construction and development of similar projects. The remaining two-thirds of the capital expenditure - R3 737 million - will be spent locally on all other goods and services required for the development of the solar power park.

Conversely, the development of one 75 - 100 MW PV block is expected to cost R1 780.6 million in 2011 prices. As the complete PV facility compromises of two (2) sets of 75 – 100 MW, the total amount necessary to build PV components is estimated at R5 314.8 million in 2011 prices. Of the total amount, the domestic capital expenditure represents roughly a third, which translates into R578.9 million per phase or R1 736.7 million in total (2011 prices).

In total, the development of the proposed 225-325 MW Solar Park will cost R11 026.8 million in 2011 prices. Of the total amount, the domestic expenditure used is estimated at R5 473.7 million whilst the remaining R5 555.1 million will be spent on imported goods and services. A summary of the construction phase expenditure assumptions regarding the CSP and PV facilities is provided in Table **71**.

It is estimated that the CSP plant will be built over a period of 30 months, whilst the duration of construction of a single PV facility is between 15 months and 18 months. For the purposes of impact estimation and projection, the construction phase of a single PV block is assumed to last for one complete year, i.e. 12 months per phase. Furthermore, it is assumed that construction of all phases will start at the same time.

Table 71: Construction phase assumptions (R'ml, 2011 prices)

Item	Detail		
	CSP	PV Phase 1, 2, and 3	Total
Capital expenditure (R'ml)	R 5 685	R1 780.6	R11 026.8
Local expenditure (R'ml)	R 3 737	R 578.9	R 5 473. 7
Imports (R'ml)	R 1 949	R1 201.7	R 5 554.1
Duration of construction (months)	30	12	-

The construction of the complete CSP and PV facility will require approximately 1 396 full-time employees of varying skills. From this total, 15 people will be international experts, whilst the rest will be sub-divided into:

- 481 full-time employees to build the CSP plant (Phase 4)
- 300 full-time employees to build each phase of the PV component, i.e. a total of 900 full-time employees for PV component of the Solar Power Park.

The vast majority of the workforce required for the establishment of the CSP and PV systems is envisaged to be sourced from different parts of South Africa. Given the opportunities for unskilled and semi-skilled workers, a significant share of positions during construction could be occupied by people from the local communities.

From a different perspective but equally in line with the approximated job opportunities, the project is estimated to create 2 102 employment person-years of which 1 202 and 900 will be created by the CSP plant and the complete PV system, respectively. The estimated salary and wage bill for the required domestic labour force will equate to R162.2 million for the CSP plant and R119.1 million for the complete PV component. Thus, the total salary and wage bill over the construction phase will equate to R281 million in 2011 prices. Table **72** presents a breakdown of the employment opportunities.

Table 72: Employment opportunities created for South Africa's labour force

Employment opportunities	CSP (Phase 4)			Three sets of PV (Phases 1,2, and 3)		
	Jobs	Person-years	%	Jobs	Person-years	%
Highly skilled	125	312	26.0%	60	60	6.7%
Skilled	214	535	44.5%	90	90	10.0%
Unskilled	142	355	29.5%	750	750	83.3%
TOTAL	**481**	**1 202**	**100.0%**	**900**	**900**	**100%**

7.12.2.2 Construction phase impacts

The impact of the proposed project on the socio-economic environment during the development phase is presented in the following sub-sections. Since the construction activities will last for no more than 30 months, the impacts presented in this chapter are of a temporary nature.

a) Evaluation of the impact on balance of payment

The construction of the proposed Rooipunt Solar Park will negatively impact the balance of payments as the required capital to finance the project will be sourced from within South Africa and about R5 555.1 million in 2011 prices will be spent on imported goods. In 2011, South Africa had a trade deficit of R98.8 billion, which accounted for 3.3% of the national GDP and grew compared to the 2010 level. If the trade deficit were to remain on the same level, the imports of goods and services required for the completion of the proposed Rooipunt Solar Park would increase it by about 5.6% to just over R100 billion. This is not considered to be detrimental to the national economy and would highly unlikely lead to the change in the fiscal and monetary policy. Moreover, a negative balance of payments in a developing economy such as South Africa is generally acceptable as the economy needs to borrow money to allow it to invest in infrastructure, people, and businesses that eventually propel growth in the years to come. Care though should be taken to ensure that the current account deficit does not grow beyond the means of the country to service its debt and that the economy is not forced into a default position, as happened with Greece in 2011.

Table 73: Evaluation of the impact on balance of payment

Impact:	Increase in imports and possible increase of the trade deficit during construction			Negative
Before mitigations				
Probability	Highly probable (4)	Scale	National (4)	

Duration	Short-term (2)	Magnitude	Low (4)
Significance	Medium (40)		
After mitigations			
Mitigations	None at this stage – requires development of the local manufacturing capabilities		

b) Evaluation of the impact on production

The proposed Rooipunt Solar Park is expected to stimulate the production in the economy to the value of R17 442.3 million in 2011 prices with the CSP component accounting for the majority of this effect. The benefits to the construction sector through the direct impact would amount to about R5 473.7 million, whilst the backward linkages would create an additional R6 637.0 million of new business sales in the economy. Households spending will further create R5 331.8 million. Some of the impacts will be retained in the local economy particularly as far as such sectors as transport, construction, mining and quarrying, trade, and personal services are concerned. Although the volume of production to be stimulated by the project is considered to be high, the overall impact is expected to be of moderate significance due to its short-term duration.

Table 74: Evaluation of the impact on production during construction

Impact:	Temporary increase in production in the country during construction			Positive
Before mitigations				
Probability	Highly probable (4)	Scale	National (4)	
Duration	Short-term (2)	Magnitude	High (8)	
Significance	Medium (56)			
After mitigations				
Mitigations	In order to optimise the stimulation of the economy through direct, indirect and induced effects, the following should be applied where possible: • Engagement with the district and local municipalities and local business forums or chambers to investigate the possibility of procurement of construction materials, goods, and products from local suppliers where feasible • Employ local contractors where possible • The proposed measures are not going to affect the rating of that impact.			
Probability	Highly probable (4)	Scale	National (4)	
Duration	Short-term (2)	Magnitude	High (8)	
Significance	Medium (56)			

c) Evaluation of the impact on GDP-R

The investment in the Solar Park will generate over R6 214.5 million of GDP-R in 2011 prices. Of this, the greatest share will ensue from the investment in construction of the CSP component, whilst each phase of PV components will stimulate about R737.8 million in GDP-R in the national economy. Similar to the net impact on production, the impact on GDP-R is of moderate significance due to its temporary nature and irrespective of the enhancement measures put in place.

Table 75: Evaluation of the impact on GDP-R during construction

Impact:	Temporary increase in GDP-R during construction		Positive
Before mitigations			
Probability	Highly probable (4)	Scale	National (4)
Duration	Short-term (2)	Magnitude	High (8)
Significance	Medium (56)		
After mitigations			
Mitigations	• The facility should be encouraged to procure materials, goods, services and products required for the operation of their businesses from local suppliers to increase the impact on local and regional economies, without jeopardising its own efficiency and competitiveness. However, this might have an impact on the local economy and will not affect the estimate of the total value-added to be generated by the project. Thus, it will not change the score.		
Probability	Highly probable (4)	Scale	National (4)
Duration	Short-term (2)	Magnitude	High (8)
Significance	Medium (56)		

d) Evaluation of the impact on employment

The proposed project will have a positive impact on employment in the local economy, as well as in the rest of the country. About 2 102 FTE employment positions will be created over the construction period in the local economy, whilst an additional 24 897 FTE employment positions will be created in the rest of the economy. The following table outlines the evaluation of the effect on employment during construction.

Table 76: Evaluation of the impact on employment during construction

Impact:	Creation of employment opportunities during construction		Positive
Before mitigations			
Probability	Highly probable (4)	Scale	National (4)
Duration	Short-term (2)	Magnitude	High (8)
Significance	Medium (56)		
After mitigations			
Mitigations	• The following is recommended to enhance the benefits of the created employment in the local area where feasible: • Consider organising local community meetings to advise them on the project that is planned to be established and the jobs that can potentially be applied for by the local labour • Establish a local skills desk to determine the potential skills that could be sourced in the area (for example in towns such as Upington and Keimos) • Recruit local labour where supply and demand of skills match • Employ labour-intensive methods in construction where feasible • Sub-contract to local construction companies where possible • Utilise local suppliers where possible • The proposed enhancement measures would increase the opportunities for local businesses and labour force, but would not change the total net impact. Thus the rating of the impact after enhancement measures remains the same.		
Probability	Highly probable (4)	Scale	National (4)
Duration	Short-term (2)	Magnitude	High (8)
Significance	Medium (56)		

e) Evaluation of the impact in standard of living

The proposed establishment of the Rooipunt Solar Park will have a positive albeit temporary impact on the welfare of affected households. About R2 359.6 million is expected to be paid out in salaries and wages due to the construction of the proposed facility. Of this, R281.4 million in 2011 prices will be paid to construction workers and the rest will be paid to workers benefiting through indirect an induced impacts.

Depending on the share of the local labour used for the construction of the plant, some of the income earned by employees on site will be distributed to local households. Regardless of the construction workers' origin though, a share of income earned by construction workers will be spent in the local economy, which will be beneficial to the local tertiary sector and subsequently households that derive their earnings from these sectors

Table 77: Evaluation of impact on standard of living

Impact:	Increase in household income during construction		Positive
Before mitigations			
Probability	Highly probable (4)	Scale	National (4)
Duration	Short-term (2)	Magnitude	High (8)
Significance	Medium (56)		
After mitigations			
Mitigations	• In order to maximise the benefits to the local households and limit the leakage of purchasing power, the developer should be encouraged to employ construction workers from local communities within the Kai IGarib and //Khara Hais LMs.		
Probability	Highly probable (4)	Scale	National (4)
Duration	Short-term (2)	Magnitude	High (8)
Significance	Medium (56)		

f) Evaluation of the impact on government revenue

The local capital expenditure of R 5 473.7 million is expected to increase government revenue to the value of approximately R 254.0 million in 2011 prices. This money will largely be gathered through company and person income taxes and will be distributed by national government to cover public spending, which includes provision and support of transport infrastructure, health and education services, and other public goods.

Table 78: Impact on government revenue during construction (R' ml, 2011 prices)

Impact:	Increase in government revenue during construction		Positive
Before mitigations			
Probability	Highly probable (4)	Scale	National (4)
Duration	Short-term (2)	Magnitude	Low (4)
Significance	Medium (40)		
After mitigations			
Mitigations	None		

g) Impact on skills development

The establishment of the Rooipunt Solar Park gives way to a host of skills transfer and development opportunities for people across the country. The impact is widespread seeing that two different types of solar power generation systems will be developed on site. At present there are no such projects in the country thus depending in the rollout of the build programme, specialised skills required to construct CSP and PV facilities will most likely be sourced abroad in the short to medium-term. Attraction of foreign experts on this particular project and the roll out of similar projects in the future could result in the development of the local expertise and knowledge in both the construction and manufacturing sectors. Furthermore, opportunities to develop skills on the R&D level will also be created, particularly if the projects of that kind become common in the country and stimulate the establishment of local manufacturing capabilities.

Table 79: Impact on skills development during construction

Impact:	Skills development of people involved in construction, project management, engineering and manufacturing		Positive
Before mitigations			
Probability	Medium probability (3)	Scale	National (4)
Duration	Permanent (5)	Magnitude	Low (4)
Significance	Medium (39)		
After mitigations			
Mitigations	• Facilitate knowledge and skills transfer between foreign experts and South African professionals • Set up apprenticeship programmes to build onto existing or develop new skills of construction workers, especially those coming from the local communities		
Probability	Medium probability (3)	Scale	National (4)
Duration	Permanent (5)	Magnitude	Moderate (6)
Significance	Medium (45)		

h) Increased levels of crime and social conflicts impacts evaluation

The local economy is not sufficiently diversified to supply the entire work force for the construction of the facility. Therefore, it is expected that a notable portion of the construction workers will be coming from outside the area. In addition, an influx of job seekers to the area could also be expected. This migration of people to the area could result in social conflicts between the local population and the migrants, and could lead to increased levels of crime, prostitution, and possibly deterioration of health amongst the local communities due to the spread of sexually transmitted diseases. The significance of such impacts is dependent to a certain extent on the proportion of workers that are brought from outside the area. The greater the number of migrant workers used in the construction, the greater social disturbances will be created.

The issue of construction workers and job seekers that decide to stay in the area after the project's establishment is also a great concern, as left without income these individuals could resolve to crime and contribute to the increase in the levels of poverty in the local communities. Aside from the broader community issues, the presence of the workforce on site could lead to negative impacts in the surrounding area such as trespassing on adjacent properties, development of informal trading, and littering.

The influx of job seekers is difficult to mitigate; however, appropriate awareness campaigns and strict adherence to the recruiting practices could potentially reduce the adverse effects. In any case, addressing the challenges related to potential social impacts is best to be done in partnership with the adjacent property owners, local communities, councils, and municipal authorities that would promote transparency, information sharing, and build good relationships between the parties.

Table 80: Evaluation of impact on crime situation and social conflicts in the local area

Impact:	Possible increase in crime and other social conflicts due to influx of job seekers and migrant construction workers		Negative
Before mitigations			
Probability	Highly probable (4)	Scale	Local (2)
Duration	Short-term (2)	Magnitude	Moderate (6)
Significance	Medium (40)		
After mitigations			
Mitigations	• The following mitigation measures are proposed to reduce the adverse effects associated with the influx of job seekers and migrant construction workers: • Employ locals as far as feasible (though the creation of the local skills base and recruitment of suitable candidates) • Control the movement of workers between the site and areas of residence to minimise loitering around the Rooipunt farm and communities by providing scheduled transportation services • Engage communities with respect to their possible involvement during construction in providing supporting services such as catering, temporary housing of workers, transportation, etc. • Formalise trading and service provision around the site, by providing a dedicate area for such services and signing contracts with service providers • Set up a recruitment office in the nearby towns (i.e. Keimos and Upington) and adhere to strict labour recruitment practices that would reduce the desire		

	of potential job seekers to loiter around the properties in hope to find temporary employment • Establish a proper fencing around the property to reduce the desire of workers to trespass between the construction site and adjacent properties • Set up a gate and controlled access system to monitor the movement of people to and from the property, as well as to reduce the influx of job seekers to the site itself		
Probability	Probable (3)	Scale	Local (2)
Duration	Short-term (2)	Magnitude	Low (4)
Significance	Low (24)		

i) Evaluation of the impact on economic and social infrastructure

The proposed development will create 2 102 FTE person-years, the greatest share of which will be created in the first year of the two and a half year construction period, assuming that all phases are being implemented simultaneously. This means that up to 1 381 persons will be involved in the project in the first year, of which the majority will be construction workers. It is expected that many of the workers will be coming from outside the area, thus they will be creating a temporary increase in demand for local social services, such as health facilities, as well as the demand for water and electricity.

Access to electricity, water and sanitation in the Kai !Garib and //Khara Hais municipalities is much better than that observed in the rest of the country. Despite this, though, basic service delivery is considered to be one of the priority issues in the municipality (Siyanda DM, 2010), suggesting that there are challenges with respect to their provision. This means that the accommodation of the construction crew coming from outside the area will need to be properly planned and consulted with the local authorities and community leaders ensure that the delivery of basic services during the construction period is not worsened.

Health facilities in Kai !Garib are not up to standards. According to the Kai !Garib IDP for 2009, the community lacks appropriate health facilities and services rendered by their mobile clinics are irregular and insufficient. Furthermore, the problem is aggregated due to the insufficient supply of necessary medical equipment, materials and medication. The situation with health facilities in the //Khara Hais is considered to be better than in Kai !Garib, although its IDP for 2011/2012 suggests that much still needs to be done to ensure adequate provision of health services and facilities in the area. Importantly, construction is underway to build a 267-bed referral hospital in Upington, which will boast multiple specialty treatment facilities. This will significantly improve the medical community in the area; however, due to the location of the proposed Solar Park outside Upington and in a rural area, a mobile clinic will most likely be needed on site to provide immediate medical attention to workers.

The effects of the project on road infrastructure should also be noted, as the development will most likely increase the local traffic in the area which could lead to significant deterioration of local road conditions. This in turn could lead to greater accidents in the area and will require greater expenses to maintain the road.

Given the above, the housing and accommodation situation, basic service provision, health facilities, and road infrastructure are expected to be under strain during the construction period. Unless proper measures are put in place, these infrastructural elements could deteriorate leading to a reduced standard of living in both of the municipalities forming part of the primary study area. Most of these impacts are possible to mitigate to a certain extent, but will require the developer to engage with the local authorities prior the construction to commence to find the most practical and least harmful solution.

Table 81: Evaluation of impact on economic and social infrastructure

Impact:	Strained and possible deteriorated economic and social infrastructure		Negative
Before mitigations			
Probability	Highly probable (4)	Scale	Local (2)
Duration	Short-term (2)	Magnitude	Moderate (6)
Significance	Medium (40)		
After mitigations			
Mitigations	• Engage local authorities prior the construction period and discuss with them the demands for various services such as water, electricity, etc. that are expected to ensure during the development • Identify in consultation with local authorities the infrastructural services that will be affected the most and would be put under significant strain depending on the supply and capacity thereof at the time of construction and created demand by the proposed project • Devise the plan to assist the municipality in addressing the challenges and thus reducing the pressure of the proposed development on the supply of such services and ensuring its uninterrupted supply to the site and other affected parties • Ensure access to a mobile clinic or an emergency medical facility on site		
Probability	Highly probable (4)	Scale	Local (2)
Duration	Short-term (2)	Magnitude	Minor (4)
Significance	Low (24)		

j) Potential to develop local solar energy manufacturing industry

With reference to the objectives of the New Growth Path (2010), the Green Economy Accord (2011) and IPAP2 (2011-2014) to support the green economy and renewable energy sources, the establishment of the proposed Rooipunt Solar Power Park is pivotal. It will not only create direct positive economic impacts, but will also aid in the establishment of the specialised manufacturing industries.

The Green Jobs report (Maia et al, 2011) estimated that 608 and 8 463 sustainable jobs could be created in the country in the long-term in manufacturing industries directly supporting the CSP and PV projects, respectively. The realisation of these opportunities is largely reliant on the economies of scale created within the economy, which requires the CSP and PV facilities to be established over a long-term period and at a steady growth trajectory.

Government has already approved the licensing of solar energy projects to a capacity of 200 MW of CSP and 1 450 MW of PV. It is also known that a number of similar projects are being proposed to be established in the Northern Cape, including the Siyanda DM where the proposed Solar Park is to be located. These include projects such as Eskom's Solar 1 facility, Macctagerts Camp 453 Solar Project, and Klipkraal Solar Project, which are proposed to be established to the east and south-east from the proposed Rooipunt Solar Power Park (refer to Figure 50 **-**).

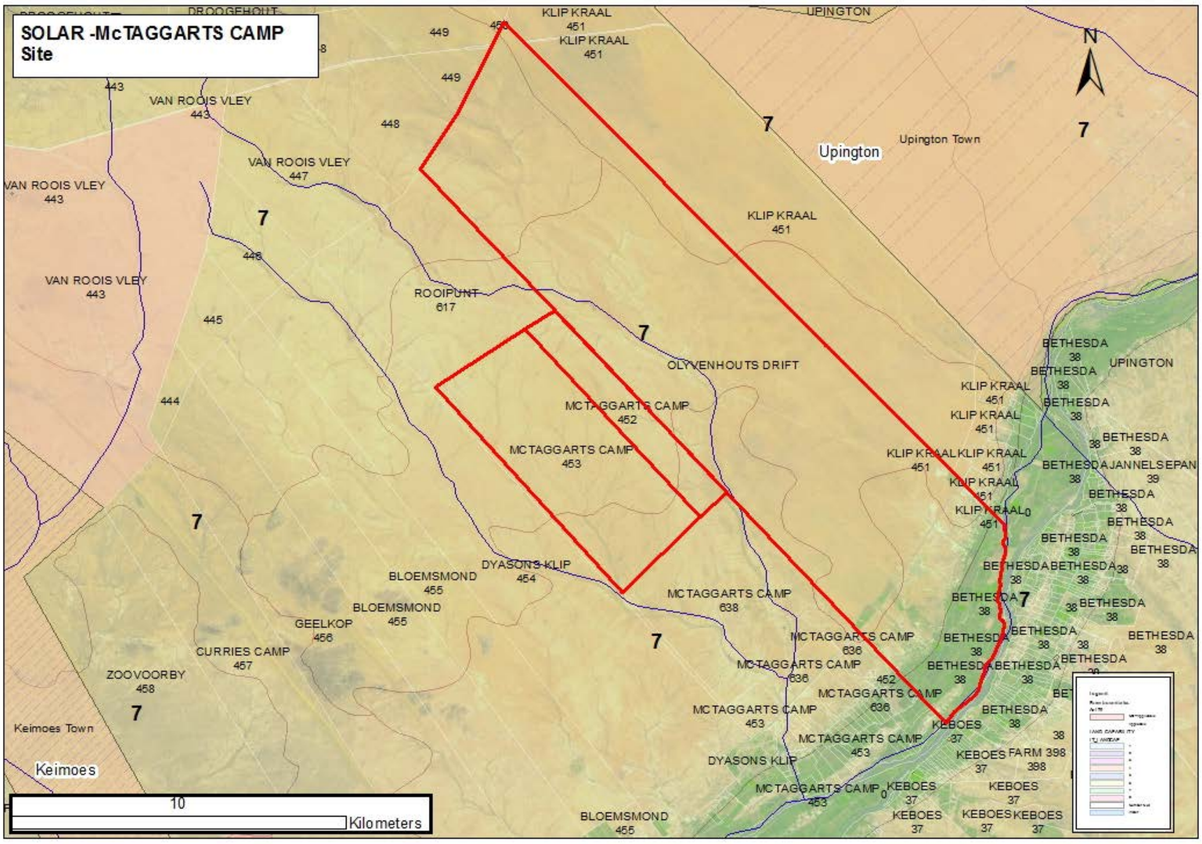


Figure 50 - Other solar projects in the vicinity

Overall, 1 000 MW of CSP and 8 400 MW of PV facilities are planned to be allocated over the next twenty years, which will create a long-term demand for inputs to CSP and PV projects. Without doubt, the development of these projects offers notable opportunities to the national and local economies not only in terms of primary or direct impacts, but importantly in terms of opportunities for establishing local manufacturing and service industries. However, realisation of economies of scale is only possible if the demand created is for the same type of inputs, materials, and equipment. Given that the CSP and PV technologies are proprietary and differ from one developer to another, realisation of local manufacturing opportunities could be constrained by either the desire or technological needs to retain a supply chain independent on the competitors. Thus, it could lead to a situation that only a fraction of potential localisation opportunities are being realised. Such a situation could change drastically if the developers are assigned a greater share of projects and thus see it feasible to invest in establishing local capabilities, which will bring knowledge and skills to the national economy and aid in the development of the entire industry.

The Rooipunt Solar Power Park proposed to be established by the SolarReserve, is one of a few solar energy projects that the above-mentioned developer applies for the license. Other projects are all located in the Northern Cape and include inter alia:

- Humansrus CSP-Tower (100 MW) facility about 30 kilometres east from Postmasburg
- Arriesfontein Solar Park south-east of Danielskuil (100MW CSP and 225MW PV)
- Rooipunt CSP EIAr on the Portion 0 of the Farm Rooipunt 617 Gordonia RD

Based on the above, it shows that if projects applied by the developer are approved it would create sufficient incentive for the developer to invest in local capabilities and develop its local supply value chain that would support the construction of CSP and PV facilities using proprietary technology of SolarReserve, as well as businesses providing necessary spare parts and materials for the maintenance of these facilities.

Table 82: Evaluation of the impact on local manufacturing industry development

Impact:	Development of the local solar energy manufacturing industry		Positive
Before mitigations			
Probability	Low (2)	Scale	National (4)
Duration	Permanent (5)	Magnitude	High (8)
Significance	Medium (34)		
After mitigations			
Mitigations	• From government perspective: • Approval of as many developers project as possible to increase its demand for the same types of inputs and materials and thus incentivise to invest in local capabilities • From the developer's perspective: • Commit to investment in the local capabilities and capacities if required thresholds for total capacity necessary are achieved/approved • Where possible engage in negotiations with other developers to co-invest in development of local capabilities with the purpose of reducing total costs of the project		
Probability	Low (4)	Scale	National (4)
Duration	Permanent (5)	Magnitude	High (8)
Significance	High (68)		

k) Evaluation of the impact associated with the sterilisation of land from agricultural potential

The development of the proposed facility will sterilise the land from agricultural potential, which will last until the closure of the project when the structures are disassembled and the land is rehabilitated. Currently, though the land where the Rooipunt Solar Power Park is proposed to be established is not used for any sustainable commercial activities. If cattle farming, for example, were practiced on site permanently, the losses would though be marginal due to the low agricultural potential of the land.

Table 83: Evaluation of the impact on agricultural potential of the site

Impact:	Sterilisation of land and loss of agricultural potential		Negative
Before mitigations			
Probability	Definite (5)	Scale	Site (1)
Duration	Long-term (4)	Magnitude	Low (4)
Significance	Medium (45)		
After mitigations			
Mitigations	• The construction of the facility should be done with a minimal impact on the natural environment • Recommendations by the agricultural specialists on the team should be taken into account and adhered to		
Probability	Definite (5)	Scale	Site (1)
Duration	Long-term (4)	Magnitude	Low (4)
Significance	Medium (45)		

l) Evaluation of the impact on sense of place

The sense of place is developed over time as the community embraces the surrounding environment, becomes familiar with its physical properties, and creates its own history. The sense of place is created through the interaction of various characteristics of the environment, including atmosphere, visual, aesthetics, climate, lifestyle, culture, and heritage. Importantly though it is a subjective matter and is dependent on the demographics of the population that resides in the area and their perceptions regarding trade-offs. Whilst a community living in poverty would be more accepting to the industrial development that would promise new employment opportunities, the more affluent residential area would most likely oppose to such intrusion as it would not be associated with any gains to that community.

Any rapid change occurring with respect to one or more of the characteristics defining the sense of place has a negative impact on it. Depending on the characteristics of the community though a change in one dimension would be less or more significant than a change in another. In the majority of cases, however, the most significant characteristics of the sense of place is determined by its aesthetics and specifically visual character of the area. Visual change is sudden and becomes more of a shock to the community than changes occurring for example with respect to climate or culture that occur over a longer period and which are less detectable.

The establishment of the proposed Rooipunt Solar Power Park will alter the environment that is defined by the boundaries of the visual impact and will have a negative impact on the sense of place experienced by households residing within the visually affected area. The biggest impact spatially will come from the CSP tower due to its height.

The biggest negative impact will be experienced by households residing within an eight (8) kilometre radius from the site. However the density of the population in this area is very small; thus, the effects on the sense of place within the high visual impact area will be marginal. However, due to the spatial extent of visual impacts, the negative change in the sense of place will extend to the residents of the nearby town of Upington and those living along the river. In addition to the visual effects, the households residing in these areas will also be affected by temporary increase in noise and traffic on the roads. Considering that another three solar facilities are proposed to be established in the vicinity of the Rooipunt site, the cumulative effect on households in Upington and along the river is expected to be notable. The remoteness of the site from the concentration of urban areas would minimise the significance of the negative effect; however the fact that visual disturbance will extend beyond the construction phase and remain until the end of the project's life makes the impact more important.

Table 84: Evaluation of the impact on sense of place

Impact:	Impact on the sense of place experience by local residents		Negative
Before mitigations			
Probability	Highly probable (4)	Scale	Local (2)
Duration	Long-term (4)	Magnitude	Moderate (6)
Significance	Medium (48)		
After mitigations			
Mitigations	• The mitigation measures proposed by traffic, visual, and noise specialists should be adhered to		
Probability	Highly probable (4)	Scale	Local (2)
Duration	Long-term (4)	Magnitude	Low (4)

Significance	Medium (40)

7.12.2.3 Operational phase assumption (impacts)

The Solar Park is expected to be in operation for 30 years, where the CSP component (Phase 4) will run for the entire duration of this period and each phase of the PV component for 25 years only. The following operating expenditure information is used in the assessment:

- Each 75 MW PV component:
  - Electricity generated – 142 880 MWh per annum
  - Annual revenue - R400.1 million in 2011 prices (assuming R2.80/kWh)
  - Annual operating expenditure - R28.4 million in 2011 prices of which R2 million will be spent on imported parts
  - Included in the operating expenditure is the annual salary and wage bill associated of R8.4 million per annum in 2011 prices
  - Local employment – 35 people, of which two-thirds will be unskilled and semi-skilled workers as ground workers, security guards, etc
- CSP component:
  - Electricity generated – 482 454 MWh per annum
  - Annual revenue - R1 114.5 million in 2011 prices (assuming R2.31/kWh)
  - Annual operating expenditure – R160.4 million in 2011 prices of which R18.2 million will be spent on imported parts
  - Included in the operating expenditure is the annual salary and wage bill associated of R13.3 million per annum in 2011 prices
  - Local employment – 42 people, of which two-thirds will be unskilled and semi-skilled workers as ground workers, security guards, etc
- In total, the Solar Park will:

- Generate about 911 004 MWh of electricity per annum and R2 314.7 million (2011 prices) of annual revenue
- Require operating expenditure of R245.6 million (2011 prices), of which R221.5 million will be spent locally
- Employ 152 people, of which 147 will be South African citizens
- Spend R38.6 million per annum (2011 prices) on salaries and wages for local employees

The evaluation of the impact of the proposed project during its operational phase is presented in the following sub-sections. The information under analysis is the average impact that can be expected on an annual basis during the operational life of the facility.

7.12.2.4 Operational phase impacts

a) Evaluation of the impact on production

The proposed project is expected to generate, on average, a turnover of R2 314.7 million per annum given that it is operating at full capacity. This turnover translates into the direct impact of the plant operations on regional business sales which, through economic spin-offs, generates a total impact of R2 745.7 million in 2011 prices. This means that the proposed project will have a positive effect on the national economy. A portion of new business sales to be generated by the facility on an annual basis will be created in the local economy, which would provide a positive stimulus for its development.

An evaluation of the net impact on production during the operational phase is provided in **Table 94**. As opposed to the construction phase, the net impact of the project during the operational phase with regard to production is of high significance. This is mainly attributed to the magnitude and duration of the impact.

Table 85: Evaluation of the impact on production over one year of full operational capacity

Impact:	Increase in production during operation		Positive
Before mitigations			
Probability	Highly probable (4)	Scale	Local (4)
Duration	Long-term (4)	Magnitude	High (8)
Significance	High (64)		
After mitigations			

Mitigations	• The Solar Park should be encouraged to procure materials, goods and products required for the operation of their businesses from local suppliers to increase the positive impact in the local economy as far as possible. In general terms, however, this will not change the total impact and will only change the distribution of the impact; as a result, the weighting for the impact will not change after mitigations.		
Probability	Highly probable (4)	Scale	Local (4)
Duration	Long-term (4)	Magnitude	High (8)
Significance	High (64)		

b) Evaluation of the impact on GDP-R during the operational phase

The net direct impact of the project on GDP-R is R1 840.5 million per annum. The biggest portion of this will be accounted for in the province where the developer's headquarters is to be located. However, some, and especially the GDP-R portion generated through salaries and wages paid to the permanent employees, will be retained in the local economy increasing it size. Through production and consumption induced impacts, the project will further stimulate the creation of R279.9 million of value added. Some of this value added will also be retained in the locally economy especially through spending of earnings by directly affected households.

Table 86: Evaluation of impact on the GDP-R (operational phase)

Impact:	Increase in GDP-R during operation		Positive
Before mitigations			
Probability	Highly probable (4)	Scale	Local (4)
Duration	Long-term (4)	Magnitude	High (8)
Significance	High (64)		
After mitigations			
Mitigations	• The facility should be encouraged to procure materials, goods, services and products required for the operation of their businesses from local suppliers to increase the impact on local and regional economies, without jeopardising its own efficiency and competitiveness.		
Probability	Highly probable (4)	Scale	Local (4)
Duration	Long-term (4)	Magnitude	High (8)
Significance	High (64)		

c) Evaluation of the impact on employment creation during the operational phase

During the operational phase about 147 people, excluding foreign labour, will be employed at the plant to oversee daily operations. Through indirect and induced effects, over 1 200 additional employment opportunities will be created in the economy. All direct employment opportunities will be created in the local economy, which will positively impact the employment situation in the area. Some of the indirect and induced employment positions will also be established in the local area largely through the increased demand for households' goods and services.

Table 87: Evaluation of the impact on employment during operations

Impact:	Creation of sustainable employment opportunities		Positive
Before mitigations			
Probability	Highly probable (4)	Scale	National (4)
Duration	Long-term (4)	Magnitude	Low (4)
Significance	Medium (48)		
After mitigations			
Mitigations	• Where possible, the local labour should be considered for employment to increase the positive impact on the local economy, i.e. the Kai !Garib and //Khara Hais LMs. However, this will not impact on the total employment opportunities created by the Solar Park and will therefore not change the weights of the impact.		
Probability	Highly probable (4)	Scale	National (4)
Duration	Long-term (4)	Magnitude	Low (4)
Significance	Medium (48)		

d) Evaluation of impact on standard of living

Households in both local and national economy are expected to benefit from the proposed Rooipunt Solar Park with over R160 million in 2011 prices to be paid through salaries and wages. This will increase in purchasing power of the households and will allow them to improve their standard of living. This will have a positive impact on health and education levels of the members of these households, which has a positive effect on productivity and employability of the existing or future labour force.

Table 88: Evaluation of the impact on standard of living

Impact:	Increase in household earnings during operations		Positive
Before mitigations			
Probability	Highly probable (4)	Scale	National (4)
Duration	Long-term (4)	Magnitude	Low (4)
Significance	Medium (48)		
After mitigations			
Mitigations	In order to increase the income retention in the local economy, local SMMEs should be employed to provide selected services, such as cleaning, security, transportation, etc.		
Probability	Highly probable (4)	Scale	National (4)
Duration	Long-term (4)	Magnitude	Low (4)
Significance	Medium (48)		

e) Evaluation on the impact on government revenue

The Solar Park plant, if established, would generate R196.1 million per annum of government revenue. Considering the total budget of government though, this amount is small; however, given that it will be generated by government throughout the lifespan of the project, the impact will be of a moderate significance.

Table 89: Evaluation of the impact on government revenue (operational phase)

Impact:	Increase of government revenue during operation		Positive
Before mitigations			
Probability	Highly probable (4)	Scale	National (4)
Duration	Long-term (4)	Magnitude	Low (4)
Significance	Medium (48)		
After mitigations			
Mitigations	No mitigations measures		

f) Evaluation of the impact on housing and services in the local area

The proposed facility is expected to create 147 additional new jobs, of which 142 will be created for South African citizens. As mentioned earlier, about 25 jobs at each phase of the PV component and 12 jobs at the CSP component will require semi-skilled and unskilled workers. Given the current unemployment rate in the Kai !Garib and //Khara Hais municipalities, it can be safely estimated that these positions could be filled by locals. The rest, though, might require attraction of workers from other parts of the Province and most likely the country.

With every new household brought to the area, the demand for affordable rental and permanent housing options will grow. The housing situation in the municipalities was not different to that observed in the country. On average, one out of five households in the primary study area did not live in formal dwellings and many of those who did not line in formal dwelling in Kai !Garib lived in hostels on farms. The fact that the //Khara Hais Municipality had a moratorium on selling land for the past few years, also negatively affected on the supply of new housing options for middle to high income groups. All of the above suggests that finding housing for households of the Solar Plant's workers who come from outside the area might be challenging in the short-term. Given that the moratorium was planned to be lifted at the end of 2011 and the area surrounding Upington has been designated for the establishment of a 1GW Solar Park (initial phase) as well as the plans for increasing industrial area in and around the Upington International Airport, it can be expected that building of new residential spaces is on its way. It will be important to ensure though that the local authorities are aware of the potential future demand for housing and associated services that will be created by the proposed Rooipunt Solar Park.

Table 90: Evaluation of the impact on housing and basic services during the operational phase

Impact:	Increase in demand for housing and basic services during operations		Negative
Before mitigations			
Probability	Medium probability (3)	Scale	Local (2)
Duration	Short-term (2)	Magnitude	Low (4)
Significance	Low (24)		
After mitigations			
Mitigations	• The developer should consider providing assistance to its workers with respect to finding suitable rental housing and permanent housing in the area. • The developer should also inform the municipalities (Kai !Garib and //Khara Hais) of the demand for housing and social services (health facilities, schools, crèches, water and electricity services, etc.), so that the municipality can plan accordingly.		
Probability	Medium probability (3)	Scale	Local (2)

Duration	Short-term (2)	Magnitude	Minor (2)
Significance	Low (18)		

g) Social benefits derived by local communities during operations

The proposed Solar Park will contribute about R23.1 million on an annual basis towards social development projects. This is considered to be a significant investment in the context of the Kai !Garib local economy, production of which is valued at R3 717 million in 2011. The allocations towards social projects could be directed at the upgrade and development of infrastructure that is of the highest priority for the local municipality, which will improve the service provision and standards of living of the local community. It could also be used for skills development and training, in the form of sponsored apprenticeships, bursaries, etc. The evaluation of the impact in the context of the local economy is presented in the next table.

Table 91: Evaluation of social benefits derived from the project's local investment

Impact:	Social benefits derived from the project by local communities		Positive
Before mitigations			
Probability	Highly probable (4)	Scale	Local (2)
Duration	Long-term (4)	Magnitude	High (8)
Significance	Moderate (56)		
After mitigations			
Mitigations	• A three-year social development programmes should be devised by the developer throughout the project's lifespan • The plan should be developed through consultation with local authorities and local communities to identify community projects that would result in the greatest social benefits • A plan should be reviewed on an annual basis and where necessary updated		
Probability	Highly probable (4)	Scale	Local (2)
Duration	Long-term (4)	Magnitude	High (8)
Significance	Medium (56)		

h) Skills development during operations

Establishing and operating the plant will result in improved skills amongst the staff as the facility will include a training centre and a certain percentage of its operating expenditure will be allocated to training and development. On-the-job training is a key element of the staff development many of the required skills during the operational phase will be taught to staff through day-to-day operations. It is also expected that the training programme implemented at the Solar Park will reduce the necessity to acquire foreign expertise in the future. Thus, potentially all employment positions created by the facility will be allocated to South Africa's residents.

Table 92: Evaluation of impact on skills development during operations

Impact:	Skills development during operations		Positive
Before mitigations			
Probability	Highly probable (4)	Scale	Local (2)
Duration	Long-term (4)	Magnitude	Moderate (6)
Significance	Medium (48)		
After mitigations			
Mitigations	• The developer should ensure that the opportunities provided for skills development offered at the centre are equitable and benefit the previously disadvantaged people.		
Probability	Highly probable (4)	Scale	Local (2)
Duration	Long-term (4)	Magnitude	Moderate (6)
Significance	Medium (48)		

i) Closure phase impacts

Upon the expiry of the Rooipunt Solar Park's lifespan, the facility would be disbanded, and where necessary, ground will be rehabilitated in an attempt to return it to the pre-project conditions. This means that all impacts that took place during the operational phase will cease to exist. At the same time, though, spending on the disassembly of the components and rehabilitation of land will increase the demand for construction services and other industries, thus stimulating economic activity in the local area and in the country albeit over a temporary period. Estimates of the costs and construction crew involved in the closure activities at this stage though are not available.

Socio-economic impacts stimulated by the expenditure during the closure phase are expected to be similar to those that take place during the construction phase. They will also be temporary; however, they will most likely require a considerably smaller expenditure than that observed during the construction phase; thus in quantitative terms it will be a fraction of what was observed during operations. It is expected that the following socio-economic impacts would ensue during the closure phase as a result of project spending:

- Temporary increase in production and value added of the construction sector and its supporting industries due to the demand for demolishing and rehabilitation services, as well as in industries providing goods and services to households due to the consumption induced effects stimulated by the closure expenditure
- Temporary increase in employment due to direct, indirect and induced effects stimulated by the closure of the project
- Temporary increase in income of households that benefit from the direct or indirect activities
- Temporary increase in government revenue though direct and indirect taxes that will need to be paid by the construction companies involved in the disassembly of the facility and rehabilitation

The following table outlines the evaluation of the socio-economic impacts expected to take place during the closure phase. Since these types of impacts are similar to those occurring during construction, the same mitigation measures would be applied to these impacts as those proposed for the construction phase. It is however, foreseen that given the minor magnitude expected with the majority of these impacts and that complete elimination of negative impacts is not possible, the significance ratings will remain the same for the after mitigation situation.

Table 93: Evaluation of impacts during closure - same before and after mitigations

Impact during closure	Nature	P	D	S	M	Total	Rating
Impact on production	Positive	3	2	4	4	30	Moderate
Impact on GDP	Positive	3	2	4	4	30	Moderate
Impact on employment	Positive	3	2	4	2	24	Low
Impact on standard of living	Positive	3	2	4	2	24	Low
Skills development impacts	Positive	3	5	4	2	33	Moderate
Government revenue impact	Positive	3	2	4	2	24	Low
Impacts on crime and social conflicts	Negative	3	2	2	2	18	Low
Impacts on social and economic infrastructure	Negative	3	2	2	2	18	Low

7.12.3 Conclusion

The proposed Rooipunt Solar Park is to be located in the Kai !Garib Local Municipality that borders with the //Khara Hais Local Municipality and which is about 25 kilometres from Upington in the Northern Cape. The economy of //Khara Hais is more vibrant than the economy of !Kai Garib largely due to the infrastructural development in the area (the Upington International Airport, hospitals, etc.) and the location of government offices in Upington. The !Kai Garib population is highly reliant on the agricultural activities that generate the majority of the local economy's GDP-R and provide for the greatest number of employment opportunities. This sector though is highly sensitive to changes in the weather patterns, which makes it an unstable economy. Thus any diversification of the local economic activities would reduce the dependency of the !Kai Garib economy on the local agriculture and aid the employment and economic stability in the area.

The proposed Rooipunt Solar Park is expected to aid in this by increasing the size of the local utilities sector and providing additional sustainable employment opportunities for the local labour force that are not likely to be affected by any exogenous factors. The establishment of the Rooipunt Solar Park would not only contribute to the growth of the local economy, but would also increase the size of the national economy through various spill over effects during all stages of the project's lifecycle and specifically during construction.

It is estimated that the construction of the Rooipunt Solar Park will generate R6 214.5 million in value added (2011 prices) and create 26 999 FTE person-years in the country. Its operations will increase the national economy by R2 120.2 million in 2011 prices and will support 1 378 FTE positions for the entire operating period. The local economy alone will see the creation of a minimum of 147 new employment opportunities during that period. Moreover, the project will allocate about R23.1 million per annum towards social development projects in the local area, which could notably improve the local communities' standard of living. From the strategic perspective, the proposed facility coupled with other developments proposed by SolarReserve and other companies offers the opportunity for the establishment of an entire new high-tech industry, focusing on the manufacturing of components required for CSP and PV projects.

Aside from the positive impacts, the project will also lead to negative effects. The establishment of the facility will sterilise the land from the agricultural potential for a long-term, but due to the low grazing capacity the impact will be relatively small. The negative impacts that raise the most concern though include possible increase in crime, social conflicts, pressure on social and economic infrastructure, aggravation of the housing situation in the municipality, and loss of sense of place. Considering that there are at least three other projects proposed to be established in the vicinity of the Rooipunt site, the extent of these negative effects could significantly increase.

Most of the negative impacts can be successfully mitigated, though, especially if it is done in partnership with local communities, local government and other businesses in the area. However, even without mitigations the positive socio-economic benefits that are expected to ensue from the development of all phases or one phase only will outweigh the negative impacts that can take place during the life of the project. Thus, from the socio-economic perspective the proposed project is highly recommended. The developer though should take the proposed measures to enhance the positive impacts and reduce the negative impacts into account.

Table 94: Summary of impact evaluation

Impacts		Nature	P	D	S	M	S	Interpretation		
							Total	Low	Med	High
Impact during construction										
Impact on balance of payment	Before	Negative	4	2	4	4	40		M	
	After		None							
Impact on production	Before	Positive	4	2	4	8	56		M	
	After		4	2	4	8	56		M	
Impact on GDP	Before	Positive	4	2	4	8	56		M	
	After		4	2	4	8	56		M	
Impact on employment	Before	Positive	4	2	4	8	56		M	
	After		4	2	4	8	56		M	
Impact on standard of living	Before	Positive	4	2	4	8	56		M	
	After		4	2	4	8	56		M	
Skills development impacts	Before	Positive	3	5	4	4	39		M	
	After		3	5	4	6	45		M	
Government revenue impact	Before	Positive	4	2	4	4	40		M	
	After		None							
Increased levels of crime and social conflicts	Before	Negative	4	2	2	6	40		M	
	After		3	2	2	4	24	L		
Impact on economic and social infrastructure	Before	Negative	4	2	2	6	40		M	
	After		4	2	2	2	24	L		
Potential to develop local manufacturing industry	Before	Positive	2	5	4	8	34		M	
	After		4	5	4	8	68			H

Impacts		Nature	P	D	S	M	S Total	Interpretation Low	Med	High
Impact on sense of place	Before	Negative	4	4	2	6	48		M	
	After		4	4	2	4	40		M	
Impact associated with sterilisation of agricultural land	Before	Negative	5	4	1	4	45		M	
	After		5	4	1	4	45		M	
Impacts during operations										
Impact on production	Before	Positive	4	4	4	8	64			H
	After		4	4	4	8	64			H
Impact on GDP	Before	Positive	4	4	4	8	64			H
	After		4	4	4	8	64			H
Impact on employment	Before	Positive	4	4	4	4	48		M	
	After		4	4	4	4	48		M	
Impact on standard of living	Before	Positive	4	4	4	4	48		M	
	After		4	4	4	4	48		M	
Skills development impacts	Before	Positive	4	4	4	4	48		M	
	After		4	4	4	4	48		M	
Government revenue impact	Before	Positive	4	4	4	4	48		M	
	After		None							
Impact on housing and services provision	Before	Negative	3	2	2	4	24	L		
	After		3	2	2	2	18	L		
Social benefits to local communities	Before	Positive	4	4	2	8	56		M	
	After		4	4	2	8	56		M	
Skills development impacts	Before	Positive	4	4	2	6	48		M	
	After		4	4	2	6	48		M	
Impacts during closure										
Impact on production	Before	Positive	3	2	4	4	30		M	
	After		3	2	4	4	30		M	
Impact on GDP	Before	Positive	3	2	4	4	30		M	

Impacts		Nature	P	D	S	M	S Total	Interpretation Low	Med	High
	After		3	2	4	4	30		M	
Impact on employment	Before	Positive	3	2	4	2	24	L		
	After		3	2	4	2	24	L		
Impact on income	Before	Positive	3	2	4	2	24	L		
	After		3	2	4	2	24	L		
Skills development impacts	Before	Positive	3	5	4	2	33		M	
	After		3	5	4	2	33		M	
Government revenue impact	Before	Positive	3	2	4	2	24	L		
	After		None							
Increased levels of crime and social conflicts	Before	Negative	3	2	2	2	18	L		
	After		3	2	2	2	18	L		
Impact on economic and social infrastructure	Before	Negative	3	2	2	2	18	L		
	After		3	2	2	2	18	L		

Note: P – Probability, D – Duration, S – Scale, M- Magnitude, S – Significance

7.13 TOURISM IMPACTS

7.13.1 Terms of Reference

Future roomnight demand in a specific market segment, for a given area, can be projected based on levels of current roomnight demand and forecasts of future demand growth, taking into account past and present growth trends.

A comparison of future supply and demand levels yields a projection of average occupancies for the relevant market as a whole. Where the projected occupancy levels exceed expected reasonable annual average room occupancies for accommodation establishments, the extent of excess demand can be used to indicate the total number of additional rooms that the projected demand could support. In order to determine net impact of the project from the perspective of tourism products, the number of additional rooms that could possibly be developed taken into account the project, should be compared to the number of additional rooms that could be developed in the absence of the project. In other words, tourism demand will grow in the absence of the project and we need to subtract this growth to isolate the growth in demand due to the project.

7.13.2 Impact Assessment and Identification

Figure 51 illustrates the current tourism facilities located within the tourism assessment area. The facilities highlighted in turquoise are the ones expected to be the most impacted on by the proposed Solar Park.

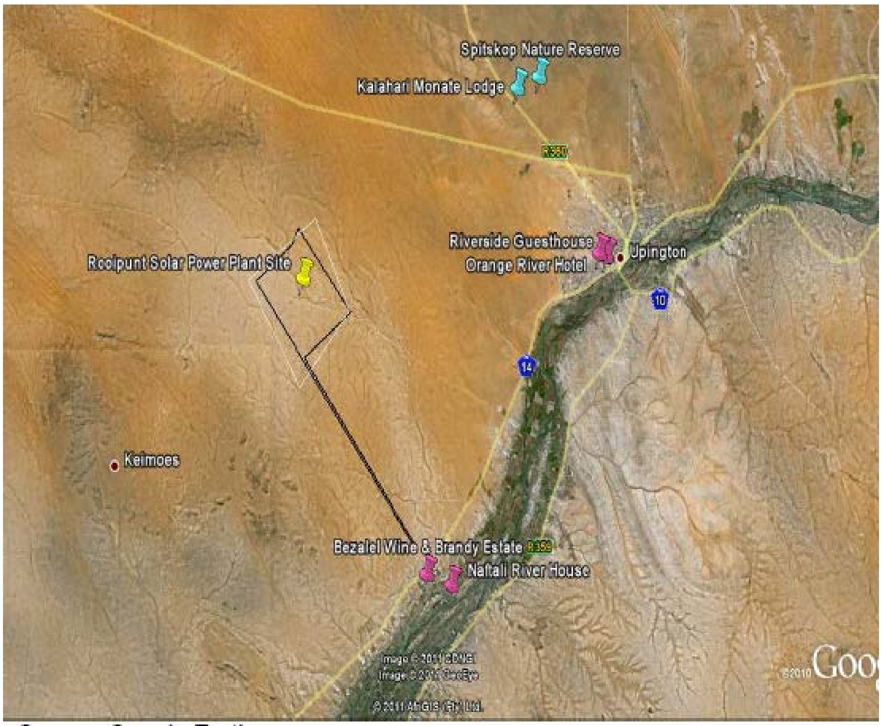


Figure 51 – Tourism Facilities in the vicinity

a) Spitskop Nature Reserve

The Spitskop Nature Reserve is located approximately 20km north-west from the proposed Rooipunt Solar Power Park, project site. This is the tourism facility currently within the tourism assessment area, expected to be the most impacted on by the proposed Solar Power Park. The Spitskop Nature Reserve is 5,641 hectares in size and entry into the reserve is R40.00 per adult and R20.00 per child. Unfortunately the owners of the reserve do not keep accurate records regarding the number of visitors the Nature Reserve receives annually and without the visitor numbers, the expected negative impact cannot be quantified. The biggest negative impact from the proposed Solar Power Park on the Spitskop Nature Reserve is expected to be the visual impact of the Plant. However, according to the owners, they believe that the Solar Power Park will not have a negative impact on their visitors and in actual fact they believe that the Rooipunt Solar Power Park will be good for tourism in the Upington area. The Spitskop Nature Reserve offers tourists a unique game viewing experience though their telescope which is located on top of Spitskop Hill within the Reserve

b) Kalahari Monate Lodge

Kalahari Monate Lodge is Spitskop Nature Reserve's accommodation offering and is located across the street from the Nature Reserve. Kalahari Monate Lodge consists of 6 self catering chalets and 43 caravan and camping sites. The rates for the self catering chalets range from R350.00 per night to R850.00 per night for the entire unit, depending on the number of guests in the chalets. The rates for the camping and caravan stands are R85 per person per night. A portion of the Lodge's views are directly in line with the proposed Rooipunt Solar Power Park project site. However interviews with the Lodge's owners revealed that they do not perceive the Solar Park to have a negative impact on their operations and indeed they feel very positive about the development, stating that they expect the Solar Power Park to increase the number of contract workers who make use of Kalahari Monate Lodge and thus increase their business levels.

c) Riverside Guest House

Riverside Guest House is situated approximately 19km east from the proposed Rooipunt Solar Park. Riverside Guest House has five (5) rooms and can accommodate 10 people in total. The guest house has a farm atmosphere and is situated just outside of Upington and is accessible via the N14.

d) Orange River Hotel

The Orange River Hotel is located approximately 20km east from the proposed Rooipunt Solar Park site. The hotel has a total of 10 rooms. Rates are R300.00 per person for a single room per night and R250.00 per person for a double room per night. This rate does not include breakfast. Interviews with the hotel staff revealed that 90% of the guests staying at the hotel are in Upington for business. The business travelers tend to be mostly employees of the Municipal Departments and thus the majority of the guests staying at the hotel are from South Africa. Business travelers stay an average of 1 week at the hotel. Only 10% of the guests staying at the hotel are visiting Upington for leisure purposes. These leisure guests tend to only stay for a night or two and are usually on-route to the Kalagadi National Park.

As a result of this guest profile, the hotel tends to be busy during the week and have an annual average occupancy of 60%.. The picture was taken in the direction in which the proposed Rooipunt

Solar Park is situated. The Orange River Hotel is also situated on the edge of Upington's industrial area and as. Again based on the lack of leisure tourism demand in the area, it is possible that the development of the Solar Power Park could have a positive impact on the occupancy levels of the hotel.

e) Naftali River House

Rekopane Estate is one of South Africa's leading grape exporters. No wine is produced by the Rekopane Estate, but there is a wedding venue, a rose and herb shop and the Naftali River House situated on the Estate. Naftali River House is situated approximately 18km south-east from the Rooipunt Solar Park Site and 25km outside of Upington. Naftali River House is a 1 bedroom self catering cottage which can accommodate a maximum of 4 guests (2 adults and 2 children). The rates are R350 per person per night, including breakfast. Based on the interview with the product owners, Naftali River House mostly accommodates the clients and reps of Rekopane Estate. These guests tend to stay for a week at a time. On weekends, the cottage is also used to accommodate wedding couples getting married on Rekopane Estate. The annual average occupancy of the self catering cottage is around 60%. Naftali River House is located on the banks of the Orange River on the opposite side of the N14. It is our believe that the proposed Solar Power Park will have no or very little impact on the Naftali River House or the wedding venue, as the Solar Plant will have no impact on the views offered by Rekopane Estate.

f) Bazalel Wine and Brandy Estate

Bazalel Estate is located approximately 27km from the proposed Rooipunt Solar Power Park, however this distance is measured along the road and thus the farms is still situated within the tourism assessment area if the direct distance been the farm and the proposed site is considered.

Currently the Bazalel Wine and Brandy Estate offers cellar tours with wine and brandy tasting experiences. There is also a wedding and conference venue situated on the Estate, but no accommodation. According to the interview with the owner, the Estate has a constant string of business, with at least 10 visitors per day (excluding conferences and weddings). During the summer months the estate can host at least 1 wedding every weekend. The only concern raised during the interview in connection to the proposed Solar Park, was the expected increase in traffic along the N14. Based

g) Greater Upington Area

Business tourism is the main driver of tourism bednights spent in Upington. Based on information received from the Socio-Economic study, the Solar Power Park is expected to create in the range of 300-600 in total jobs during the construction period (this figure will depend on the construction period and the final design of the Solar Power Park. However, not all these contract employees will qualify as business tourist as they will either be employed from within the local area or these employees will be accommodated within the envisioned temporary construction camp that will be located within the proposed Rooipunt Solar Plant site. Only a very small amount of contract employees will be travelling to and from the construction site and would then require accommodation within the Upington area (estimated at a proximately 200 management staff, depending on the construction phase final timelines and roll out plan).

Once the Solar Power Park is operational between 50 to 100 people could be employed at the site, depending on the final plant design. However, once again most of these employees will not qualify as business tourists as they will be employed from within the local area or if not, will be encouraged to relocate to the Upington area. It is expected that once the Solar Power Park is operational, only SolarReserve employees will visit the site and is expected to travel in groups of 2-10 people, travelling every 2 months (thus 6 times per year) and staying for 1-2 nights.

These predicted employment levels is expected to have a positive impact on the surrounding tourism industry as the Rooipunt Solar Plant site is located in close proximity to the tourism centre of Upington. There are a large number of accommodation facilities (bed and breakfasts, hotels, and guesthouses) available in the Upington area and based on the interviews conducted with the tourism product owners in the area, it is expected that the presence of the plant would have a positive impact on the surrounding accommodation sector by increasing the average occupancies in the area.

h) Potential Impact on the Future Development of the Tourism Industry in Upington

The closest sites with tourism potential in the area are the wine farms that run along the N14 from Upington. The Orange River Wine Cellars (situated approximately 30km from the proposed development site) and Bazalel Wine and Brandy Estate are already operating tours. According to the Kai !Garib Municipality's Tourism Department, the other farmers in the area are not considering developing their wine farms into tourist attractions which offer wine tours and tasting. However, if additional farmers do decide in the future to develop tourism facilities, it is our belief that the proposed Solar Plant will have a limited or no impact on their tourism potential as most of the wine farms are located on the Orange River side of the N14.

The owners of Bazalel Wine and Brandy Estate have indicated that they are planning to expand on their tours and offer heritage tours of the entire farm as well as develop accommodation facilities on the premises, however, these plans are in their infancy stages and needs to be finalized. Also, based on the limited impact expected on the current tourism facilities at Bazalel Estate, we do not believe that the Solar Power Park will have any impact on these planned expansions.

There are no game farms in the area and the quality of the land surrounding the Rooipunt Solar Power Park site makes the prospect of future game farm developments unlikely. The envisioned employment levels expected to be created by the Solar Power Park is expected to have a positive impact on the current accommodation sector in and around Upington, however the fact that several tourism facilities are already in existence within the 20km radius of the site means that the contribution of the plant to the development of new accommodation facilities is limited.

7.13.3 Analysis of Impact on Tourism Demand in the Study Area

7.13.3.1 Growth in Tourism Numbers

We estimated that the Upington area received around 72 901 tourists in 2011. **Table 95** illustrates our estimated growth rates in tourists numbers (by purpose of visit), assuming both the absence and inclusion of the Rooipunt development.

The management of the Riverside Guest House was not available for an interview, however, based on the lack of leisure tourists visiting the surrounding accommodation establishments, the guest houses' distance to the proposed Solar Park Site and the its location on the edge of Upington's industrial area, it is expected that the visual impact of the proposed Solar Park will not have a great impact on the guests visiting the Riverside Guest House. In contrast the Solar Park could potentially have a positive impact on the Riverside Guesthouse by providing additional business tourism demand.

Table 95: Projected Growth Rate by Purpose of Visit

	Purpose of Visit	Planning Phase		Phased Construction			Project Operation				
		Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Without Rooipunt	Business	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
	Transit (Leisure)	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
With Rooipunt	Business	3.5%	3.5%	4.0%	4.0%	4.0%	3.8%	3.8%	3.8%	3.8%	3.8%
	Transit (Leisure)	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%

a) Without the Inclusion of Rooipunt Development

During our research, we did not find any planned developments within the municipal area which will have a significant impact on tourism growth figures, thus we projected a stable growth of 3,5% and 2,0% respectively for business and leisure (transit) tourists for the area without inclusion of the Rooipunt project. Our projected growth rates for the various tourist markets were based on our knowledge of the tourism industry as well as our primary research in the study area.

b) With the inclusion of the Rooipunt Development

In the planning phase (Year 3-Year 4), the forecasted percentage growth remains the same for both business and leisure tourists, because construction of the Rooipunt plant is assumed to only start in Year 3. The forecasted growth in business tourists increased during the construction phase because there is expected to be an increase in employees who will need accommodation in the Upington area during the construction of the Rooipunt Power Plant. For the purpose of our analysis, we assumed that the PV and CSP will be built at the same time, resulting in the combined 4 year construction period.

However, not all of the employees will require formalized accommodation during the construction period as the bulk of people will be construction workers who will be housed in construction camps on or near the site. Based on the information received from SolarReserve, around 200 management staff and experts will require formalised (tourist) accommodation during the construction period. Once the construction is completed, the influx of people to the Upington area is expected to decrease again. The Rooipunt Solar Power Park is expected to operate with about 100 permanent staff members, who will live in the area permanently, and it is expected that the plant will receive approximately 10 visitors every two months, who will stay for a night or two.

Taking these assumptions into consideration, the projected growth in business tourists decreases again in Year 6 (the start of the operation phase) from 4,0% to 3,8%. The forecasted growth stays stable at 3,8% for the remainder of the plant’s operation. We did not inflate the projected 2,0% growth in leisure (transit) tourists, as the development of the project is not expected to have an impact on the leisure tourism in the Upington area. Based on the projected growth rates illustrated in **Table 95**, we estimated the annual tourist numbers to the Upington area, both with and without taking the Rooipunt development into consideration (**Table 96**).

Table 96: Projected Tourists Numbers, by Purpose of Visit

	Purpose of Visit	Planning Phase		Phased Construction			Project Operation				
		Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Without Rooi-punt	Business	50 623	52 395	54 229	56 126	58 091	60 124	62 228	64 406	66 661	68 994
	Transit (Leisure)	24 470	24 959	25 458	25 968	26 487	27 017	27 557	8 108	28 670	29 244
	Total	75 093	77 354	79 687	82 094	84 578	87 141	89 785	92 515	95 331	98 237
With Rooi-punt	Business	50 623	52 395	54 490	56 670	58 937	61 176	63 501	65 914	68 419	71 019
	Transit (Leisure)	24 470	24 959	25 458	25 968	26 487	27 017	27 557	28 108	28 670	29 244
	Total	75 093	77 354	79 949	82 638	85 424	88 193	91 058	94 022	97 089	100 263

Based on the calculations presented in **Table 96**, we can see that the development of the Rooipunt Solar Power Park is expected to have a positive impact on the number of tourists to the Upington area from Year 3 onwards.

7.13.3.2 Possible changes in Tourism Product Supply

a) Without the Rooipunt Development

In Annexure A, we projected the annual roomnight demand in the Upington area without taking the Rooipunt development into consideration. **Table 97**, illustrated this annual roomnight demand based on the annual tourists numbers shown in **Table 96**, an average length of stay of 3 nights and an average double occupancy percentage (i.e. the extent to which rooms/units are occupied by more than one person) of 32%.

Table 97: Projected Per Annum Roomnight Demand in the Study Area (without the Rooipunt Development)

	Planning Phase		Phased Construction			Project Operation				
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Annual Room-night Demand	180 999	186 449	192 073	197 875	203 862	210 039	216 414	222 992	229 780	236 786

Based on the annual roomnight demand for the area and the current daily room supply of 823 rooms/units, we estimated the annual average occupancy of the market to be 58% in 2011.Without taking the Rooipunt Solar Power Park into consideration, we determined the additional rooms/units the market could potentially develop in the future. These projected numbers of additional rooms/ units are shown in **Table 98**.

Table 98: Projected Additional Rooms/Units in the Study Area without the inclusion of the Rooipunt Development

	Planning Phase		Phased Construction			Project Operation				
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Addi-tional rooms/ units	0	0	0	0	0	0	0	0	25	25

As can be seen in **Table 98**, we have projected low levels of development within the study area, scattered over time. We estimate that around 50 rooms will be added into the market over the 10 year period. This is because we assume that future tourism demand will first be taken up by existing facilities (which operated at 58% occupancy levels during 2011) before new facilities will be developed. Following these calculations, we could determine the following annual occupancies for the accommodation market in the study area (**Table 99**).

Table 99: Projected Annual Occupancy Levels for the Study Area without the inclusion of the Rooipunt Development

	Planning Phase		Phased Construction			Project Operation				
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Annual Occu-pancies	60%	62%	64%	66%	68%	70%	72%	74%	74%	74%

b) Including the Rooipunt Development

Table 100, illustrates the annual roomnight demand (when the Rooipunt development is taken into consideration) based on the following assumptions:

- all the 200 management staff will require paid tourist accommodation (e.g. guest houses, B&B rooms, selfcatering units etc.) during the 3-year construction phase.
- 10 additional tourists will travel to the Rooipunt Power Plant during the operational phase. It is assumed that these business tourists will stay an average of 2 nights and visit the plant every 2 months (i.e. 6 times a year).

Table 100: Projected Additional Roomnights in the Study Area with the inclusion of the Rooipunt Development

	Planning Phase		Phased Construction			Project Operation				
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Addi-tional Room-night Demand	0	0	73 000	73 000	73 000	120	120	120	120	120

Taking the projected annual roomnight demand calculated in **Table 97**into consideration, plus the additional roomnight demand as a result of the Rooipunt Development, the new annual roomnight demand in the study area is illustrated in **Table 101**

Table 101: Projected Annual Roomnight Demand in the Study Area with the inclusion of the Rooipunt Development

	Planning Phase		Phased Construction			Project Operation				
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Annual Room-night Demand	180 999	186 449	265 073	270 875	276 862	210 159	216 534	223 112	229 900	236 906

Based on the annual roomnight demand illustrated in **Table 100**, and the current room/unit supply in the study area (823 rooms/units), we then determined the additional unit/rooms which should be added to the market as well as the occupancy levels the market will be able to achieve when the Rooipunt Development is considered **Table 102**, summaries the projected additional room/ unit developments expected in the study area, taking consideration of both with and without the Rooipunt in Upington (with and without the inclusion of the Rooipunt Solar Power Park).

Table 102: Projected Additional Rooms/Units in the Study Area

	Planning Phase		Phased Construction			Project Operation				
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Without Rooipunt Develop ment	0	0	0	0	0	0	0	0	25	25
With Rooipunt Develop ment	0	0	0	150	0	0	0	0	0	0

From **Table 102**, we can see that when the Rooipunt Development is considered, the market will have to add 150 rooms in Year 4 to cater to the needs of the 200 management staff that will require tourist accommodation during the construction phase. This inclusion of a large amount of rooms/units all at once means that no real growth in room supply will be experienced within the rest of 10 year forecast period (Year 5-Year 10) in the market.

Our analysis indicates that the Rooipunt Solar Power Park will have a positive impact on the room/unit supply in the Upington area, however, because such a large number of rooms/units will be added to the market all at once, it will result in a type of oversupply in the area in which no new rooms/units will be added to the market until around Year 14. Summary on the Impact of the Rooipunt Solar Power Park Development on the Tourism Market in Upington

Without Rooipunt, there is a total growth in the market supply of 50 rooms, staggered from Year 5 – Year 10 and the market achieves an average annual occupancy percentage of 68% over the 10 year period. When the Rooipunt development is considered, there is a total growth in the market supply of 150 rooms however, this growth will happen all at once, resulting in no new rooms/units coming into the market until 2025. As is clearly visible for this analysis, the largest impact of the Rooipunt development on the tourism market in the Upington area will happen during the construction phase (Year 3-Year 5).

7.13.4 Results of Final Tourism Impact Assessment

Based on the findings of our scoping phase as well as the tourism demand and economic impact assessments completed above, we identified the following possible impacts of the Rooipunt Solar Power Park development on the surrounding tourism industry of Upington.

- Increase growth in tourist numbers to the study area
- Changes in growth of the accommodation product supply in the area
- Increase in tourism spend in the area
- Increase in employment opportunities in the area
- Impact on the tourism revenue of the Spitskop Nature Reserve
- Impact on the tourism revenue of the Kalahari Monate Lodge
- Impact on the tourism revenue of the Riverside Guesthouse
- Impact on the tourism revenue of the Orange River Hotel
- Impact on the tourism revenue of the Bezalel Wine and Brandy Estate
- Impact on the tourism revenue of the Naftali River House
- Increase tourism traffic along the N14

7.13.4.1 Increase growth in tourist numbers to the study area

Our study shows that the project will definitely result in stronger growth in overnight tourists to the Upington area, but this increase in growth will be limited to the short-term (5 years or less) as growth rates return to only slightly higher than standard growth levels after the construction phase of the project .Based on our primary research, our experience in the tourism industry and the assumptions provided to us in terms of the number of additional workers that would be involved in the construction and operation of the plant, we are certain that the increased growth in overnight tourists will definitely occur and that it will be beneficial (to the study area in light of economic development and job creation (thus the scale is a local impact). The magnitude of the impact is Moderate, as the increase in growth in overnight tourists to the area will only result in short- to medium term effects. We don't believe any mitigation measures such as tourism promotion, is available to increase the magnitude of the impact to HIGH, as it is not the responsibility of the Client to promote the Upington area as a tourist destination.

7.13.4.2 Changes in growth of the accommodation products supply

Because the growth in tourist numbers are mostly limited to the construction phase of the project (with tourism growth expectations reducing to close to normal growth levels during the operation phase), we believe that there will be a change in the accommodation products supply over the projected 10 year period. We expect that accommodation supply will increase with 150 rooms/units during the construction phase and then no additional rooms/units will be added to the market within the 10 year projection period. Thus there will be an overall growth in the tourist accommodation supply of the area of 150 rooms/units over the projected 10 year period. Because of this, we believe the overall growth in tourism products will be effected on the medium term. As with the increase in the growth in overnight tourists, we are certain that this impact will definitely occur and that it will be beneficial to the study area (on a local scale). The significance of the changes in the growth in tourism products is moderate, as the greatest impact will occur during the construction phase and even though there is an overall growth in the tourism supply the growth will occur all in one year.

7.13.4.3 Increase in tourism spend

We believe that the development of the Rooipunt Solar Power Park will definitely have an impact on the tourism spend; both in the study area and the greater Northern Cape area (i.e. the impact will be on a regional scale). We believe that the this positive impact will be over the long term, as the levels of business tourists will continue to increase as long as the Rooipunt Solar Power Park is operational. We believe the Rooipunt development will have a moderate impact on the economy and GDP contribution of the tourism industry in the study area and the greater Northern Cape Province.

7.13.4.4 Increase in employment opportunities

It is expected that the development of the Rooipunt Solar Power Park will definitely have a positive impact on the job opportunities; both in the study area and the greater Northern Cape area (i.e. the impact will be on a regional scale). We believe that the this positive impact will be over the long term, as the levels of business tourists will continue to increase as long as the Rooipunt Plant is operational. We believe the Rooipunt development will have a moderate impact on the job opportunities, and thus the economy and GDP contribution of the tourism industry in the study area and the greater Northern Cape.

7.13.4.5 Impact on the tourism revenue of Spitskop Nature Reserve

It is expected that there is a medium probability of the development having a significant impact on the revenue stream of the Spitskop Nature Reserve (i.e moderate magnitude), as any impact will mostly be limited to the construction phase of the project (i.e. over the short term). There is a possibility that the Rooipunt Solar Power Park could have a negative visual impact on the tourists visiting the Nature Reserve, however we believe this to be very unlikely. The owners of the nature reserve also believes that the Rooipunt Power plant will have a positive impact on the number of tourists who visit Upington for business and thus these tourists could be targeted to visit the Nature Reserve. We also believe that there is an opportunity to mitigate the possible negative impact. The Rooipunt Nature Reserve offers guests a unique game viewing experience through their telescope which is located on top of the Spitskop Hill within the Reserve. It is expected that tourists (and locals) might be interested in the Rooipunt Solar Power Park and will visit the Spitskop Nature Reserve in order to get a better view of the Plant through the Reserve’s telescope. By promoting the Spitskop telescope to interested parties (and other possible mitigation strategies), the probability of the Rooipunt development having an impact on the revenue of the Spitskop Nature Reserve will decrease to low and the magnitude of the possible negative impact could be reduced the low as well.

7.13.4.6 Impact on the tourism revenue of Kalahari Monate Lodge

It is expected that there is a medium probability of the development having a significant impact on the revenue stream of the Kalahari Monate Lodge (i.e moderate magnitude), as any impact will mostly be limited to the construction phase of the project (i.e. over the short term). There is a possibility that the Rooipunt Solar Power Park could have a negative visual impact on the tourists visiting the Kalahari Monate Lodge, however we believe this to be very unlikely. The owners of the Lodge also believes that the Rooipunt Power plant will increase the number of contractors and other business tourists who will need accommodation in Upington and they believe that this will then possibly increase the Lodge’s occupancy levels. We also believe that there is an opportunity to mitigate the possible negative impact, by reaching an arrangement between the Rooipunt management and the owners of Kalahari Monate Lodge that a portion of the 200 management staff could be housed at the Lodge for the duration of the 3-year construction period (thus securing a constant revenue stream for the establishment). Furthermore, it is possible that the two parties could sign a preferred supplier agreement, meaning that the expected 10 business tourists who will visit the Solar Plant every two months during the operational phase of the project, could stay at the Lodge, thus again securing a constant flow of revenue for the tourism enterprise. By implementing possible mitigation strategies as the ones mentioned here, the probability of the Rooipunt development having an impact on the revenue of the Lodge will decrease to low and the magnitude of the possible negative impact could be reduced the low as well.

7.13.4.7 Impact on the tourism revenue of Riverside Guesthouse

It is expected that due to the lack of leisure tourists to the Upington area and the Riverside Guesthouse's location just outside Upington's Industrial Area, that there is a low likelihood of the Rooipunt Solar Power Park to have a negative impact on the revenue of the Riverside Guesthouse (i.e. low magnitude). Any possible negative impact will only be during the construction phase, when there might be more noise in the area than usual (i.e. duration will be over the short term). It is also possible that any negative impacts could be mitigated by negotiating a preferred supplier agreement with the Rooipunt management to have the 10 visiting business tourists stay at the Riverside Guesthouse. By implementing any possible mitigation strategies, probability of the Rooipunt development having an impact on the revenue of the Riverside Guesthouse will decrease to improbable and the magnitude of the possible negative impact could be reduced the minor as well.

7.13.4.8 Impact on the tourism revenue of the Orange Rivier Hotel

It is expected that due to the high portion of business tourists staying at the hotel currently (90% of their total demand), the fact that the leisure tourists only make use of the hotel as a stopover destination and the hotel's location just outside Upington's Industrial Area, that there is a low likelihood of the Rooipunt Solar Power Park to have a negative impact on the revenue of the Riverside Guesthouse. In contrast we believe that there is a high probability that Rooipunt Solar Power Park will have a positive impact (i.e moderate magnitude) on the occupancy levels and thus the revenue of the Orange River Hotel over the long term as this is the largest tourist accommodation establishment located along the N14 and near the Rooipunt Development site.

7.13.4.9 Impact on the tourism revenue of the Naftali River House

Because the Naftali River House mostly accommodate the clients and the reps of the Rekopane Estate as well as the honeymoon couples who get married at the Rekopane Estate, we do not believe that the Rooipunt Development will have any positive or negative impact on the occupancy levels or revenue stream of the Naftali River House. Furthermore, we also believe that the Rooipunt Solar

Plant will have no impact on the views offered by Rekopane Estate, thus no impact is expected on the wedding venue either.

7.13.4.10 Impact on the tourism revenue of the Bazalel Wine and Brandy Estate

The Bazalel Wine and Brandy Estate does not include any accommodation offerings. The Estate offers cellar tours with brandy and wine tasting as well as a wedding and conference venue. As the Rooipunt Solar Power Park will not have an influence on the views or the tranquility offered by the Estate, we believe that there will be no impact (either positive or negative) on the revenue streams of the Bazalel Wine and Brandy Estate.

7.13.4.11 Increased tourism traffic along the N14

It is expected that there will be definite increase in tourism traffic along the N14, especially during the construction phase of the project, as more business tourists will be travelling from Upington to the development site. We believe that magnitude of this impact is moderate, as the significant increases in tourism traffic (we are only referring to the business tourists travelling and not the construction vehicles) is only expected during the construction phase of the project (i.e. short term). However, with mitigation measures such as accommodating the bulk of the construction workers on the actual site or very close to the site, the magnitude of the impact could be reduced to low. The potential tourism impact was calculated and depicted in **Table 103** below:

Table 103 Impact table summarising the significance of Tourism impacts

Potential Environmental Impacts	Criteria					PS	Significance		
	Nature	P	D	S	M	TOTAL	LOW	MOD	HIGH
Increase in the tourist numbers	Positive	5	2	2	6	50		M	
Changes in the accommodation supply	Positive	5	3	2	6	55		M	
Increase in tourism spend	Positive	5	4	3	6	65			H
Increase in employment opportunities	Positive	5	4	3	6	65			H
Impact on the tourism revenue of Spitskop Nature Reserve (without mitigate)	Positive	3	2	1	6	27	L		
Impact on the tourism revenue of Spitskop Nature Reserve (with mitigate)	Positive	2	2	1	4	14	L		
Impact on the tourism revenue of Kalahari Monate Lodge (without mitigate)	Negative	3	2	1	6	27	L		
Impact on the tourism revenue of Kalahari Monate Lodge (with mitigate)	Negative	2	2	1	4	14	L		

Potential Environmental Impacts	Criteria					PS	Significance		
	Nature	P	D	S	M	TOTAL	LOW	MOD	HIGH
Impact on the tourism revenue of Riverside Guesthouse (without mitigate)	Negative	2	2	1	4	14	L		
Impact on the tourism revenue of Riverside Guesthouse (with mitigate)	Negative	1	2	1	2	5	L		
Impact on the tourism revenue of Orange River Hotel	Positive	4	4	1	6	44		M	
Impact on the tourism revenue of Naftali River House	Neutral	0	5	1	2	0	No Impact		
Impact on the tourism revenue of Bazalel Wine and Brandy Estate	Neutral	0	5	1	2	0	No Impact		
Increased tourism traffic along the R31 (without mitigation)	Negative	5	2	2	6	50		M	
Increased tourism traffic along the R31 (with mitigation)	Negative	5	2	2	4	40		M	

7.13.5 Conclusion

This section provides an overview and our final conclusions for the EIA Phase of the Rooipunt Solar Power Park.

7.13.5.1 Tourism Industry in the Northern Cape

a) Summary of the Foreign Tourism Market in the Northern Cape

- The Northern Cape Province is the least visited Province in South Africa.
- In 2010, the Northern Cape Province only received 1.2% of the total foreign tourists to South Africa and only 0.8% of all the foreign bednights were spent in the Province.
- Foreign tourists visiting the Northern Cape Province tend to be repeat leisure tourists, who travel in small groups or as couples, making use of their own transport.

b) Summary of the Domestic Tourism Market in the Northern Cape

- The Northern Cape also receives the lowest share of domestic arrivals and revenues across all the provinces.
- In 2010, only 0,7% of all domestic trips were undertaken to the Northern Cape and only 1.1% of the total domestic spend was recorded in the Province.
- Kimberley and Upington are the two most visited cities in the Province.
- VFR is the main reason why domestic travelers visit the Northern Cape, followed usually by business or holiday.
- Most of the domestic visitors to the Northern Cape originate from within the Province, while no visitors from Limpopo visited the Province in 2010.
- Mpumalanga and the Western Cape are also important source markets.
- Domestic visitors to the Northern Cape tend to stay an average of 4 nights per trip.

7.13.5.2 Summary of the Tourism Profile in Upington

- Currently, Upington has 92 accommodation establishments, representing 823 rooms and 1 584 beds.

- Majority of visitors to Upington (between 66%) stay in the area for business purposes.
- The majority of business visitors tend to be from South Africa with the most being Government employees (such as Municipal employees, police employees or teachers), while the private sector businesses, such as the car manufacturing companies, tend to receive more foreign visitors.
- Business travelers tend to stay between 3-5 nights.
- A much smaller percentage of guests (between 34%) are in the area for leisure purposes.
- Of the leisure guests, VFR is the main reason why they visit the Upington area and these guests tend to be domestic South African visitors who stay on average only for a weekend.
- There are only a very small percentage of guests who actually come to Upington for holiday, but the remaining leisure guests are only passing through Upington on their way to Kgalagadi National Park and only stay for 1 night.
- Because of the high levels of domestic business and VFR guests, the tourism industry in Upington is mostly made up of 67% domestic travelers and 33% foreign guests.
- Foreign tourists tend to come from Europe and the UK.
- Domestic travelers tend to originate mostly from within the Northern Cape, Gauteng or Mpumalanga.
- Because of the high level of business tourism in the area, the Upington tourism industry tend to be busier during the week than the weekends and have seasonality slumps during the school holidays
- However, during the school holidays and the December eriod, the transit leisure business tends to pick up.

7.13.5.3 Summary of the Tourism Impact Assessment of the Rooipunt Solar Power Pant

The final identified possible impacting factors of the Rooipunt Development can be summarised as follows:

- Increase growth in tourist numbers to the study area- PS of 50- Moderately positive impacting factor

- Changes in growth of the accommodation product supply in the area- PS of 55- Moderately positive impacting factor
- Increase in tourism spend – PS of 65- Highly positive impacting factor
- Increase in employment opportunities- PS of 65- Highly positive impacting factor
- Impact on the tourism revenue of Spitskop Nature Reserve– PS of 27 without mitigation and a PS of 14 with mitigation – Low impacting factor
- Impact on the tourism revenue of Kalahari Monate Lodge– PS of 27 without mitigation and a PS of 14 with mitigation – Low impacting factor
- Impact on the tourism revenue of Riverside Guesthouse– PS of 14 without mitigation and a PS of 5 with mitigation – Low impacting factor
- Impact on the tourism revenue of Orange River Hotel– PS of 44- Moderately positive impacting factor
- Increase tourism traffic along the N14- PS of 50 with mitigation and a PS of 40 with mitigation- Moderate impacting factor

7.14 SENSITIVITY MAPPING

The sensitivity map depicted in **Figure 52** and **Figure 53** illustrates the enviromentally sensitive areas found within the project site boundaries. On site components were regarded as of higher signifiance thus the restriction of the sensitivity map to on site impacts. Specific attention was paid to wetlands, biodiversity aspects, heritage sites…etc.

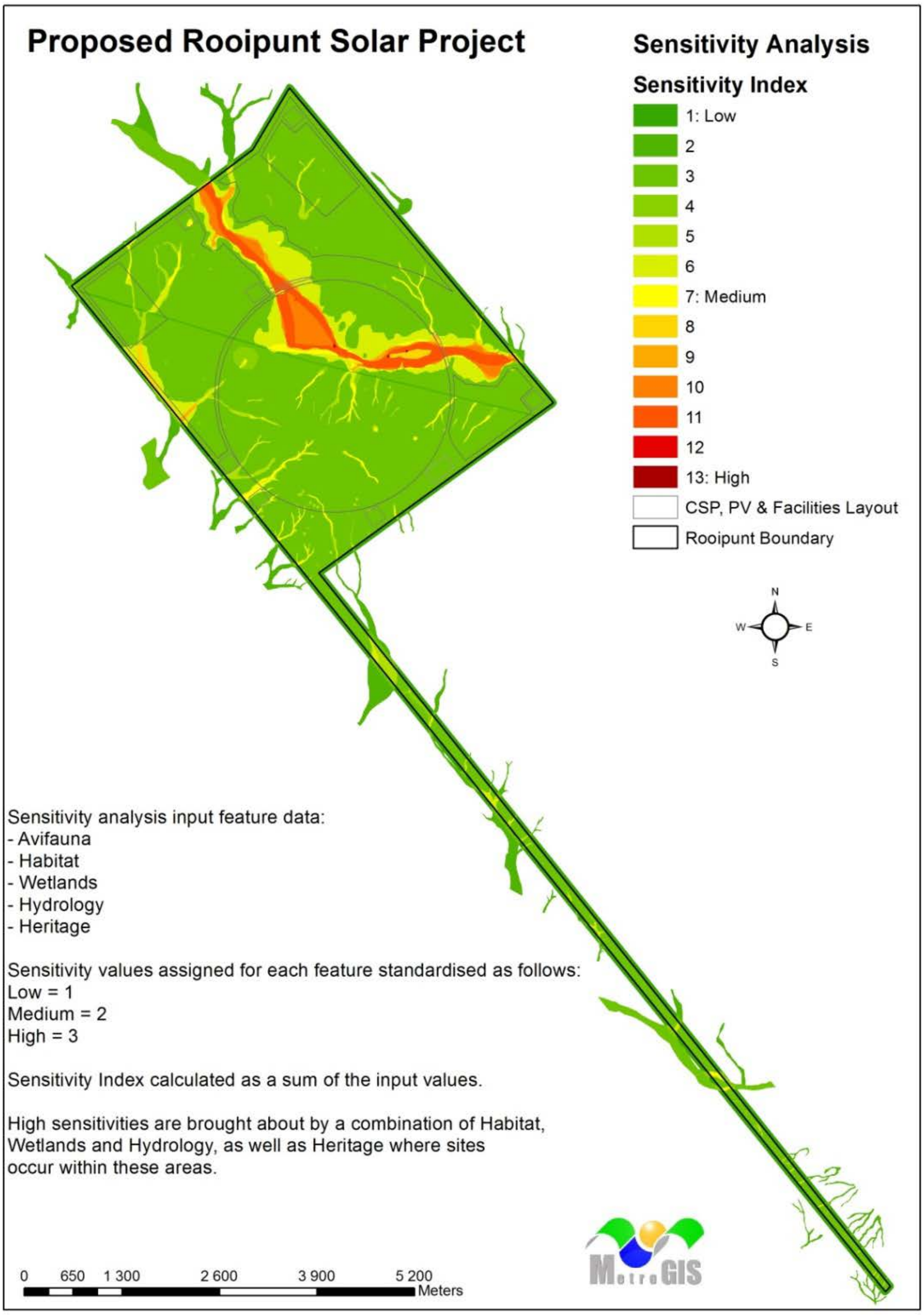


Figure 52 – Sensitivity Map 1

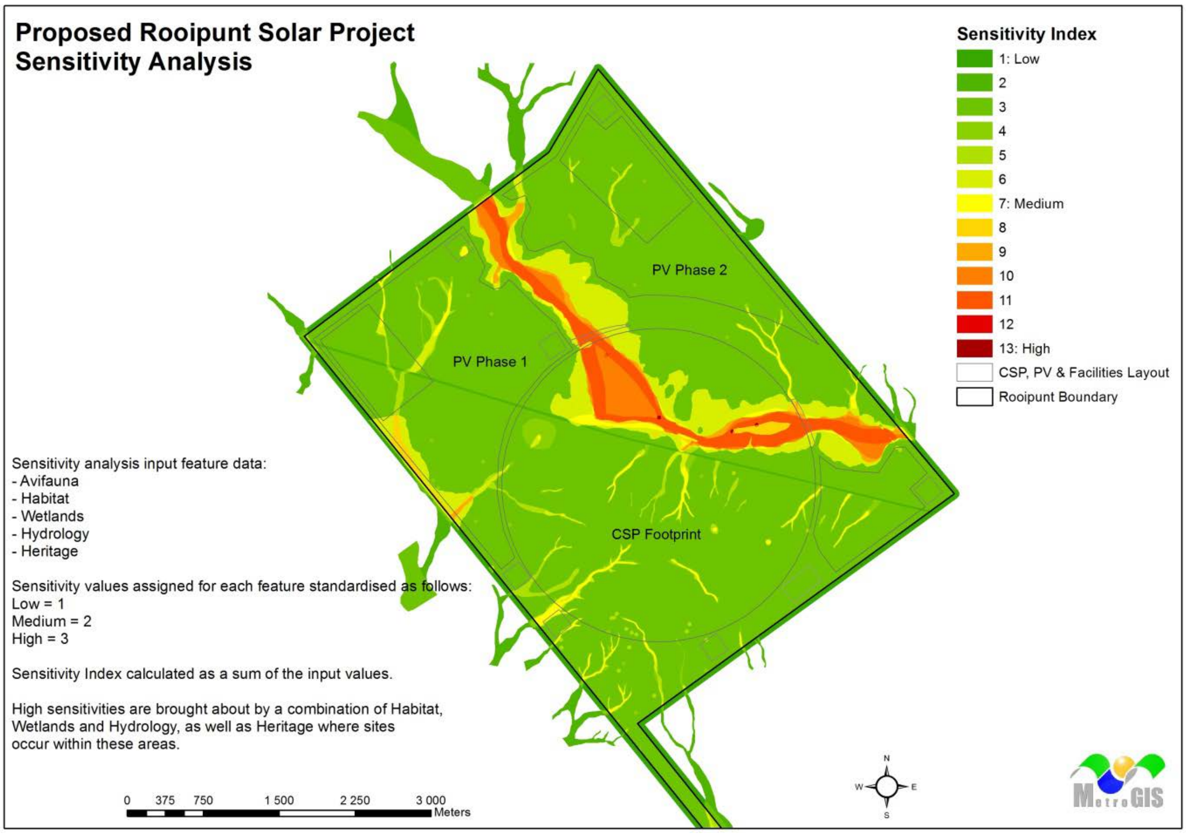


Figure 53 – Sensitivity Map 2

8. ENVIRONMENTAL MANAGEMENT PROGRAM

The EMP specifies all the potential environmental impacts, control and mitigation measures, performance criteria and relevant reporting and monitoring procedures for all the phases of the proposed project.

The EMP furthermore delineates the roles, responsibilities and timeframes for the sustainable operation of the proposed project. The EMP forms a crucial part of the conditions for approval and ensures that the project Applicant remains accountable for compliance issues.

Refer to Appendix Q for the EMP

9. RECOMMENDATION

SRSA proposed the construction and operation of a Solar Power Park on the Portion 0 of the Farm Rooipunt 617 Gordonia RD i.e. Rooipunt Solar Power Park.

An extensive and rigorous EIA process was undertaken for the proposed Rooipunt Solar PV Power Plant. The EIA was conducted within the context of the broader South African environmental legislative framework and particularly in line with the NEMA: EIA Regulations. The process undertaken during the EIA Phase included the continuation of the extensive PPP initiated during the Scoping Phase, the independent specialist assessment of anticipated impacts and proposal of mitigation measures, conducting of a sensitivity analysis and the compilation of a detailed EMP.

The PPP during the EIA Phase will provide stakeholders and I&Aps with the opportunity to review whether their issues and concerns raised during the Scoping Phase has been sufficiently addressed, mitigated and to highlight additional issues that requires attention.

SRSA made a conscious decision based on the recommendations and guidelines by the DEA to undertake 13 independent specialist assessments in order to assess both significant and less significant environmental impacts proposed by the development.

The detailed assessment of the anticipated impacts were undertaken with the purpose of highlighting any areas of concern regarding the proposed project during its construction and operation and proposes necessary mitigation measures of the significant impacts.

10. CUMULATIVE IMPACTS

As a result of an increase in interest and the number of EIAs for renewable energy developments (solar and other renewable energy technologies) it is important to follow a precautionary approach in accordance with the NEMA to ensure that cumulative impacts are addressed or avoided. The following aspects have been identified as potentially significant cumulative impacts that may result from the proposed development. These anticipated impacts were assessed by the specialists during the EIA Phase to get a handle on their cumulative effect. The impacts that were assessed included:

10.1 VISUAL

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. They may also affect the way in which the landscape is experienced. Cumulative effects may be positive or negative. Where they comprise a range of benefits, they may be considered to form part of the mitigation measures.

Cumulative effects can also arise from the inter-visibility (visibility) of a range of developments and /or the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual components or developments may not be significant, but together they may create an unacceptable degree of adverse effect on visual receptors within their combined visual envelopes. Inter-visibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance, as this affects visual acuity, which is also influenced by weather and light conditions (Institute of Environmental Assessment and The landscape Institute (1996)).

The biggest negative impact will be experienced by households residing within an eight kilometre radius from the site. However the density of the population in this area is very small; thus, the effects on the sense of place within the high visual impact area will be marginal. However, due to the spatial extent of visual impacts, the negative change in the sense of place will extend to the residents of the nearby town of Upington and those living along the river. In addition to the visual effects, the households residing in these areas will also be affected by temporary increase in noise and traffic on the roads. Considering the Khi Solar Development and the possible future construction of the Sasol and Eskom CSP plants close to the Rooipunt Project Site, the cumulative effect on households in Upington and along the Orange River is expected to be notable. The remoteness of the site from the concentration of urban areas would minimise the significance of the negative effect; however the fact that visual disturbance will extend beyond the construction phase and remain until the end of the project's life makes the impact more important.

10.2 ECOLOGICAL

From a biodiversity perspective there are cumulative impacts which were assessed by the biodiversity specialist. These impacts are:

10.2.1 Direct Impacts on Flora Species of Conservation Importance

This is a direct impact since it results in the physical damage or destruction of Red Data species/ communities, areas where these species are known to occur or areas that are considered particularly suitable for these species. Plant species of conservation importance, in most cases, do not contribute significantly to the biodiversity of an area in terms of sheer numbers, as there are generally few of them, but a high ecological value is placed on the presence of such species in an area as they represent an indication of pristine habitat conditions. Conversely, the presence of pristine habitat conditions can frequently be accepted as an indication of the potential presence of species of conservation importance, particularly in moist habitat conditions.

Red Data species are particularly sensitive to changes in their environment, having adapted to a narrow range of specific habitat requirements. Changes in habitat conditions resulting from human activities is one of the greatest reasons for these species having a threatened status. Surface transformation/ degradation activities within habitat types that are occupied by flora species of conservation importance will ultimately result in significant impacts on these species and their population dynamics. Effects of this type of impact are usually permanent and recovery or mitigation is generally not perceived as possible. One of the greatest limitations in terms of mitigating or preventing this particular impact, is the paucity of species specific information that describe their presence, distribution patterns, population dynamics and habitat requirements. To allow for an accurate assessment, it is usually necessary to assess the presence/ distribution, habitats requirements, etc. associated with these species in detail and over prolonged periods; something that is generally not possible during EIA investigation such as this.

However, by applying ecosystem conservation principles to this impact assessment and subsequent planning and development phases, potential impacts will be limited largely. The likelihood of Red Data flora species occurring within the study area is moderate, but protected trees (National Forest Act) are present within the study area, albeit at low densities. Furthermore, other species of conservation importance were indicated to be present, although none was observed during the survey period.

10.2.2 Loss or Degradation of Natural Vegetation/ Sensitive or Protected Habitat

The loss or degradation of natural vegetation or habitat that are regarded sensitive as a result of restricted presence in the larger region (atypical habitat) represents a potential loss of habitat and biodiversity on a local and regional scale. Sensitive habitat types might include mountains, ridges, koppies, wetlands, rivers, streams and localised habitat types of significant physiognomic variation and unique species composition. These areas represent centres of atypical habitat and contain biological attributes that are not frequently encountered in the greater surrounds. A high conservation value is generally ascribed to floristic communities and faunal assemblages that occupy these areas as they contribute significantly to the biodiversity of a region.

10.2.3 Impacts on Surrounding Habitat/ Species & Ecosystem Functioning

Surrounding areas and species present in the direct vicinity of the study area could potentially be affected by indirect impacts resulting from construction and operational activities. This indirect impact also includes adverse effects on any processes or factors that maintain ecosystem health and character, including the following:

Disruption of nutrient-flow dynamics;

- • Introduction of chemicals into the ground- and surface water through leaching;
- • Impedance of movement of material or water;
- • Habitat fragmentation;
- • Changes to abiotic environmental conditions;
- • Changes to disturbance regimes, e.g. increased or decreased incidence of fire;
- • Changes to successional processes;
- • Effects on pollinators; and
- • Increased invasion by plants and animals not endemic to the area.

Changes to factors such as these may lead to a reduction in the resilience of ecological communities and ecosystems or loss or changes in ecosystem function. Furthermore, regional ecological processes, particularly aquatic processes that is dependent on the status and proper functioning of the drainage line, is regarded important. It is well known that the status of a catchment is largely determined by the status of the upper reaches of the rivers. Small drainage lines, such as the one on this property, might be insignificant on a regional scale, but the combined status of numerous such small drainage lines will determine the quality of larger rivers further downstream.

10.2.4 Impacts on SA's Conservation Obligations & Targets

This impact is regarded a cumulative impact since it affects the status of conservation strategies and targets on a local as well as national level and is viewed in conjunction with other types of local and regional impacts that affects conservation areas or threatened areas. The importance of vegetation types is based on the conservation status ascribed to regional vegetation types (Vegmap, 2006) and because impacts that result in irreversible transformation of natural habitat is regarded significant. However, only a moderate disruption of ecosystem functioning is assumed in the 'Least Threatened' vegetation types that occupy the study area.

10.2.5 Increase in Local & Regional Fragmentation/ Isolation of Habitat

Uninterrupted habitat is a precious commodity for biological attributes in modern times, particularly in areas that are characterised by moderate and high levels of transformation. The loss of natural habitat, even small areas, implies that biological attributes have permanently lost that ability of occupying that space, effectively meaning that a higher premium is placed on available food, water and habitat resources in the immediate surrounds. This, in some instances might mean that the viable population of plants or animals in a region will decrease proportionally with the loss of habitat, eventually decreasing beyond a viable population size.

The danger in this type of cumulative impact is that effects are not known or is not visible with immediate effect and normally when these effects become visible, they are usually beyond repair. Impacts on linear areas of natural habitat affect the migratory success of animals in particular.

The general region is characterised by low levels of transformation and habitat fragmentation. However, it is known that numerous other similar developments are planned in this particular region. The level of fragmentation and habitat isolation is therefore likely to increase significantly within the next few years.

10.2.6 Increase in Environmental Degradation, Pollution (soils, surface water)

Cumulative impacts associated with this type of development could lead to initial, incremental or augmentation of existing types of environmental degradation, including impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases, these effects are not bound and is dispersed, or diluted over an area that is much larger than the actual footprint of the causal factor.

Similarly, developments in untransformed and pristine areas are usually not characterised by visibly significant environmental degradation and these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced. The nature of the development is such that pollution and degradation of the surrounding areas are expected to some extent.

10.2.7 Specialist Recommendations

10.2.7.1 Avifaunal

The proposed facility has the potential to impact on avifauna in the area. Since our experience of these facilities and associated impacts is so limited in South Africa, a precautionary approach has been taken in the identification of impacts**. However due to the relatively low importance of the site for many bird species, most impacts have been rated as low significance**. It is recommended that a pre and post construction monitoring programme be conducted at the site, and the data from this programme will contribute significantly towards eliminating uncertainty associated with the impacts.

10.2.7.2 Biodiversity

Anticipated impacts are regarded significant and long-term, but mostly restricted to a local milieu. **It should be noted that none of the impacts represents a 'Red Flag' to the development**. While an offset strategy will not result in any amelioration of potential and likely impacts, the contribution of the offset programme towards local and regional conservation of sensitive habitat places, the loss of portions of sensitive habitat in a context of a need for the proposed development, rendering the biodiversity losses that will inevitably result, more acceptable. It is important to note that an Offset Strategy is not recommended instead of mitigation measures; the implementation of sensible mitigation measures is not negotiable.

An Offset Strategy should therefore be viewed as a last resort in light of significant impacts on the ecological environment. Significant adverse impacts resulting from the proposed development on sensitive ecological attributes of the proposed site are most likely to be restricted to the wetland regimes of the site.

Due to the nature of significant impacts in the wetland regime, the Offset Strategy will therefore mostly be guided by the wetland aspect, while the biodiversity component will be augmentative in recommendations.

The recommendation of a suitable stream diversion will be determined by the layout of the development footprint. From the various alternatives, it appears that most of the options will result in unavoidable impacts of the wetland environs and will therefore require a suitable diversion in order to allow for artificial functionality of the habitat type. The efficacy of such a diversion would however be strongly informed by the nature of nearby developments that will affect these systems up- and downstream of the Rooipunt site; diverting a portion of the system in isolation when no similar approaches up- and downstream are implemented, would be nonsensical. In such an event, the obligation and contribution to a suitable offset strategy will increase significantly.

The diversion of the stream should therefore be viewed as a last resort, based on development criteria and requirements (CSP) and should take cognisance of cumulative aspects.

10.2.7.3 Wetland

The wetland and riparian habitats on site are dominated by the riparian habitat associated with the Helbrandleegte stream which drains across the study area from north west to south east. The Helbrandleegte riparian habitat makes up more than 55 % of the riparian and wetland habitat on site and covers 5.88 % of the study area. The only wetland habitat identified and delineated on site is associated with 4 small pans covering a combined area of only 1.02 hectare.

The NFEPA database classified the pan wetlands of the area as being generally of a natural to largely natural condition (PES category A/B) based on the fact that the pan catchments are characterised by more than 75 % natural vegetation cover. The hydrological driver of these pans is still intact. The pan basins at the time of the site visit were heavily trampled by livestock and mostly devoid of vegetation. Trampling would however also have occurred under natural conditions by larger herbivores attracted to the accumulation of surface water and the minerals within the pan sediments. The pan wetlands on site are thus considered to be in a largely natural condition (PES category B).

As in the case of the pans, the hydrological drivers of the majority of watercourses and riparian habitats on site are still intact. The NFEPA Rivers database considered the Helbrandleegte and Helbrandkloofspruit to be in an A/B category, while the 1999 DWA PES data rates them as moderately modified (PES category C) systems. The smaller watercourses on site are considered to range from natural/largely natural (PES category A/B) to moderately modified (PES category C). The Helbrandleegte is rated as largely natural (PES category B).

From a sensitivity point of view, the higher order watercourses, including the main watercourse (i.e. the Helbrandleegte which traverses the study area from north west to south east) are more sensitive and, therefore, more important to protect than the low order ephemeral streams. This assessment is based on the greater importance of these systems in terms of biodiversity through providing greater habitat diversity, higher species richness, supporting larger trees that can provide nesting habitat to a number of Red Data listed bird species, and providing surface water for longer periods than the smaller watercourses.

A number of layout alternatives for the PV and CSP were considered in terms of their impacts on the riparian habitat on site. The alternative with the southern CSP and the Northern PV, which was considered the preferred alternative out of the three options assessed from a wetland and riparian habitat perspective, was also selected by the project team as the preferred alternative.

10.2.7.4 Tourism

When excluding other factors that lead to growth in the tourism industry, we project that the project will result in 9,268 additional tourists to the study area over the forecast period of 10 years.

This additional tourism demand could lead to the development of 150 additional rooms/ units over the forecast period however these will come into the market all at once at the start.

The Rooipunt Solar Power Park, is expected to result in an increase in the tourist direct spend in the area (and thus the GDP contribution) and an increase in employment opportunities for the Upington area **From the final tourism impact assessment it is clearly visible that the proposed Rooipunt Solar Power Park will have a far more positive impact on the tourism industry in the Upington area. The the negative impacts associated with the PV Projects are regarded of low significance and fairly easily mitigated**.

10.2.7.5 Geohydrological

Based on the conclusion of this report the following is recommended:

- The positioning of the PV modules do not pose a groundwater pollution hazard.
- All existing boreholes (used and unused) must be properly sealed at the surface to prevent surface pollution of the groundwater. This measure will also prevent bees from invading the boreholes and interfering with access for monitoring
- The numerical model should be regularly verified and updated using most recent observed data, at a minimum interval of five years.

10.2.7.6 Socio-Economic

The proposed Rooipunt Solar Power Park PV Project(s) is expected to aid in this by increasing the size of the local utilities sector and providing additional sustainable employment opportunities for the local labour force that are not likely to be affected by any exogenous factors. The establishment of the Rooipunt Solar Power Park, PV Project(s) would not only contribute to the growth of the local economy, but would also increase the size of the national economy through various spill over effects during all stages of the project's lifecycle and specifically during construction.

It is estimated that the construction of the Rooipunt Solar Power Park will generate R6 214.5 million in value added (2011 prices) and create 26 999 FTE person-years in the country. Its operations will increase the national economy by R2 120.2 million in 2011 prices and will support 1 378 FTE positions for the entire operating period. The local economy alone will see the creation of a minimum of 147 new employment opportunities during that period. Moreover, the project will allocate about R23.1 million per annum towards social development projects in the local area, which could notably improve the local communities' standard of living. From the strategic perspective, the proposed facility coupled with other developments proposed by SolarReserve and other companies offers the opportunity for the establishment of an entire new high-tech industry, focusing on the manufacturing of components required for CSP and PV projects.

Aside from the positive impacts, the project will also lead to negative effects. The establishment of the facility will sterilise the land from the agricultural potential for a long-term, but due to the low grazing capacity the impact will be relatively small. The negative impacts that raise the most concern though include possible increase in crime, social conflicts, pressure on social and economic infrastructure, aggravation of the housing situation in the municipality, and loss of sense of place. Considering that there are at least three other projects proposed to be established in the vicinity of the Rooipunt site, the extent of these negative effects could significantly increase.

Most of the negative impacts can be successfully mitigated, though, especially if it is done in partnership with local communities, local government and other businesses in the area. However, even without mitigations the positive socio-economic benefits that are expected to ensue from the development of all phases or one phase only will outweigh the negative impacts that can take place during the life of the project. **Thus, from the socio-economic perspective the proposed project is highly recommended. The developer though should take the proposed measures to enhance the positive impacts and reduce the negative impacts into account**.

10.2.7.7 Visual

The potential visual impact on users of national, arterial and secondary roads in close proximity of the solar facility will be of high significance and the potential visual impact on residents of towns, settlements and homesteads in close proximity to the proposed solar facility and within the region, as well as on protected areas and eco-tourism will be of moderate significance.

In terms of the ancillary infrastructure, the potential visual impact is low from PV panels.

This anticipated visual impact is not, however, considered to be a fatal flaw from a visual perspective, considering the low incidence of visual receptors in the region and the contained area of potential visual exposure.

It is therefore recommended that the facility as proposed be supported, subject to the recommended mitigation measures and management actions

10.2.7.8 Noise

The following are recommended:

- The National Noise Control Regulations and SANS 10103:2008 should be used as the main guidelines for addressing the potential noise impact on this project.
- Various measures to reduce the potential noise impact from the development are possible, and the mitigation measures indicated in Section 7 need to be considered.
- The power generation unit of the Solar Power Park should be constructed at an offset of at least 3,000 metres from the nearest noise sensitive receptor, depending on the intended periods of operation.
- The noise mitigation measures will need to be designed and/or checked by an acoustical engineer in order to optimise the design parameters and ensure that the cost/benefit of the measure is optimised.
- Once the layout of infrastructure of the components at the proposed Solar Power Park is finalised and the actual noise profile of plant and equipment is known, the position of the noise contours should be checked.
- At commissioning of the Solar Power Park, the noise footprint of each discrete element should be established by measurement in accordance with the relevant standards, namely SANS ISO 8297:1994 and SANS 10103. The character of the noise (qualitative aspect) should also be checked to ascertain whether there is any nuisance factor associated with the operations.

10.2.8 EAP Recommendation

The impacts identified and assessed by the independent specialist impact assessments and the sensitivity analysis conducted, allowed for the development of effective mitigation measures (as presented in the EMP).

The result of the independent specialist impact assessments and the subsequent sensitivity analysis proved that there is residuals impact that will prevail after the implementation of proposed mitigation measures identified during the EIA Process. .

The propsed PV developments layout is dependant on the Location of the CSP. The proposed PV developments will not have significant impacts on the biophysical environment as the layout of the panels can be altered to accommodate any sensitive area identified.

The social impact of the proposed plant will have both negative and positive impacts. It will impact negatively on the surrounding landowners, especially from a visual perspective but will contribute significantly to the local economy.

Overall, the development of an alternative source of electricity will be a significant positive impact not only for the Northern Cape Province but for South Africa as a whole. In respect of the findings presented in this EIAR, it can be stated that when the potential negative impacts are weighed up; against the potential positive impacts, overall the positive impacts associated with the proposed PV Projects outweigh the negative impacts.

It is therefore the recommendation of the EAP that the proposed PV Projects proposed within the Rooipunt Solar Power Park receives a positive Environmental Authorisation from the competent authority as the Project poses no imminent threat to the recieveing enviornment that can not be sufficiently mitigated in order to manage and mitigate the impact withing acceptable levels.

Appendix A Department of Environmental Affairs Scoping Acceptance Letter

Appendix B Final Scoping Report

Appendix C Technical Report

Appendix D Avifaunal Environmental Impact Assessment

Appendix E Biodiversity Environmental Impact Assessment

Appendix F Geotechnical Environmental Impact Assessment

Appendix G GeoHydrological Environmental Impact Assessment

Appendix H Heritage Environmental Impact Assessment

Appendix I Hydrological Environmental Impact Assessment

Appendix J Noise Environmental Impact Assessment

Appendix K Soils and Agriculture Potential Environmental Impact Assessment

Appendix L Socio-Economic Impact Assessment

Appendix M Tourism Environmental Impact Assessment

Appendix N Visual Environmental Impact Assessment

Appendix O Wetland Environmental Impact Assessment

Appendix P Environmental Sensitivity Analysis

Appendix Q Environmental Management Program

Appendix R Preferred Layout Map

Appendix S Title Deed

Appendix T CAA Authorisation