ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
DRAFT ENVIRONMENTAL IMPACT REPORT

PROPOSED ESTABLISHMENT OF THE KAROSHOEK LINEAR FRESNEL (LF) 1 FACILITY ON SITE 1.1, AS PART OF THE LARGER KAROSHOEK SOLAR VALLEY DEVELOPMENT, ON A SITE LOCATED 30 KM EAST OF UPINGTON

NORTHERN CAPE PROVINCE
(DEA Ref No: 14/12/16/3/3/2/293)

DRAFT FOR PUBLIC REVIEW
25 JUNE 2012 – 25 JULY 2012

Prepared for:

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PROJECT DETAILS

DEA Reference No.	:	14/12/16/3/3/2/293
Title	:	Environmental Impact Assessment Process Draft Scoping Report: Proposed establishment of the Karoshoek Linear Fresnel 1 (LF1) Facility on Site 1.1, as part of the larger Karoshoek Solar Valley development, on a site located 30 km east of Upington, Northern Cape Province
Authors	:	Savannah Environmental (Pty) Ltd Alicia Govender & Jo-Anne Thomas
Project Developer	:	FG Emvelo (Pty) Ltd
Report Status	:	Draft EIA Report for public review
Review Period	:	25 June 2012- 25 July 2012

When used as a reference this report should be cited as: Savannah Environmental (2012) Draft EIA Report: Proposed establishment of the Karoshoek LF1 Facility on Site 1.1, as part of the larger Karoshoek Solar Valley development, on a site located 30 km east of Upington, Northern Cape Province.

PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

WWK Development (Pty)Ltd is currently undertaking an Environmental Impact Assessment (EIA) process to determine the environmental feasibility of a proposed wind energy facility on the West Coast, on a site north of Kleinsee, in the Northern Cape Province. WWK Development has appointed Savannah Environmental, as independent environmental consultants, to undertake the EIA. The EIA process is being undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

The EIA Report consists of nine sections:

» **Chapter 1: Introduction** - provides background to the proposed facility, the environmental impact assessment process; and the environmental assessment practitioner.
» **Chapter 2: Technology Description** - provides an overview of the proposed solar technology.
» **Chapter 3: Project Overview** - provides an overview of the consideration of alternatives, and the proposed activities during the different phases in the project timeline.
» **Chapter 4: Regulatory and Legal Context** - provides an overview of the regulatory and legal context for electricity generation projects within South Africa.
» **Chapter 5: Overview of the EIA Process** - outlines the process followed during the EIA Phase, including the public participation process.
» **Chapter 6: Description of the Affected Environment** - describes the baseline biophysical and socio-economic conditions of the proposed development site and surrounds.
» **Chapter 7: Impact Assessment** - presents the assessment of impacts, both positive, negative, direct, indirect, and cumulative associated with the facility and its associated infrastructure.
» **Chapter 8: Conclusions and Recommendations** - presents the conclusions of the EIA Phase, as well as an impact statement (i.e. conclusions), and recommendations for the implementation of the proposed project.
» **Chapter 9: References -** provides a list of references and information sources used in compiling the EIA Report.

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. The EIA Phase addresses those identified potential environmental impacts and benefits associated with all phases of the project including design, construction and operation, and recommends appropriate mitigation measures for

potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

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

INVITATION TO COMMENT ON THE DRAFT EIA REPORT

Members of the public, local communities and stakeholders are invited to comment on the draft EIA Report which has been made available for public review and comment at the following locations from **25 June 2012 to 25 July 2012.**

» Upington Public Library (Market Street)
» Upington Police Station (Schroder Street)
» www.savannahSA.com

Please submit your comments to
Shawn Johnston of Sustainable Futures ZA PO Box 749, Rondebosch, Cape Town, 7701 Tel: 083 325 9965 Fax: 086 510 2537 E-mail: swjohnston@mweb.co.za
The due date for comments on the Draft Scoping Report is **25 July 2012**

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

PUBLIC FEEDBACK MEETING

In order to facilitate comments on the draft EIA Report and provide feedback on the findings of the studies undertaken, a public feedback meeting was held as follows:

Date: 19 June 2012
Time: 18:30
Venue: NG Kerk

SUMMARY

Background and Project Overview

FG Emvelo (Pty) Ltd, an independent developer of concentrating solar power plants (CSP), is in the process of investigating the possible establishment of a **CSP facility, using Linear Fresnel (LF) technology** on **site 1.1**, as part of the larger Karoshoek Solar Valley Development. The proposed development site is located approximately 30 km east of Upington within the Khara Hais Local Municipality, which falls under the Siyanda District Municipality in the Northern Cape. The facility is proposed on the farm **portion 0 of Zandemm 944** (refer to Figure 1.1).

The broader area proposed for the entire Karoshoek Solar Valley Development includes the following farm portions:

» Portion 0 of Karos 959;
» Portion 3 of Annashoek 41;
» Portion 0 of Zandemm 944;
» Portion 2 of Matjiesrivier 41; and
» [1]Portion RE of Matjiesrivier 41

The proposed project will be referred to as "Karoshoek LF1[2] facility on Site 1.1" which ultimately forms part of the future proposed Karoshoek Solar Valley Development. The proposed project includes the establishment of a CSP facility comprising Linear Fresnel technology and associated infrastructure for the purposes of commercial electricity generation. The facility is proposed to have a maximum generating capacity of up to **100 MW**, while the larger Karoshoek facility is proposed to have a maximum generating capacity of 1 GW.

Associated infrastructure proposed includes:

» The solar field - this will comprise multiple loops of Linear Fresnel mirrors which serve to receive and concentrate the solar radiation. They will be directly associated with pipelines which will convey the heat transfer fluid between the mirrors and the steam cycle.
» The power block - comprising a conventional steam turbine generator and a substation into which the electricity can be evacuated.
» Water related infrastructure - where the water source is the Orange River, with the water abstraction point at the existing abstraction point of the Boegoeberg Water Users Association at coordinate S 28° 24' 7.68" and E 21° 29' 50.51". Associated water supply pipelines; water treatment and storage reservoirs and

[1] No development is proposed on RE Portion of Matjiesrivier 41 at this stage, but the farm portion is included in the project scope as it is envisaged for future development
[2] LF stands for Linear Fresnel

evaporation ponds will be required. **This infrastructure has already been authorised through the EIA process undertaken for Project Ilanga on site 1.2 (DEA ref no. 12/12/20/2056).** A pipeline would however be required to be constructed to each facility from the central water reservoir.

» Cables linking the power block to the on-site substation.
» Power line(s) which will connect to the future Eskom CSP MTS. The Eskom 400 kV power line to be located to the west of the site (planned to be constructed in 2016) (to be assessed through a separate EIA process (DEA ref no. 14/12/16/3/3/2/288)).
» Internal and external access roads.
» Accommodation facilities and storerooms.
» Temporary waste storage facilities may be required.

The nature and extent of this facility, as well as potential environmental impacts associated with the construction of a facility of this nature is explored in more detail in this EIA Report.

The EIA Study for the proposed CSP Facility east of Upington in the Northern Cape Province has been undertaken in accordance with the EIA Regulations published in Government Notice 33306 of GN R543, R544, R545 and R546 (18 June 2010), in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

Environmental Impact Assessment

The EIA phase for the proposed project forms part of the EIA process and has been undertaken in accordance with the EIA Regulations. The Scoping Report aimed to identify potential issues associated with the proposed project, and define the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project involving specialists with expertise relevant to the nature of the project and the study area, the project proponent, as well as a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs).

A comprehensive public participation process is being undertaken in accordance with Regulation 54 of Government Notice No R543 of 2010 during the Scoping phase of this EIA process. This public participation process comprises the following:

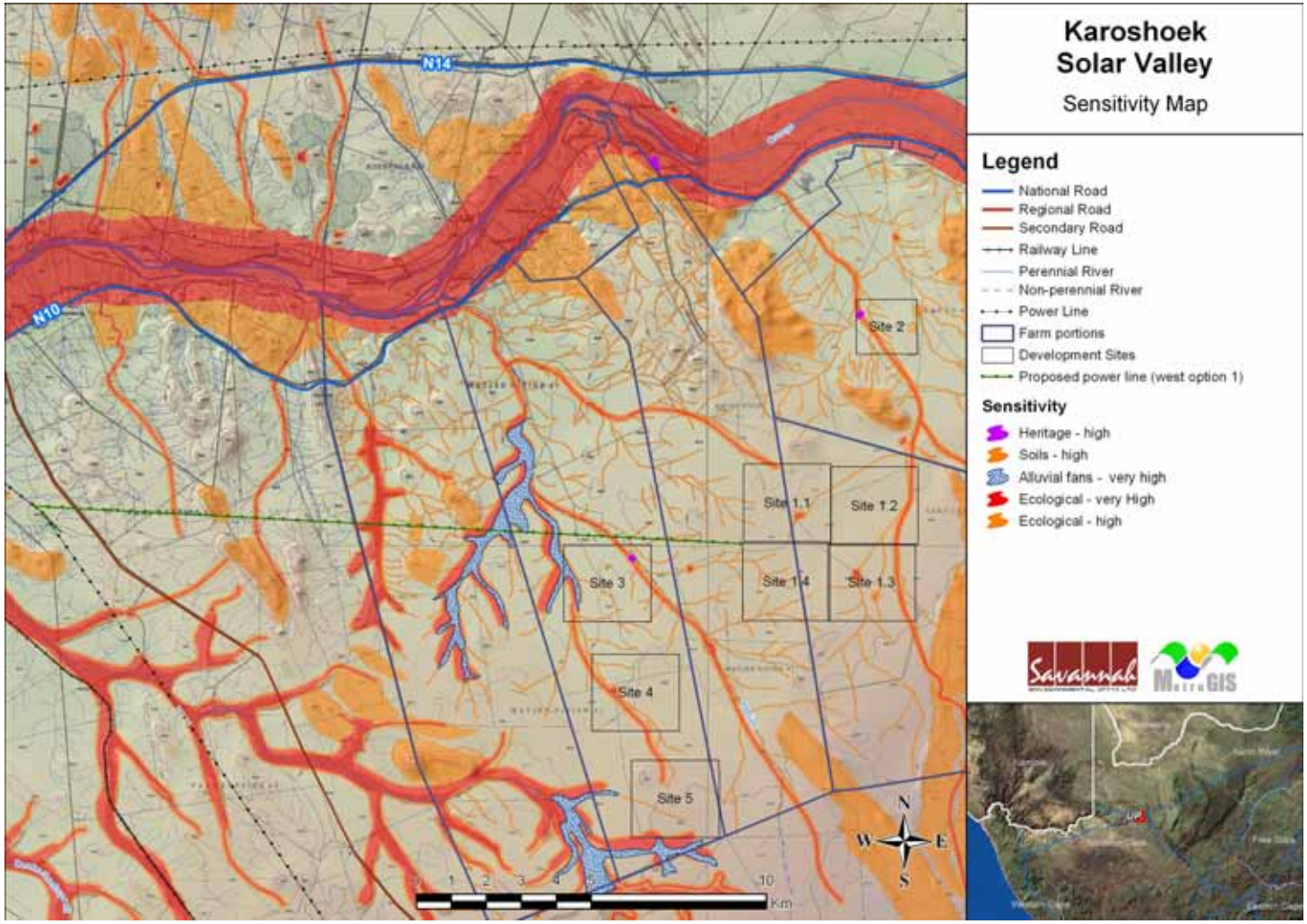
» **Notification of the EIA Process** in printed media and on site, as well as through written notification to identified stakeholders and affected landowners.
» **Identification and registration** of I&APs and key stakeholders.

» Compilation and distribution of a **Background Information Document** (BID) to all identified I&APs and key stakeholders.
» **On-going consultation** with identified I&APs and stakeholders, including Telephonic communication, Focus Group Meetings and one-one-one meetings.
» Compilation and maintenance of a **database** containing the names and addresses of all identified I&APs and key stakeholders.
» Preparation of a **Comments and Response Report** detailing key issues raised by I&APs as part of the EIA Process.

Evaluation of the Proposed Project

Refer to **Figures 1**

» Impacts on biodiversity which includes any impacts on protected trees species (i.e. *Boscia albitrunca*; *Acacia erioloba* and *Aloe dichotoma*), and species of conservation concern (i.e. Largemouth Yellowfish, Namaqua Barb, Rock Catfish, Honey Badger, Littledale's Whistling Rat, Dassie Rat, Kori Bustard, Ludwig's Bustard, Martial Eagle, Secretarybird, Lanner Falcon, Sclater's Lark, and Giant Bullfrog), and on overall species richness.
» Impacts on sensitive habitats (i.e. drainage lines located across the site, reed bed wetland systems along the Orange River, and dunes primarily in the south-western quarter and in some northern parts of the site), that leads to direct or indirect loss of such habitat. These areas should be avoided as far as possible. If it is not possible to avoid them, then appropriate licenses must be obtained to impact on these features.
» Soil degradation, wind/water erosion and subsequent sedimentation of drainage lines and the Orange River.



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DEFINITIONS AND TERMINOLOGY

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

Ambient sound level: The reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

Concentrating solar power: Solar Generating Facilities use the energy from the sun to generate electricity. Concentrating Solar Power facilities collect the incoming solar radiation and concentrate it (by focusing or combining it) onto a single point, thereby increasing the potential electricity generation.

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

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

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

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

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of

individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place.

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

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

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

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

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

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

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

Interested and affected party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local

communities, investors, work force, consumers, environmental interest groups, and the public.

Linear Fresnel: technology is an evolution from the parabolic trough technology; it uses flat glass mirrors in place of parabolically curved mirrors. Parallel lines of mirrors reflect solar energy onto a receiver in which water is vaporized. Fresnel plants can be designed to incorporate thermal storage.

Natural properties of an ecosystem (*sensu* Convention on Wetlands): Defined in Handbook 1 as the "…physical, biological or chemical components, such as soil, water, plants, animals and nutrients, and the interactions between them." (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.)

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

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

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

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

ABBREVIATIONS AND ACRONYMS

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

INTRODUCTION CHAPTER 1

FG Emvelo (Pty) Ltd, an independent developer of concentrating solar power plants (CSP), is in the process of investigating the possible establishment of a **CSP facility, using Linear Fresnel (LF) technology** on **site 1.1**, as part of the larger Karoshoek Solar Valley Development. The proposed development site is located approximately 30 km east of Upington within the Khara Hais Local Municipality, which falls under the Siyanda District Municipality in the Northern Cape. The facility is proposed on the farm **portion 0 of Zandemm 944** (refer to Figure 1.1).

The broader area proposed for the entire Karoshoek Solar Valley Development includes the following farm portions:

» Portion 0 of Karos 959;
» Portion 3 of Annashoek 41;
» Portion 0 of Zandemm 944;
» Portion 2 of Matjiesrivier 41; and
» [3]Portion RE of Matjiesrivier 41

The proposed project will be referred to as "Karoshoek LF1[4] facility on Site 1.1" which ultimately forms part of the future proposed Karoshoek Solar Valley Development. The proposed project includes the establishment of a CSP facility comprising Linear Fresnel technology and associated infrastructure for the purposes of commercial electricity generation. The facility is proposed to have a maximum generating capacity of up to **100 MW**, while the larger Karoshoek facility is proposed to have a maximum generating capacity of 1 GW.

[3] No development is proposed on RE Portion of Matjiesrivier 41 at this stage, but the farm portion is included in the project scope as it is envisaged for future development

[4] LF stands for Linear Fresnel

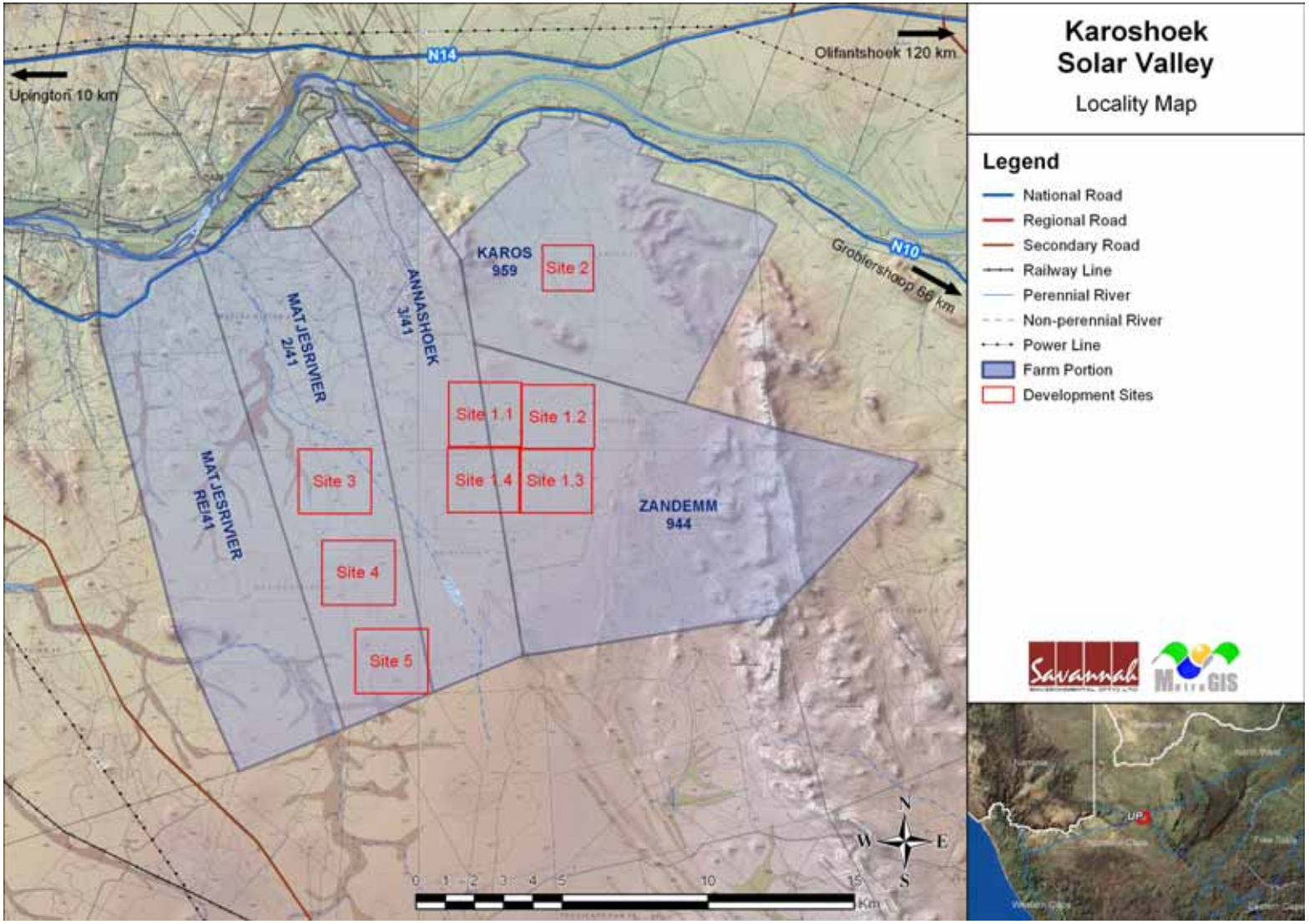


Figure 1.1: Locality map showing the broader Karoshoek Solar Valley site east of Upington

1.1. Project Components Proposed As Part of the Karoshoek Solar Valley Development

Through a previous environmental process undertaken on the proposed broader Karoshoek development, a scoping study was undertaken and various technically feasible sites for development of future plants were identified. These sites are now being investigated for the establishment of various concentrating solar power plants as part of the Karoshoek Solar Valley Development. The following table provides an indication of what is being proposed at each of the sites:

Table 1.1 Description of entire Karoshoek Solar Valley Development:

Site reference (refer to Figure 1.1)	Project Name and Description	DEA Reference number
Site 2	Karoshoek CPVPD 1 (1 x 25 MW **Concentrating photovoltaic or parabolic dish** technology project)	14/12/16/3/3/2/292
	Karoshoek CPVPD 2 (1 x 25 MW **Concentrating photovoltaic or parabolic dish** technology project)	14/12/16/3/3/2/291
	Karoshoek CPVPD 3 (1 x 25 MW **Concentrating photovoltaic or parabolic dish** technology project)	14/12/16/3/3/2/290
	Karoshoek CPVPD 4 (1 x 25 MW **Concentrating photovoltaic or parabolic dish** technology project)	14/12/16/3/3/2/289
Site 1.1	Karoshoek LF 1 (1 x 100 MW **Linear Fresnel**)	14/12/16/3/3/2/293
Site 1.3	Karoshoek PT (1 x 100 MW **Parabolic Trough**)	14/12/16/3/3/2/294
Site 1.4	Karoshoek LFT 2 (1 x 100 MW **Linear Fresnel or Parabolic Trough**)	14/12/16/3/3/2/299
Site 3	Karoshoek Tower 1 (1 x 50MW **Tower**)	14/12/16/3/3/2/298
	Karoshoek Tower 2 (1 x 50MW **Tower**)	14/12/16/3/3/2/297
Site 4	Karoshoek LFTT 1 (1 X 100 MW **Linear Fresnel or Parabolic Trough or Tower**)	14/12/16/3/3/2/296
Site 5	Karoshoek LFTT 2 (1 X 100 MW **Linear Fresnel or Parabolic Trough or Tower**)	14/12/16/3/3/2/295
Grid connection	Electricity distribution line(s) which will connect to an on-site substation / switchyard	14/12/16/3/3/2/288

Note that Site 1.2 as indicated in Figure 1.1 was previously investigated for the establishment of a Parabolic Trough Plant with a capacity of up to 125MW, known

as Project Ilanga (DEA Ref No: 12/12/20/2056). This facility and associated infrastructure has already been authorised.

Site 1.1 of the proposed Karoshoek Solar Valley Development, the subject of this report, will be comprised of the following primary elements (refer to Chapter 3 for more details):

» The solar field - this will comprise multiple loops of Linear Fresnel mirrors which serve to receive and concentrate the solar radiation. They will be directly associated with pipelines which will convey the heat transfer fluid between the mirrors and the steam cycle.
» The power block - comprising a conventional steam turbine generator and a substation into which the electricity can be evacuated.
» Water related infrastructure - where the water source is the Orange River, with the water abstraction point at the existing abstraction point of the Boegoeberg Water Users Association at coordinate S 28° 24' 7.68" and E 21° 29' 50.51". Associated water supply pipelines; water treatment and storage reservoirs and evaporation ponds will be required. **This infrastructure has already been authorised through the EIA process undertaken for Project Ilanga on site 1.2 (DEA ref no. 12/12/20/2056).** A pipeline would however be required to be constructed to each facility from the central water reservoir.
» Cables linking the power block to the on-site substation.
» Power line(s) which will connect to the future Eskom CSP MTS. The Eskom 400 kV power line to be located to the west of the site (planned to be constructed in 2016) (to be assessed through a separate EIA process (DEA ref no. 14/12/16/3/3/2/288)).
» Internal and external access roads.
» Accommodation facilities and storerooms.
» Temporary waste storage facilities may be required.

The nature and extent of the proposed facility is evaluated further within this Draft EIA Report. This EIA Report consists of the following sections:

» **Chapter 1: Introduction** - provides background to the proposed facility, the environmental impact assessment process; and the environmental assessment practitioner.
» **Chapter 2: Technology Description** - provides an overview of the proposed solar technology.
» **Chapter 3: Project Overview** - provides an overview of the consideration of alternatives, and the proposed activities during the different phases in the project timeline.

» **Chapter 4: Regulatory and Legal Context** - provides an overview of the regulatory and legal context for electricity generation projects within South Africa.
» **Chapter 5: Overview of the EIA Process** - outlines the process followed during the EIA Phase, including the public participation process.
» **Chapter 6: Description of the Affected Environment** - describes the baseline biophysical and socio-economic conditions of the proposed development site and surrounds.
» **Chapter 7: Impact Assessment** - presents the assessment of impacts, both positive, negative, direct, indirect, and cumulative associated with the facility and its associated infrastructure.
» **Chapter 8: Conclusions and Recommendations** - presents the conclusions of the EIA Phase, as well as an impact statement (i.e. conclusions), and recommendations for the implementation of the proposed project.
» **Chapter 9: References -** provides a list of references and information sources used in compiling the EIA Report.

1.2. Conclusions from the Scoping Phase

The broader Karoshoek site was evaluated within the Scoping Study (Savannah Environmental, April 2012). No environmental fatal flaws were identified to be associated with the site. However, from the preliminary sensitivity analysis undertaken, potentially sensitive areas within the broader 34 000 ha were identified (refer to Figure 1.3). These sensitive areas included areas of ecological sensitivity, areas of visual exposure, areas of high agricultural potential, and areas with potentially sensitive noise receptors. The sensitivities are expanded on below.

» *Areas of high ecological sensitivity* - there are high concentrations of dunes primarily in the south-western quarter and in some northern parts of the site, which are potentially sensitive to disturbance, and several non-perennial drainage lines and pans.
» *Areas of visual exposure* - the construction and operation of the proposed facility may have a negative visual impact on a limited number of potentially sensitive visual receptors within, but not restricted to, those receptors within an 8 km radius of the facility.
» *Areas of high agricultural potential* – the agricultural potential of the soils on the proposed development site range from low to high. The low rainfall, however, inhibits dry-land crop production and therefore production relies on irrigation from the Orange River. Construction of the proposed facility will result in the loss of land affected by the infrastructure for agricultural activities particularly for those areas in close proximity to the Orange River.

» *Areas with sensitive noise receptors* - there are a number of rural settlements near the Orange River and the N10. No potential noise sensitive receptors are located in the immediate vicinity of the proposed site. However, any receptor located within 2 km of the proposed development site may be affected.

As a result of the above, the recommendations of the Scoping Phase were that these areas of sensitivity be avoided as far as possible through an effective design process of the different components of the facility.

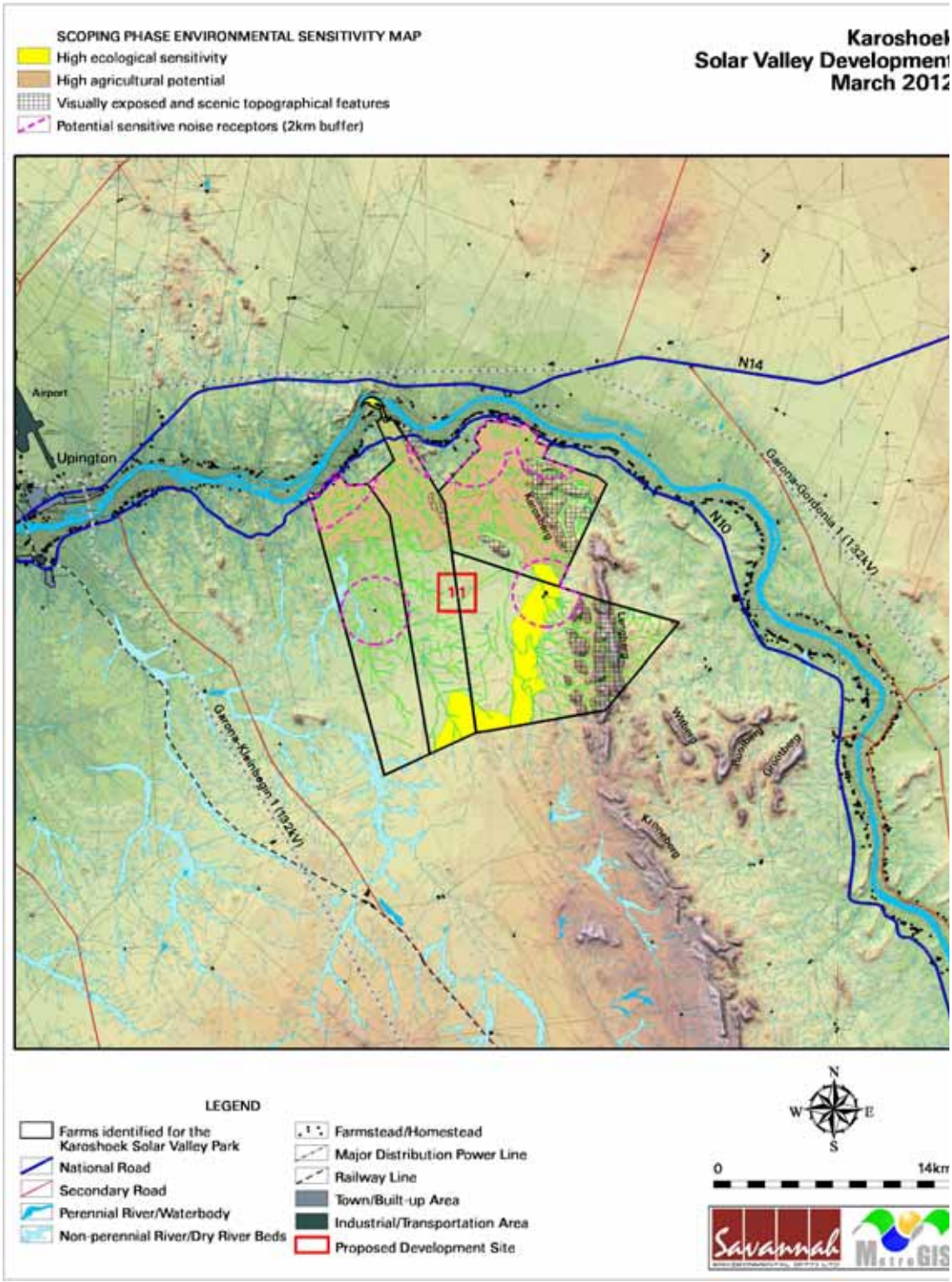


Figure 1.3: Environmental sensitivity map for the proposed Karoshoek Solar Valley site, which will include site 1.1.

1.3. The Purpose of the Proposed Project

The Karoshoek LF1 facility on site 1.1 is proposed to be developed as a commercial energy facility. The purpose of the proposed facility is to add new capacity for generation of renewable energy to the national electricity supply (which is short of generation capacity to meet current and expected demand) and to aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE).

Globally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as climate change and exploitation of non-renewable resources. In order to meet the long-term goal of a sustainable renewable energy industry, a goal of 17,8GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to ~42% of all new power generation being derived from renewable energy forms by 2030. This is however dependent on the assumed learning rates and associated cost reductions for renewable options.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, FG Emvelo is proposing the establishment of the Karoshoek LF facility to add new capacity to the national electricity grid. FG Emvelo will be required to apply for a generation license from the National Energy Regulator of South Africa (NERSA), as well as a power purchase agreement from Eskom (typically for a period of 20 years) in order to build and operate the proposed facility. As part of the agreement, Karoeshoek LF will be remunerated per kWh by Eskom who will be financially backed by government. Depending on the economic conditions following the lapse of this period, the facility can either be decommissioned or the power purchase agreement may be renegotiated and extended.

It is considered viable that long-term benefits for the community and/or society in general can be realised should the site identified prove to be acceptable from a technical and environmental perspective for the establishment of the proposed CSP facility. The Karoshoek LF1 facility proposed on site 1.1 has the potential to contribute to national electricity supply and to increase the security of supply to consumers. In addition, it may provide both economic stimulus to the local economy through the construction process and long term employment (i.e. management and maintenance) during the operation phase.

1.4. Requirements for an EIA Process

In terms of the Environmental Impact Assessment (EIA) Regulations published in Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998), site 1.1 of the larger Karoshoek Solar Valley Development requires authorisation from the National Department of Environmental Affairs (DEA)[5] (in consultation with the Northern Cape Department of Agriculture and Nature Conservation (DENC)), for the establishment of the proposed CSP facility. An application for authorisation has been accepted by DEA under application reference number **14/12/16/3/3/2/293**. This application included the following listed activities which are triggered by the proposed CSP facility and its associated infrastructure:

Relevant notice:	Activity No:	Description of listed activity:
545, 18 June 2010 as amended	1	The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more ***The CSP facility is proposed to have a generating capacity of up to 100MW***
GN 545, 18 June 2010	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 ha or more, Except where such physical alteration takes place for: (i) Linear development activities. (ii) Agriculture or afforestation where activity 16 in this schedule will apply. ***The development footprint for the proposed facility will be in excess of 20ha.***
544, 18 June 2010 as amended	10	The construction of facilities or infrastructure for the transmission and distribution of electricity – i. Outside urban areas or industrial complexes with a capacity of more than 33 but less than 275kV;or ii. Inside urban areas or industrial complexes with a capacity of 275kV or more.

[5] As this is a proposed electricity generation project and thereby considered to be of national importance, the National Department of Environmental Affairs is the competent authority for the proposed project.

Relevant notice:	Activity No:	Description of listed activity:
		Underground cabling between the CSP facility and the on-site substation will be 33kV cables.
GN 544, 18 June 2010	11 (iii); (x); (xi)	The construction of: iii. bridges; x. buildings exceeding 50 square metres in size; or xi. infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. ***There will be drainage lines on the development site affected by the proposed development.***
GN 544, 18 June 2010	13	The construction of facilities or infrastructure for the storage, or for the storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres. ***The CSP facility may require the storage of dangerous goods.***
GN 544, 18 June 2010 as amended	18 (i)	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock or more than 5 cubic metres from: i. a watercourse; ***There will be drainage lines on the development site affected by the proposed development.***
GN 546, 18 June 2010	13(c)ii	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation.

In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543, a Scoping and an EIA Phase are required to be undertaken as part of the EIA process which comprises the following four stages:

» *Notification Stage* - where the project is registered with DEA and the public participation process is initiated. This phase is complete.
» *Scoping Phase* - where the potential impacts of the facility are identified in preparation for the EIA Phase. This phase is complete.
» *EIA Phase* - the *current* phase whereby the potential impacts of the facility are assessed and evaluated in terms of their significance). The findings of this stage are detailed within this report.
» *Decision Making Phase* – whereby the competent authority (i.e. DEA) is provided with all the necessary information to compile an environmental authorisation (previously referred to as a Record of Decision). This phase will follow the submission of the Final EIA Report.

1.5. Objectives of the EIA Process

The Scoping Phase was completed in April 2012 and served to identify potential impacts associated with the proposed project and to define the extent of studies required within the EIA Phase. The Scoping Phase included input from the project proponent, specialists with experience in the study area and in EIAs for similar projects, as well as a public consultation process with key stakeholders that included both government authorities and interested and affected parties (I&APs).

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

1.6. Details of the Environmental Assessment Practitioner

Savannah Environmental was contracted by FG Emvelo as the independent Environmental Consultant to undertake the EIA process for the proposed Karoshoek Solar Valley Development. Neither Savannah Environmental, nor any of its specialist sub-consultants on this project are subsidiaries of, or are affiliated

to FG Emvelo. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

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

» *Jo-Anne Thomas* who will be the project manager responsible for planning, programming, and overseeing of the EIA process. Jo-Anne has considerable experience (more than 14 years) in conducting EIAs and in EIA project management.
» *Alicia Govender* who will be the EAP responsible for preparation of the EIA reports and assessment of environmental aspects. Alicia has 4 years experience in the environmental field and has been involved with the EIA Process for multiple solar energy facilties, particularly in the Northern Cape.

Savannah Environmental has gained extensive knowledge and experience on potential environmental impacts associated with electricity generation projects through their involvement in related EIA processes. Savannah Environmental has completed the EIA process and received environmental authorisations for a number of renewable energy projects throughout South Africa.

Savannah Environmental has developed a valuable understanding of impacts associated with the construction and operation of renewable energy facilities. Savannah Environmental has successfully managed and undertaken EIA processes for other power generation projects throughout South Africa.

In order to adequately identify and assess potential environmental impacts associated with the proposed project, Savannah Environmental has appointed the following specialist sub-consultants to conduct specialist impact assessments:

» Terrestrial Fauna and Flora study – Simon Todd Consulting
» Geological Impact Assessment – Outeniqua Geotechnical Services cc

- Heritage study – G&A Heritage
- Visual study– MetroGIS (Pty) Ltd
- Social study– Batho Earth
- Water Resources Assessment Study - Scherman Colloty & Associates

Refer to Appendix A for the curricula vitae for Savannah Environmental and the specialist sub-consultants team.

TECHNOLOGY DESCRIPTION CHAPTER 2

2.1. Solar Thermal Power

The generation of electricity can be easily explained as the conversion of energy from one form to another. Solar[6] thermal facilities, like conventional fossil fuel-fired power plants, operate by heating water for the purpose of steam generation. This superheated steam is routed to the steam turbine where it expands through the turbine blading to drive the steam turbine, which actuates the AC generator. The generator converts mechanical energy into electrical energy by creating relative motion between a magnetic field and a conductor. Where conventional power stations burn fossil fuels (i.e. coal or gas) to generate steam, their solar counterparts extract this energy from the sun. Different types of solar thermal technologies make use of reflectors / mirrors to concentrate the incoming solar radiation onto a focal point/line. These are referred to as concentrating solar power (CSP) technologies and include parabolic trough, power tower, **Linear Fresnel**, and parabolic dish technology, of which the linear Fresnel is applicable to the proposed LF1 facility on site 1.1 of the larger Karoshoek Solar Valley Development.

2.1.1. What is a Linear Fresnel?

Fresnel collector technology is an evolution of parabolic trough technology, using almost flat glass mirrors in place of parabolically curved mirrors. 16 parallel lines of mirrors reflect solar energy onto a receiver in which water is directly vaporized. The resulting steam can be directed to a steam turbine for power generation or used for seawater desalination, solar cooling and other industrial heat applications.

[6] Solar technologies can be divided into two categories, those that use water (i.e. solar thermal technology), and those that do not (i.e. photovoltaic technology). The proposed Karohoek LF1 facility will utilise water.

Figure 2.1: Linear Fresnel technology (Source: Novatec)

The key positive attributes of the technology are outlined as follows:

» Direct steam generation:
  – Superheated steam of up to 500 ºC and 100 bars
  – No heat exchangers resulting in higher efficiencies
  – No toxic oil in the absorber tubes
» Proven and bankable technology that passed extensive due diligence processes
» Scalable solar field size due to modular structure
» Use of standard materials such as sheet plats and glass mirrors
» High land use efficiency of about 50%
» Minimization of required earth movements as a land slope of 5% can be accommodated
» Low sensitivity to wind loads due to low profile solar field concept
» Low operating cost and water use due to robotic cleaning system

2.1.2. Description of key components

» The Primary reflector is the most important component of each collector. It is comprised of four flat mirrors pressure glued on to a zinc-coated steel substructure. The sandwich box design of Primary's sub-structure is extremely rigid and provides a secure mounting platform for the mirror segments. The production process aims to ensure each Primary reflector will accurately focus the sun's radiation towards the receiver structure, 7,40 m above mirror level.

Figure 2.2: Primary reflector (Source: Novatec)

» Solar radiation is focused towards a receiver structure consisting of a Secondary Reflector and an absorber tube. The Secondary Reflector increases the focus target area. Direct focused solar and reflected radiation heats the circulating water / steam mix in the absorber tube at temperatures up to 300°C at pressures of up to 80 bar. The absorber tube is formed from 70mm diameter high-temperature steel coated with a selective layer to reduce heat losses through thermal emission and maximize thermal absorption.

Figure 2.3: Receiver and Secondary Reflector Primary reflector (Source: Novatec)

» The Primary Reflectors in each half of the collector are mechanically coupled and driven as a gang by a small 40W 24V motor. Approximately 256m^2 of mirror are controlled by one motor. A computer algorithm determines the exact angle of reflection for each Primary Reflector row at each minute of the day at the precise reflector location. Positioning is then further optimised by

PV cell readings on either side of the Secondary Reflector allowing fine-tuning commands to be sent to the drive motor as required.

Figure 2.4: Tracking motor (Source: Novatec)

» The support structure acts as the framework on which the Primary Reflectors are positioned and on which the Receiver is mounted. The support structure distributes weight effectively and maintains structural rigidity. It uses comparatively small amount of steel. Depending on soil conditions, its lightweight design allows "nail" foundations to be used, saving preparation and assembly time on site.

Figure 2.5: Support Structures (Source: Novatec)

» One of the proprietary pieces of equipment designed by Novatec Solar (a potential supplier) is its cleaning robot. Once placed on the Primary Reflector, the cleaning robot automatically cleans the mirror surface using cleaning brushes and a minimal quantity of water.

Figure 2.6: Cleaning Robot (Source: Novatec)

2.1.3. Description of the Linear Fresnel Technology

The main components of boiler technology are slightly curved glass mirrors (primary reflectors), radiation receivers, foundations, supporting structure and systems that control primary reflector tracking and solar array output.

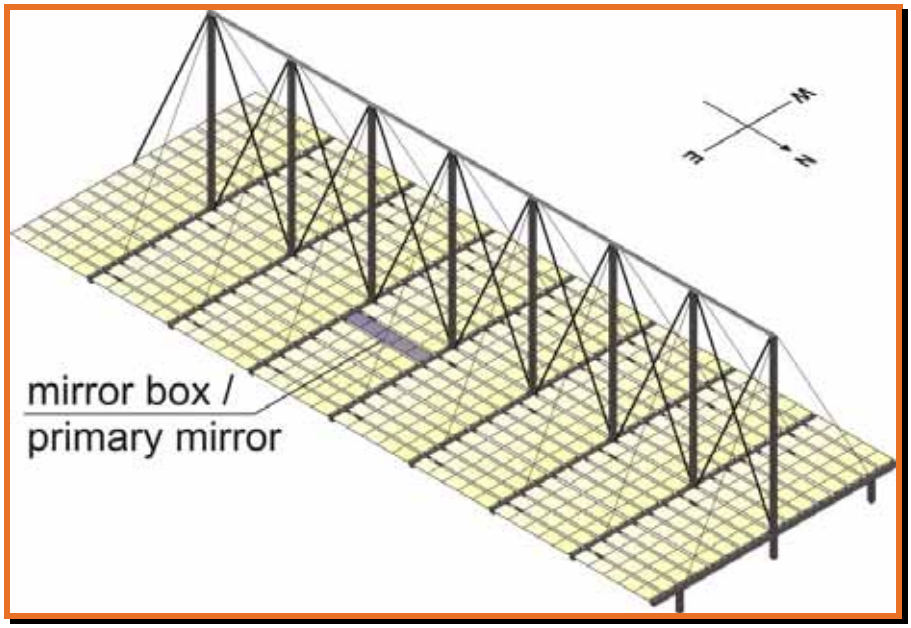


Figure 2.7: Basic Model of Linear Fresnel Technology (Source: Novatec)

The primary reflectors are installed in parallel rows and focus reflected incident solar radiation onto a focal line.

A receiver is installed along the focal line which consists of a secondary reflector and an absorber pipe. The inclusion of the secondary reflector increases the

acceptable target area for the reflected solar radiation from the primary reflector. The absorber pipe absorbs the solar radiation and evaporates water inside the pipe. The receiver structure carries the absorber tube on low friction bearings which accommodate the significant diurnal expansion and contraction of the absorber tube. A flexible connection to the water pipe at the cold end of the row allows the absorber tube to expand and contract. The complete receiver assembly is supported on guyed columns at a height of about 7.40 m above mirror level.

The solar boiler is separated into two sections. The evaporative section works with a water surplus which improves the heat transfer from the absorber pipe to the water and avoids overheating of the absorber pipe. The steam is separated from the water in a water separator with the steam being sent to the superheating section. The resulting superheated steam is utilised in a turbine (or other processes). The water is recirculated to the solar field inlet by circulation pumps. The only difference in design between the evaporative and superheating solar field section is the absorber tube which is vacuum sealed in the superheating part and therefore allows higher temperatures. The steam temperature is controlled at temperature levels of up to 500°C.

During daylight hours the mirror elements are continuously rotated around one axis by servo-motors via gears and a linkage system to maintain the focus of the solar energy on the receiver, regardless of the position of the sun.

Figure 2.8: Solar Boiler (Source: Novatec)

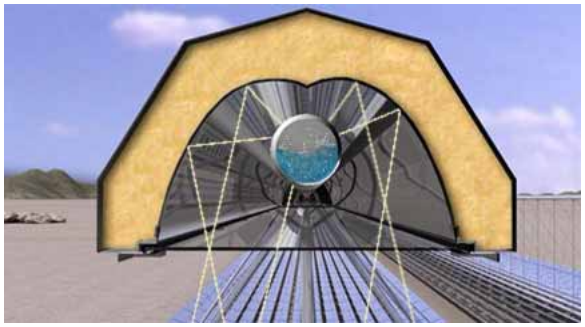


Figure 2.9: Receiver (Source: Novatec)

As other CSP technologies, FG Emvelo is considering technology that can be coupled with existing storage concepts. Nevertheless, due to the high temperature level of the steam produced from a system that FG Emvelo are considering, higher performance can be achieved. The storage technology offering the biggest advantage to the customer will be determined by a detailed project specific evaluation. Possible configurations include short-term steam storage to smoothen fluctuations as applied at the Novatec projects in Spain PE1 and PE2, and long term storage on the basis of molten salt for load shifting in the evening hours.

2.1.4. Functionality of the proposed Concentrated Solar Power (CSP) Plant

The functionality of the proposed CSP is briefly discussed below as five steps.

Step 1 Feedwater conveyed through the absorber tubes is evaporated by the concentrated solar energy.

Step 2 Saturated water is separated from the saturated steam which then is transferred to the superheating section of the solar boiler.

Step 3 The superheated steam is driving the turbine and electricity is generated.

Step 4 An air cooled condenser is used to condensate the exhaust steam from the turbine.

Step 5 From the condenser the water is pumped back to the solar boiler via a Deaerator /Feedwater Tank

The CSP Power Plant uses only water as heat transfer fluid. It is working as a conventional steam power plant except for the fact that the boiler is using solar radiation as energy source instead of fossil fuels.

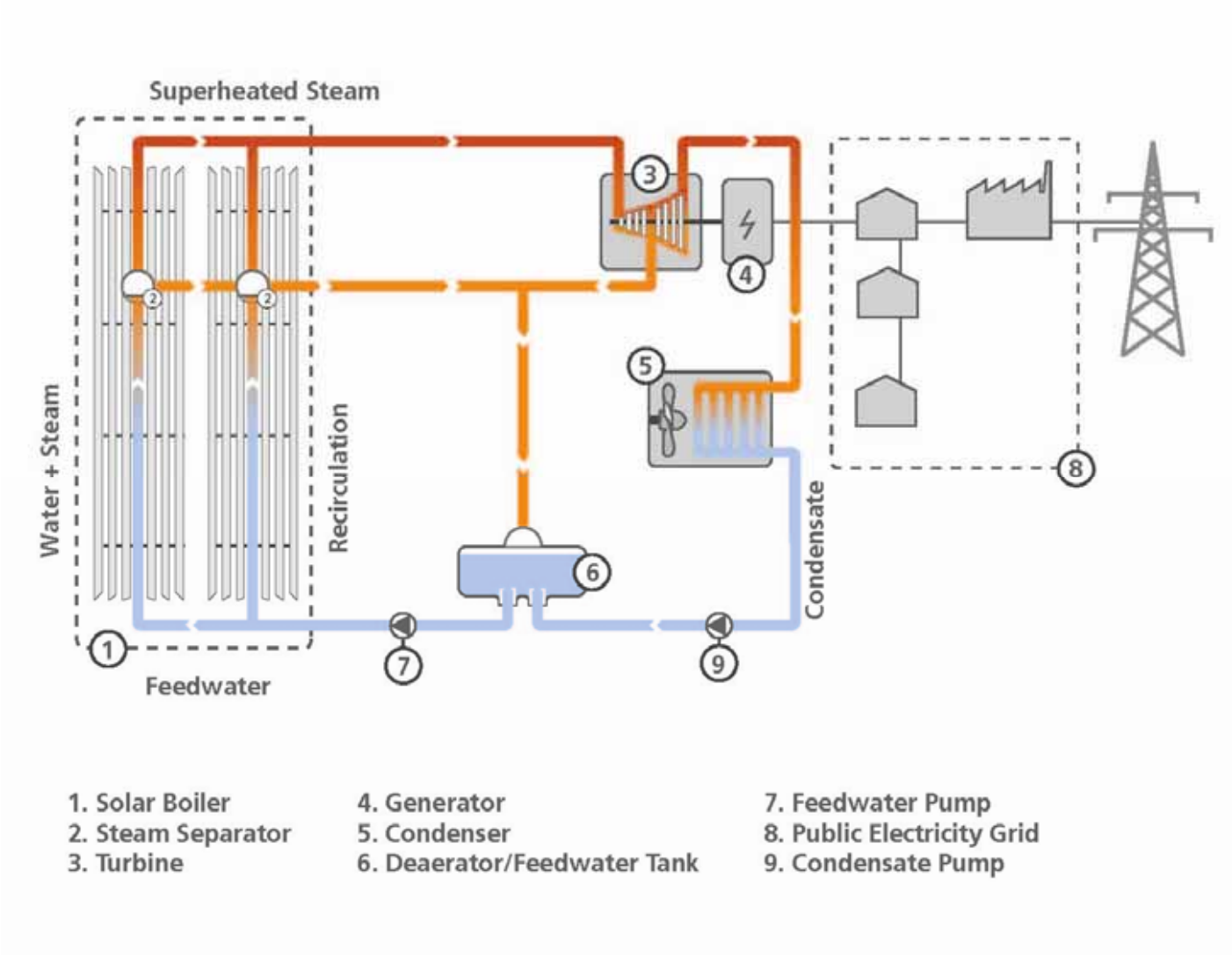


Figure 2.10: Schematic diagram of concentrating solar thermal power plant utilising Linear Fresnel technology (Source: Novatec)

2.1.5. Benefits of Renewable Energy Facilities

South Africa depends on fossil fuels for its energy needs. Fossil fuels supply nearly 90% of the primary energy needs with coal providing about 75% of the national energy demand (i.e. electrical power included). This dependence on fossil fuels, particularly on coal raises a number of issues including but not limited to:

» *Air pollution and the emission of greenhouse gases* - environmental pollution and the emission of CO_2 from the combustion of fossil fuels constitute a threat to the environment. The use of fossil fuels is reportedly responsible for approximately 70% of greenhouse gas emissions worldwide. Solar thermal facilities produce an insignificant quantity of greenhouse gases when compared to conventional coal-fired power stations. Therefore, the large scale implementation of renewable energy (including CSP) facilities should contribute significantly in the reduction of greenhouse gas production (Fluri, 2009).
» *Increasing energy requirements* - economic development over the next several decades will result in an ever increasing demand for energy. However there is some uncertainty as to the availability of economically extractable coal reserves for future use. Furthermore, several of South Africa's power stations are nearing the end of their economic life which is coupled with the expense of the Return to Service (RTS) of older power stations (i.e. Camden, Komati, and Grootvlei is expected to cost in the region of R20 billion to return on line).

As such, countries worldwide are being pressured to increase their share of renewable energy generation. Grid connected renewable energy is currently the fastest growing sector in the global energy market. Targets for the promotion of renewable energy now exist in more than 58 countries, of which 13 are developing countries. The South African Government has recognised the country's high level of renewable energy potential and presently has in place targets of 10 000 GWh of renewable energy by 2013 (to be produced mainly from biomass, wind, solar and small-scale hydro). This amounts to approximately 4% (1 667 MW) of the total estimated electricity demand (41 539 MW) by 2013. The IRP 2010 recently approved by Cabinet has outlined 42% of renewable energy by 2030.

PROJECT OVERVIEW CHAPTER 3

This chapter provides an overview of the proposed project including the consideration of alternatives and the scope of works for the different phases of the proposed facility (i.e. design, construction, operation, and decommissioning).

3.1 Nomination of the Northern Cape for Solar Energy Development

The University of Stellenbosch determined which areas of South Africa are most suitable for solar facilities, particularly for solar thermal facilities which require water for steam generation, much like conventional fossil fired power plants (Fluri, 2009). This suitability was determined by overlaying several GIS layers/screens with certain areas such as nature conservancies, airports, military bases, water surfaces, and built up areas being ruled outright.

These GIS layers included:

» *The solar resource* – only sites with an annual average daily direct normal irradiation (DNI) higher than 7 kWh/m^2/day were deemed suitable. The proposed site has a mean annual DNI for CSP of 2 806 kWh/m^2/annum.
» *Land use* – areas characterised as "Least Threatened" according to Mucina and Rutherford's Vegetation Map of South Africa were deemed suitable.
» *Topography* – a digital elevation model was used to select only those areas with a slope of less than 1%.
» *Potential for evacuation options* – the CSP plants would need to be sited at a reasonable distance from a point of evacuation to the National Grid in order to remain efficient from a cost and line loss[7] perspective.

The solar resource in the Northern Cape Province has shown the most potential for the development of large scale Concentrating Solar Power (CSP) facilities[8] (Pletka et al, 2007). However, the possible lack of additional water in certain areas of the Northern Cape for industrial development *may* serve to eliminate the establishment of multiple facilities, or at the very minimum encourage the use of dry cooling methods. Following the screening process, only those suitable areas larger than 2 km^2 were deemed viable as solar facilities typically require significant space for the equipment to be installed in the solar field. The study

[7] Line losses usually refer to energy waste resulting from the transmission of electrical energy across power lines.
[8] CSP facilities function by concentrating the incoming solar radiation in order to maximise the efficiency.

concluded that the Northern Cape alone could accommodate approximately 500 GW (Fluri, 2009).

3.2 Identification of the proposed Development Site within the Northern Cape

The broader Karoshoek site was selected based on several key factors required to develop a CSP plant which included the solar resource, access to water, site access, access to the national electricity grid for power evacuation, and the proximity of the site to Upington (a major centre).

Site 1.1 was selected within the broader development site by FG Emvelo by virtue of technical, economic and environmental characteristics. This site is located roughly in the middle of the broader development site and suitability for a solar facility includes:

» Site slope and topography is beneficial for CSP Linear Fresnel developments.
» Only very limited obstacles for radiation in the area, (i.e. hills and koppies).
» Site access from the N10 national road is along an existing gravel road on Farm Annashoek.
» Supply of fresh water from the Orange River is easily possible.
» Access to the National Grid infrastructure is easily possible.

Furthermore, the meteorological station that was installed to measure the climatic conditions of the broader site is located in close proximity to Site 1.1.

3.3 Project Alternatives

In accordance with the requirements of the EIA Regulations[9], alternatives are required to be considered within the EIA process, and may refer to any of the following:

» Site alternatives
» Activity alternatives
» Design or layout alternatives
» Technology alternatives
» Operating alternatives
» No-go alternative

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

3.3.1. Site Alternatives

No site alternatives have been evaluated as part of the EIA process as only Site 1.1 (i.e. located on farm Zandemm 944, portion 0, and Portion 3 of Annashoek 41) will be evaluated for the location of the proposed CSP development. This portion of land is located at 28° 29' 17.25" 21° 31' 12.22" (elevation: 877m) and covers an extent of 4.84 km^2.

3.3.2. Activity Alternatives

No activity alternatives are being considered in this EIA Process.

3.3.3. Design or Layout Alternatives

This alternative was not assessed in the EIA Phase. However, social and environmental issues were considered prior to the production of the layout. The location of Site 1.1 considered environmental sensitivities identified in the Scoping Study (refer to Section 1.2) as well as technical criteria.

The rationale for not considering alternatives in this category is explained below.

» *linear fresnel* - the linear Fresnel mirrors require a north to south orientation in order to be able to optimally absorb the solar radiation by tracking the sun's path from east to west on the firmament.
» *Site access* - the study site is accessible via the N10 from Upington to Groblershoop. Access off the N10 will be via Farm Annashoek and will use the existing gravel road on the Farm Annashoek which will also lead to Site 1.1. Furthermore, this new alignment allows for the consolidation of linear infrastructure (i.e. the road and water pipeline). In addition SANRAL has approved the plan to realign the N10 entrance to Annashoek, this will be an added benefit to the public as it will reduce the number of accidents that used to take place around this section of the N10.

3.3.4. Technology Alternatives

CSP technology was determined as the preferential technology for the proposed development site (i.e. over wind and photovoltaic (PV) technologies) for several reasons. Grid stability is highly important for managing the grid load and performance. PV and wind technologies provide direct power only when the sun shines or the wind blows, therefore their momentary production follows the changes in weather (clouds and wind strength). However, CSP production is significantly more stable because of its inherent nature of transforming sunlight to power through heat energy. The large volume of water and steam in the system (Linear Fresnel technology), together with the ability to support the production by means of backup fuel heaters and thermal storage, enables the provision of stable and predictable power to the grid. CSP can be dispatched unlike PV or wind, and production hours can be extended by storage of the produced heat and releasing it when required, thus achieving more flexibility. This can also be achieved through hybridisation and offers better scope for localisation. Furthermore, CSP is less prone to adverse effects on efficiency due to ambient heat, which is a given phenomenon in the Karoo area.

3.3.5. Operating Alternatives

The following options were considered regarding the operating alternatives of the steam turbine generator.

» *Preferred option* - solar with no thermal storage.
» *Alternative option* - solar with thermal storage - where excess heat is collected and stored in a thermal storage tank. When needed, the heat from the thermal storage tank can be fed into the power block to continue electricity generation, again allowing for a longer operational period beyond daylight hours.

The economic and sustainable development criteria, as well as the outcomes of the EIA process will determine the final technology option for the plant.

The water use required by this project is relatively small in a regional context (Scherman, 2011). Cooling alternatives were not assessed as the implementation of dry cooling is preferred by the Department of Water Affairs.

3.3.6. No-go Alternative

Also referred to as the ‘do-nothing’ option, this refers to FG Emvelo not constructing the proposed site 1.1 as part of the larger Karoshoek Solar Valley

Park on the identified development site east of Upington. In this scenario the potential environmental and social impacts will not occur and the status quo will be maintained. However, should the project not proceed, the contribution of the project (i.e. 100 MW) towards the Government target for renewable energy will not be realised. This alternative is assessed further in this EIA Report.

3.4 Activities associated with the Project Phases

The main activities associated with the construction, operation and decommissioning phases of site 1.1 are detailed in the table that follows.

PRE-CONSTRUCTION AND CONSTRUCTION
» *Staff requirements* – on average an estimated labour force of 600 will be used on-site during the construction phase. However during peak construction periods approximately 700 – 800 workers will be required on-site. These positions will be comprised of approximately 250 low skilled, approximately 250 semi-skilled, and approximately 250 skilled workers The specialists / foreigners forming part of the construction team are likely to make use of the local establishments for accommodation facilities. A feasibility study being undertaken by the developer is considering the possibility of an on-site village that will have the appropriate facilities and amenities to accommodate approximately 600 people. It is expected that most of the construction (i.e. civil works) will be done by local South African companies. The use of local contractors such as Small, Medium, and Micro Enterprises (SMMEs) operating in the area will be considered by the EPC partner[10], and will be driven largely by what skills and services could be sourced from local SMMEs (i.e. as part of a competitive tendering process). The EPC partner will determine the standards which all workers need to comply to and this will be in line with South African standards and laws applicable to the construction industry. The construction of the power line will be done by Eskom or its approved contractor. Eskom or its approved contractor will determine the size of the labour force that will be involved in the construction of the power lines. The actual planning and recruitment phase is expected to start approximately 6 months to one year after financial close. » *Construction materials and equipment requirements* **-** around 30 - 40% of the construction material and equipment may be sourced locally (i.e. within South Africa), depending on technical capabilities and prices of local industry. The materials and equipment will be transported to site by road, rail, and air if necessary. » *Housing of the labour force* – although the majority of the low and semi-skilled work force will be sourced from the local area and will be housed off-site, it is possible that approximately 600 people will be housed permanently on-site within the proposed location for a site village. The security team will operate on site in shifts over 24 hours. » *Length of the construction phase* - commencement of the construction phase is dependent on the project being awarded preferred bidder status and, successfully reaching financial close. Thereafter, the construction phase is expected to take approximately 24-30 months to complete. The construction of the entire Karoshoek Solar Valley development is expected to take approximately 10-12 years.

Activity	***Detailed description***
Pre-construction surveys	Prior to initiating construction, a number of detailed surveys will be required including, but not

[10] The EPC partner for this development is still to be finalised.

Activity	***Detailed description***
	limited to: » *Geotechnical survey* – the geology and topography of the study area which was originally identified in the EIA Process will be confirmed. The geotechnical study will look at flood potential, foundation conditions, potential for excavations, and the availability of natural construction materials. This study will serve to inform the type of foundations required to be built (i.e. for the power block, and substation), and the extent of earthworks and compaction required in the establishment of the short internal access road to Site 1.1. » *Site survey* - in order to finalise the design layout of the solar field, the power block, and the other associated infrastructure. The finalisation will need to be confirmed in line with the Environmental Authorisation issued for the facility. » *Power line servitude survey* – once the placement of the power line towers has been finalised, a walk through survey will be undertaken for ecological, archaeology and heritage resources which may necessitate certain towers to be moved to avoid sensitivities (to be assessed through a separate EIA process (DEA ref no. 14/12/16/3/3/2/288)).
Undertake site preparation	» Site preparation activities will include: * Clearance of vegetation at the footprint of the area infrastructure (i.e. solar field, power block, and associated infrastructure). * Levelling of site (as necessary) * Clearance of vegetation at the footprint of the linear component (i.e. internal access road, water supply pipeline). * The development of stormwater control management systems which will include drainage channels which will collect all rain water and lead it to the natural stormwater drainage system after it has been settled/treated in a stormwater retention dam.

Activity	***Detailed description***
	» These activities will require the stripping of topsoil which will need to be backfilled as construction progresses and stockpiled for future rehabilitation.
Establishment of the access road and powerline servitudes	» The study site is accessible via the N10 from Upington to Groblershoop. Access off the N10 will be facilitated via an existing access road on the Farm Annashoek. A new road will branch off this existing road and lead to the area designated for the facility (i.e. a distance of approximately 1.2 km). The new road is required for construction purposes and is likely to remain in place for maintenance purposes during the operational phase. 3 options are currently being investigated through different EIA processes for the Eskom grid integration as follows: » The power will be evacuated via power lines which will connect to the future Eskom 400kV CSP MTS (planned to be constructed by Eskom in 2016) and will be located to the west of the site (DEA ref no. 14/12/16/3/3/2/288) » a new 132 kV power line running north from the north-western corner of Site 1.2 towards the existing 132 kV distribution line on the northern side of the Orange River. Here the newly proposed line will encounter the existing Gordonia/Garona 132kV line, turn westwards, and run alongside the current power line servitude up to the Gordonia Sub Station. This line will be approximately 13km in length (DEA ref no. 14/12/16/3/3/1/554). This will necessitate crossing the Orange River. » A new 132kV power line will run directly west from the north-western corner of Site 1.2 until it connects up with the existing Gordonia/Kleinbegin 132 kV line and will then follow this line servitude (i.e. using the same servitude) up to the Gordonia Sub Station. This line will be around 17km long (DEA ref no. 14/12/16/3/3/1/554). NB: These were the options investigated through various studies but the first option has been determined to be the most preferred alternative from an environmental and technical

Activity	*Detailed description*
	perspective and is also preferred by Eskom. A servitude of approximately 35 m width for each power line will need to be established. Only the centre line may need to be cleared for stringing purposes. The reminder of the servitude will not be cleared, except where trees higher than 4m exist which could interfere with the operation of the power line. This work will be undertaken by an Eskom approved contractor.
Transport of components to site	» Depending on the local availability of equipment, the majority of the facility components and civil engineering construction equipment (i.e. excavators, trucks, graders, compaction equipment, cement trucks, etc.) will be sourced locally from Upington and will either be transported to site via provincial and local roads. The important equipment is likely to be imported to Saldanha Bay harbour and then transported to site via road or rail. This is still to be finalised through the Transportation Study. » Some of the power block components may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)[11] by virtue of dimensional limitations (i.e. length and weight). » In some instances, the dimensional requirements of the loads to be transported (e.g. the steam turbine, the main transformers, etc.) may require alterations to the existing road infrastructure (i.e. widening on corners), and protection of road-related structures (i.e. bridges, culverts, etc) due to those loads that are defined as abnormal.
Establishment of construction camps, storage facilities, laydown areas, and accommodation facilities	» Once the required equipment has been transported to site, dedicated construction camp(s), storage facilities, and laydown area/s will need to be established. These areas serve to confine activities to a designated area to limit potential site disturbance. The laydown area

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

Activity	*Detailed description*
	will be used for the assembly of the solar field components, as a logistical area for the contractors and as a prefabrication area. » An area for accommodation will be established for the purpose of housing approximately 800 people during the construction phase, with the potential to construct more permanent structures in the future. An application will be made to the //Khara Hais Municipality for sanitation, water, electricity, and waste disposal services for this accommodation facility. » The fuel required for on-site construction vehicles and equipment will need to be secured in a temporary bunded facility within the construction camp to prevent leakages and soil contamination.
Establishment of electricity generation infrastructure	» Following the pre-construction surveys and clearing activities, the power block infrastructure (i.e. the steam turbine, generator, substation,) will be constructed. Foundations will be established using concrete mixed at an off-site or on-site batching plant. »
[12]Establishment of water supply infrastructure	» *Abstraction point* - the water required for the steam cycle is proposed to be abstracted from the Orange River via an existing abstraction point near Farm Annashoek. The water will be piped via a 200 mm (ø) pipeline a distance of approximately 250 m to pass through a still basin, the main pump set, a sand filter, and a coffer dam[13]. » *Pipelines, reservoirs, etc* – the pipeline will continue from the sand filter in a south-westerly direction for approximately 200 m until it reaches the N10. » At this point it will cross under the N10 (800 mm - 1000 mm cover at road crossing) and continue alongside it for approximately 1.3 km to meet with the existing gravel road that crosses the Farm Annashoek.

12 This infrastructure has already been authorised through the EIA process undertaken for Project Ilanga on site 1.2 (DEA ref no. 12/12/20/2056)

[13] The coffer dam will be used to store filter backwash for future use.

Activity	*Detailed description*
	» The pipeline will then follow the road for approximately 1.5 km to meet up with a 24 hour holding raw water reservoir (steel reservoir 12.2 m (L) x 12.2 m (W) x 4.88 m (H)), a water treatment works, and a 48 hour holding potable water steel reservoir (15.86 m (L) x 15.86 m (W) x 4.88 m (H). » Thereafter the pipeline will continue for approximately 5 km to a 72 hour holding reservoir (steel reservoir 19.52 m (L) x 19.52 m (W) x 4.88 m (H)) for potable water[14]. Water will gravitate from this 72 hour reservoir to a 24 hour reservoir at Site 1.1 via a 250 mm ø pipeline. » At Site 1.1 a 24 hour holding reservoir, a package treatment plant (i.e. for production of demineralised water that will be used in the water steam cycle and cleaning of the troughs), and a 48 hour holding reservoir for plant use will be located. » Any concrete that may be required for these facilities is proposed to be mixed at both an on and off-site batching plants.
Undertake site rehabilitation	» Areas requiring rehabilitation will include those areas disturbed during the construction phase and are not required for operation and maintenance operations. Rehabilitation should be undertaken in an area as soon as possible after the completion of construction activities within that area. » Where relevant disturbed areas must be rehabilitated/re-vegetated with appropriate natural vegetation and/or local seed mix. Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved. » All temporary facilities, temporary equipment, and waste materials must be removed from site.

[14] At a point on this route (i.e. about 700 m from the water treatment plant), the pipeline will T-off to the west to deliver water to the proposed site for the accommodation areas for the construction crew.

Activity	***Detailed description***
	» Erosion control measures (i.e. drainage works and anti-erosion measures) should be used in sensitive areas (i.e. steep slopes, hills, and drainage lines), to minimise loss of topsoil and control erosion. » Any access points and/or access roads which are not required during the operational phase must be closed as part of the post-construction rehabilitation. » An alien invasive management plan will be implemented during construction and operation of the facility
Pipe cleaning	» In order to get a clean piping, a pipe cleaning process will be undertaken. This consists mainly of blow-out, acid pickling, and cleaning. The final acid pickling agent to be used is not defined yet, but most probably hydrofluoric acid will be used. Waste from acid pickling will be collected, adequately treated, and carefully disposed according to the applicable regulation.

OPERATION

» *Staff requirements* – approximately 40 staff members are expected to be required on-site during the operational phase of the project.
» *Length of the operation phase* – the facility is expected to be commissioned in March 2016 and is expected to be operational for - 40 years, where after it could be decommissioned or its lifespan extended depending on the power generation requirements at the time.

Activity	*Detailed description*
Sourcing, treatment and use of water	» Approximately 224 110 m^3 of water will need to be abstracted annually from the Orange River to meet all the proposed developments on site and including the water that will be used by the 100 MW CSP facility, approximately 20,000 m3/annum. The water will be pumped to the de-gritting and filtration reservoir. The water will flow by gravity through the pipeline (as described above) to the storage reservoir at the power block area, where it will be treated according to the needs of the project. » The CSP Linear Fresnel technology operates with direct steam generation. The solar boiler is fed with feedwater which than will be evaporised and superheated. The superheated steam drives the steam turbine. When the expanded steam leaves the steam turbine it will be condensate in an air cooled condenser and send back to the feed water tank. Since the water steam cycle will be a closed loop only a small amount of water will be necessary during the operation due to the degasification, the vacuum devices in the air cooled condenser and the blowdown system. » Once the water leaves the steam cycle, it will be released into the evaporation pond.
Treatment and disposal of waste water	» Water from the condensate polishing plant will be collected in a neutralisation basin and then will be forwarded to the collecting pond while wastewater from the demineralisation plant will go directly to the collecting pond. All surface water, storm water, and drains, etc. will pass through an oil separator station and all chemical wastewater will be pH adjusted before entering the collecting pond. The water from the collecting pond is finally forwarded to the evaporation pond. Any water from ablution facilities will be collected in a septic tank.
Chemical dosing for the water-steam cycle	» In order to maintain the required condensate quality of the water-steam cycle, ammonia is dosed in small quantities.
Inhibitor dosing for the closed	» To minimize oxidation of the system the condensate will be degasified in a thermal

Activity	***Detailed description***
cooling system	degasifier and a small amount of corrosion inhibitor (carbohydrazide) is dosed to the closed system.
Operation of the solar field	» The solar radiation will be concentrated by the mirrors onto the receiver structure consisting of a secondary reflector and an absorber tube. The secondary reflector increases the focus target area. Direct focused solar and reflected radiation heats the circulating water / steam mix in the absorber tube at temperatures up to **500 °C** at pressures of up to 10**0 bar** . » The thermal energy in form of superheated steam is routed to the steam turbine generator in which the thermal energy is converted into electric power. » The solar collectors will track the sun during the progression of the day in order to maximise the solar energy yield.
Antifreeze heating	» Due to the fact that the Linear Fresnel technology operates only with water and steam no antifreezing system is necessary. Only for small slotted lines it consists a risk of freezing during the night in the winter months. If this occurs they will be protect by insulating them or by a small electrical heating system.
Operation of the electrical infrastructure	» The steam turbine generator will generate electricity at a voltage of approx 16 kV and will be alternating current (AC). The electricity will be stepped up to a voltage of 132 kV and evacuated into the overhead distribution line and into the electricity grid.
Site operation and maintenance	» It is anticipated that a full-time security, maintenance, and control room staff will be required on site. » The facility will be operational except under circumstances of mechanical breakdown, unfavourable weather conditions, or routine maintenance activities.

DECOMMISSIONING

» *Length of the decommissioning phase* – following the operational phase it could be decommissioned or its lifespan extended depending on the power generation requirements at the time.
» *Activities during the decommissioning phase* - it is most likely that decommissioning would comprise the disassembly and replacement of the individual components with more appropriate technology/infrastructure available at that time.

Activity	***Detailed description***
Site preparation	» Site preparation activities similar to those undertaken in the construction phase will be required during the decommissioning phase. This will include confirming the integrity of site access to the site in order to accommodate the required equipment (e.g. lay down areas and decommissioning camp) and the mobilisation of decommissioning equipment.
Disassemble and replace existing components	» The components would be disassembled, and reused and recycled (where possible), or disposed of in accordance with regulatory requirements.

REGULATORY AND LEGAL CONTEXT CHAPTER 4

4.1. Policy and Planning Context

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

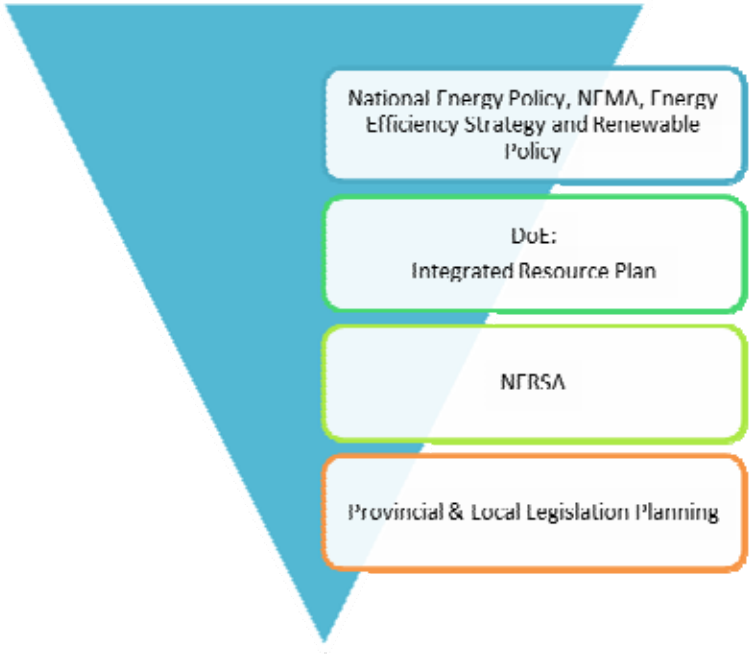


Figure 4.1: Hierarchy of electricity policy and planning documents

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

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

Investment in renewable energy initiatives, such as the proposed solar energy facility, is supported by the White Paper on Energy Policy for South Africa. In this regard the document notes that government policy is based on an understanding that renewable energy sources have significant medium - long-term commercial potential and can increasingly contribute towards a long-term sustainable energy future in South Africa. The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly ***solar*** and wind and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account.

4.1.2. Renewable Energy Policy in South Africa, 1998

The White Paper on Renewable Energy (DME, 2003) supplements the Energy Policy, and sets out Government's vision, policy principles, strategic goals, and objectives for promoting and implementing renewable energy in South Africa. The support for the Renewable Energy Policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind, and that renewable applications are, in fact, the least cost energy service in many cases from a fuel resource perspective (i.e. the cost of fuel in generating electricity from such technology); more so when social and environmental costs are taken into account. Government policy on renewable energy is therefore concerned with meeting economic, technical, and other constraints on the development of the renewable industry.

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

4.1.3. Integrated Energy Plan, 2003

In response to the requirements of the National Energy Policy, the DME commissioned the Integrated Energy Plan (IEP) in 2003 to provide a framework in which specific energy policies, development decisions and energy supply trade-offs can be made on a project-by-project basis. The framework is intended to create a balance between the energy demand and resource availability to provide low cost electricity for social and economic development, while taking into account health, safety, and environmental parameters.

The draft IEP recognised that South Africa is likely to be reliant on coal for at least the next 20 years as the predominant source of energy. However, the

potential and a need to diversify energy supply through increased use of natural gas and new and renewable energies were recognised.

4.1.4 Final Integrated Resource Plan, 2010 - 2030

The Energy Act of 2008 obligates the Minister of Energy to develop and publish an integrated resource plan for energy. Therefore, the Department of Energy (DoE), together with the National Energy Regulator of South Africa (NERSA) has compiled the Integrated Resource Plan (IRP) for the period 2010 to 2030. The objective of the IRP is to develop a sustainable electricity investment strategy for generation capacity and transmission infrastructure for South Africa over the next twenty years. The IRP is intended to:

» Improve the long term reliability of electricity supply through meeting adequacy criteria over and above keeping pace with economic growth and development;
» Ascertain South Africa's capacity investment needs for the medium term business planning environment;
» Consider environmental and other externality impacts and the effect of renewable energy technologies;
» Provide the framework for Ministerial determination of new generation capacity (inclusive of the required feasibility studies)

The objective of the IRP is to evaluate the security of supply, and determine the least-cost supply option by considering various demand side management and supply-side options. The IRP also aims to provide information on the opportunities for investment into new power generating projects.

The outcome of the process confirmed that coal-fired options are still required over the next 20 years and that additional base load plants will be required from 2010. The first and interim IRP was developed in 2009 by the Department of Energy. The initial four years of this plan was promulgated by the Minister of Energy on 31 December 2009, and updated on 29 January 2010. The Department of Energy released the Final IRP in March 2011, which was accepted by Parliament at the end of March. This Policy-Adjusted IRP is recommended for adoption by Cabinet and subsequent promulgation as the final IRP. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9.6 GW of nuclear; 6.3 GW of coal; 17.8 GW of renewables (including 8,4GW solar); and 8.9 GW of other generation sources.

4.2. Provincial and Local Level Developmental Policy

4.2.1. Northern Cape Growth and Development Strategy (2004-2014)

The Northern Cape Provincial Growth and Development Strategy (NCPGDS; 2004 - 2014) notes that the most significant challenge that the government and its partners in growth and development are confronted with is the **reduction of poverty**. All other societal challenges that the province faces emanate predominantly from the effects of poverty. The NCPGDS notes that the only effective way to reduce poverty is through long-term sustainable economic growth and development. The sectors where economic growth and development can be promoted include:

» Agriculture and Agro-processing;
» Fishing and Mariculture;
» Mining and mineral processing;
» Transport;
» Manufacturing;
» Tourism.

However, the PGDS also notes that economic development in these sectors also requires:

» Creating opportunities for lifelong learning;
» Improving the skills of the labour force to increase productivity;
» Increasing accessibility to knowledge and information.

The achievement of these primary development objectives depends on the achievement of a number of related objectives that, at a macro-level, describe necessary conditions for growth and development. These are:

» Developing requisite levels of human and social capital;
» Improving the efficiency and effectiveness of governance and other development institutions;
» Enhancing infrastructure for economic growth and social development.

Of specific relevance to the Karoshoek Development proposal, the NCPGDS makes reference to the need to ensure the availability of energy. The section notes that in order to promote economic growth in the Northern Cape the availability of electricity to key industrial users at critical localities. At the same time, the development of new sources of energy through the promotion of the adoption of

energy applications that display a synergy with the province's natural resource endowments must be encouraged. In this regard the NCPGDS notes "the development of (renewable) energy sources could be some of the means by which new economic opportunity and activity is generated in the Northern Cape". The NCPGDS also highlights the importance of close co-operation between the public and private sectors in order for the economic development potential of the Northern Cape to be realised. The proposed project will support the government developmental objectives that include potential for localisation in the area it will operate in.

The NCPGDS also highlights the importance of enterprise development, and notes that the current levels of private sector development and investment in the Northern Cape are low. In addition, the province also lags in the key policy priority areas of SMME Development and Black Economic Empowerment (BEE).

In this regard, care will need to be taken to ensure that the proposed solar thermal power plant and other renewable energy facilities will not significantly impact on the region's natural environment. The NCPGDS notes that the sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile eco-systems and vulnerability to climatic variation. The document also indicates that due to the province's exceptional natural and cultural attributes, it has the potential to become the preferred adventure and ecotourism destination in South Africa. Care therefore needs to be taken to ensure that the development of large renewable energy projects, such as the proposed solar thermal energy facility, have minimal impact on the tourism potential of the province.

4.2. Regulatory Hierarchy for Energy Generation Projects

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments (i.e. National, Provincial, and Local). The main regulatory agencies at a national level include:

» *Department of Energy (DoE)* - This department is responsible for policy relating to all energy forms, including renewable energy, and are responsible for forming and approving the IRP (Integrated Resource Plan for Electricity). Solar energy is considered under the White Paper for Renewable Energy (2003) and the Department undertakes research in this regard. It is the controlling authority in terms of the Electricity Regulation Act (Act No 4 of 2006)..

- *National Energy Regulator of South Africa (NERSA)* - this body is responsible for regulating all aspects of the electricity sector, and will ultimately issue generation licenses for renewable energy developments.
- *Department of Environmental Affairs (DEA)* - this department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. DEA has been made the competent authority responsible for granting the relevant environmental authorisations for all renewable energy projects which are regarded of national importance.
- *The South African Heritage Resources Agency (SAHRA)* - the National Heritage Resources Act (Act No. 25 of 1999) and the associated provincial regulations provides legislative protection for listed or proclaimed sites, such as urban conservation areas, nature reserves and proclaimed scenic routes.
- *South African National Roads Agency Limited (SANRAL):* this department is responsible for all national road routes.
- *Department of Water Affairs (DWA):* This department is responsible for effective and efficient water resources management to ensure sustainable economic and social development.
- *Department of Forestry and Fishery (DAFF):* This department the custodian of South Africa's agriculture, fisheries and forestry resources and is primarily responsible for the formulation and implementation of policies governing the Agriculture, Forestry and Fisheries Sector.

The main regulatory agencies at a provincial level include:

- *Northern Cape Department of Environment and Nature Conservation (DENC)* - this department is responsible for environmental policy and is the provincial authority in terms of NEMA and the EIA Regulations. The DENC is the commenting authority for this project.
- *Northern Cape Department of Transport and Public Works* - this department is responsible for provincial roads in the Northern Cape and the granting of exemption permits for the conveyance of abnormal loads on public roads.
- *Northern Cape Department of Agriculture* - this department's involvement relates specifically to sustainable management of the agricultural resources in the Northern Cape.
- *Northern Cape Department of Water Affairs* – this department will be involved in the allocation of water resources for a project of this nature.
- *Ngwao Boswa ya Kapa Bokone (Northern Cape Heritage Authority):* This body is responsible for all heritage related issues in the Northern Cape Province.

By-laws and policies have been formulated by local authorities to protect visual and aesthetic resources relating to urban edge lines, scenic drives, special areas, signage, communication masts, etc. Bioregional planning involves the

identification of priority areas for conservation and their placement within a planning framework of core, buffer, and transition areas. These could include reference to visual and scenic resources and the identification of areas of special significance, together with visual guidelines for the area covered by these plans. The main regulatory agencies at a local level include:

» *The Khara Hais Local Municipality* – this municipality is one of the principal regulatory authorities responsible for planning, land use, and environmental management.
» *The Siyanda District Municipality* – like the local municipality, this department is also a regulatory authority responsible for planning, land use, and environmental management. An Environmental Management Framework (EMF) has been developed by the Siyanda District Municipality to ensure that future development in the area occurs in a manner that is appropriate to the unique features and character of the area. The EMF identifies constraints, opportunities, issues, and the relative desired state for a wide range of biophysical, social, and socio-economic topics.
» *Municipal Systems Act (Act No. 32 of 2000)* - it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.

4.3. Applicable Legislation and Guidelines

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

» National Environmental Management Act (Act No 107 of 1998)
» EIA Regulations, published under Chapter 5 of the NEMA (GNR R545, GNR 546 in Government Gazette 33306 of 18 June 2010)
» Guidelines published in terms of the NEMA EIA Regulations, in particular:
  * Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010)
  * Public Participation in the EIA Process (DEA, 2010)
» International guidelines – the Equator Principles

Several other acts, standards, or guidelines have also informed the project process and the scope of issues addressed and assessed in the EIA Report. A review of legislative requirements applicable to the proposed project is provided in Table 4.1.

Table 4.1: Relevant legislative and permitting requirements applicable to the establishment of site 1.1 as part of the larger Karoshoek Solar Valley Development

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
National Legislation			
National Environmental Management Act (Act No. 107 of 1998)	» NEMA requires, inter alia, that: ∗ Development must be socially, environmentally, and economically sustainable." ∗ Disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied." ∗ A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions." » EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations. » In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority charged by NEMA with granting of the relevant	» National Department of Environmental Affairs » Northern Cape Department of Environment and Nature Conservation (DENC)	» This EIA Report is to be submitted to the DEA for review and decision making. » The DENC will act as the commenting authority.

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	environmental authorisation. » In terms of GNR 543 of 18 June 2010, a full Scoping and EIA Process is required to be undertaken for the proposed project.		
National Environmental Management Act (Act No. 107 of 1998)	» A project proponent is required to consider a project holistically and to consider the cumulative effect of potential impacts. » In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with a project is avoided, stopped or minimised.	» National Department of Environmental Affairs	» While no permitting or licensing requirements arise directly, the holistic consideration of the potential impacts of the proposed project has found application in the EIA Phase. » The implementation of mitigation measures are included as part of the Draft EMP and will continue to apply throughout the life cycle of the project.
National Environmental Management: Biodiversity Act (Act No. 10 of 2004)	In terms of S57, the Minister of Environmental Affairs has published a list of critically endangered, endangered, vulnerable, and protected species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came into effect on 1 June 2007. In terms of GNR 152 of 23 February 2007: Regulations relating to listed threatened and	» National Department of Environmental Affairs	» As the applicant will not carry on any restricted activity in terms of S57, no permit is required to be obtained in this regard. » In terms of GNR 152 specialist flora and fauna studies have been undertaken as part of the EIA process. These studies have been undertaken as part of the previously EIAs undertaken for the power station site. » A permit may be required should

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	protected species, the relevant specialists must be employed during the EIA Phase of the project to incorporate the legal provisions as well as the regulations associated with listed threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements at an early stage of the EIA Phase. » The Act provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GoN 1002), 9 December 2011).		any protected plant species on site be disturbed or destroyed because of the proposed development.
National Environmental	» The Minister may by notice in the	» National Department of	» A waste license will be required

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
Management: Waste Act, 2008 (Act No. 59 of 2008)	Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. » In terms of the regulations published in terms of this Act (GN 718), a Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities. » Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that (a) The containers in which any waste is stored, are intact and not corroded or in any other way rendered unlit for the safe storage of waste; (b) Adequate measures are taken to prevent accidental spillage or leaking; (c) The waste cannot be blown away; (d) Nuisances such as odour, visual impacts and breeding of vectors do not arise; and (e) Pollution of the environment and harm to health are prevented.	Water and Environmental Affairs » Provincial Department of Environmental Affairs	for the storage of waste, and for the wastewater treatment plant. This waste license application process is required to be supported by an EIA process. » Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of this Act, as detailed in the EMP.
» National Environmental Management: Air Quality Act (Act No. 39 of 2004)	» S18, S19 and S20 of the Act allow certain areas to be declared and managed as “priority areas” » Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of	» National Department of Environmental Affairs » Local authority	» While no permitting or licensing requirements arise from this legislation, this act will find application during the construction phase of the

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	Act) with relevant emission standards » The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.		project. » As the 15% fossil fuel augmentation plant has a generating capacity of less than 50 MW, an air emissions license will not be required from DEA. However, a license may be required from the local authority.
National Water Act (Act No. 36 of 1998)	» Under S21 of the act, water uses must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation. » In terms of S19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing, or recurring.	» National Department of Water Affairs » Northern Cape Department of Water Affairs	» The abstraction of water, the storage of water, and the alteration of the characteristics of a watercourse are regarded as a water use (as defined in terms of S21 of the NWA). As such a Water Use License (WUL) is being applied for in parallel with the EIA process. » Crossing of drainage lines is a water use requiring a water use license in terms of S21. This is included in the WUL application process for the project. » Requirements set by S19 will apply throughout the life cycle of the project.
Environment Conservation Act (Act No. 73 of 1989)	» National Noise Control Regulations (GN R154 dated 10 January 1992)	» National Department of Environmental Affairs » Northern Cape Department of Environment and Nature	» There is no requirement for a noise permit in terms of the legislation. » Any noisy activities carried out

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
		Conservation » Local Authorities	during the construction phase that could present an intrusion impact to the local community should be limited to 6:00am to 6:00pm Monday – Saturday (excluding public holidays). » Should these specific activities need to be undertaken outside of these times, the surrounding communities will need to be notified and appropriate approval will be obtained from the DEA and the Local Municipality.
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	» A mining permit or mining right may be required where a mineral in question is to be mined (i.e. materials from a borrow pit) in accordance with the provisions of the Act. » Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act.	» Department of Minerals and Energy	» As no borrow pits are expected to be required for the construction of the facility, no mining permit or mining right is required to be obtained.
National Heritage Resources Act (Act No. 25 of 1999)	» S38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including » The construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length;	» South African Heritage Resources Agency	» As per S38 an HIA has been undertaken as part of the EIA Phase. » A permit may be required should identified cultural/heritage sites on site be required to be disturbed or destroyed as a

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	» Any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent » The relevant Heritage Authority must be notified of developments such as linear developments (i.e. roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided. » Stand alone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of S38. In such cases only those components not addressed by the EIA should be covered by the heritage component.		result of the proposed development. » If concentrations of archaeological heritage material and human remains are uncovered during construction, all work must cease immediately. The find must be reported to a heritage specialist so that systematic and professional investigation/ excavation can be undertaken.
National Forests Act (Act No. 84 of 1998)	» In terms of S5(1) no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any	» National Department of Forestry	» This Act has found application during the EIA Phase and a recommendation will be made that a permit would need to be obtained for any protected trees that are affected.

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated". » GN 1042 provides a list of protected tree species.		
National Veld and Forest Fire Act (Act 101 of 1998)	» Provides requirements for veldfire prevention through firebreaks and required measures for fire-fighting. Chapter 4 places a duty on landowners to prepare and maintain firebreaks, and Chapter 5 places a duty on all landowners to acquire equipment and have available personnel to fight fires. » In terms of S21 the applicant would be obliged to burn firebreaks to ensure that should a veldfire occur on the property, that it does not spread to adjoining land. » In terms of S12 the firebreak would need to be wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. » In terms of sS17ection 17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.	» Department of Forestry	» While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project in terms of fire prevention and management.

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
Subdivision of Agricultural Land Act (Act No. 70 of 1970)	» Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land in the province	» National Department of Agriculture	» Subdivision will have to be in place prior to any subdivision approval in terms of S24 and 17 of LUPO. » Subdivision is required to be undertaken following the issuing of an environmental authorisation for the proposed project.
Hazardous Substances Act (Act No. 15 of 1973)	» This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising, or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc, nature or because it generates pressure through decomposition, heat or other means,	» Department of Health	» It is necessary to identify and list all the Group I, II, III, and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled.

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; » Group IV: any electronic product; » Group V: any radioactive material. » The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
National Road Traffic Act (Act No 93 of 1996)	» The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. » Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. » The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to	» South African National Roads Agency Limited (national roads) » Provincial Department of Transport	» An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. » Transport vehicles exceeding the dimensional limitations (length) of 22m. » Depending on the trailer configuration and height when loaded, some of the power station components may not meet specified dimensional limitations (height and width).

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.		
Development Facilitation Act (Act No 67 of 1995)	» Provides for the overall framework and administrative structures for planning throughout the Republic » S2- 4 provide general principles for land development and conflict resolution.	» Local and District Municipality	» The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. » A land development applicant who wishes to establish a land development area must comply with procedures set out in the Act.
Promotion of Access to Information Act (Act No. 2 of 2000)	» All requests for access to information held by state or private body are provided for in the Act under S11.	» National Department of Environmental Affairs	» No permitting or licensing requirements.
Promotion of Administrative Justice Act (Act No. 3 of 2000)	» In terms of S3 the government is required to act lawfully and take procedurally fair, reasonable, and rational decisions. » Interested and affected parties have right to be heard.	» National Department of Environmental Affairs	» No permitting or licensing requirements.
Provincial Legislation			
Northern Cape Nature	» This Act provides for:	» Northern Cape Department	» No permitting requirements have

Legislation	***Applicable Requirements***	***Relevant Authority***	***Compliance requirements***
Conservation Act, No. 9 of 2009	* The sustainable utilisation of wild animals, aquatic biota and plants. * Offences and penalties for contravention of the Act. * The appointment of nature conservators to implement the provisions of the Act. » The Act provides lists of protected species for the Province.	of Environmental Affairs	been identified however several mitigation measures will find place in the management of the project in terms of: * Erection of boundary fences. * Impact on aquatic habitats. * Management of invasive species.
Nature Conservation Ordinance (Act No. 19 of 1974)	» Article 63 prohibits the picking of certain fauna (including cutting, chopping, taking, and gathering, uprooting, damaging, or destroying). » Schedule 3 lists endangered flora and Schedule 4 lists protected flora. » Articles 26 to 47 regulate the use of wild animals.	» Provincial Department of Environmental Affairs	» Permits are required to be obtained for impacting on listed protected and endangered flora.

APPROACH TO UNDERTAKING THE EIA PHASE CHAPTER 5

An EIA process is dictated by the EIA Regulations which involves the identification of and assessment of direct, indirect, and cumulative environmental impacts (both positive and negative) associated with a proposed project. The EIA process forms part of the feasibility studies for a project, and comprises a Scoping Phase and EIA Phase which culminates in the submission of an EIA Report together with an Environmental Management Programme (EMP) to the competent authority for decision-making.

The EIA Process for the proposed facility has been undertaken in accordance with the EIA Regulations in terms of Sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR544; GNR545; and GNR546 of Section 24(5) of NEMA (Act No. 107 of 1998). The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations.

5.1. Phase 1: Scoping Phase

The Scoping Study, which was completed in June 2012 with the acceptance of Scoping by the DEA, served to identify potential issues associated with the proposed project, and define the extent of studies required within the EIA Phase. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs).

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

The Scoping Report was submitted to the National Department of Environmental Affairs in April 2012. The Final Scoping Report and Plan of Study for the EIA were accepted by the DEA, as the competent authority, in June 2012. In terms of this acceptance, an EIA was required to be undertaken for the proposed project.

5.2. Phase 2: Environmental Impact Assessment Phase

Through the Scoping Study, a number of issues requiring further study for all components of the project were highlighted. These issues have been assessed in detail within the EIA Phase of the process (refer to Chapter 7). The EIA Phase aims to achieve the following:

» Provide a comprehensive assessment of the social and biophysical environments affected by the proposed alternatives put forward as part of the project.
» Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed facility.
» Comparatively assess any alternatives put forward as part of the project (i.e. in this case the options of storage versus no storage were assessed).
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public participation process to ensure that I&AP are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA Report addresses potential direct, indirect, and cumulative[15] impacts (both positive and negative) associated with all phases of the project including design, construction, operation and decommissioning. In this regard the EIA Report aims to provide the relevant authorities with sufficient information to make an informed decision regarding the proposed project.

5.2.1. Tasks to be completed during the EIA Phase

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

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
» Undertaking a public participation process throughout the EIA process in accordance with Regulation 54 of GN R543 of 2010 in order to identify any additional issues and concerns associated with the proposed project.

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

» Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of GN R543 of 2010).
» Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.
» Preparation of a Draft EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.
» Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of GN R543 of 2010).
» Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.
» Preparation of a Draft EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.

5.2.2. Authority Consultation

Authority consultation has continued throughout the EIA process and has included the notification of the following relevant organs of state:

» National Department of Environmental Affairs
» National Department of Water Affairs
» National Department of Agriculture, Forestry and Fisheries
» Northern Cape Department of Environment and Nature Conservation
» Northern Cape Department of Agriculture and Land Reform
» Northern Cape Department of Economic Development
» Northern Cape Department of Roads and Public Works
» Northern Cape Department of Water Affairs
» South African Heritage Resources Agency
» South African National Roads Agency Limited - Western Region
» Khara Hais Local Municipality
» Siyanda District Municipality

A record of all authority consultation undertaken thus far in the EIA process is included within Appendix B and is summarised in the table below.

5.2.3. Public Consultation

Public consultation which was initiated at the start of the EIA process has continued throughout the Scoping and EIA Phases. The aim of the public participation process was primarily to ensure that:

- Information containing all relevant facts in respect of the proposed project was made available to potential stakeholders and I&APs.
- Community/public meetings were facilitated in Afrikaans where necessary.
- Participation by potential I&APs was facilitated in such a manner that all potential stakeholders and I&APs were provided with a reasonable opportunity to comment on the proposed project.
- Comment received from stakeholders and I&APs was recorded, considered, and, where appropriate, incorporated into the EIA process.

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping Phase for inclusion within the EIA Phase were confirmed. All relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to Appendix C). While I&APs were encouraged to register their interest in the project from the onset of the process, the identification and registration of I&APs has been on-going for the duration of the EIA process and the project database has been updated on an on-going basis.

In order to accommodate the varying needs of stakeholders and I&APs, as well as ensure the relevant interactions between stakeholders and the EIA specialist team, the following opportunities have been provided for I&APs issues to be recorded and verified through the EIA Phase, including focus group meetings (pre-arranged and stakeholders invited to attend); public meetings (advertised in the local press), and written, faxed or e-mail correspondence. The following table outlines the meetings proposed for the EIA Phase.

In order to facilitate comments on the Draft EIA Reports, a **public meeting** will be held during the review period, all I&APs were invited to attend as follows:

Date: 19 June 2012
Venue: NG Kerk Grootrivier, Sultana-Oord
Time: 18:30

Scoping Phase	
Activity	**Date**
Placement of site notices	24 April 2012
Placement of an advert informing of the commencement of the EIA process and review period in: » Die Gemsbok (Afrikaans) » Die Volksblad (English)	 30 March 2012 23 March 2012
Distribution of a background information document	March 2012 - on-going
Distribution of stakeholder letter to Organs of State and registered I&APs	23 March 2012
Distribution of the draft Scoping Report for comment	23 March 2012- 25 April 2012
Public meeting and focus group meetings	No meetings were held during the scoping phase, as the study area under investigation was scoped previously for Project Ilanga (DEA ref.: 12/12/20/2056). Meetings are planned for the EIA phase.
Notification to registered I&APs of submission of final Scoping Report to DEA & if any comments on the document	30 April 2012

5.2.4. Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs over the duration of the EIA process have been synthesised into a Comments and Response Report (refer to Appendix E for the Comments and Response Reports compiled from both the Scoping and EIA Phases).

The Comments and Response Report includes comments received on the proposed project as well as responses from members of the EIA project team and/or the project proponent. Where issues are raised that the EIA team considers beyond the scope and purpose of this EIA process, clear reasoning for this view is provided.

5.2.5. Assessment of Issues Identified through the Scoping Process

Based on the findings of the Scoping Study, potential visual impacts (i.e. during construction) and noise related impacts were identified as being of potential low significance.

Issues which require further investigation within the EIA phase, as well as the specialists involved in the assessment of these impacts are indicated in the table below.

Specialist	Area of Expertise	Appendix
Simon Todd of Simon Todd Consulting	Ecology	Appendix F
Iain Paton of Outeniqua Geotechnical Services cc	Geology and erosion potential	Appendix G
Stephen Gaigher of G & A Heritage Management Consultants	Heritage	Appendix H
Lourens du Plessis of MetroGIS	Visual and mapping	Appendix I
Patsy Scherman and Brian Colloty of Scherman Colloty and Associates cc	Water Resources	Appendix J
Ingrid Snyman of Batho Earth Social and Environmental Consultants	Social	Appendix K

The specialist studies considered direct and indirect environmental impacts associated with the development of all components of the proposed CSP facility on site 1.1. Issues were assessed in terms of the following criteria:

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

    - 10 is very high and results in complete destruction of patterns and permanent cessation of processes
- The *probability of occurrence*, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
    - Assigned a score of 1–5, where 1 is very improbable (probably will not happen)
    - Assigned a score of 2 is improbable (some possibility, but low likelihood)
    - Assigned a score of 3 is probable (distinct possibility)
    - Assigned a score of 4 is highly probable (most likely)
    - Assigned a score of 5 is definite (impact will occur regardless of any prevention measures)
- The *significance*, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high
- The *status*, which is described as either positive, negative or neutral
- The degree to which the impact can be reversed
- The degree to which the impact may cause irreplaceable loss of resources
- The degree to which the impact can be mitigated

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

S = (E+D+M) P; where
S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

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

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

As FG Emvelo has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. A draft Environmental Management Programme (EMP) is included as Appendix M.

5.2.6. Assumptions and Limitations

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

» All information provided by FG Emvelo and I&APs to the environmental team was correct and valid at the time it was provided.
» It is assumed that the development site represents a technically suitable site for the establishment of the proposed CSP facility on site 1.1. No feasible sites have been identified for this proposed development.
» It is assumed that the point of connection with the Eskom grid is feasible and that the grid has capacity to accommodate the additional load.
» This report and its investigations are project-specific, and consequently the environmental team did not evaluate any other power generation alternatives.

DESCRIPTION OF THE AFFECTED ENVIRONMENT CHAPTER 6

This section of the EIA Report provides a description of the environment that may be affected by the proposed project against which the potential impacts of the proposed facility can be assessed and future changes monitored. This information is provided in order to assist the reader and the competent authority in understanding the possible effects of the proposed project on the environment. Aspects of the regional, local, and site-specific biophysical, social, and economic environment that could directly or indirectly be affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area as well as collected field data, and aims to provide the context within which this EIA is being conducted. A more detailed description of each aspect of the affected environment is included within the specialist reports contained within Appendices F - K.

6.1. Regional Setting

The proposed development site is located approximately 30 km east of Upington in the Northern Cape Province of South Africa. The Northern Cape is the largest province in South Africa and covers an area of approximately 360 000 km^2 which constitutes approximately 30% of South Africa. The study area falls within the Siyanda District and Khara Hais Local Municipalities, of which the latter has Upington as its main town which serves as both the agricultural hub of the region and a portal to Namibia, the Kalahari, and the Kgalagadi Transfrontier Park.

This region of the Northern Cape is sparsely populated with small concentrations in and around small towns along the Orange River. This key natural feature has to a large degree dictated the settlement pattern by providing a source of irrigation water for the cultivation of grapes and other crops (i.e. lucerne, wheat, vegetables, deciduous fruits, and maize). The Orange River supplies irrigation water to the urban and agricultural areas of Upington, Kakamas, and Keimoes and to the Upington Irrigation Scheme. Various canal schemes within the region have been established to supply water to those areas requiring irrigation.

The main access routes to the area include the N14 and the N10. Regional roads include the R360 and the R27 from Keimoes. These roads, as well as the local roads are generally in a good condition even though large volumes of heavy vehicle traffic are experienced on the main routes. Industrial infrastructure includes the Upington

Airport[16], transmission, and distribution power lines (e.g. the Garona-Gordonia No 1 132kV line to the north east of the proposed development site, and the Garona-Kleinbegin No 1 132kV line to the west of the proposed development site), as well as several substations. The railway line through Upington connects the area to Karasburg in Namibia, Keimoes, and Kakamas to the west of Upington and De Aar in the south, which again links with Johannesburg, Kimberley and Cape Town.

6.2. Climatic Conditions

The Northern Cape is characterised by an arid climate with summer rainfall with a long-term average annual rainfall in the region of 175 mm, of which 81% falls between November and April. Rainfall events are erratic, both locally and seasonally and therefore cannot be relied on for agricultural practices (refer to Figure 6.1). The average evaporation is 2 375 mm per year, peaking at 11.2 mm per day in December. Temperatures vary from an average monthly maximum and minimum of 35ºC and 18.7ºC for January to 20.8ºC and 3.3°C for July respectively. Frost occurs most years on 6 days on average between mid-June and mid-August.

The Weinert Climatic N-number[7] for the area, which is between 40 and 50, indicates that the climate is extremely arid and mechanical weathering processes are dominant.

[16] Upington airport caters for daily passenger flights from the main centres in South Africa, as well as various national and international cargo carrier flights. The establishment of an International Development Zone (IDZ) at the airport has been proposed to further enhance its strategic importance for the local, regional and provincial economy.

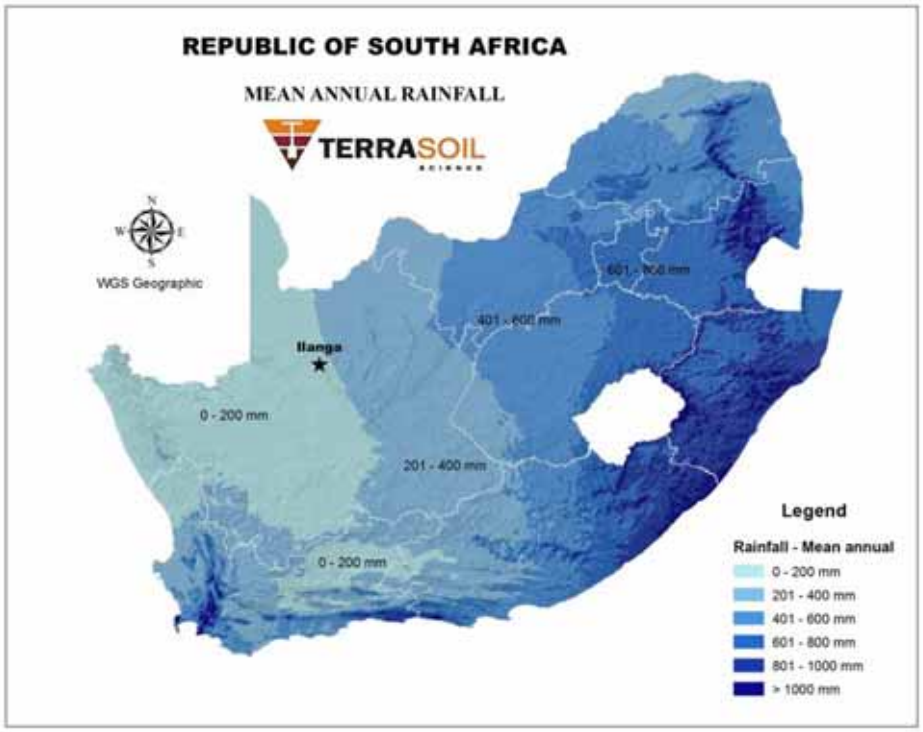


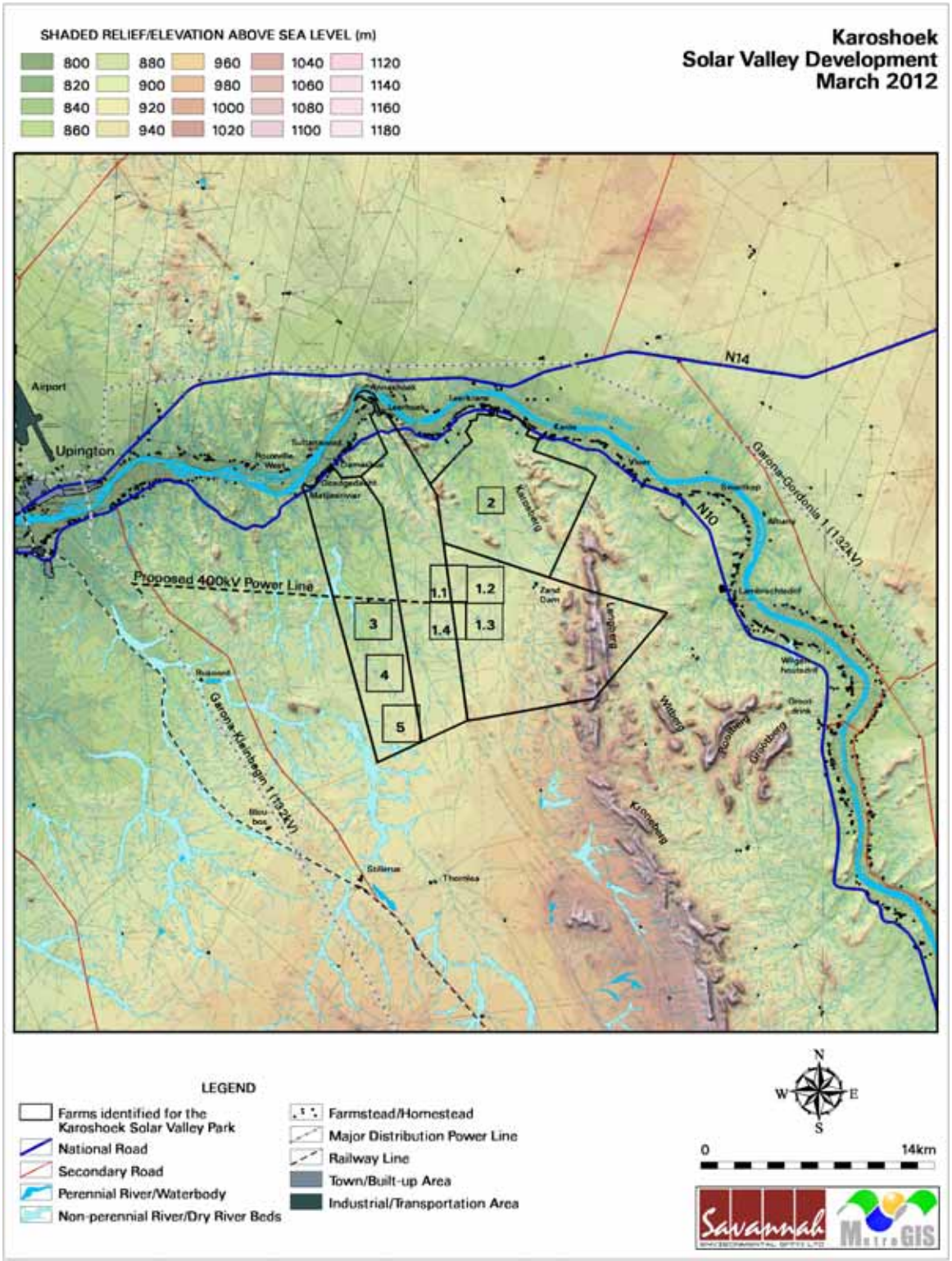
Figure 6.1: Rainfall map of South Africa indicating the survey site

6.3. Topography and Geology

There is a range of steep hills running in a north-south direction along the eastern part of the broader development site and a series of scattered hills in the central northern part of the site. The elevation on the broader site varies from 820 to 950 m above sea level (amsl).

The study area is located within the Namaqualand Metamorphic Belt which comprises very old and very highly deformed sedimentary and igneous rocks of the Mokolian and Namibian Erathem that form part of the Southern African Basement Complex. The rocks have undergone both regional and contact metamorphism and the culminating deformation phase has been dated at about 1000Ma. These basement rocks are covered by Quaternary sands of the Gordonia Formation and sporadic Tertiary Calcrete deposits (refer to Figure 6.3). A significant percentage of the proposed site is underlain by unconsolidated or semi-consolidated Quaternary soil cover of the Gordonia Formation. Aerial photography indicates that rock outcrops are likely to be concentrated in the northern and eastern portions of the study area, with sand cover

likely to be thickest in the southern lowland areas. There are several geological faults traversing the study area which are considered dormant with a low seismic activity[17].



[17] The anticipated seismic activity is rated as V[17] on the Modified Mercalli Scale and peak horizontal ground accelerations are typically less than 50cm/s with a 10% chance of being exceeded at least once in a 50 year period.

Figure 6.2: Shaded relief map indicating the topography and elevation of the broader site

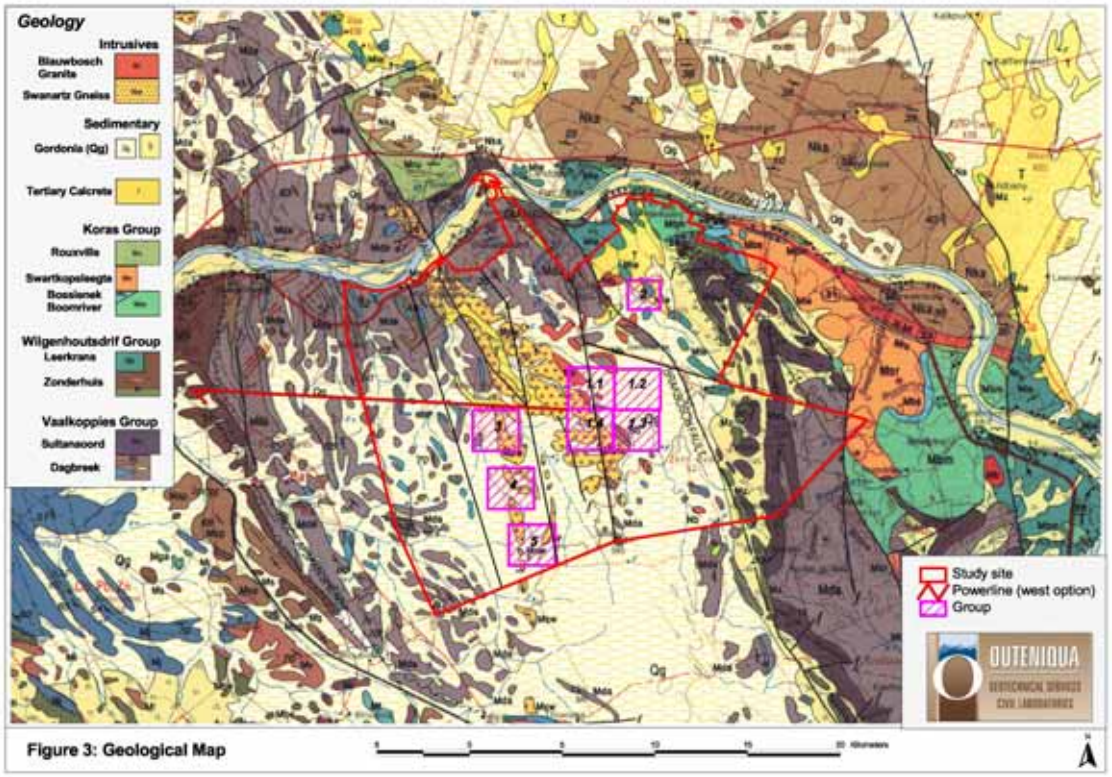


Figure 6.3: Geology of the study area, various CSP facilities indicated by the pink blocks.

6.4. Hydrological Profile

The study area falls within the Lower Orange Water Management Area which stretches from the Namibian border to just beyond Groblershoop. The Lower Orange River is the stretch between the Orange-Vaal confluence and Alexander Bay where the river meets the ocean. The proposed development site is situated within quaternary catchments D73D and D73E, which are dominated by several highly ephemeral river systems that flow directly towards the Orange River. Potential run-off from the site would flow in a northerly direction towards the Orange River via drainage systems such as the Klein-leerkransspruit and Matjies River or directly into the canal systems and siphons that run along the Orange River.

The Lower Orange River Management Strategy (2005) study found that the Lower Orange River is characterised as largely modified. From an ecosystem point of view, all the dry river beds and the associated riparian systems are extremely sensitive to development, in particular the mainstem systems such as the Klein-leerkransspruit and Majties (Matjes) River within the study area.

Surface water quality

The water quality in the Lower Orange Water Management Area is affected by upstream activities in the Vaal and Orange River catchments. Given the arid nature of the Lower Orange River and the high potential evaporation, the evaporative losses result in an increase in concentrations along the length of the lower Orange River (ORASECOM, 2007).

Water quality between Boegoeberg and Onseepkans is generally good despite extensive irrigation and settlements in the Upington area. The salinity deteriorates downstream of the confluence of the Vaal and Orange rivers but still remains good. There is an increase in Electrical Conductivity (i.e. salinity) from Prieska to Vioolsdrift along the reaches of the lower Orange River (i.e. due to irrigation return flows and evaporative losses along the river). Eutrophication is evident in localised areas along the Lower Orange River, and intermittent blooms of toxic algae have been reported in the Upington area. Some of the water withdrawn for irrigation is returned to the river environment for reuse, but its quality is degraded as a result of considerably higher salts, and nutrient concentrations which contribute significantly to the salts load in the Orange River.

Although the inflows from the Vaal River systems are low, the poor water quality from this system would seem to have a significant impact on the sub-basin and the Lower Orange WMA. In its natural state, water in the Orange River is of good quality. The ORASECOM study (2007) indicated that the salinity in this sub-basin deteriorates downstream of the confluence of the Vaal and Orange rivers, but remains acceptable for human use. Detailed information on the water quality data is contained in the Lower Orange Management Study (LORMS) (LORMS, 2005).

Groundwater quality

The quality of the groundwater is considered brackish or mineralised, but is suitable for the majority of uses and is commonly used in drier areas. The mineralogical groundwater quality class is relatively high within the Lower Orange sub-basin, with Total Dissolved Solids (TDS) values ranging between 601 and 1800 mg/L (DWAF, 2002 cited in ORASECOM, 2007). This can be compared to the overall surface water TDS values ranging between 260 and 600 mg/L (DWAF, 2002), which is a tolerable range or class in terms of its fitness for human use range criteria. The potential for faecal contamination is considered low due to the type and extent of local aquifers.

Surface water quantity

In terms of national demand, the total water requirements of all the users within the Lower Orange sub-basin amounts to approximately 11 490 million m^3/annum spread among:

» Environmental requirement including natural evaporative losses from the Orange River.
» Namibia including water use from the Orange and Fish rivers.
» Lesotho and transfers to South Africa with the full Lesotho Highlands Water Project Phase 1 active.
» South Africa Orange River demand including transfers to the Eastern Cape.
» South Africa Vaal River demand where the Vaal demand is supplied from locally generated runoff.
» Evaporation and losses.

In terms of regional demand, three major areas downstream of the proposed facility receive water directly from the Orange River, i.e. Upington (urban and surrounds), Upington Irrigation Scheme, and Kakamas/Keimoes (urban and irrigation). Various canal schemes within the region are used to supply the irrigated areas. Future demand in the study area is limited largely to the increase in agricultural production, with emphasis on emerging farmers within the Upington Irrigation Area and future CSP facilities.

Groundwater quantity

It is estimated that approximately 60% of the Lower Orange sub-basin depends solely on groundwater for rural supplies, stock watering, and supply to inland towns. The low rainfall for the area impedes recharge, resulting in only small quantities that can be abstracted on a sustainable basis. Groundwater abstracted near the river induces recharge from the river, i.e. surface water from the Orange River is drawn into the surrounding aquifers because of water being abstracted. The hard geological formation underlying most of the region has resulted in unfavourable aquifer characteristics, i.e. low borehole yields and poor storage of groundwater.

6.5. Soils and Agricultural Potential

The broader survey site lies in the Ae11, Ae111, Ag4, Ag5, Af25 and Ic156 land type (Land Type Survey Staff, 1972 - 2006) (refer to Figure 6.4). These land types consist of shallow apedal (structureless) soils with regular occurrences of rock outcrops and lime in the soil profiles. The soils are typical of arid environment soils in that distinct soil formation is lacking and the soils exhibit only signs of physical weathering processes of parent materials. In terms of land capability and land use, extensive grazing dominates over crops due to climatic and soil constraints. The agricultural potential of the study site is very low in its natural state due to soil and climate constraints with the potential

of improvement in the case of land preparation, provision of irrigation and intensive land management.

This area is characterised by a range of soils mainly derived from aeolian sands. These red soils have formed due to the long-term slow wind deposition of Kalahari sands and the subsequent weathering of these profiles to lead to the formation of lime rich subsoil horizons). In the transitional zones (between the rocky areas and flat areas) the soils are often covered with quartz pebbles grading into shallow soils. Due to the sand and well-drained nature of these soils they are suited to irrigated crop production activities with water availability being the obvious restricting factor. In a dry-land environment their agricultural potential is low due to climatic constraints.

6.6. Flora

Broad-Scale Vegetation Patterns

According to the national vegetation map (Mucina & Rutherford 2006), there are six vegetation types within the broad area around the site (refer to figure 6.4), but only four of these are likely to be potentially impacted by the development. The basic statistics for these vegetation types are listed in the flora and fauna study (Refer to Appendix F). The only vegetation type of conservation concern in the area is Lower Gariep Alluvial Vegetation which is Endangered on account of the fact that only 50% of this vegetation unit remains intact. This vegetation unit is associated with the alluvium along the Orange River and would not be impacted by the current developments which are some distance from the river itself. The other vegetation types are of similar sensitivity at a broad scale and all are overwhelmingly intact and have been little impacted by intensive agriculture. Gordonia Duneveld is well protected in comparison to the other vegetation units which are all poorly conserved, with virtually no extent within formal conservation areas. No endemic species are known from Kalahari Karroid Shrubland, while both Gordonia Duneveld and Bushmanland Arid Grassland are known to contain some endemic species, but given that these are some of the most extensive vegetation types within South Africa, the endemic species tend to be widespread within the vegetation type itself and local-level impacts are not likely to be of significance for any of these species.

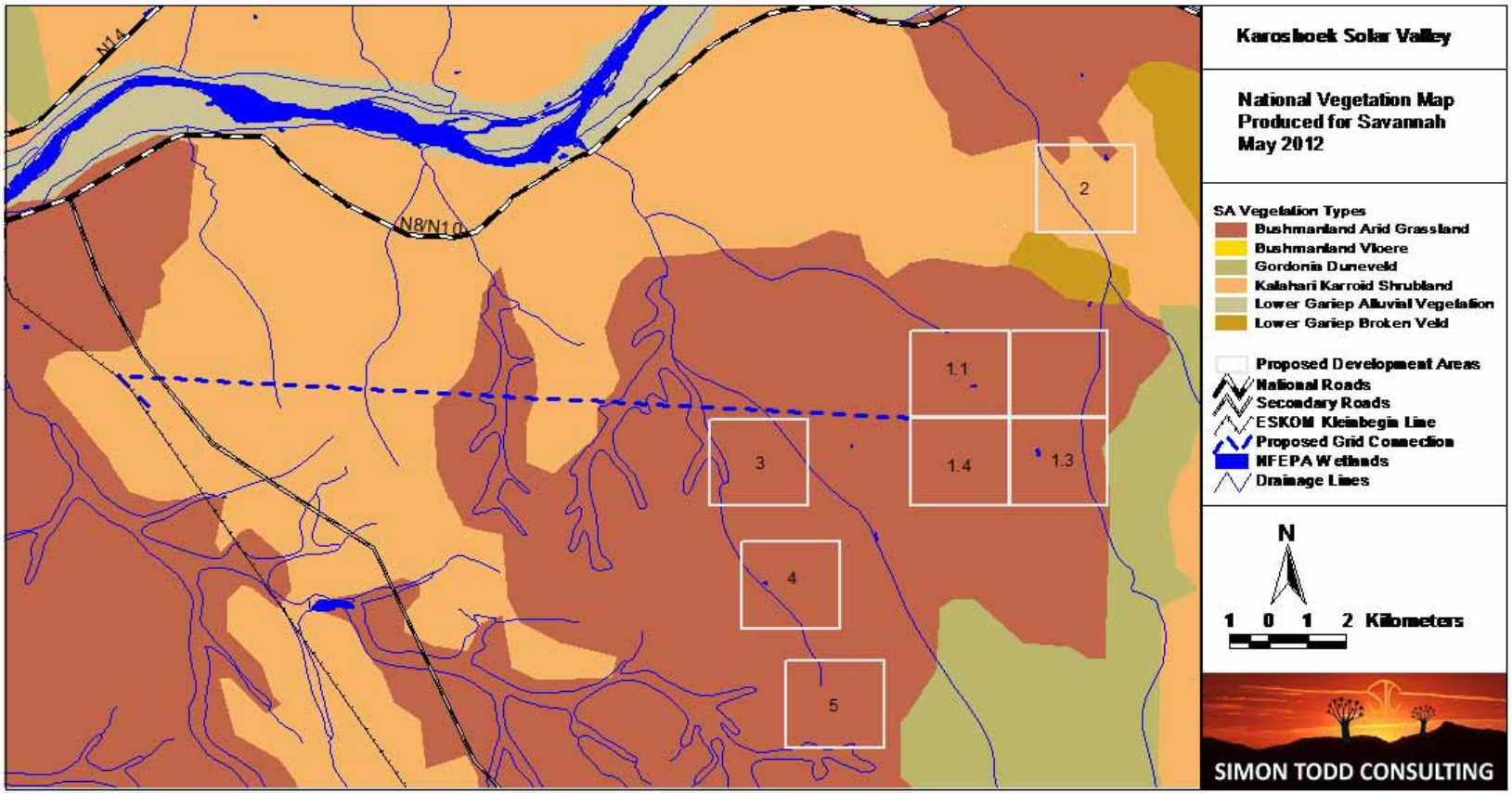


Figure 6.4: The vegetation in and around the Karoshoek Solar Valley development. The vegetation map is an extract of the National Vegetation Map as produced by Mucina and Rutherford (2006)

Bushmanland Arid Grassland

According to the vegetation map of Mucina & Rutherford (2006), all the proposed development areas except for Site 2 fall within Bushmanland Arid Grassland. Within the site, the areas of Bushmanland Arid Grassland were generally extensive open plains with greater or lesser amounts of scattered taller woody species and trees present. Typically, this vegetation unit was dominated by grasses such as *Stipagrostis ciliata*, *S.uniplumis*, *S.amabilis* and *Schmidtia kalahariensis*. Trees and shrubs of the open plains included *Boscia foetida*, *Boscia albitrunca*, *Parkinsonia africana*, *Phaeoptilum spinosum*, *Rhigozum trichotomum* and *Aptosimum albomarginatum*.

There were also rocky and stony outcrops within this vegetation unit that contained a greater amount of woody shrubs and grass species not common in other areas. These areas were dominated by species such as *Aptosimum spinescens*, *Barleria rigida*, *Leucosphaera bainesii*, *Zygophyllum dregeanum* and grasses such as *Enneapogon scaber*, *Stipagrostis obtusa* and *Oropetium capense*. These areas also contained some protected species not observed elsewhere such as *Adenia oleifolium*, *Aloe claviflora* and *Hoodia gordonii*. The drainage lines within this vegetation unit were generally broad and flat, often without a distinct drainage channel. These areas generally contained similar grass species to the surrounding plains but contained a greater proportion of woody trees and shrubs, particularly *Acacia erioloba*, *A.mellifera*, *Boscia albitrunca*, *B.foetida*, *Rhigozum trichotomum* and *Lycium oxycarpum*.

Kalahari Karroid Shrubland

According to Mucina & Rutherford (2006), Site 2 falls largely within this vegetation unit. However, in the field the majority of this site corresponded more closely with Bushmanland Arid Grassland, and only the northern extent of the site could be considered to be representative of Kalahari Karroid Shrubland. Some of the rocky areas and low ridges which occurred in some of the other sites, particularly site 3, also corresponded to this vegetation unit but have not been mapped by Mucina & Rutherford, probably on account of their small extent. Species commonly observed within the areas of Kalahari Karroid Shrubland include shrubs such as *Leucosphaera bainesii*, *Hermannia spinosa*, *Monoechma genistifoilium*, *Salsola rabieana*, *Aptosimum albomarginatum*, *A.spinecens*, *Kleinia longiflora*, *Limeum argute-carinatum*, *Phyllanthus maderaspatensis*, grasses such as *Stipagrostis anomala*, *S.ciliata*, *S.uniplumis*, *S.hochstetteriana*, *S.uniplumis* and *Schmidtia kalariensis*. Few forbs were observed in this vegetation unit at the time of the site visit.

Gordonia Duneveld

No areas of Godonia Duneveld occur within the proposed development areas, but some areas of this vegetation type occur along the eastern margin of the development areas. Common species observed within the areas of Gordonia Duneveld include trees such as *Parkinsonia africana*, *Boscia foetida*, *Boscia albitrunca* and *Acacia erioloba*, shrubs such

as *Phaeoptilum spinosum*, *Rhigozum trichotomum*, *Crotalaria orientalis* and *Lycium bosciifolium*, grasses such as *Stipagrostis ciliata*, *S.uniplumis*, *S.amabilis*, *Schmidtia kalahariensis*, and forbs such as *Senna italica*, *Tribulis pterophorus*, *Hermannia tomentosa* and *Requienia sphaerosperma*.

Drainage Lines

Although the drainage lines in the area have not been mapped by Mucina & Rutherford as distinct vegetation units, their composition is distinct and deserves to be recognized independently of the surrounding vegetation types. The vegetation composition of the drainage lines was to some extent contingent on the size of the drainage line as well as the local substrate. Drainage lines within areas of shallow soils and exposed calcrete, were usually confined and narrow and dominated by woody species such as *Acacia mellifera*, *Boscia foetida*, *Phaeoptilum spinosum*, *Cadaba aphylla* and *Parkinsonia africana*, with an understorey of low shrubs and grasses such as *Zygophyllum rigidum*, *Monechma spartioides*, *Indigofera heterotricha*, *Fingerhutia africana* and *Cenchrus ciliaris*. Within areas of deeper sands, the drainage lines tended to be broad and less well defined and in many cases an actual channel where water movement regularly tales place was absent. In these areas, many of the drainage lines appear to result from the in-filling of the shallow valleys and depressions with sand over time. Many of these areas do not appear to ever actually have overland flow, which is not surprising given the infiltration capacity of the sand and low rainfall in the area. Nevertheless these areas may receive some runoff from the adjacent areas and on account of this and the greater depth of the sand have greater water holding capacity, which is expressed as the presence of the greater number of large trees such as *Acacia erioloba*. In some places, particularly where the rocky ridges were in close proximity, the drainage lines were better developed with clear, incised active channels, resulting from the greater runoff input from the adjacent hills.

The sensitivity of the different drainage lines can only be reliably assessed in the field and it is therefore recommended that sensitive areas associated with the drainage lines should be demarcated by an ecologist with experience in arid areas, prior to construction or even during the planning stage so that these areas can be properly accommodated during the design phase of the development.

Protected and Listed Plant Species

A number of protected species were observed within the study area, in areas that would potentially be impacted by the various developments. This includes *Acacia erioloba*, which was common within some of the larger drainage lines, *Boscia albitrunca* was also widespread at the site and was also particularly common in drainage lines and in areas of red Kalahari sand. *Aloe clavifora* was observed to be common in areas of stony ground, calcrete and on gravel plains. *Adenia oleifolium* was observed to be common on some of the gravel and quartz outcrops, particularly within Site 3. *Hoodia gordonii* was

not common, but a few individuals were observed within Site 4 and it may occur more widely at the site. Listed species that are known to occur in the area, but which were not observed include *Brachystelma huttonii* (Rare) and *Pelargonium reniforme* subsp. *reniforme* (Data Deficient Data). A permit is required for any activities which are likely to directly or indirectly impact the survival of any of these species. Although the various species listed above are regulated under a number of different acts, a single integrated permit obtainable from DENC is required which would cover all of the affected species. A blanket clearing permit would also be required.

Critical Biodiversity Areas & Broad-Scale Processes

No fine-scale conservation planning has been done in the district and as a result, no Critical Biodiversity Areas have been defined. The site also does not fall within areas that have identified as focus areas under the National Protected Areas Expansion Strategy, indicating that the development areas do not occur within areas that have been identified as being important for biodiversity maintenance at a landscape scale. Furthermore, there was no evidence to suggest that the area is likely to be highly significant as faunal movement or migration pathway. The area is generally homogenous and given the extensive amount of intact vegetation in the area, there is likely to be little overall disruption to the broad-scale connectivity of the landscape. Given the large amount of development which is planned for the area, a significant local impact is likely to occur, but there would remain sufficient intact habitat in the broader area to retain the overall ecological functioning of the landscape.

6.7. Fauna

Mammals

The site falls within the distribution range of 46 terrestrial mammals, indicating that the mammalian diversity at the site is likely to be moderate to low. At a broad scale, it is likely that a large proportion of these species occur at the area. However, within the affected development areas, mammalian diversity is likely to be quite low on account of the limited range of habitats available. No species associated with rocky outcrops are likely to occur within the proposed development areas, which would significantly reduce the number of the species that would be directly affected. As the affected habitats are widely available in the area, as well as at a broader scale, the impacts would be local in nature and it is not likely that the long-term viability of any populations of terrestrial mammals would be compromised by the development. Three listed terrestrial mammals may occur at the site, the Honey Badger (Endangered), Brown Hyaena (Near Threatened) and Black-footed cat (Vulnerable). Although the area is used for livestock production, human activity in the area is low and it is possible that all three listed species occur in the area. Some habitat loss for mammals is an inevitable consequence of the development but is not likely to be of broader significance. Faunal disturbance and human presence would be highest during the construction phase and terrestrial

faunal impacts are also likely to be largely concentrated to this phase of the development.

The site lies within the distribution range of 6 bat species, indicating that the richness of bats at the site is probably quite low. Bat activity is probably focused along the Orange River, where there is ample food as well as an abundance of natural and artificial shelter. The lack of wetlands and large drainage lines away from the Orange River suggests that bat activity patterns within the site is likely to be quite low. Areas of higher activity are likely to be near the larger ridges of the area and the wooded drainage lines. It is however highly unlikely that the development would create a significant negative impact on bats in the area.

In terms of potential differences in mammalian fauna between the proposed development sites, there is not likely to be a high degree of differentiation, since the range of habitats present is largely similar within each development area. None of the sites had large rocky outcrops or drainage lines which are likely to hold water for significant periods. As most sites had areas of higher and lower grass and shrub cover as well as some areas of deeper sands or harder ground, the suite of mammals present is likely to be broadly similar. There were also few significant differences in land-use or rangeland condition which would have a large impact on mammalian community structure.

Reptiles

The site lies within the distribution range of 34 reptile species, suggesting that the reptile diversity in the area is likely to be quite low. Within the affected plains habitat of the site, the reptile composition is likely to be dominated by species which inhabit open areas, such as Horned Adders, Sand Lizards, Ground and Barking Geckos. As there were no large rocky outcrops within the proposed development areas, species associated with rocky habitats are not likely to occur in these areas and would not be impacted by the development. As with mammals, the development is likely to result in some significant local habitat loss for reptiles but as there are not range-restricted reptiles which would occur in the affected areas, the impacts are not likely to be of broader significance. The development would be likely to create some novel habitats for reptile, which would potentially benefit a limited number of species which could take advantage of the novel habitat created within the development areas. This is likely to be restricted to species such as geckos and agamas, which would utilise the buildings and other vertical infrastructure of the development. This would however be a very limited number of species and is not considered an overall positive outcome.

Given the relative homogeneity of the affected habitat, there is not likely to be a high degree of differentiation in reptilian composition between the proposed development areas. Some of the site contained a greater proportion of trees and drainage lines,

which would represent habitat for tree and shrub-dwelling species such as Skinks and Agamas. Important reptile habitats such as rocky outcrops did not occur within the proposed development areas, and most species present within the plains habitat which characterizes the sites are likely to be widespread species of low conservation concern.

Amphibians

The site lies within the distribution range of 10 amphibian species. The only listed species which may occur at the site is the Giant Bullfrog which is listed as Near Threatened. Some of the pans observed within the proposed development areas represent potentially suitable breeding habitat for this species as well as any other species present which breed in temporary pools. Those amphibians which require perennial water are likely to be restricted to the vicinity of the Orange River and the plains of the site are likely to contain low amphibian diversity and are not likely to be highly significant from an amphibian perspective. Impacts on amphibians are likely to be local in nature and of low magnitude.

Those development areas which contain pans and extensive drainage systems are likely to contain the greatest amphibian abundance and diversity. The pans have been assessed as being of Very High ecological sensitivity and the development should avoid these areas, including the provision of an adequate buffer between the development and the sensitive receptors.

Avifauna

According to the SABAP 1 and 2 data sets, 190 bird species are known from the broad area surrounding the Karoshoek Solar Valley site. This includes 7 IUCN listed species, detailed below in Table 1. All of the listed species are susceptible to some degree to either or both electrocution or collision from power-line infrastructure. Larger raptors are susceptible to both collision and electrocution, while storks and bustards are all vulnerable to collision with power lines. This is a potentially significant source of impact for these species. Given the relatively long length of the power lines which are required for the development, the potential for negative impacts on avifauna is high. Although the Black Stork would probably occur largely along the Orange River, these birds make long-distance movements between sites and would be vulnerable to collision during such local movement patterns. The two bustard species also move about the karoo in response to rainfall patterns and the distribution of food and are likely to frequent the area on a regular basis. These species are particularly vulnerable to collisions with power lines, and a number of Kori Bustards were observed in the area during the site visits. Apart from direct habitat loss and destruction, the disturbance created during the construction phase of the project would disturb some bird species and deter them from the area temporarily. However, the major impacts on avifauna are likely to occur after construction and without mitigation these would operate on a long-term basis.

6.8. Heritage Resources

Stone Age

The study area is home to all three of the known phases of the Stone Age, namely: the Early- (2.5 million – 250 000 years ago), Middle- (250 000 – 22 000 years ago) and Late Stone Age (22 000 – 200 years ago). The Late Stone Age in this area also contains sites with rock art from the San and Khoi San cultural groups. Early to Middle Stone Age sites are less common in this area, however rock-art sites and Late Stone Age sites are much better known.

During the Middle Stone Age, 200 000 years ago, modern man or Homo sapiens emerged, manufacturing a wider range of tools, with technologies more advanced than those from earlier periods. This enabled skilled hunter-gatherer bands to adapt to different environments. From this time onwards, rock shelters and caves were used for occupation and reoccupation over very long periods of time.

The Late Stone Age, considered to have started some 20 000 years ago, is associated with the predecessors of the San and Khoi Khoi. Stone Age hunter-gatherers lived well into the 19th century in some places in SA. Stone Age sites may occur all over the area where an unknown number may have been obliterated by mining activities, urbanisation, industrialisation, agriculture and other development activities during the past decades especially associated with the town of Upington.

A limited number of Rock-Art sites are located in this area, mostly due to the lack of suitable shelter sites.

Historic period

The town of Upington, originally known as Olijvenhoutsdrift, was founded in 1871 as part of a mission station by the German missionary Rev Schröder. The town was renamed in 1884 after Sir Thomas Upington, who was the Prime Minister of the Cape Colony. An irrigation canal was reportedly started by Rev Schröder in 1883, and completed in 1885. By 1884 there were already 77 irrigation farms.

Two small house structures were identified on the northern outer edge of the development site.

The Historic Era

Although the town which today is Upington only officially came to be named in 1884, its tempestuous prior history cannot be ignored. Long before white settlers reached the area, Korana Hottentots had settled at the ford in the Great River they called Gariep, the northern border of the Cape Colony. They had been ousted from their ancestral lands in the south and found a last refuge here, on the lush banks of the river. When, inevitably, eventually the white man followed, war broke out between them and the Korana, who had nowhere else to go. They were defeated and the few remaining tribes people dispersed.

Earlier, a Dutch Reformed Mission had been established under the guidance of the Reverend C. Schreuder at Olijvenhouts Drift, as the ford was called by hunters and traders because of the many wild olivewood trees growing there.

In 1879, after the second and last Korana War, Sir Thomas Upington, Attorney-General of the Cape Colony, sent 80 policemen to the Drift to maintain law and order along the river. Commanded by Captain Dyason they set up camp under the trees, but by 1885 already barracks had been built where later the police station was erected. Dyason's police was very unpopular as they impounded loose animals and generally tried to keep order, while Schreuder only wanted to run a Mission. He venomously referred to the police as ""idle ne'erdowells"" and said of Dyason, ""we beseech to be delivered from such tyranny"."

Schreuder wanted the Mission to be moved elsewhere and in a letter dated the 11th of February 1884 writes, ""It is my wish that Olyvendrift or Upington not become a town but remain a Mission Station.""

This was the first time the name Upington was officially written to denote the place known as Olijvenhouts Drift and then only out of resentment against the police sent by Thomas Upington.

Archaeological and palaeontological sites of known significance on/near the study area

Landscape Type	Description	Occurrence still possible?	Likely occurrence?
1. Paleontological	Mostly fossil remains. Remains include microbial fossils such as found in Baberton Greenstones	Yes, sub-surface	Unlikely
2. Archaeological	Evidence of human occupation associated with the following phases – Early-, Middle-, Late Stone Age, Early-, Late Iron Age, Pre-Contact Sites, Post-Contact Sites	Yes	Unlikely

Landscape Type	Description	Occurrence still possible?	Likely occurrence?
3. Historic Built Environment	- Historical townscapes/streetscapes - Historical structures; i.e. older than 60 years - Formal public spaces - Formally declared urban conservation areas - Places associated with social identity/displacement	No	No
4. Historic Farmland	These possess distinctive patterns of settlement and historical features such as: - Historical farm yards - Historical farm workers villages/settlements - Irrigation furrows - Tree alignments and groupings - Historical routes and pathways - Distinctive types of planting - Distinctive architecture of cultivation e.g. planting blocks, trellising, terracing, ornamental planting.	Yes	Likely
5. Historic rural town	- Historic mission settlements - Historic townscapes	No	No
6. Pristine natural landscape	- Historical patterns of access to a natural amenity - Formally proclaimed nature reserves - Evidence of pre-colonial occupation - Scenic resources, e.g. view corridors, viewing sites, visual edges, visual linkages - Historical structures/settlements older than 60 years - Pre-colonial or historical burial sites - Geological sites of cultural significance.	Yes	Likely
7. Relic Landscape	- Past farming settlements - Past industrial sites - Places of isolation related to attitudes to medical treatment	No	Unlikely

Landscape Type	Description	Occurrence still possible?	Likely occurrence?
	- Battle sites - Sites of displacement,		
8. Burial grounds and grave sites	- Pre-colonial burials (marked or unmarked, known or unknown) - Historical graves (marked or unmarked, known or unknown) - Graves of victims of conflict - Human remains (older than 100 years) - Associated burial goods (older than 100 years) - Burial architecture (older than 60 years)	Yes,	Likely
9. Associated Landscapes	- Sites associated with living heritage e.g. initiation sites, harvesting of natural resources for traditional medicinal purposes - Sites associated with displacement & contestation - Sites of political conflict/struggle - Sites associated with an historic event/person - Sites associated with public memory	No	No
10. Historical Farmyard	- Setting of the yard and its context - Composition of structures - Historical/architectural value of individual structures - Tree alignments - Views to and from - Axial relationships - System of enclosure, e.g. defining walls - Systems of water reticulation and irrigation, e.g. furrows - Sites associated with slavery and farm labour - Colonial period archaeology	Yes	Irrigation farming within the Orange River Valley.
11. Historic institutions	- Historical prisons - Hospital sites - Historical school/reformatory sites - Military bases	No	Unlikely
12. Scenic visual	- Scenic routes	No	No

Landscape Type	Description	Occurrence still possible?	Likely occurrence?
13. Amenity landscape	- View sheds - View points - Views to and from - Gateway conditions - Distinctive representative landscape conditions - Scenic corridors	No	No

6.9. Social Characteristics of the Study Area

The proposed site falls within the municipal jurisdiction of the //Khara Hais Local Municipality and the Siyanda District Municipality in the Northern Cape Province. Upington is the main town of the //Khara Hais Local Municipality and serves as portal to Namibia, the Kalahari, and the Kgalagadi Transfrontier Park. Furthermore, it functions as the agricultural hub of the area (//Khara Hais SDF, 2008).

6.9.1. Northern Cape

The Northern Cape has the smallest population[18] of South Africa (i.e. 1.8%), despite having the largest surface area.

» *Education* - 71.3% have primary or secondary education, while 15.1% has received no formal education. Those with a higher educational qualification accounted for 3.7% of the population.

» *Income and economic activity* - a high percentage of the population lives in extreme poverty, with the economy being heavily dependent on the primary sectors of the economy (i.e. mining and agriculture). Of the economically active population, 55.5% were employed while 26.1% could not find employment (i.e. this is lower than the national figure of 29.5%).

6.9.2. Khara Hais Municipality

The //Khara Hais Local Municipality has twelve wards and the following settlements:

» Upington (including Paballelo and Louisvaleweg);
» Lambrechtsdrift;

[18] The population can be classified as young with 57.7% < than 30 years old and a third of the total population < 15 years old. The female proportion makes up approximately 51.2% of the total with males making up the remaining 48.8%.

» Karos;
» Leerkrans;
» Leseding;
» Louisvale;
» Raaswater;
» 6 Brugge and Klippunt; and
» Kalksloot (//Khara Hais SDF, 2008).

The population of the //Khara Hais Municipality is distributed in and around Upington, Paballelo and Louisvaleweg. A Community Survey undertaken in 2007, indicated a significant increase from the 2001 Census data as the population of //Khara Hais is estimated at 100 920 for 2007 which represents an increase of 33.36% (//Khara Hais SDF, 2008). The discrepancies in the population count and growth could negatively influence the financial and planning processes of the Municipality and subsequently influence the development and service delivery capabilities of the municipality. The //Khara Hais Local Municipality has thus launched a socio-economic survey to update the population profile with the correct figures (//Khara Hais SDF, 2008).

» *Education* - 19% of the population has some secondary education; 12% have completed Matric; 3% have some form of higher education; 16% is functionally illiterate; and 7% are completely illiterate. This is directly connected to low income levels and will have severe negative socio-economic implications for the area if not attended to (//Khara Hais SDF, 2008).

» *Employment status and income* - 63% of the total population falls within the working age category (i.e. 15 - 65 years; //Khara Hais SDF (2008)). Of this only 24% of these individuals are employed, 13% are unemployed, and 26% are not economically active (i.e. housewives/homemakers, students, pensioners and retired people, and those not seeking work). Of those employed (i.e. the labour force), 55% earn between R401 and R1 600 per month, and 19% earn less than R400 per month. As the employed labour force constitutes only 24%, it is thus concluded that the majority of the population lives in extreme poverty and are dependent on the income of the employed sector.

» *Safety and security* - the area is characterised by relatively low crime levels. The main challenges revolve around vandalism, family violence, smuggling of illegal substances, as well as alcohol and drug related violence (//Khara Hais SDF, 2008).

6.9.3. Tourism in the Study Area

Tourism is an important economic sector in this region and includes a broad range of tourist amenities and opportunities, which include, amongst others:

- Agri-tourism opportunities and associated with vineyard farming, wine-making, and so forth.
- The Orange River Wine Route includes five wineries in Upington, Kakamas, Keimoes, Grootdrink, and Groblershoop respectively.
- Game and eco-tourism opportunities associated with the Orange River and various lodges outside of Upington.
- Game and eco-tourism opportunities associated with the Spitskop Nature Reserve, Augrabies Falls National Park, as well as the Kgalagadi Transfrontier Park.
- A number of festivals throughout the year such as the Kalahari Kuierfees, the Upington Agricultural Show (Northern Cape Expo) and the Orange River Young Wine Show
- Conferencing facilities.
- Culture tourism presented in Paballelo.
- Testing of vehicles within extreme conditions by car manufacturers in the area.

6.9.4. Land use characteristics of the broader study site

The farms affected by the proposed development are mainly used for cattle farming and leisure activities. Smaller farming units to the north of the N10 are mainly used for the cultivation of grapes and raisins by means of irrigation farming.

Homesteads in the area are scarce and of the twelve wards within the //Khara Hais Local Municipality the following settlements are located within 20 km of the facility:

- Lambrechtsdrift
- Karos
- Leerkrans
- Ntsikelelo
- Luisvale

Only one homestead is located on the site, of which it is only used occasionally.

ASSESSMENT OF POTENTIAL IMPACTS: CHAPTER 7

This chapter serves to determine the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) associated with the development of the Linear Fresnel (LF1) facility on site 1.1 as part of the larger Karoshoek Solar Valley Development. This assessment is done for all the phases of the project's development and for all the facility's components which will comprise:

» The solar field - this will comprise multiple loops of Linear Fresnel mirrors which serve to receive and concentrate the solar radiation. They will be directly associated with pipelines which will convey the heat transfer fluid between the mirrors and the steam cycle.
» The power block - comprising a conventional steam turbine generator and a substation into which the electricity can be evacuated.
» Water related infrastructure - where the water source is the Orange River, with the water abstraction point at the existing abstraction point of the Boegoeberg Water Users Association at coordinate S 28° 24' 7.68" and E 21° 29' 50.51". Associated water supply pipelines; water treatment and storage reservoirs and evaporation ponds will be required. **This infrastructure has already been authorised through the EIA process undertaken for Project Ilanga on site 1.2 (DEA ref no. 12/12/20/2056).** A pipeline would however be required to be constructed to each facility from the central water reservoir.
» Cables linking the power block to the on-site substation.
» Power line(s) which will have a loop-in loop-out connection to the future Eskom CSP MTS 400 kV power line to the west of the site (expected to be constructed in 2016) (grid connection to be assessed through a separate EIA process (DEA ref no. 14/12/16/3/3/2/288)).
» Internal and external access roads.
» Accommodation facilities and storerooms.
» Temporary waste storage facilities may be required.

The development of the LF1 facility on site 1.1 as part of the larger Karoshoek Solar Valley Development will comprise the following phases:

» *Pre-Construction and Construction* – will include preconstruction surveys; site preparation; establishment of the access road, electricity generation infrastructure, water supply infrastructure, power line servitudes, construction camps, storage facilities, laydown areas, and temporary construction crew accommodation

facilities[19]; transportation of components/construction equipment to site; and undertaking site rehabilitation and establishment and implementation of a stormwater management plan.

» *Operation* – will include sourcing of water and water treatment; operation of the facility and the generation of electricity; and site operation.

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

7.1. Areas of sensitivity identified across the broader Karoshoek site during the Scoping Study

Several potentially sensitive areas were identified for the broader Karoshoek site, including:

» *Areas of high ecological sensitivity* – high concentrations of dunes within parts of the site, and several non-perennial drainage lines and pans.

» *Areas of visual exposure* – receptors within an 8 km radius of the facility (i.e. users of national and secondary roads).

» *Areas of high agricultural potential* – the northern portion of the site (i.e. south of the N10[20]).

» *Areas with sensitive noise receptors* – several rural settlements located near the Orange River and the N10 and any receptor located within 2 km of the facility[21].

These and other environmental issues have been assessed during the EIA Phase. The sensitivity map produced from the Scoping Phase of the EIA process has been updated to include the preliminary layout of the proposed facility (refer to Figure 7.1). This map indicates how the design of the proposed facility has taken identified sensitive areas into consideration.

[19] Note that this facility may become a permanent facility if proven feasible through a feasibility study and separate EIA process

[20] The development of dry land cropping in these areas is limited by low rainfall, and lack of irrigation facilities.

[21] Note that since the proposed Project Ilanga development site is located more than 2km from sensitive noise receptors, no noise impact assessment has been undertaken within this EIA.

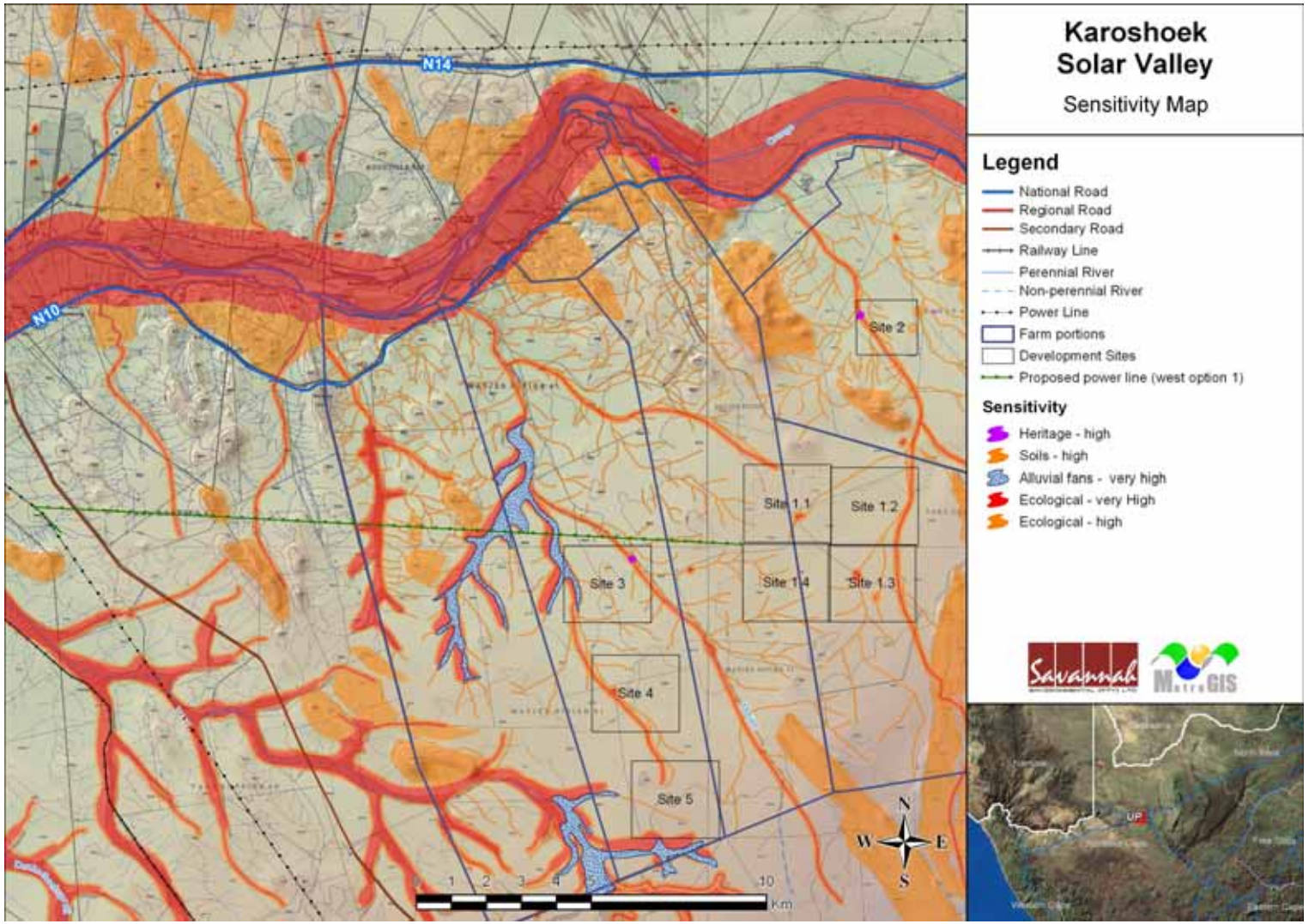


Figure 7.1: Sensitivity map illustrating those sensitive areas across the broader site, in relation to the proposed layout for the LF1 facility on **site 1.1** as part of the larger Karoshoek Solar Valley Development.

7.2. Methodology for the assessment of potentially significant impacts associated with the LF1facility on site 1.1

A broader site of 34 000 ha (i.e. the broader Karoshoek site) was originally identified by the project developer for the purpose of establishing the proposed Karoshoek Solar facility, of which the LF facility on site 1.1 forms part of. This assessment therefore only considers potential environmental impacts associated with the development of the proposed solar facility on Site 1.1, as well as those impacts associated with the associated infrastructure. Recommendations are made regarding mitigation and management measures for potentially significant impacts and the possibility of residual and cumulative impacts are noted.

The assessment of potential issues has involved key input from specialist consultants, the project developer, key stakeholders, and interested and affected parties (I&APs). The Comments and Response Report included within Appendix E lists these issues, the initial response given by the EAP during the Scoping Phase, and a revised response (if applicable) following the completion of the specialist studies as part of the EIA Phase.

In order to assess the potential impacts associated with the proposed facility, it was necessary to quantify the extent of the permanently and temporarily affected areas (i.e. both area and linear infrastructure). This includes the area required for the solar field (i.e. linear fresnel), the power block and its associated infrastructure, the linear infrastructure (i.e. pipeline, road, power lines).

Permanent Component – Site 1.1 (total 484 ha)	**Approximate extent (in ha)**
Solar field (linear fresnel) and power block[22]	400

Permanent Component –outside Site 1.1 but within the broader development site (total 25 516 ha)	**Approximate extent (in ha)**
Power lines – assuming a length of 10 km and a servitude width of 55 m[23]	**55**
Internal access road – assuming a length of 1.2 km and a width of 10 m	**1.2**
TOTAL (ha)	**<40**

[22] Assuming the facility is developed with storage, the area amounts to 4 km^2.

[23] The power lines are assessed through a separate EIA process (DEA ref. 14/12/16/3/3/2/288)

Permanent Component –beyond the broader development site	Approximate area/extent (in ha)
Pipeline – assuming a distance of 2 km and servitude width of 70 m	14
TOTAL	**N/A**

Temporarily affected areas include the pipeline outside Site 1.1 but within the broader Karoshoek site.

7.3. Assessment of the Potential Impacts associated with the proposed CSP Plant

The sections which follow provide a summary of the findings of the assessment undertaken for potential impacts associated with the construction and operation of the proposed facility on the identified site (i.e. Site 1.1) (refer to Appendix F to K for specialist reports). Issues were assessed in terms of the criteria detailed in Chapter 5. The nature of the potential impact is discussed and the significance is calculated (i.e. with and without mitigation/enhancement[24]). Recommendations have been made regarding mitigation and management measures for potentially significant impacts, and the possibility of residual and cumulative impacts[25] are noted. Recommended mitigation have been included within the draft Environmental Management Programme (EMP) included within Appendix M.

7.3.1. Ecology

a) Impact Risk Factors:

Potential ecological impacts resulting from the development would stem from a variety of different activities and risk factors associated with the construction and operational phases of the project including the following:

Construction Phase

- Vegetation clearing for troughs, lay down areas, roads, buildings etc. could impact listed plant species as well as high-biodiversity plant communities. Vegetation clearing will also lead to habitat loss for fauna and potentially the loss of sensitive faunal species, habitats and ecosystems.
- High erosion risk may result due to the loss of plant cover and soil disturbance created during the construction phase. This may impact downstream riparian and wetland habitats if a lot of silt enters the drainage systems. Although the effects

[24] Where relevant for positive impacts.

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

would probably only become apparent during the operational phase, the impact stems from the construction phase and suitable mitigation measures will also need to be applied at this stage.

» Presence and operation of construction machinery on site. This will create a physical impact as well as generate noise, pollution and other forms of disturbance at the site.
» Increased human presence can lead to poaching, illegal plant harvesting and other forms of disturbance such as fire.
» Loss of connectivity & habitat fragmentation may result due to the presence of the generation infrastructure, roads, site fencing and other support infrastructure of the development.

Operational Phase

» The daily maintenance and operation activities of the facility would generate some noise and disturbance which may deter some fauna from the area, amounting to a loss of connectivity and habitat fragmentation.
» Maintenance activities such as vegetation clearing will impact the biodiversity of the site if not conducted in a sensitive manner.
» Persistent avifaunal impacts would potentially result from the presence of power transmission infrastructure at the site.

Site specific information- Site 1.1

Within Site 1.1 there are some small pans present, which contained water at the time of the site visit on account of the recent rains that had occurred. As it had rained only just before the site visit, fauna such as amphibians had not yet started to breed in the pans and so it was not possible to evaluate the significance of the pans in this regard. However, some of the pans contained some emergent vegetation and appeared to be quite favorable as breeding habitat. Given the ecological significance of the pans, these areas should be avoided by the development and an adequate buffer of 100m should also be afforded to these areas. The pans which occur within this site should be considered sensitive and should not be impacted (these areas are indicated as red areas in Figure 7.2). The drainage system which occurs within this site is diffuse and not very well differentiated from the surrounding landscape. The areas mapped as part of the drainage system in the sensitivity map take the form of bare or sparsely vegetated areas on the ground. These areas probably only have some overland flow in exceptional circumstances, but have become more silty and less vegetated on account of silt deposition from the surrounding areas. The sensitive areas within these broad drainage systems should be delineated by an ecologist prior to construction.

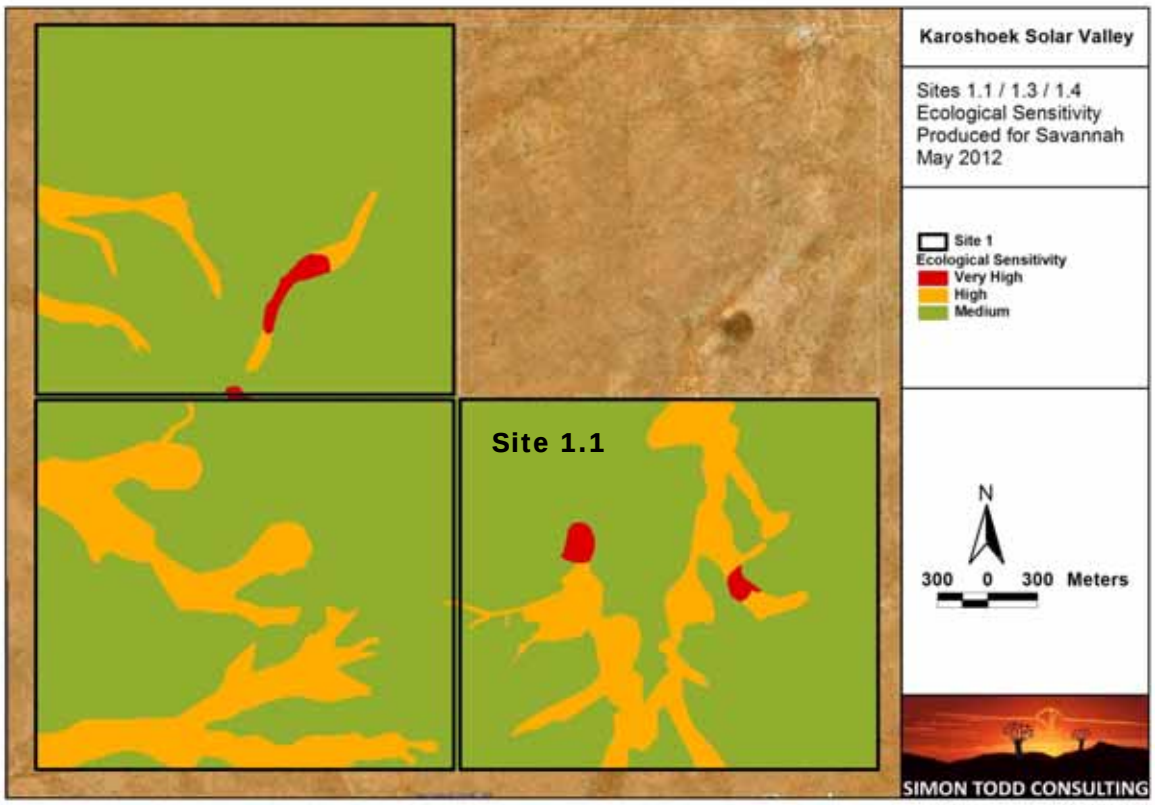


Figure 7.2: Ecological Sensitivity map of **Sites 1.1 (top left),** 1.3 (bottom right) and 1.4 (bottom left)

Figure 4. Vegetation within Site 1.1. In the left image, typical view of the site, with dense *Stipagrostis* and scattered *Rhigozum trichotomum*, *Phaeoptilum spinosum* and occasional *Boscia albitrunca* trees. In the right image, the pan which occurs within Site 1.1 and which should be considered a sensitive area that should be avoided by development within the site.

Impact tables summarising the significance of impacts on ecology during the construction and operation phases

Nature: Impacts on vegetation and listed plant species

Some loss of vegetation is an inevitable consequence of the development. The vegetation types within the affected area are however widespread and the loss of even a few thousand hectares of these vegetation would be of relatively minor significance when considered at a broad scale. However, the potential impacts on listed plant species is of greater significance given the abundance of certain listed species within the site.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Highly Probable (3)
Significance	**Medium (40)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	To some extent	

Mitigation:

» Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.
» All areas to be cleared should be clearly demarcated prior to construction.
» Sensitive areas as demarcated on the sensitivity map should be avoided as far as possible, and where these areas cannot be avoided, precautions should be taken to ensure that impacts are minimized.
» Final development footprint should be surveyed by an ecologist for species of conservation concern for search and rescue.
» Sensitive areas such as drainage lines should be demarcated by an ecologist prior to construction.

Cumulative impacts:

» As the development is part of a larger development focus area, there potential for cumulative impacts is quite high as the total area affected and number of individuals of listed species that might be affected would be high.

Residual impacts:

» The development would result in some permanent loss of vegetation.

Nature: Increased Erosion Risk

Increased erosion risk would result from soil disturbance and the loss of plant cover within cleared and disturbed areas. As some solar generation technologies such as CSP, usually require that the development footprint is sterilised (completely cleared), these areas would generate a lot more runoff than intact vegetation. As a result, the receiving areas would be vulnerable to erosion and regular monitoring to ensure that erosion problems are addressed would be

required.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Short-term (1)
Magnitude	Medium (4)	Low (3)
Probability	Highly Probable (3)	Improbable (3)
Significance	**Medium (27)**	**Very Low (15)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	Yes	

Mitigation:

» All roads should run along the contour where possible.
» All roads should have water diversion structures present at regular intervals to regulate the flow and erosive power of runoff water.
» Cleared areas which are not surfaced or required for construction should be re-vegetated with seed or plants of locally occurring species.
» All construction vehicles should remain on a single track and multiple tracks across the veld should not be allowed.
» Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and re-vegetation techniques.

Cumulative impacts:

» Due to the large number of developments within a relatively confined area, the potential for large sediment loads to impact riverine ecosystems and drainage systems is high.

Residual impacts:

» If erosion at the site is controlled, then there will be very little residual impact

Nature: Increased alien plant invasion

The disturbance created during the construction phase of the project would leave the site highly vulnerable to invasion by alien plant species, which would impact diversity and ecological processes within the area. Alien species that were observed and which might increase in response to the disturbance include *Prosopis glandulosa, Salsola kali* and *Flaveria bidentis*.

	Without mitigation	***With mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Short-term (1)
Magnitude	Medium-High (6)	Low (3)
Probability	Highly Probable (4)	Improbable (3)
Significance	**Medium (48)**	**Very Low (15)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	

Irreplaceable loss of resources	Yes
Can impacts be mitigated	Yes

Mitigation:

» Cleared areas which are not surfaced or required for construction should be revegetated with seed or plants of locally occurring species.
» Regular monitoring for alien plants within the development footprint.
» Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.

Cumulative impacts:

» If alien species became abundant within the different development areas, it is likely that alien plant abundance would also increase within adjacent intact areas and drainage lines on account of the high seen input from the invaded areas

Residual impacts:

» If alien species at the site are controlled, then there will be very little residual impact

Nature: Faunal Impacts

Increased levels of noise, pollution, disturbance and human presence will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present. Some mammals and reptiles such as tortoises would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. The development areas would also amount to habitat loss for most fauna, although there are some species which would potentially increase in the developed areas. Depending on how the development areas were fenced off, the fencing would probably also restrict animal movement and disrupt the connectivity of the landscape for fauna.

	Without mitigation	***With mitigation***
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (3)
Magnitude	Medium (4)	Medium-Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (40)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources	No	
Can impacts be mitigated	To some extent	

Mitigation:

» Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
» The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site.
» Fires should only be allowed within fire-safe demarcated areas.
» No fuel wood collection should be allowed on-site.

» No dogs should be allowed on site.
» All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
» No unauthorized persons should be allowed onto the site.
» Staff present during the operational phase should receive environmental education so as to ensure that that no hunting, killing or harvesting of plants and animals occurs.
» If the site must be lit at night for security purposes, this should be done with low-UV type lights (such as most LEDs), which do not attract insects.
» Roofs and other building structures should be properly sealed and constructed so as to avoid creating potential bat roosting sites.

Cumulative impacts:

» There is likely to be an intense period of faunal disturbance during the construction phase which would however be transient. The various developments within the Karoshoek Solar valley would amount to a significant cumulative impact on fauna which would be likely to disrupt the connectivity of the landscape for sensitive fauna. However, as there are no range-restricted fauna which are likely to be abundant at the site, these impacts would not be of broader significance.

Residual impacts:

» Residual impacts for fauna would amount to some permanent habitat loss as well as decline in the quality of faunal habitat in the vicinity of the development.

Nature: Avifaunal Impacts

Direct and indirect impacts of the development on avifauna would result from habitat loss as well as from the risk of electrocution and collisions with transmission lines. Larger species, such as eagles, flamingos, cranes and bustards many of which are listed, are particularly vulnerable to impacts from transmission infrastructure. Transmission line-related impacts may account for a large proportion of mortalities in vulnerable species. Unless mitigation measures are implemented the significance of this impact is potentially very high on account of the fact that the risk would be persistent and would remain for as long the transmission infrastructure is in place.

	Without mitigation	***With mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (5)	Short-term (2)
Magnitude	Medium (4)	Low (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (44)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	The habitat loss cannot be mitigated as the facility will occupy the space.	

Mitigation:

» Ensure that no poaching or disturbance of birds takes place outside of the development areas. » If any breeding sites of large raptors or other species of conservation concern are observed within the development areas, then an avifaunal expert should be contacted to confirm the most appropriate action for the species concerned. This may involve avoiding the area until breeding has been completed, or leaving an appropriate species-specific buffer around the site.
Cumulative impacts: » The development would contribute to cumulative avifaunal impacts in the area resulting from habitat loss, but would be of small magnitude.
Residual impacts: » The loss of habitat would be more of less permanent as it would persist as long as the facility was present. Thereafter it may not be possible to fully restore the quality of habitat.

Implications for Project Implementation

» No impacts which would prevent the project from proceeding were identified through this assessment.
» The majority of impacts are expected to be of low to very low significance after the implementation of appropriate mitigation measures.
» Although there are some sensitive ecosystems within the site, these are generally restricted in nature and should not pose a very large obstacle for the development of the site as it should be reasonably easy to avoid these areas. The final layout should aim to avoid these areas as far as possible. If this is not possible then appropriate mitigation must be implemented and a water use licence is to be obtained if alluvial pans and drainage lines are to be crossed. Furthermore, construction camps should also be positioned to avoid these sensitive areas.
» Despite the presence of a relatively high number of protected tree species at the site, it is not deemed to be a highly sensitive area on account of the widespread nature of the species and vegetation types that would be affected by the development. Permits are required to be obtained for any protected trees that may be affected.
» A permit is required from the Department of Water Affairs if there are expected impacts on any water resources (i.e. the drainage lines).
» A [26]TOPS permit is required for any activities involving any TOPS listed species

7.3.2. Geology, Soils and Erosion Potential

The construction activities will include excavation, loosening, displacement and/or burial of soil, stockpiling, mixing, wetting, filling and compaction. These activities may negatively affect the soil profile, contributing to soil degradation and possibly accelerated

[26] Threatened or protected species

erosion[27]. These activities could also cause negative indirect impacts such as increased siltation in other areas away from the site impacting on water sources and agriculture with potential socio-economic repercussions.

Impact tables summarising the significance of impacts on Geology, Soil, and Erosion Potential

Nature: Excavation and removal of soil for infrastructure (roads, pipelines and foundations).

No quarrying activities have been proposed and excavations for foundations or pipelines are localised and typically limited to a depth of approximately 1.5m. Therefore, the impact on the bedrock is likely to be insignificant in terms of these activities. However, the cutting of access roads through areas of high relief will involve significant excavations into bedrock and this activity could carry a moderate to high impact on bedrock, depending on the proposed road layouts. The main environmental impacts of cutting into bedrock include unsightly scars in the hillside, alteration of the hydrological regime, soil degradation and slope instability.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**Moderate (55)**	**Moderate (45)**
Status (positive or negative)	Negative	Negative
Reversibility	Partially reversible	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	Yes, to a certain extent.	

Mitigation:

» Use existing roads where possible.
» Design platforms and roads according to contours to minimise cut and fill operations.
» Restrict activity outside of authorised construction areas.
» Rehabilitate soil in activity areas after construction.

Cumulative impacts:

» Although the impact of soil removal for the proposed activity has a moderate significance, the cumulative impact of soil removal in the area is considered low due to the undeveloped nature of the area.

Residual impacts:

» Minor negative residual impacts due to the slow regeneration of topsoil.

[27] The Erosion Index for South Africa indicates that the area where the site is located has a moderate to low susceptibility to erosion, primarily due to the very dry climate.

Nature: Soil degradation Through loosening, mixing, wetting, and compacting of in situ soil during earthworks.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Medium term (3)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**Moderate (50)**	**Moderate (35)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	Yes, to a certain extent	
Mitigation: » Use existing roads where possible. » Design platforms and roads according to contours to minimise cut and fill operations. » Control activity outside of construction disturbance areas. » Rehabilitate soil in disturbance areas after construction.		
Cumulative impacts: » Although the impact for the proposed activity has only moderate-low significance, the cumulative impact of earthworks in the area is considered low due to the undeveloped nature of the area		
Residual impacts: » Minor negative residual impacts due to the slow regeneration of topsoil.		

Nature: Soil degradation Pollution of soil by waste products (human and synthetic) and contaminants used in construction (e.g. fuel, oil, chemicals, cement). Soil pollution may affect soil forming processes primarily during the construction phase due to the presence of vehicles and construction equipment.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Medium term (2)	Very short term (1)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (12)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources	Yes, minor	Yes, minor
Can impacts be mitigated	Yes	
Mitigation: » Control use and disposal of potential contaminants or hazardous materials. » Provide sufficient ablution and sanitation facilities. » Remove contaminants and contaminated topsoil and replace topsoil in affected areas.		

Cumulative impacts:

» The cumulative impact of soil pollution is considered low due to the undeveloped nature of the study area.

Residual impacts:

» Minor negative residual impacts due to the slow regeneration of soil processes in and under topsoil.

Nature: Soil erosion

Water erosion is generally considered as more important due to the magnitude of the potential impact over a relatively short period of time which can be very difficult to control. Erosion potential is increased on construction sites where soil is loosened and vegetation cover is stripped. Unconsolidated or partly consolidated fine-grained soils of low plasticity along drainage lines and on moderate to steep slopes or at the base of steep slopes are most vulnerable to severe levels of water erosion. These areas are typically called "highly sensitive" areas. Erosion will continually occur all over the site, as this is a natural process, but severe erosion is usually related to human impacts and this needs to be restricted as far as possible.

A significant percentage of the proposed site is underlain by unconsolidated or semi-consolidated Quaternary soil cover of the Gordonia Formation. The soil cover in this geological terrain may be sensitive to water erosion, if subjected to concentrated run-off, such as along natural drainage lines or on construction sites where water is discharged onto the ground in an uncontrolled manner. The presence of shallow rock or outcrops in other areas will restrict severe erosion.

Wind erosion from areas that are stripped of vegetation should not be underestimated and can lead to severe dust pollution which will attract negative responses from neighbours.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Medium term (3)	Very short term (1)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (30)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Practically irreversible
Irreplaceable loss of resources	Yes, moderate to low	Yes, low
Can impacts be mitigated	Yes	

Mitigation:

» Restrict size of areas to be disturbed during construction.
» Control activities outside of authorised construction areas.
» Implement effective erosion control measures.
» Carry out earthworks in phases across site to minimise exposed ground at any one time.
» Keep to existing roads, where practical, to minimise loosening of undisturbed ground.
» Protect and maintain bare slopes, excavations, and material stockpiles to minimise erosion and instability.

Cumulative impacts:
» The cumulative impact of soil erosion in the area is considered low due to the undeveloped nature of the area.
Residual impacts:
» Minor residual impacts due to the localised movement of sediment and slow regeneration of soil processes.

Nature: Siltation of waterways and dams downstream from site

The proposed activity may potentially result in indirect impacts, such as increased siltation in drainage systems downstream from the site or dust pollution in the area surrounding the site. The severity or significance of the various impacts is related to the nature and extent of the activity.

	Without mitigation	***With mitigation***
Extent	Regional (3)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (33)**	**Low (21)**
Status (positive or negative)	Negative	
Reversibility	Irreversible	
Irreplaceable loss of resources	Yes, low	
Can impacts be mitigated	Yes	

Mitigation:

» Install appropriate anti-erosion measures such as silt fences, geosynthetic erosion protection, and/or flow attenuation along watercourses below construction sites.
» Strictly control activities in or near water courses/natural drainage lines as sediment transport is higher in these areas.

Cumulative impacts:

» Due to all the agricultural activity in the area, as well as other developments proposed in the area, the cumulative impact of siltation in the area is potentially high.

Residual impacts:

» Minor residual impacts are expected do to the localised movement of soil across the site.

Nature: Dust pollution

If not managed properly, construction sites may result in the creation of dust which may affect surrounding areas (i.e. depending on the wind direction, and presence of receptors).

	Without mitigation	***With mitigation***
Extent	Regional (2)	Local (1)
Duration	Very short term (1)	Very short term (1)
Magnitude	Low (4)	Minor (2)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Moderate (28)**	**Low (16)**

Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes, low	Yes, minor
Can impacts be mitigated?	Yes	
Mitigation: » Place dust covers on stockpiles. » Use suitable gravel wearing course on access roads. » Apply straw bales or dampen dusty denuded areas.		
Cumulative impacts: » The cumulative impact of dust in the area is considered low.		
Residual impacts: Minor residual impacts are expected do to the localised movement of soil across the site.		

Implications for Project Implementation

» The natural drainage lines/watercourses on the site are regarded as highly sensitive in terms of erodibility potential. Some facility components are sited near / across these drainage lines. Special engineering designs such as culverts etc may need to be considered to minimise impacts on these features.
» Areas underlain by thick Quaternary Gordonia Formation soils are regarded as moderately sensitive as minor natural erosion is currently taking place. Heavy downpours or increased flow due to concentrated discharge of construction water may exacerbate this erosion.
» The identified potential impacts on the geological environment range from a low to moderate significance and with effective implementation of mitigating measures the impacts can be reduced to an acceptable level.

7.3.3. Agricultural Potential

The establishment of the facility and its associated infrastructure will not affect land of high agricultural potential (i.e. closer to the river). Furthermore, the agricultural potential of the rest of the site is very low due to climatic constraints as well as the shallow and rocky soils distributed throughout. The improvement of the agricultural potential is dependent on extensive and costly soil preparation and establishment of irrigation infrastructure.

Impact tables summarising the significance of impacts on agricultural potential

Nature: Loss of agricultural potential and land capability owing to the development		
	Without mitigation	***With mitigation***
Extent	Low (1) – Site	Low (1) – Site

Duration	Permanent (5)	Permanent (5)
Magnitude	Low (2)	Low (2)
Probability	Improbable (2)	Improbable (2)
Significance	**16 (Low)**	**16 (Low)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated	No	
Mitigation: » There are no mitigation measures that can combat the long term loss of agricultural potential. » Mitigation is restricted to the limitation of the developmental footprint to the immediate area of impact and minimisation of off-site impacts.		
Cumulative impacts: » Soil erosion may arise owing to increased surface water runoff. Adequate management nd erosion control measures should be implemented.		
Residual impacts: » The loss of agricultural land is a long term loss which extends to the post-construction phase. The agricultural potential however is very low.		

Implications for Project Implementation

» Irrigated farming activities exist within the broader site between the N10 and the Orange River. However, these activities will not be directly impacted by the proposed facility. In addition, additional/alternative farming activities are being investigated by FG Emvelo for the broader Karoshoek site (i.e. within areas of higher agricultural potential identified during the Scoping Phase). A prefeasibility study has identified the potential of growing more table grapes, vegetables, and paprika. Crop production will only be possible with very intensive preparation, in the form of ripping and land form shaping, and irrigation. The preparation and establishment costs are such that it is only considered if a long term plan, with adequate market research and funding, has been drawn up.
» Site 1.1 falls mainly within soil type Ag5 which has regular occurrences of rock outcrops. This will be taken into consideration during the geotechnical survey which will look at the potential for excavations and the availability of natural construction materials. This study will also serve to inform the type of foundations required to be constructed (i.e. for the power block).

7.3.4. Water Resources

The impact assessment of the water study deals with three separate components, i.e. riparian vegetation, flow and quality, and fish fauna. Generic information is taken from the Project Ilanga report.

NB: In terms of water related infrastructure - where the water source is the Orange River, with the water abstraction point at the existing abstraction point of the Boegoeberg Water Users Association at coordinate S 28° 24' 7.68" and E 21° 29' 50.51". Associated water supply pipelines; water treatment and storage reservoirs and evaporation ponds will be required. **This infrastructure has already been authorised through the EIA process undertaken for Project Ilanga on site 1.2 (DEA ref no. 12/12/20/2056)**. A pipeline would however be required to be constructed to each facility from the central water reservoir.

In generic terms of impacts, many of the potential environmental impacts on the Orange River due to construction activities associated with the water abstraction infrastructure on the banks and riparian zones are similar, and will be applicable to any construction activity in or adjacent to rivers. A general description of the possible causes of these common impacts on aquatic habitats and biota (particularly on the fish fauna), as well as a description of their ecological consequences, is provided below.

Impact tables summarising the significance of impacts on water resources during the construction and operation phases

Nature: Impact on the biological environment through loss of riparian systems

From a habitat and ecosystem point of view, all the dry river beds and associated riparian systems are rated as extremely sensitive to development, in particular the mainstem systems such as Klein-leerkransspruit and Majties (Matjes) River.

The physical removal of the narrow strips of woody riparian zones, being replaced by hard engineered surfaces (i.e. at the location of the abstraction point). This biological impact would however be localised, as a large portion of the remaining farm and the catchments would remain intact.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (55)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	High	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

» The most significant form of mitigation would be to select a development area per site, which contains no drainage lines. All sites are also a significant distance from the main drainage

systems, and is thus unlikely to be flooded or in itself pose a risk to the aquatic systems should there be any major spills (coolants).

Cumulative impacts:

» Some cumulative impact due to the number of sites to be developed, but not considered high due to current land use impacts (e.g. grazing) on riparian zones. Little natural habitat remains along the Orange River.

Residual impacts:

» Changes in run-off characteristics within the development area will cause residual impacts.

Nature: Impact on the physical environment (i.e. dry riverbeds and localised drainage systems) through loss of riparian systems

The physical removal of narrow strips of woody riparian zones being replaced by hard engineered surfaces will alter the hydrological nature of the area, by increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils. Although this impact would extend to a large section of the Karoshoek Solar Valley farms, the extent of the impacts would still be considered local.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Definite (5)	Probable (3)
Significance	**Medium (45)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	High	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

» The most significant form of mitigation would be to select a development area which contained no or the least number of drainage lines. Storm water within each site should be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant, and install stilling basins to capture large volumes of run-off, trap sediments and reduce flow velocities.

Cumulative impacts:

» Possible cumulative impacts due to the loss of these systems due to agricultural activities and other developments.

» The increase in surface run-off velocities and the reduction in the potential for groundwater infiltration is unlikely to occur, considering that the sites are not near the main drainage channel and the annual rainfall figures are low.

Residual impacts:

» Diversion of run-off away from downstream systems is unlikely to occur as the site is not near the main drainage channel and the annual rainfall figures are low. i.e. the overall hydrological regime will be altered in a limited fashion.

Nature: Impact on riparian systems through the increase in surface water runoff

The increase in surface water runoff my lead to increased erosion and subsequently increased sedimentation in the river.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	Low (2)
Probability	Definite (5)	Probable (3)
Significance	**Medium (35)**	**Low (19)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

» Any storm water within the site will be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant. It is also recommended that stilling basins to capture large volumes of run-off, trap sediments, and reduce flow velocities (e.g. water used when washing the mirrors) are installed.

» The project should also try to capture and recycle any form of run-off created by the daily operations. This would minimise the amount of water required by the project, but also serve to limit the downstream impacts on the riparian systems through an increase in run-off, a situation that these systems are currently unaccustomed too.

Cumulative impacts:

» Downstream alteration of hydrological regimes due to the increased run-off from the area, particularly when all plants are operational.

Residual impacts:

» Possible impact on the remaining catchment due to changes in run-off characteristics in the development area.

Nature: Increase in sedimentation and erosion

Potential causes

There is a risk of elevated sediment input into the Orange River during the establishment or extension of the water abstraction facilities on the banks and floodplains of the Orange River. In addition, although relatively far from the river itself, sediment-laden runoff from the proposed sites of the Karoshoek Solar Valley Development could occur, particularly if flash floods occur during the site clearing and construction phases of the project. Sediment mobilisation could result from, among others:

» Disturbance of existing flood protection embankments.

» Inadequate erosion control or containment of sediment-laden runoff during site clearing and construction activities for infrastructure at both the abstraction points (e.g. pipe lines and reservoirs) and at the solar plant site.

» Backwash water discharged from the sand filters could result in sediment laden water reaching the Orange River, with a resultant impact on habitat availability for instream biota.

Consequences

Increased siltation and sedimentation has been described as one of the biggest threats facing some rivers in South Africa and could result in a number of negative impacts, including:

» Reducing the depth of pools in the river channel causing these sanctuary habitats to become too shallow during low flows to support fish life or other aquatic biota.
» Fine sediment could be washed downstream and smother important fish spawning areas, such as gravel and cobble riffles used by Largemouth yellowfish and rock catfish.
» Sediment deposits would further encourage reed invasion in the river channel and thus degrade preferred fish habitats.

Elevated turbidity levels associated with increased sediment washing into the river has a number of negative impacts on aquatic biota, including fish. These include:

» The whole food web can be disrupted due to reduced light penetration and photosynthesis, resulting in reduced primary production, a reduction in submerged plant life, including phytoplankton.
» Reduced number of bottom organisms (e.g. benthic algae, crabs, small aquatic invertebrates) due to smothering by layers of silt.
» The smothering of incubating eggs (fish, tadpoles, etc.) and larval fish.
» Clogging, abrading and damage to fish gills, leading to reduced oxygen absorption, damage to gill filaments, resulting in increased stress, disease and even death, (Whitfield and Paterson, 1995).
» Reduced feeding efficiency – a major impact on visual predators such as Largemouth yellowfish, as they are unable to see and find enough food in the turbid water.

The above impacts could eliminate sensitive species from the affected areas and cause fish species and other biota to vacate the area. Fish species such as the near threatened Largemouth yellowfish that require silt-free gravel and/or cobble habitats for spawning, would be particularly affected by elevated sediment inputs.

The ecological functioning of the potentially impacted reach of the Orange River could therefore be seriously impacted by high sediment inputs associated with the proposed construction activities, particularly of the water abstraction facilities.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (1)	Low (1)
Probability	Definite (5)	Probable (3)
Significance	**Medium (30)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	
Irreplaceable loss of	No	

resources	
Can impacts be mitigated	Yes

Mitigation:

» Any storm water within each site should be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant, and install stilling basins to capture large volumes of run-off, trap sediments and reduce flow velocities (e.g. water used when washing the mirrors).

Cumulative impacts:

» Downstream erosion and sedimentation of the irrigation canal systems. During flood events, any unstable banks and sediment bars will be washed into the Orange River. It is also therefore recommended that storm water is not released directly into the Orange River.

Residual impacts:

» Possible impact on the remaining catchment due to changes in run-off characteristics in the development area.

Nature: Sediment input into the Orange River

Vegetation clearing and earthmoving operations at the sites during pre-construction and construction of the infrastructure (including access roads, water pipelines, reservoirs, etc.) will increase the risk of soil erosion and sediment being washed into the Orange River during heavy rains. The risk will obviously be lower for sites further away from the river, i.e. site 1.1.

	Without mitigation	***With mitigation***
Extent	Site (2)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**40 (medium)**	**10 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	
Irreplaceable loss of resources	Medium	
Can impacts be mitigated	High	

Mitigation:

» Site clearing and preparation for the construction of the solar facilities should take steps to avoid surface run-off and storm-water erosion of cleared areas where practicable.

» A comprehensive Storm Water Management Plan (SWMP) incorporating anti-erosion measures on site should be put in place.

» All surface run-off should be discharge via detention dams to allow sediment to settle out before leaving the site.

Cumulative impacts:

» Man-induced erosion and sedimentation in this area from intensive farming activities along the Orange River is expected to be unnaturally high. The cumulative impact on the Orange River could thus exceed the tolerances of the aquatic biota, including sensitive fish species, should appropriate mitigation not be conducted.

Residual impacts:

» Residual Impacts should be minimal with appropriate mitigation.

Nature: Chemical and other pollutants into the Orange River

During both pre-construction, construction and operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities could be washed downslope via the ephemeral streams into the Orange River.

During the operational phase, spills and leaks from the evaporation or blow down ponds could be washed by storm water run-off via the natural drainage lines into the Orange River.

Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility.

	Without mitigation	***With mitigation***
Extent	Site (2)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**30 (medium)**	**10 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes (high)	
Irreplaceable loss of resources	Yes (medium)	
Can impacts be mitigated	Yes (high)	

Mitigation:

» Strict use and management of all hazardous materials used on site.
» Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles and machinery, cement during construction, etc.).
» Containment of all contaminated water by means of careful run-off management on the development site.
» Strict control over the behaviour of construction workers.
» Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced.

Cumulative impacts*:*

» The widespread use of chemicals in farming activities (fertilizers, insecticides, herbicides, etc.) means that any chemical pollution from the solar facilities will have a marked cumulative impact on aquatic biota.

Residual impacts:

» Residual impacts will be negligible after appropriate mitigation.

Nature: Abstraction of water from the Orange River: timing and volume

The proposed constant abstraction of large volumes of water from the Orange River

(approximately 1.5 million m^3/a for the Solar Valley Park) may reduce present day flows and impact negatively on aquatic biota. This impact would be particularly evident in summer when high river flows are required for fish spawning migrations and egg incubation. It is anticipated that constant pumping during droughts may impact on drought flow requirements needed to meet the EWR. Cognisance will therefore have to be taken of other user requirements.		
	Without mitigation	***With mitigation***
Extent	Region (3)	n/a
Duration	Long term (4)	n/a
Magnitude	Moderate (6)	n/a
Probability	Probable (3)	n/a
Significance	**39 (medium)**	n/a
Status (positive or negative)	Negative	n/a
Reversibility	Moderate	n/a
Irreplaceable loss of resources	Yes (moderate)	n/a
Can impacts be mitigated	Low/none	
Mitigation*:* Mitigation measures may be difficult and expensive, however, the possible measures to reduce volumes of water abstracted from the Orange River could include the following: » Optimise the design or technology of the each solar power facility to reduce consumptive water requirements as far as possible. » Adapt the abstraction regime to meet the EWR and requirements of other users where required. » Implement the proposed dry cooling process		
Cumulative impacts: » Cumulative impacts due to water abstraction in the Lower Orange River are already considered to be high and will be exacerbated by the abstractions for the Karoshoek project.		
Residual impacts*:* » No residual impacts expected if water use is reduced as much as possible.		

Implications for Project Implementation

» With suitable mitigation and careful placement of the proposed facility, the development should have limited impact on the overall status of the riparian systems within the region.
» Potential impacts of the proposed development on the fish biota of Orange River did not reveal any significant impacts on the fish fauna and associated aquatic habitats, provided the appropriate mitigation measures are undertaken.
» The Orange River system is highly regulated which may affect the site (i.e. releases from the Vanderkloof Dam, although the release patterns are re-evaluated every year to provide for irrigators and is therefore well known).
» From a habitat and ecosystem point of view, all the dry river beds and the associated riparian systems are rated as extremely sensitive to development, in particular the mainstem systems such as Klein-leerkransspruit and Majties (Matjes) River.

Therefore during the planning and design phase, these sensitive areas will need to be considered with respect to the layout.

» The facility is deemed to have a limited potential impact on the aquatic environment. The only significant risk to the project is the water use license not being granted by the Department of Water Affairs. Although dry cooling will be practiced which will reduce water requirements, the Orange River system is under pressure in terms of water requirements.

7.3.5. Heritage Resources

Impacts on heritage resources are largely expected during the construction phase of the facility. Construction activities including clearance or excavation activities could alter or destroy the context of heritage resources or the resources themselves in the event of such archaeological materials being present. All sites identified within the broader study area are classified as being of Grade III significance, i.e. heritage resources worthy of conservation on a local authority level.

The [28]NHRA stipulates the assessment criteria and grading of archaeological sites. The following categories are distinguished in Section 7 of the Act:

» Grade I: Heritage resources with qualities so exceptional that they are of special national significance;
» Grade II: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and
» Grade III: Other heritage resources worthy of conservation on a local authority level.

The occurrence of sites with a Grade I significance will demand that the development activities be drastically altered in order to retain these sites in their original state. For Grade II and Grade III sites, the applicable mitigation measures would allow the development activities to continue. All the sites identified within the area, and listed below have been classified as Grade III sites.

No heritage sites were recorded on site 1.1. Therefore the only impact assessed is the impact on the built environment and cultural landscape.

Impact tables summarising the significance of impacts on heritage resources

Nature: Impact on the Built Environment due to the construction of CSP plant

[28] National Heritage Resource Act

The area has some agricultural features such as fences, roads and concrete dams. The built environment could be affected by the placement of the solar facility.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Short term (1)	Long term (1)
Magnitude	Low (3)	Low (3)
Probability	Improbable (1)	Improbable (1)
Significance	**Low (5)**	**Low (5)**
Status	Positive	Positive
Reversibility	Reversible	Reversible
Irreplaceable loss of resources	No	
Can impacts be mitigated	No	

Mitigation:

» No mitigation is recommended.

Cumulative impacts:

» N/A

Residual impacts:

» N/A

Nature: Limited impacts on the cultural landscape are anticipated

Several possible cultural landscape components were identified within the study areas. The construction of the solar power plant could result in alteration in the cultural characteristics of the landscape.

	Without mitigation	***With mitigation***
Extent	Local (2)	Local (2)
Duration	Short term (2)	Long term (2)
Magnitude	Low (1)	Low (1)
Probability	Improbable (3)	Improbable (3)
Significance	**Low (15)**	**Low (15)**
Status	Positive	Positive
Reversibility	Reversible	Reversible
Irreplaceable loss of resources	No	
Can impacts be mitigated	No	

Mitigation:

» No mitigation is recommended.

Cumulative impacts:

» N/A

Residual impacts:

» N/A

Implications for Project Implementation

- In the event of archaeological materials being present such activity would alter or destroy their context (even if the artefacts themselves are not destroyed, which is also obviously possible).
- No sites, features or objects of cultural heritage significance were identified in the study area. Therefore, there would be no impact from the proposed development.
- From a heritage point of view it is recommended that the proposed development be allowed to continue.
- In the event that such resources are found, they are likely to be of a nature that potential impacts could be mitigated by documentation and/or salvage following approval and permitting by the South African Heritage Resources Agency and, in the case of any built environment features, by Ngwao Boswa ya Kapa Bokone (the Northern Cape Heritage Authority).

7.3.6. Visual Aesthetics

Potential visual impacts associated with the construction phase

The construction phase will last for approximately 24 – 30 months. During this time construction related traffic (i.e. in terms of vehicles and construction workers) will frequent the area and may cause a visual nuisance to other road users and landowners in the area.

Potential visual impacts associated with the operational phase

The facility would be visually exposed to those areas that lie within the broader site, and to the immediate west and south west (Refer to figure 7.2). The Orange River valley is, for the most part, shielded from potential visual exposure by virtue of its topography. However, those areas north of the Orange River are very flat and visually exposed. The low hills beyond the river in the north-west offer some visual protection for outlying areas in that direction. The low hills within and to the east of the site also shield the region further east.

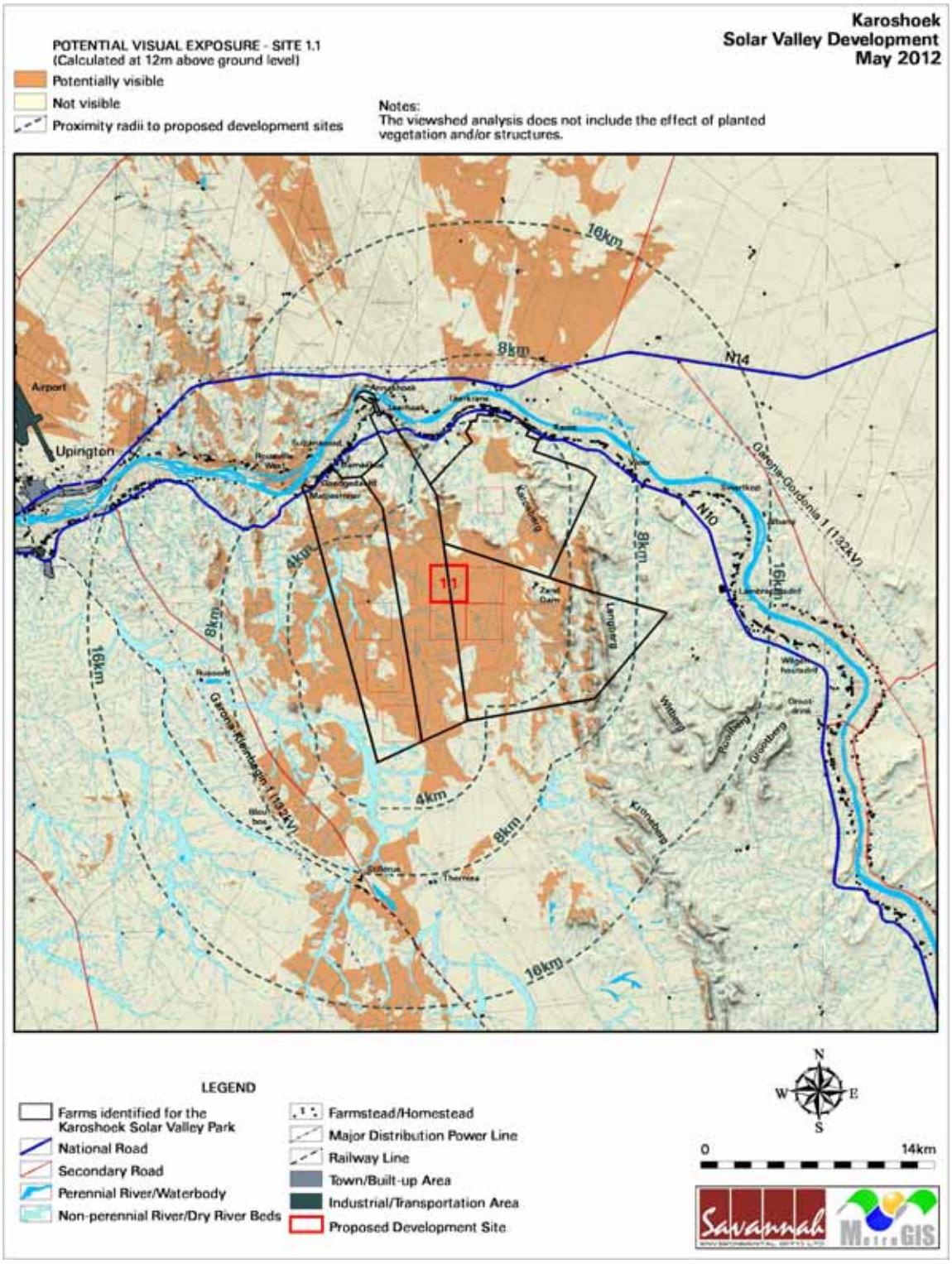


Figure 7.2: Map illustrating the theoretical potential visual exposure of the facility

In terms of the observer proximity, viewer incidence is highest from certain positions along the N10 and N14 national roads and as well as the secondary roads within the study area. Commuters and tourists using these roads could potentially be negatively

impacted upon by visual exposure to the facility. Tourists travelling through the area are seen as possible sensitive visual receptors upon which the construction of the proposed facility could have a negative visual impact.

Other than along the above roads, viewer incidence within a 16 km radius of the facility is concentrated among the homesteads and settlements located along the Orange River. The severity of the impact on these receptors decreases with increased distance from the proposed facility.

The remaining areas beyond 16 km consist predominantly of vacant natural land (i.e. for grazing purposes) and very sparsely scattered homesteads. The highest concentration of potential observers is in Upington, which lies more than 20 km from the site, and it is unlikely that the facility will be visible from this distance.

The combined results of the visual exposure, viewer incidence / perception and visual distance of the proposed facility was calculated. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been 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 focusing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

The visual impact index map (refer to Figure 7.4) represents the anticipated visual impact for the facility and its associated infrastructure located within the development footprint[29]. It indicates a core area of potentially moderate visual impact within a 4 km radius of the proposed facility. No infrastructure or settlements lie within this area. Potential areas of low visual impact lie between 4 km and 8 km from the proposed CSP. No infrastructure or settlements will be affected. Between the 8 km and 16 km radius, areas of low visual impact include a very short stretch of the N14 (north of the Orange River), and the secondary road south east of the site. In addition, a number of homesteads (Rouxville West) along the Orange River, to the north west of the site, will potentially be exposed to low visual impact. Remaining areas between 8 km and 16 km from the site will be exposed to very low visual impact. Visual impact beyond 16 km, including the eastern outskirts of Upington, is likely to be negligible.

[29] The map does not indicate the index for the power lines.

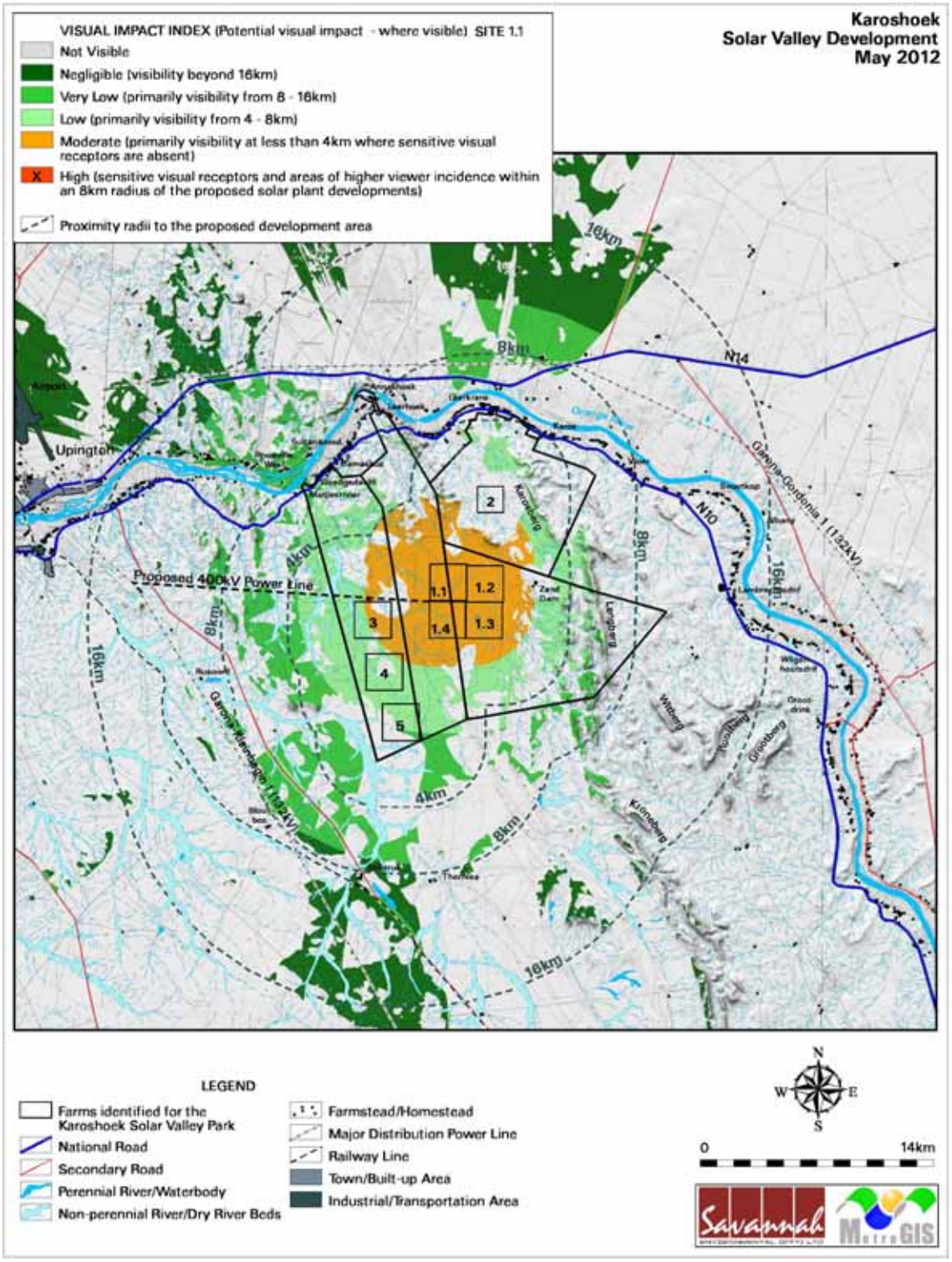


Figure 7.4 Visual impact index

Impact tables summarising the significance of visual impacts

Nature: Potential visual impact on users of roads in close proximity to the proposed Solar Valley development.

The potential visual impact on users of the national road (i.e. the N10 and N14) and the secondary roads in close proximity (i.e. within 4-8km) to the proposed solar energy facility is expected to be of low significance, and may be mitigated to a lower significance.

The **overall** (cumulative) potential visual impact on users of the national road (i.e. the N10 and N14) and the secondary roads in close proximity (i.e. within 4-8km) to the proposed solar energy facility is expected to be of high significance, and may be mitigated to moderate.

	Without mitigation	***With mitigation***
Site 1.1		
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	V Improbable (1)
Significance	**Low (24)**	**Low (12)**
Status	Negative	Negative
Cumulative impacts entire Karoshoek Solar Valley Development		
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	High (8)
Probability	Highly Probable (4)	Probable (3)
Significance	**High (64)**	**Moderate (48)**
Status	Negative	Negative
Reversibility	Recoverable	Recoverable
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

Planning:

» Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the perimeter of each development site.
» Retain and maintain natural vegetation in all areas outside of the development footprint.
» Plan internal roads and ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible.

Construction:

» Rehabilitation of all construction areas.
» Ensure that vegetation is not cleared unnecessarily to make way for the access road and ancillary buildings.

Operations:

» Maintain the general appearance of the facility as a whole.
» Maintenance of roads to avoid erosion and suppress dust.

Decommissioning:

» Remove infrastructure and roads not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

» The construction of the solar energy facilities will increase the cumulative visual impact of industrial type infrastructure within the region. This is due to the construction of the seven individual solar energy facilities, as well as the Ilanga Solar Thermal Plant (site 1.2) on the Karoshoek Solar Valley Development site.

Residual impacts:

» The visual impact will be removed after decommissioning. Failing this, the visual impact will remain.

Nature: Potential visual impact on residents of settlements and homesteads in close proximity to the proposed solar energy facilities.

From the Visual assessment report, there will be no potential visual impact on residents of homesteads in close proximity (i.e. within 4-8km) of the proposed CSP facility. The affected homesteads lie mainly to the north and north west of the proposed solar park.

The **overall** potential visual impact on residents of homesteads in close proximity (i.e. within 4-8km) of the proposed solar energy facilities is expected to be of moderate significance both before and after mitigation. The affected homesteads lies mainly to the north and north west of the proposed Karoshoek Solar Valley park.

	Without mitigation	***With mitigation***
Site 1.1		
Extent	Nil (0)	Nil (0)
Duration	Nil (0)	Nil (0)
Magnitude	Nil (0)	Nil (0)
Probability	Nil (0)	Nil (0)
Significance	**Nil (0)**	**Nil (0)**
Status	N/A	N/A
Cumulative impacts entire Karoshoek Solar Valley Development		
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	High (8)
Probability	Probable (3)	Improbable(2)
Significance	**Moderate (48)**	**Moderate (32)**
Status	Negative	Negative
Reversibility	Recoverable	Recoverable
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

Planning:

» Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the perimeter of each development site.
» Retain and maintain natural vegetation in all areas outside of the development footprint.
» Plan internal roads and ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible.

Construction:

» Rehabilitation of all construction areas.
» Ensure that vegetation is not cleared unnecessarily to make way for the access road and ancillary buildings.

Operations:

» Maintain the general appearance of the facility as a whole.
» Maintenance of roads to avoid erosion and suppress dust.

Decommissioning:

» Remove infrastructure and roads not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

» The construction of the solar energy facilities will increase the cumulative visual impact of industrial type infrastructure within the region. This is due to the construction of the seven individual solar energy facilities, as well as the Ilanga Solar Thermal Plant (site 1.2) on the Karoshoek Solar Valley Development site.

Residual impacts:

» The visual impact will be removed after decommissioning. Failing this, the visual impact will remain.

Nature: Potential visual impact on sensitive visual receptors within the region

The potential visual impact on users of roads and residents of homesteads within the greater region (i.e. beyond 8km of the proposed solar energy facility) is expected to be of low significance, and may be mitigated to an even lower significance.

The **overall** potential visual impact on users of roads and residents of homesteads within the greater region (i.e. beyond 8km of the proposed solar energy facilities) is expected to be of moderate significance, and may be mitigated to low.

	Without mitigation	***With mitigation***
Site 1.1		
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	V Improbable (1)
Significance	**Low (22)**	**Low (11)**

Status	Negative	Negative
Cumulative impacts entire Karoshoek Solar Valley Development		
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (33)**	**Low (22)**
Status	Negative	Negative
Reversibility	Recoverable	Recoverable
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

Planning:

» Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the perimeter of each development site.
» Retain and maintain natural vegetation in all areas outside of the development footprint.
» Plan internal roads and ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible.

Construction:

» Rehabilitation of all construction areas.
» Ensure that vegetation is not cleared unnecessarily to make way for the access road and ancillary buildings.

Operations:

» Maintain the general appearance of the facility as a whole.
» Maintenance of roads to avoid erosion and suppress dust.

Decommissioning:

» Remove infrastructure and roads not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

» The construction of the solar energy facilities will increase the cumulative visual impact of industrial type infrastructure within the region. This is due to the construction of the seven individual solar energy facilities, as well as the Ilanga Solar Thermal Plant (site 1.2) on the Karoshoek Solar Valley Development site.

Residual impacts:

» The visual impact will be removed after decommissioning. Failing this, the visual impact will remain.

Nature: Potential visual impact of on-site ancillary infrastructure on sensitive visual receptors in close proximity to the proposed solar energy facilities.

Ancillary infrastructure to be located within the solar energy facility footprints includes the internal access roads; storerooms, accommodation, waste storage facilities etc.

Although no dedicated viewshed has been generated for the infrastructure, it is expected that the area of potential visual impact will lie within that of the primary solar energy facility structures. The visual impact is expected to be of low significance, both before and after mitigation, as it is expected to be absorbed entirely by the visual impact of the primary infrastructure.

	Without mitigation	***With mitigation***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Improbable(2)	Very Improbable(1)
Significance	**Low (28)**	**Low (14)**
Status	Negative	Negative
Reversibility	Recoverable	Recoverable
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

Planning:

» Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the perimeter of each development site.
» Retain and maintain natural vegetation in all areas outside of the development footprint.
» Plan internal roads and ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible.

Construction:

» Rehabilitation of all construction areas.
» Ensure that vegetation is not cleared unnecessarily to make way for the access road and ancillary buildings.

Operations:

» Maintain the general appearance of the facility as a whole.
» Maintenance of roads to avoid erosion and suppress dust.

Decommissioning:

» Remove infrastructure and roads not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

» The construction of the solar energy facilities will increase the cumulative visual impact of industrial type infrastructure within the region. This is due to the construction of the seven individual solar energy facilities, as well as the Ilanga Solar Thermal Plant (site 1.2) on the Karoshoek Solar Valley Development site.

Residual impacts:

» The visual impact will be removed after decommissioning. Failing this, the visual impact will remain.

Nature: Potential visual impact of lighting on sensitive visual receptors in close proximity to the solar energy facilities

The area surrounding the proposed solar valley development has a relatively low incidence of populated places. Therefore light trespass and glare from the security and after-hours operational and security lighting will have some significance for residents in the area.

In addition, the potential lighting impact known as sky glow will be of relevance. 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, contribute to the increase in sky glow. The solar valley development may contribute to the effect of sky glow in an otherwise dark environment.

Mitigation of this impact entails the pro-active design, planning and specification lighting for the each of the solar energy facilities by a lighting engineer. The correct specification and placement of lighting and light fixtures will go far to contain rather than spread the light.

The potential visual impact of lighting on sensitive visual receptors in close proximity to the proposed solar energy facility is expected to be of low significance, and may be mitigated to an even lower significance.

The **overall** (cumulative) assessment of this anticipated impact, which is likely to be of moderate significance both before and after mitigation.

	Without mitigation	***With mitigation***
Site 1.1		
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	V Improbable (1)
Significance	**Low (24)**	**Low (12)**
Status	Negative	Negative
Cumulative impacts entire Karoshoek Solar Valley Development		
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	High (8)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (48)**	**Moderate (32)**
Status	Negative	Negative
Reversibility	Recoverable	Recoverable
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

Planning & operation:

» Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
» Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
» Making use of minimum lumen or wattage in fixtures;

» Making use of down-lighters, or shielded fixtures; » Making use of Low Pressure Sodium lighting or other types of low impact lighting. » Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.
Cumulative impacts: » The construction of the solar energy facilities will increase the cumulative visual impact of industrial type infrastructure within the region. This is due to the construction of the seven individual solar energy facilities, as well as the Ilanga Solar Thermal Plant (site 1.2) on the Karoshoek Solar Valley Development site.
Residual impacts: » The visual impact will be removed after decommissioning. Failing this, the visual impact will remain.

Nature: Potential visual impact of construction activities on sensitive visual receptors.

The construction phase of the Karoshoek Solar Valley Development may exceed 10 years should all the proposed solar generation facilities be constructed.

During the construction period, there will be a noticeable increase in heavy vehicles utilising the N10 to the development site that may cause, at the very least, a visual nuisance to other road users and land owners in the area.

In this environment, dust from construction work is also likely to represent a significant visual impact. Mitigation entails proper planning and management of the construction sites to forego residual visual impacts.

	Without mitigation	***With mitigation***
Extent	Local (4)	Local (4)
Duration	Medium (3)	Medium (3)
Magnitude	Moderate (6)	Low (4)
Probability	High (4)	Probable (3)
Significance	**Moderate (52)**	**Moderate (33)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

Construction:

» Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
» Reduce the construction period through careful logistical planning and productive implementation of resources.
» Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
» Restrict the activities and movement of construction workers and vehicles to the immediate

construction site and existing access roads. » Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities. » Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent). » Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting. » Rehabilitate all disturbed areas, construction areas, roads, slopes etc immediately after the completion of construction works.
Cumulative impacts: » The simultaneous construction of up to 8 solar energy facilities within the Solar Valley Development (including site 1.2- Project Ilanga) has the potential to manifest as a cumulative visual impact.
Residual impacts: » None

Nature: Potential visual impact on the visual character of the landscape, sense of place and tourism potential of the region.

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria and specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc) play a significant role.

A visual impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

Specific aspects contributing to the sense of place of this region include the rugged natural beauty of the area and the wide open vistas and expanses.

The anticipated visual impact of the solar valley development and associated infrastructure on the regional visual character, and by implication, on the sense of place, is expected to be moderate.

In terms of tourism potential, the Karoshoek Solar Valley Development is not expected to significantly influence the regional appeal or jeopardise the area's tourism value and potential. The anticipated visual impact of the proposed development on existing tourist routes is expected to be low.

	Without mitigation	***With mitigation***
Site 1.1		
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	V Improbable (1)

Significance	**Low (22)**	**Low (11)**
Status	Negative	Negative
Cumulative impacts entire Karoshoek Solar Valley Development		
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	High (8)
Probability	Highly Probable (4)	Probable (3)
Significance	**Moderate (60)**	**Moderate (45)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

Planning:

» Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the perimeter of each development site.
» Retain and maintain natural vegetation in all areas outside of the development footprint.
» Plan internal roads and ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible.

Construction:

» Rehabilitation of all construction areas.
» Ensure that vegetation is not cleared unnecessarily to make way for the access road and ancillary buildings.

Operations:

» Maintain the general appearance of the facility as a whole.
» Maintenance of roads to avoid erosion and suppress dust.

Decommissioning:

» Remove infrastructure and roads not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

» The construction of the solar energy facilities will increase the cumulative visual impact of industrial type infrastructure within the region. This is due to the construction of the seven individual solar energy facilities, as well as the Ilanga Solar Thermal Plant (site 1.2) on the Karoshoek Solar Valley Development site.

Residual impacts:

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

Implications for Project Implementation

» The construction and operation of the CSP facility and ancillary infrastructure will have a visual impact on the natural scenic resources and rural character of the study area, and particularly within 4-8km radius of the proposed facility.

» The anticipated visual impact is not likely to detract from the regional tourism appeal, numbers of tourists travelling along the N10 and N14 or the tourism potential of the area. These receptors will be exposed to the proposed facility for a very short period of their journey.
» As a result of the location of the proposed facility, the majority of impacts identified are expected to be of low to moderate significance.
» Due to the nature of the facility, it is not always possible to mitigate the visual impacts associated therewith. However, where possible, recommended mitigation of visual impacts should be implemented and maintained on an on-going basis.
» No fatal flaws have been identified which would prevent the project from proceeding.

7.3.7. Socio-Economics

During the construction phase of the project, several socio-economic impacts may materialise. These issues may include change in Employment Creation, Local Procurement And Economic Benefits, Population change, Impact on farming activities, Impact on daily living and movement patterns, and Impact on sense of.

Impacts associated with this phase of the project is of a relatively short duration, while temporary in nature, but could have long term effects on the surrounding environment.

Impact tables summarising the significance of social impacts associated with the construction and operational phases

Nature: Employment Creation, Local Procurement And Economic Benefits

During the construction phase a maximum of six hundred (600) employees would be required for the construction of the LF. These employees would consist of low skilled, semi-skilled and skilled individuals. It is highly likely that the semi-skilled and low skilled individuals could be sourced from Upington, Straussburg (Ntsikelelo), Dagbreek, Karos and Leerkrans situated along the N10 in close proximity to the farms Annashoek and Zandemm. These individuals would be employed for some basic construction activities requiring manual labour. As large sectors of the local population have been involved in the agricultural sector it is assumed that they would thus be able to undertake the basic construction activities required with the minimum additional training required. Even though this could be the case, skills training and capacity building remain imperative.

Skilled individuals could be sourced from South Africa or even include some foreigners, as the broad-spectrum profile of the local communities does not include individuals with high levels of education or experience regarding the construction of the LF facility.

At this stage it is anticipated that forty (40) permanent employees would be required during the operational period of the LF facility. Due to the relative limited number of individuals involved it is thus anticipated that the short term employment boost during the construction phase would have

a more intense impact on the local communities than the permanent employment opportunities. This benefit, however, could be further enhanced by focused training, capacity building and skills development enabling individuals to be considered for permanent employment. Should this be achieved, the short term employment benefits could be altered to long term sustainable development amongst some individual community members.

As there is a shortage of credible suppliers of the materials and equipment required for the LF facility, local procurement during the construction phase would only be focused on general goods, materials and services such as the hiring of construction vehicles and the transportation of the materials. During the operational life of the facility it is more likely that local services could be procured such as those required for security purposes and the general maintenance of the facility (e.g. repairs, painting of buildings and so forth).

Regional economic benefits of the Karoshoek Development would not only accrue through the creation of an additional stable electricity supply but also through the downstream benefits to the local and regional economy.

	Without enhancement	***With enhancement***
Extent	Regional (3)	Regional (3)
Duration	Short duration (2)	Short duration (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Highly probable (4)
Significance	**Medium (33) (+)**	**Medium (44) (+)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be enhanced	Positive impacts can be enhanced	

Enhancement:

» The local labour content should be maximised as far as possible.
» A skills audit should be undertaken to determine the skills available in the local communities and the discrepancy with the requirements of the project.
» Training and capacity building of locals are imperative and should also aim to equip locals with sufficient skills to enable them to be employable as permanent employees. Short term construction related employment opportunities could then be changed to long term benefits which could then accrue to the local communities who are in dire need of employment.
» Skills training should thus be transferable and employment opportunities sustainable.
» A broad-based approach should be followed to identify and involve relevant organisations which could assist the main contractor and project proponent in identifying people whose skills may correspond with the job specifications
» Employing as many locals as possible would assist in combatting crime in the area.
» The project proponent and contractors should create conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMMEs during the construction process.
» Tender documentation should contain guidelines for the involvement of labour, entrepreneurs, businesses, and SMMEs from the local sector.
» Communication efforts concerning job creation opportunities should refrain from creating unrealistic expectations.

Cumulative impacts:

» Cumulative employment opportunities associated with all the components of the Karoshoek Development, and other proposed solar facilities in the Upington area
» Should the construction timeframes of the Karoshoek Development overlap with other proposed facilities, a lack of sufficient individuals within the study area with some skills could occur.

Residual impacts:

» Trained and skilled individuals as a result of the proposed Karoshoek Solar Valley Development as well as the other possible solar facilities proposed in the Upington area.

Nature: Employment Creation, Local Procurement And Economic Benefits

At this stage it is anticipated that 40 permanent employees would be required during the operational period of the LF facility. Due to the relative limited number of individuals involved it is thus anticipated that the short term employment boost during the construction phase would have a more intense impact on the local communities than the permanent employment opportunities. This benefit, however, could be further enhanced by focused training, capacity building and skills development enabling individuals to be considered for permanent employment. Should this be achieved, the short term employment benefits could be altered to long term sustainable development amongst some individual community members.

During the operational life of the facility it is more likely that local services could be procured such as those required for security purposes and the general maintenance of the facility (e.g. repairs, painting of buildings and so forth).

Regional economic benefits of the Karoshoek Development would not only accrue through the creation of an additional stable electricity supply but also through the downstream benefits to the local and regional economy

	Without Enhancement	***With Enhancement***
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Improbable (2)	Probable (3)
Significance	**Low (22) (+)**	**Medium (39) (+)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be enhanced	Positive impacts can be enhanced	

Enhancement:

» The developer should capacitate locals where possible to enable them to secure full time employment. Skills development focused on the operational phase should thus start during the construction phase where practically possible.
» Where possible, the developer should consider training and capacity building programmes to lessen the skills disparity between the local community and the permanent jobs on offer.
» Individual tailor made training programmes for full time employees should be embarked upon in association with accredited training facilities to ensure long term benefits to those involved.

- » Bursaries to suitable candidates should be considered.
- » Long term permanent job opportunities should be advertise in a "user friendly" and easily accessible manner.
- » The project applicant should create conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMME's during the operational phase for rendering ancillary services to the proposed facility

Cumulative impacts:

- » Cumulative employment opportunities associated with all the components of the Karoshoek Development, and other proposed solar facilities in the Upington area

Residual impacts:

- » Improved quality of life for those permanently employed
- » Improved socio-economic conditions for locals permanently employed
- » Positive economic-spin offs due to increased buying power and local economic processes

Nature: Population change: Construction Phase

Population change refers to the inflow of temporary workers and jobseekers during the construction phase, as well as the presence of permanent personnel during the operational phase of the project.

The inflow of six hundred (600) workers to the area would have definite impacts on the local social environment of those living in close proximity to the site as the area is currently scarcely populated and characterized as a peaceful rural environment. The possible negative impacts would refer to the movement of the workers to and from the construction site, possible increased noise on site, safety and security risks, spreading of sexually transmitted diseases, littering and even social conflict between locals and these workers with regards to employment opportunities or conflict between "outside" workers and locals during after hour social contact.
Safety and security of the locals are always a source of concern when large construction workforces enter an area. It is therefore critically important to ensure that the existing security profile of the communities not be negatively affected through trespassing of properties, housebreaks and theft of goods and livestock. Construction workers should be easily identifiable and should remain at the construction site during working hours.

Some of the construction workers are likely to be sourced from outside the area as the positions available would require specific technical and management skills. Labourers and skilled employees not originally residing in the Upington area, or at the local settlements such as Straussburg (Ntsikelelo), Dagbreek, Karos and Leerkrans would thus be accommodated within the town of Upington. No accommodation facilities would therefore be established on site. The positive economic impact in this regard would thus be focused on the town of Upington where the majority of accommodation facilities are located.

Should the inflow of workers to the area be associated with the inflow of jobseekers, the negative impacts on the social environment can be increased. Due to the proximity of the farms to the Leerkrans and Karos settlements it is quite likely that jobseekers would congregate at the entrance to the site at the N10.

Positive impacts would refer to the local increased buying power and economic spin-offs associated with an increase in the local population size and density during the construction period, although this is anticipated to be felt within the larger urban nodes such as Upington and not necessarily in the study area. The negative impacts as a result of the population change on the social fabric of the locals with possible long term negative consequences thus overshadow the limited possible short-term positive economic impacts on the local farming community and those residing in the smaller settlements.

Forty permanent employees would be involved with the operations of the LF facility. Their presence would have some negative intrusion impacts on the social environment, but if local community members could be employed it could be altered to a positive impact. No additional impact on the provision of services and infrastructure is thus foreseen, although the cumulative impact of the inflow of various individuals to the area as a result of the Karoshoek Development and other solar facilities proposed in the Upington area should be noted.

The short-term and long-term cumulative increase in the local population figures could thus have some financial bearings on the //Khara Hais Municipality if not properly managed.

	Without mitigation	***With mitigation***
Extent	Local (3)	Local (3)
Duration	Short duration (2)	Short duration (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (44)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

» Locals should be employed as far as possible
» Should local accommodation facilities within the study area be available, it should be considered for housing some members of the construction workforce
» Construction workers should be transported to and from the site via busses. These vehicles should be in good working order and should adhere to all traffic related regulations
» Construction workers should be easily identifiable and should remain at the construction site during working hours
» No trespassing of private properties should be allowed
» Construction workers should be supervised at all times.
» Construction activities should be kept to normal working hours e.g. from 7 am until 5 pm during weekdays
» Employees should understand that excessive noise could be problematic and should thus attend to this issue in a sensitive manner
» Local community representatives, policing forums and those from the //Khara Hais Local Municipality should be informed of the size and presence of the construction workforce
» The construction site should be kept litter free and proper sanitation and waste management

infrastructure should be implemented
» HIV/Aids awareness campaigns should be undertaken among the workforce
» The construction site should be fenced and managed by permanent security personnel
» Accommodation requirements should be communicated to the hospitality industry within Upington, representatives of the //Khara Hais Municipality and the local community forums to ensure adequate facilities are available as required for the entire workforce of the Karoshoek Development
» Workers should preferably not be accommodated within the smaller settlements such as Karos and Leerkrans as these settlements would probably require additional or upgrading of existing infrastructure and services to lodge additional individuals. This could then result in undesirable planning and cost implications to the //Khara Hais Municipality.

Cumulative impacts:

» Possible need for additional accommodation facilities due to the entire Karoshoek Development and the other developments taking place within the Upington area
» Possible additional pressure on services and infrastructure regarding the inflow of people due to the Karoshoek Development and the other planned solar facilities in the Upington area
» Increased safety and security risks
» Increased health risks

Residual impacts:

» Long term consequences concerning the provision of services and implementation of infrastructure should construction workers from outside the study area remain in the area without suitable accommodation facilities or permanent employment
» Possible permanent increased population size

Nature: Population change: Operational Phase

Eighty (40) permanent employees would be involved with the operations of the LF facility. Their presence would have some negative intrusion impacts on the social environment, but if local community members could be employed it could be altered to a positive impact. No additional impact on the provision of services and infrastructure is thus foreseen, although the cumulative impact of the inflow of various individuals to the area as a result of the Karoshoek Development and other solar facilities proposed in the Upington area should be noted.

The short-term and long-term cumulative increase in the local population figures could thus have some financial bearings on the //Khara Hais Municipality if not properly managed.

	Without mitigation	***With mitigation***
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (3)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (39)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation:		

» Normal working hours (e.g. 7am to 5pm) should be considered. » Locals should be employed as far as possible.
Cumulative impacts: » The cumulative impact of the inflow of various individuals to the area as a result of the Karoshoek Development and other solar facilities proposed in the Upington area should be noted
Residual impacts: » Possible permanent increased population size

Nature: Impact on farming activities: Construction Phase

The impact on the farming activities refers to crop production as well as any other type of farming activities undertaken on the affected property and the surrounding properties e.g. cattle, sheep and game farming.

Impacts on the vegetation due to construction activities such as site preparation and clearing would have a definite impact on the agricultural and farming activities undertaken on the property. The increased risk of veld fires, as a result of construction worker conduct and/or activities, also remains of serious concern to the farmers in the area. Other intrusion impacts as a result of construction activities would relate to noise and dust pollution. The farms are currently mainly used for cattle farming. As vegetation would be lost (approximately 500 ha), a negative impact on the grazing capacity of the properties would occur. To limit the negative impacts in this regard it is proposed that the LF facility be fenced to ensure the continuation of cattle farming activities on the remaining section of the property.

High potential farming areas exist along the Gariep River where grapes and raisins are produced. These are situated to the north of the N10 and the farms Annashoek and Zandemm. A small section of the farm Annashoek is also used for the production of raisins (north of the N10). These farms would thus not be directly affected by the proposed LF facility. It is furthermore not anticipated that the construction activities or the proposed facility would have direct negative impacts on the farming activities of the neighbouring property as these would form part of the overall Karoshoek Development. Farming activities on those adjoining farms (east and west) are therefore expected to continue in the areas outside the development footprint. The distance of the facility to the farms to the south of Annashoek and Zandemm further serves as mitigation measure to ensure that no farming activities to the south would be affected by the proposed development.

Of concern to the farmers in the area is the recruitment of local labourers for the proposed development and the remuneration packages offered. Should the local labourers usually used for the harvesting (January until March) and pruning activities (July to August) be employed as part of the permanent construction team for the entire construction period, it would result in a situation whereby the local farmers would not have sufficient resources available to assist them with their farming practices. Although such a concern could materialise, it should be noted that some local farmers are not only employing local labourers during the pruning and harvesting seasons and are already sourcing labourers or adding to their labour content by recruiting

additional individuals from nearby towns or outside the municipal area (e.g. from Kuruman, Kakamas, Keimoes, and so forth). Should there be a shortage of local labourers, it is however anticipated that it could again be mitigated by sourcing temporary labourers from elsewhere to assist the farmers with their farming practices during peak times. As the applicant could further limit this impact by rather employing labourers that are not involved with the grape and raisin farming industry, one cannot restrict those farm workers to apply for employment at the facility.
Another possible impact relates to contesting remuneration packages. Concerns relate to the possibility that the employment opportunities created because of the presence of the facility in the area would lead to a situation that remuneration packages for farm workers would have to be adopted to compete with those packages provided to employees at the facility with subsequent negative financial impacts to the farmers.

From a social perspective, the impacts discussed above could thus occur but is expected to respond to mitigation.

	Without mitigation	***With mitigation***
Extent	Local (3)	Local (3)
Duration	Short duration (2)	Short duration (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (22)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	Yes at development footprint	
Can impacts be mitigated	Yes	

Mitigation:

» Construction activities should not interfere with the farming activities that would continue on the larger site.
» Local labourers should be used during the construction phase to limit the inflow of outsiders to the area.
» Remuneration packages should be market related and should take note of the sensitivities at hand.

Cumulative impacts

» Possibility of insufficient numbers of farm workers available for nearby farmers during the peak seasons

Residual impacts

» None anticipated

Nature: Impact on farming activities: Operational Phase

Of concern to the farmers in the area is the recruitment of local labourers for the proposed development and the remuneration packages offered. Concerns relate to the possibility that the employment opportunities created because of the presence of the facility in the area would lead to a situation that remuneration packages for farm workers would have to be adopted to compete with those packages provided to employees at the facility with subsequent negative financial impacts to the farmers.

From a social perspective, the impacts discussed above could thus occur but is expected to respond to mitigation.

	Without mitigation	***With mitigation***
Extent	Local (3)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (39)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	Yes, but only at footprint of facility	
Can impacts be mitigated	Yes	

Mitigation:

» The facility should be fenced to enable the property owner to continue with cattle farming activities if feasible.

Cumulative impacts:

» Cumulative loss of farmland as a result of the entire Karoshoek Development and other facilities proposed in the area

Residual impacts:

» Permanent loss of grazing areas and sterilisation of the land for farming practices due to footprint of facility.
» Possible economic losses due to downscaling of farming activities
» Possible continuation of farming activities on larger site not affected by the footprint of the facility.

Nature: Impact on daily living and movement patterns: Construction Phase

The impacts on the daily living and movement patterns on the local community would mainly refer to the intrusions felt during the construction phase, such as the increase in movement of workers in the area, increase in traffic levels and associated increased risks of accidents, as well as noise and dust pollution.

An increase of people movement could likely increase the possibility of criminal activities in the area such as housebreaks, theft of livestock, crops and materials. To avoid such negative impacts especially during the construction phase, strict safety and security measures should be put in place. It should, however, be noted that the developer and/or contractors cannot be held responsible for worker conduct after working hours.

Movement of construction personnel and construction equipment and material (e.g. graders, cement trucks, trucks, excavators and so forth) would negatively impact on the daily living and movement patterns of residents in the area. The N10 would be the only main access route to be used between Upington and the construction site. The road is not currently under pressure from large volumes of traffic although various heavy vehicles make use of this section of the road, mainly to transport agricultural produce. Additional heavy traffic, however, during the

construction period would thus increase the overall risk of accidents (vehicle and pedestrians) on the N10, especially at sharp bends and at the local settlements. Traffic from Upington would pass Leerkrans where school children frequently cross the road and specific safety precautions in this area could thus be required. Additional concerns relate to the possible impact on the road surface as a result of the overall traffic increase during the entire Karoshoek Development's construction phase and the anticipated lack of funding from government departments to upgrade and repair damages to the road.

The transportation of some type of equipment during the construction phase, however would require upgrading of the roads e.g. widening on corners to ensure that the road infrastructure can accommodate these abnormal vehicles. This expense, however, would have to be funded by the developer and not the local or provincial government.

An existing access road from the N10 would be used to access the site. The entrance to the site on a bend is of concern with regards to the turning of vehicles into the access road. Possible upgrading of the entrance would be required. No additional access roads are thus envisaged. Internal access roads, however, would have to be constructed to link the various facilities to each other and to the main access road. The usage of the gravel roads would thus result in dust and possible noise pollution during the construction phase and the loss of additional agricultural land.

The area is considered to have low ambient levels. Construction activities, vehicle movement and workers on site would result in intermittent noise pollution. Sensitive receptors, such as homesteads and other type of dwellings located to the south of the N10 and to the north of the farm Zandemm, as well as the Leerkrans and Karos settlements could be negatively affected by the increased noise. It is anticipated that the noise impact would be minimal due to the distance of these receptors to the facility.

	Without mitigation	***With mitigation***
Extent	Local (3)	Local (3)
Duration	Short duration (2)	Short duration (2)
Magnitude	Moderate (6)	Moderate (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (44)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

» The construction site and storage areas should be fenced off to avoid unauthorised entry
» Construction vehicles and those transporting materials and goods should be inspected to ensure that these are in good working order and not overloaded.
» Construction vehicles should adhere to the speed limits and traffic regulations.
» Upgrading of the entrance to the site from the N10 should be investigated and discussed with the relevant road agency or department.
» Additional access roads at the construction sites should be kept to a minimum.
» Construction related noise and dust pollution should be limited.
» Gravel roads should be sprayed with water to limit dust creation if economically feasible and

reasonable from an environmental perspective (water scarce area) or an appropriate dust suppressant should be used.
» Normal working hours (e.g. 7am to 5pm) should be considered.
» Permanent security personnel should be on site

Cumulative impacts:

» Traffic related, and road surface impacts during the entire Karoshoek Development's construction phase as well as due to the movement of vehicles associated with other developments in the area.

Residual impacts:

» None anticipated

Nature: Impact on daily living and movement patterns: Operational Phase

The impacts on the daily living and movement patterns on the local community would mainly refer to the intrusions felt due to activities such as the increase in movement of workers in the area, increase in traffic levels and associated increased risks of accidents, as well as noise and dust pollution. During the operational phase, the impacts on the living and movement patterns of the local communities are not anticipated to be severe.

An increase of people movement could likely increase the possibility of criminal activities in the area such as housebreaks, theft of livestock, crops and materials. To avoid such negative impacts strict safety and security measures should be put in place. It should, however, be noted that the developer and/or contractors cannot be held responsible for worker conduct after working hours.

The presence of the anticipated eighty (40) workers on site during the operational phase and the movement to and from the site could be noticed by the property owners, but their presence on site is not expected to have negative impacts on the social environment in the long term.

	Without mitigation	***With mitigation***
Extent	Local (3)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (39)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

» Locals should be employed as far as possible.
» Normal working hours (e.g. 6am to 6pm) should be considered.
» Employees should understand that excessive noise could be problematic and should thus attend to this issue in a sensitive manner.
» The facility should be properly maintained and managed to avoid any form of pollution.
» The local access road to the site should be regularly maintained to keep the local road conditions in a good quality state

Cumulative impacts:

» Possible cumulative impact on the social environment due to the proposed Karoshoek Development and other solar facilities planned in the larger Upington area
Residual impacts:
» Visual impact on the natural environment

Nature: Impact on sense of place: Construction Phase

The visual impact during the construction phase is anticipated to be low and of a temporary nature as it would be associated with the actual construction equipment camp and laydown are where material and equipment would be stored. Fuel for on-site vehicles would also be stored on site. It is furthermore unlikely that the construction site would be clearly visible from the N10 or the surrounding farms.

	Without Enhancement	***With Enhancement***
Extent	Local (3)	Local (3)
Duration	Short duration (2)	Short duration (2)
Magnitude	Low (4)	Minor (2)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (18)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation measures:

» Storage areas should be fenced off.
» Soils should be replaced and the construction area, as well as laydown areas should be rehabilitated as soon as possible after construction.
» The construction site should be kept litter free.
» Overall site rehabilitation should occur as soon as the construction process allows.
» The recommendations made by the Visual Impact Assessment should be adhered to

Cumulative impacts:

» None anticipated

Residual impacts:

» None anticipated

Nature: Impact on sense of place: Operational Phase

The site for the proposed LF facility and the surrounding area can be described as an undisturbed rural landscape. Even though the study area for the entire Karoshoek Development is traversed by the Garona-Gordonia 132 kV power line to the north east of the site and the Garona-Kleinbegin 132 kV line to the west of the site, it does not interfere with the local landscape characteristics of the farms Annashoek and Zandemm due to the distance of these lines from the farm.

New infrastructure such as a LF facility would thus have a severe negative impact on the landscape character and aesthetic quality of the area. The cumulative impacts of sites 1.1, 1.2

(Ilanga facility), 1.3 and 1.4 should also be noted, as the concentration of the infrastructure in this specific area is anticipated to increase the impact on the sense of place. Even though the viewer incidence of the facility would be limited due to the distance of homesteads, dwellings and the N10 from the site, the proposed facility could still be visible from specific viewpoints. The Langberg could limit the visual impact to the east of the farms Annashoek and Zandemm. Lighting (for security purposes) also remains of concern.

	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (52)**	**Medium (39)**
Status (positive or negative)	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources	No	
Can impacts be mitigated	To a limited extent	

Mitigation measures:

» The design and specific positioning of the facility should aim to minimise the possible negative visual impact of the facility on the surrounding property owners.
» The design of the security buildings should blend in with surrounding environment.
» Lighting issues should receive the attention it deserves to avoid any light pollution at night.
» The mitigation measures of the Visual Impact Assessment should be strictly implemented

Cumulative impacts:

» Cumulative visual impacts on the sense of place of the rural character of the area are associated with the proposed PV facilities and CSP facilities proposed in the Upington area, the DOE Solar Park and the Eskom CSP plant.

Residual impacts:

» Negative visual intrusion of the landscape

Implications for Project Implementation

» Site 1.1 of the facility would involve some eight hundred workers (800) during the peak of the construction phase and approximately eighty (80) permanent employees. The benefits to the local human resources are thus significant even if the majority of employment opportunities would only be available during the construction phase of the project. Benefits can be enhanced should the applicant and all of their partners be truly committed to the social upliftment and capacity building of the local community.
» The inflow of 800 workers to the area would have definite impacts on the local social environment of those living in close proximity to the site as the area is currently scarcely populated and characterized as a peaceful rural environment.
» The escalation in people movement and presence of workers (and possibly jobseekers) on site could result in increased risks for criminal activities compromising the current safety and security profile of the local communities.

» The farm Zandemm is currently used for cattle farming. As vegetation would be lost (approximately 400 ha), a negative impact on the grazing capacity of the properties would occur. It is however not anticipated that the construction activities or the proposed facility would have direct negative impacts on the farming activities of the neighbouring property as these would form part of the overall Karoshoek Development. Farming activities on those adjoining farms are expected to continue in the areas outside the development footprint.
» Farming activities on the farm Karos (to the north of the farm Zandemm) are thus expected to continue in the areas outside the development footprint. Construction activities or the proposed facility would also not have direct negative impacts on the farming activities of the neighbouring property owners to the southern and south-western side of the property, except if livestock theft occurs on those properties and if the safety and security of those farmers are compromised due to the influx of workers to the area.
» The impacts on the daily living and movement patterns on the local community would mainly refer to the intrusions felt during the construction phase, such as the increase in movement of workers in the area, increase in traffic levels and associated increased risks of accidents, as well as noise and dust pollution. During the operational phase, the impacts on the living and movement patterns of the local communities are not anticipated to be severe.
» New infrastructure such as a LF facility would have a moderate to low negative impact on the landscape character and aesthetic quality of the area. The cumulative impacts of sites 1.1, 1.2 (Ilanga facility), 1.3 and 1.4 should also be noted, as the concentration of the infrastructure in this specific area is anticipated to increase the impact on the sense of place. Even though the viewer incidence of the facility would be limited due to the distance of homesteads, dwellings and the N10 from the site, the proposed facility could still be visible from specific viewpoints. The Langberg could limit the visual impact to the east of the farms Annashoek and Zandemm. Lighting (for security purposes) also remains of concern. It is not anticipated that the impact on the sense of place can be successfully mitigated.

7.4. Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertakings in the area[30]. The cumulative impacts associated with the proposed facility primarily refer to those impacts associated with visual, water, and social impacts, and are mainly associated with the agricultural activities in the area as well as with other developments of a similar nature proposed within the broader region.

[30] Definition as provided in the EIA Regulations, 2010 (GNR 543).

- *Ecology* – impacts as a result of loss of natural vegetation to agricultural activities and development of natural land. As facilities such as that proposed result in the loss of vegetation and habitats within the footprint of the development site, numerous developments of a similar nature within one area could result in cumulative impacts on sensitive species of conservation concern as well as on protected species. The other proposed CSP facilities within the broader Karoshoek Solar Valley Development would cumulatively add to the loss of ecologically sensitive environments.
- *Agricultural Potential* – future proposed development in the study area may lead to an impact on the agricultural potential of the region. However, with respect to this facility as well as the other facilities proposed as part of the broader Karoshoek Solar Valley Development, the cumulative impact will be small as the site has low agricultural potential.
- *Water Resources* - Cumulative impacts can be expected in terms of increased sedimentation (as a result of erosion), pollution, and water abstraction for existing farming activities and proposed industrial activities (such as solar energy facilities) in the area which in turn will cumulatively affect the ecological functioning of this system. The development of the proposed facility will potentially add to the already elevated sediment load into the river due to agricultural activities. The widespread use of chemicals in farming activities (fertilisers, insecticides, herbicides, etc.) means that any chemical pollution from the facility (i.e. most likely to be from the construction of infrastructure / operation near the river) would add to this impact. Cumulative impacts due to water abstraction in the Lower Orange River are already considered high and will be exacerbated by the abstractions for this project. However, the water use required by this project is relatively small in a regional context due to the proposed implementation of dry cooling technology for all proposed developments.
- *Heritage* – Impacts on heritage resources relate to the loss of heritage sites as well as a change in the sense of place of an area. Numerous developments within an area could therefore result in a significant impact in this regard if appropriate mitigation measures are not implemented. This is not considered to be the case with the current proposed developments within broader Karoshoek Solar Valley Development due to the low significance of heritage sites identified within the study area as well as the fact that the site is removed from potentially sensitive visual receptors.
- *Visual* – The construction of the facility and its associated infrastructure will increase the cumulative visual impact of electricity related infrastructure within the region. This is relevant in light of the authorised Eskom and Khi CSP facilities to be located west of Upington as well as other CSP facilities proposed within the broader Karoshoek Solar Valley Development, and the existing power line infrastructure surrounding the site, albeit limited in extent and scale.

- *Social* – The development of the facility will have a cumulative impact on several existing issues within the area, predominately within rural settlements associated with the potential influx of workers and job seekers. With the increased population density, this may lead to a cumulative impact on housing requirements, services (i.e. water, electricity and sanitation), health issues, safety and security New informal townships are unlikely to have the required infrastructure and services,. With the existing rural settlements in the area this will have a cumulative impact on the environment and health (i.e. in terms of ablution facilities). This will be impacted on even further with respect to other proposed solar facilities in the area.
- *Positive impacts* - Cumulative positive impacts are, however, also anticipated should a number of similar solar developments be developed in the area, largely due to job creation opportunities, business opportunities for local companies, skills development and training. The development of renewable energy facilities will have a positive impact at a national and international level through the generation of "green energy" which would lessen South Africa's dependency on coal generated energy and the impact of such energy sources on the bio-physical environment. The proposed project would fit in with the government's aim to implement renewable energy projects as part of the country's energy generation mix over the next 20 years. As a whole, the proposed Karoshoek Solar Valley Development would provide 1GW of renewable energy.

Cumulative effects have been considered within the detailed specialist studies, where applicable (Refer to Appendices F – K).

7.5 Assessment of the No Go Alternative

South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer carbon emissions. The national government has set targets for renewables substitution. The No-Development option would represent a lost opportunity for South Africa to supplement its current energy needs with clean, renewable energy. Given South Africa's position as one of the highest per capita producer of carbon emissions in the world, this would represent a negative social cost. The proposed LF facility on site 1.1 would contribute 100 MW to South Africa's energy needs, with the full facility (Karoshoek Solar Valley Development) contributing up to 1 GW. The proposal is unique as there are no other large developments like this being proposed by IPPs. A significant number of renewable energy projects have however been proposed in other parts of South Africa. Foregoing the proposed LF facility on site 1.1 is therefore unlikely to impact negatively on South Africa's ability to achieve its stated renewable energy targets. A CSP facility with storage (as is considered for the proposed project) can provide almost a base load power supply – i.e. can provide power

almost continuously whereas other renewable energy technologies (like PV) are only able to provide power when the sun is shining or when the wind is blowing for a wind energy facility.

However, at a local level, the No-Development option would result in a loss in employment opportunities associated with both the construction and operational phase. The revenue from the proposed CSP facility can be used to support a number of social and economic initiatives in the area. These local benefits would be forgone if the proposed CSP facility is not developed in the proposed area. The no go option is therefore not considered favourable.

Nature: ***Implementation of the no development option***

The no-development option would result in the lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy. The No-Development option would also result in the loss of the benefits to the local community and economy associated with the creation of employment opportunities.

	Without Mitigation	**With Mitigation**
Extent	Local, Regional and National (3)	Local, Regional and National (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Medium (6)
Probability	Probable (3)	Highly Probable (4)
Significance	Moderate (33)	Moderate (56)
Status	Negative	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact be mitigated?	Yes	

Enhancement:

The proposed solar energy facility should be developed and the mitigation and enhancement measures identified in the EIA should be implemented.

Cumulative impacts:

Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.

Residual impacts:

Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.

CONCLUSIONS: CHAPTER 8

FG Emvelo (Pty) Ltd, an independent developer of concentrating solar power plants, is investigating the possible establishment of a 100 MW Concentrating Solar Power (CSP) facility and associated infrastructure for the purpose of commercial electricity generation. Hereafter referred to as the **Linear Fresnel (LF) technology** on **site 1.1**, this facility is proposed as a phase of the future proposed 1GW Karoshoek Solar Valley Site situated approximately 30 km east of Upington in the Northern Cape. Additional phases of this broader development are currently undergoing separate EIA processes.

This chapter of the EIA Report provides the conclusions drawn from the assessment of potential impacts associated with the development of the proposed **CSP facility, using Linear Fresnel (LF) technology** on **site 1.1**, as part of the larger Karoshoek Solar Valley Development. This environmental impact assessment (EIA) has been undertaken in accordance with the EIA Regulations published in Government Notice 33306 of June 2010, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

The broader area proposed for the entire Karoshoek Solar Valley Development includes the following farm portions (refer to Figure 8.1):

» Portion 0 of Karos 959;
» Portion 3 of Annashoek 41;
» Portion 0 of Zandemm 944;
» Portion 2 of Matjiesrivier 41; and
» [31]Portion RE of Matjiesrivier 41

The scope of the proposed solar energy facility assessed through this EIA included:

» The solar field - this will comprise multiple loops of Linear Fresnel mirrors which serve to receive and concentrate the solar radiation. They will be directly associated with pipelines which will convey the heat transfer fluid between the mirrors and the steam cycle.
» The power block - comprising a conventional steam turbine generator and a substation into which the electricity can be evacuated.

[31] No development is proposed on RE Portion of Matjiesrivier 41 at this stage, but the farm portion is included in the project scope as it is envisaged for future development

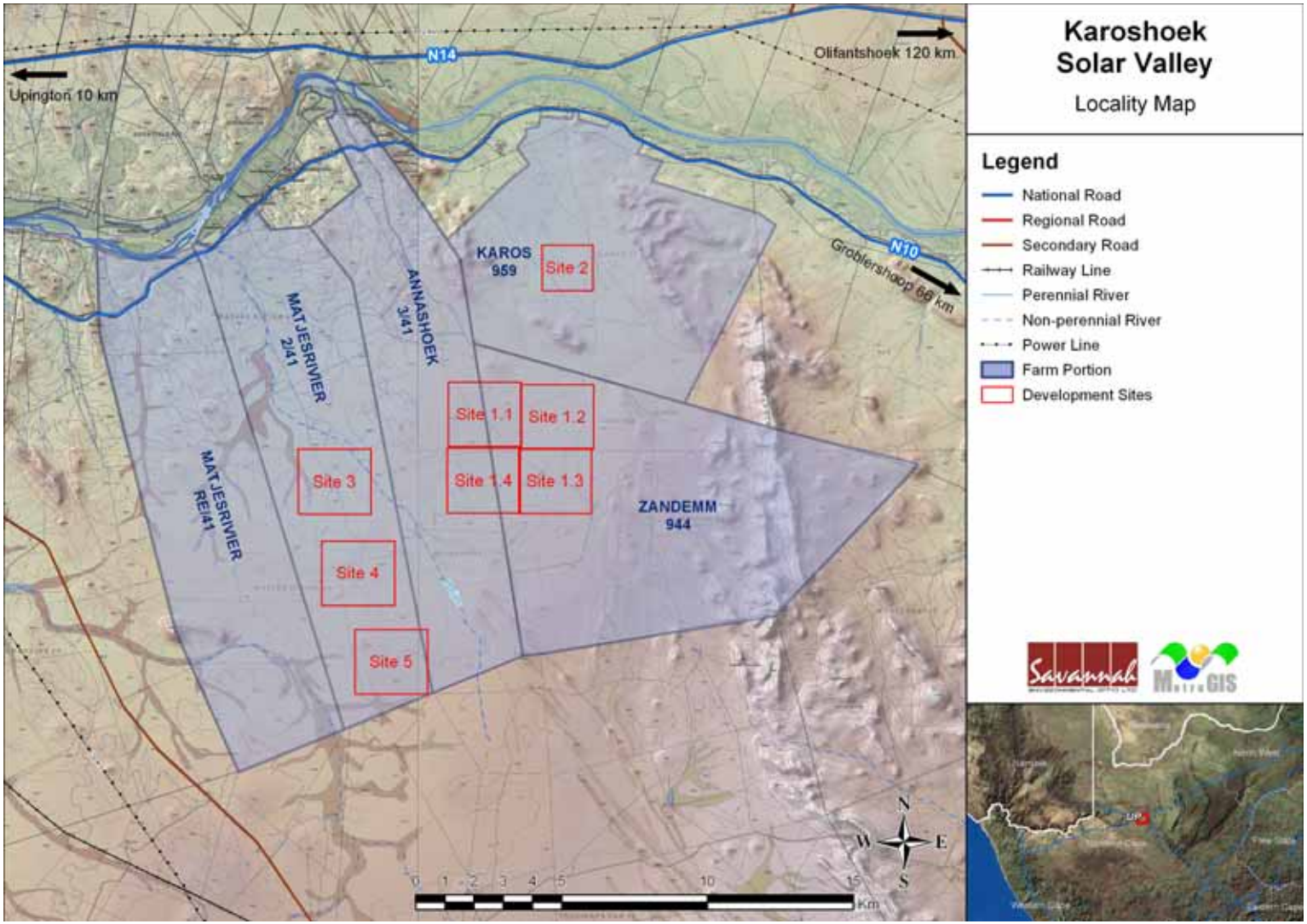


Figure 8.1: Locality map showing the broader Karoshoek Solar Valley site east of Upington

» Water related infrastructure - where the water source is the Orange River, with the water abstraction point at the existing abstraction point of the Boegoeberg Water Users Association at coordinate S 28° 24' 7.68" and E 21° 29' 50.51". Associated water supply pipelines; water treatment and storage reservoirs and evaporation ponds will be required. **This infrastructure has already been authorised through the EIA process undertaken for Project Ilanga on site 1.2 (DEA ref no. 12/12/20/2056).** A pipeline would however be required to be constructed to each facility from the central water reservoir.
» Cables linking the power block to the on-site substation.
» Power line(s) which will connect to the future Eskom CSP MTS. The Eskom 400 kV power line to be located to the west of the site (planned to be constructed in 2016) (the power line to be assessed through a separate EIA process (DEA ref no. 14/12/16/3/3/2/288)).
» Internal and external access roads.
» Accommodation facilities and storerooms.
» Temporary waste storage facilities may be required.

The EIA Phase aimed to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the proposed alternatives put forward as part of the project.
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed wind energy facility.
» Evaluate the an on-site substation site, [32]associated power line and underground cabling, and access roads, for consideration by the decision-making authorities.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

The preceding chapters of this report together with the specialist studies contained within Appendices F - K provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the proposed project. This chapter concludes the Draft EIA Report by providing a summary of the conclusions of the assessment of the proposed site for the solar energy facility and associated infrastructure. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the

[32] The power line is assessed through a separate EIA process (DEA ref. 14/12/16/3/3/2/288)

environmental consultants during the course of the EIA and presents an informed opinion of the environmental impacts associated with the proposed project. The conclusions and recommendations of this EIA are the result of assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area.

8.1. Assessment of Alternatives

In accordance with the requirements of the EIA Regulations[33], the following alternatives were considered within the EIA process from an environmental perspective.

8.1.1. Operating alternatives

In this alternative FG Emvelo technically assessed to develop the facility with dry cooling and thermal storage. Due to water related constraints wet cooling was not considered an option within the EIA.

The land utilised for the area infrastructure at Site 1.1 will effectively be sterilised for the duration of the construction and operational phase, regardless of which operating alternative is implemented. Furthermore the vegetation located underneath the parabola would need to be removed to prevent the risk of veld fires or damage to the moving parts of the machinery[34]. It is not envisaged that Site 1.1 would be utilised for any other activities during the operational phase (i.e. grazing). Therefore, from an ecological perspective, due to the potential impact or sterilisation of the land, the alternative options with a smaller area could be regarded as preferable. However, the size differences between the affected extents of the options with a larger area are not considered significantly different.

The use of storage will assist in providing grid stability due to the ability to provide power for longer periods, since production hours can be extended through the storage of the produced heat and the releasing thereof when required. This is highly important for managing the grid load and performance and preferred from a technical perspective. The large volume of heat transfer fluid (HTF), together with the ability to support the production by means of thermal storage will enable the provision of stable and predictable power to the grid.

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

[34] An erosion control mechanism would need to be initiated following the removal of the vegetation and the supporting root structures (i.e. gravel layer).

From an environmental perspective, the implementation of a CSP Plant with storage would not result in significantly higher impacts than the development of the CSP without storage.

8.1.2. No-go Alternative

In this alternative FG Emvelo will not establish and operate the proposed LF facility on site 1.1. In this scenario the status quo will be maintained, and subsequently the potential environmental and social impacts that have been identified and assessed will not occur. However, should the project not proceed, the contribution of the project (i.e. 100 MW) towards the Government target for renewable energy will not be realised. When assessing this alternative, the biophysical and social value of the land in its current state must be weighed up against the potential value of the land as part of a proposed development.

» *Alternative land use* – an alternative land use for the proposed development site is agriculture. However, due to the low rainfall within the study area, this would require the development of irrigation infrastructure from the Orange River. This option will in all probability have similar impacts to those expected from the proposed solar energy facility. It is unknown whether this option would be economically feasible due to the high costs associated with such infrastructure. From the landowner's perspective (i.e. the developer), this is not considered to be a preferred alternative. However, the development of the proposed solar facility may present opportunities to cultivate other areas of the site which were previously not feasible for this type of development, due to the supply of water via the solar facility.

» *Water* – water demand from the Orange River catchment is dominated by irrigation along the river, where approximately 1 800 million m^3 is used per year. Although the volume required by the proposed development is relatively small in a regional context (i.e. 224 110 m^3/a with dry cooling), the cumulative impact due to other proposed solar facilities as well as the NamPower Lower Orange Hydroelectrical Power Scheme will be exacerbated by the abstractions for this project. Therefore depending on the outcomes of the water allocation exercise to be undertaken by the Department of Water Affairs, the no-go alternative may be preferred.

» *Visual* – generally speaking, should the no-go alternative be implemented then the visual aesthetics of an area, and potential sensitive receptors would not be affected by a proposed facility. In addition, the construction of the facility and associated infrastructure may increase the cumulative visual

impact of electricity related infrastructure within the region. This is relevant in light of the future Eskom CSP and Khi CSP[35] plants to be located west of Upington, the SolAfrica Bokpoort CSP facility[36] located to the east of the site, photovoltaic facilities proposed in the area, as well as the other CSP facilities proposed to be part of the Karoshoek Solar Valley Development (i.e. Project Ilanga for which environmental authorisation has been issued as well as the other developments currently under consideration) and existing power line infrastructure already present in the area, albeit limited in extent and scale. However, due to the characteristics of the LF facility on site 1.1, the remote location of the site, and the local topography the potential visual impact is not significant in a way to motivate for the no go alternative.

» *Social* – the no-go alternative may be preferable where potentially significant negative impacts on the social environment are expected. This may include the inflow of construction workers and jobseekers into the area which can lead to an increase in the transmission of sexually transmitted diseases and the proliferation of violence. However, with the implementation of mitigation measures (i.e. the use of local labourers) the significance of these issues can be managed to acceptable levels. However, with respect to positive impacts expected to be associated with local procurement, job opportunities, and skills development the loss of these opportunities is significant in that the no-go alternative is not preferred.

» *Energy generation* – if the LF facility on site 1.1 is not established (i.e. the no-go alternative) the evacuation of 100 MW of energy generated to the Eskom grid will not be realised at this point within the electricity network. In addition, the potential for extended periods of power generation (should the option of storage be implemented) would not be realised. This is unfavourable as the development and implementation of new generation capacity has been identified as being critical for economic growth and sustainability in South Africa. In addition, with the implementation of the no go alternative will not assist the Department of Energy in meeting their target for renewable energy projects (mainly solar and wind developments) as part of the energy mix for power generation over the next 20 years. Therefore, the establishment of the LF facility on site 1.1 is supported as it will also contribute to the government's green growth strategy and job creation.

[35] Phase 1 of this project (i.e. CSP system consisting of a field of heliostats/ mirrors positioned around a central receiver/power tower) was awarded preferred bidder status by the Department of Energy in December 2011.

[36] This project (50MW parabolic trough) was awarded preferred bidder status by the Department of Energy in May 2012.

Overall, the implementation of the no go alternative is not supported as a preferred alternative.

8.2. Nomination of the proposed Site for the Development of a Solar Facility

The Northern Cape was nominated for the establishment of the proposed facility primarily due to the solar resource. The broader Karoshoek site was selected based on several key factors including access to water, site access, proximity to current and future evacuation points, land availability and the proximity of the site to Upington. From an ecological sensitivity perspective, the broader development site is preferable due to the following.

» The site is not within a National Protected Area – the closest is 150 km north.
» The site is not within a National Protected Area Expansion Strategy Focus area – the closest is 10 km east.
» No World Heritage Sites or Biosphere Reserves have been identified within the study area.
» No wetland areas that are protected according to international conventions occur near the site.
» There are no fine-scale plans for the municipality within which the site is located or provincial conservation plans that cover the whole province. Furthermore, no Critical Biodiversity Areas (CBAs) have been identified that cover the site.
» The site is further than 10 km from a National Park, and the site is more than 5 km from any other protected area.
» As the site is inland, high water marks and development setbacks are not applicable.

Site 1.1 was selected for the development of the LF facility[37] by virtue of technical, economic, and environmental considerations.

[37] Due to logistical reasons certain infrastructural requirements will be located outside the boundary of Site 1.1 and will cross the broader site (i.e. power line, pipelines, access road, abstraction point, and several water storage/treatment reservoirs).

8.4. Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within Appendices F - K provide a detailed assessment of the potential impacts on the social and biophysical environment that may result from the proposed project. This chapter concludes the EIA Report by providing conclusions of the assessment of the proposed facility. In doing so, it draws on the information gathered as part of the EIA Process and the knowledge gained by the environmental consultants and presents an informed opinion of the potential environmental impacts.

No environmental fatal flaws were identified to be associated with the proposed facility. However the following potentially significant environmental impacts have been identified through the EIA Phase.

» Local site specific impacts resulting from the physical modification/disturbance of the site primarily during the construction phase.
» Impacts on water resources.
» Impacts on the social environment.

8.4.1. Local site-specific impacts

The broader development site is approximately 34 000 ha in extent, the bulk of which will not be disturbed by the proposed 100 MW LF facility on site 1.1 and associated infrastructure. Concentrating Solar Power technology, as proposed for this project, typically require a large area for the establishment of the solar field, and the power generation infrastructure (i.e. the power block). This infrastructure is typically located in close proximity to each other. This will result in broad scale disturbance to the development site (i.e. Site 1.1). Permanently affected areas include the area infrastructure and linear infrastructure within Site 1.1, outside Site 1.1 but within the broader Karoshoek site, and beyond this broader site.

From the scoping study undertaken, several potentially sensitive areas were identified for the broader Karoshoek site (refer to Figure 8.2), including:

» *Areas of high ecological sensitivity* –several non-perennial drainage lines and pans.
» *Areas of visual exposure* – receptors within an 8 km radius of the facility (i.e. users of national and secondary roads).

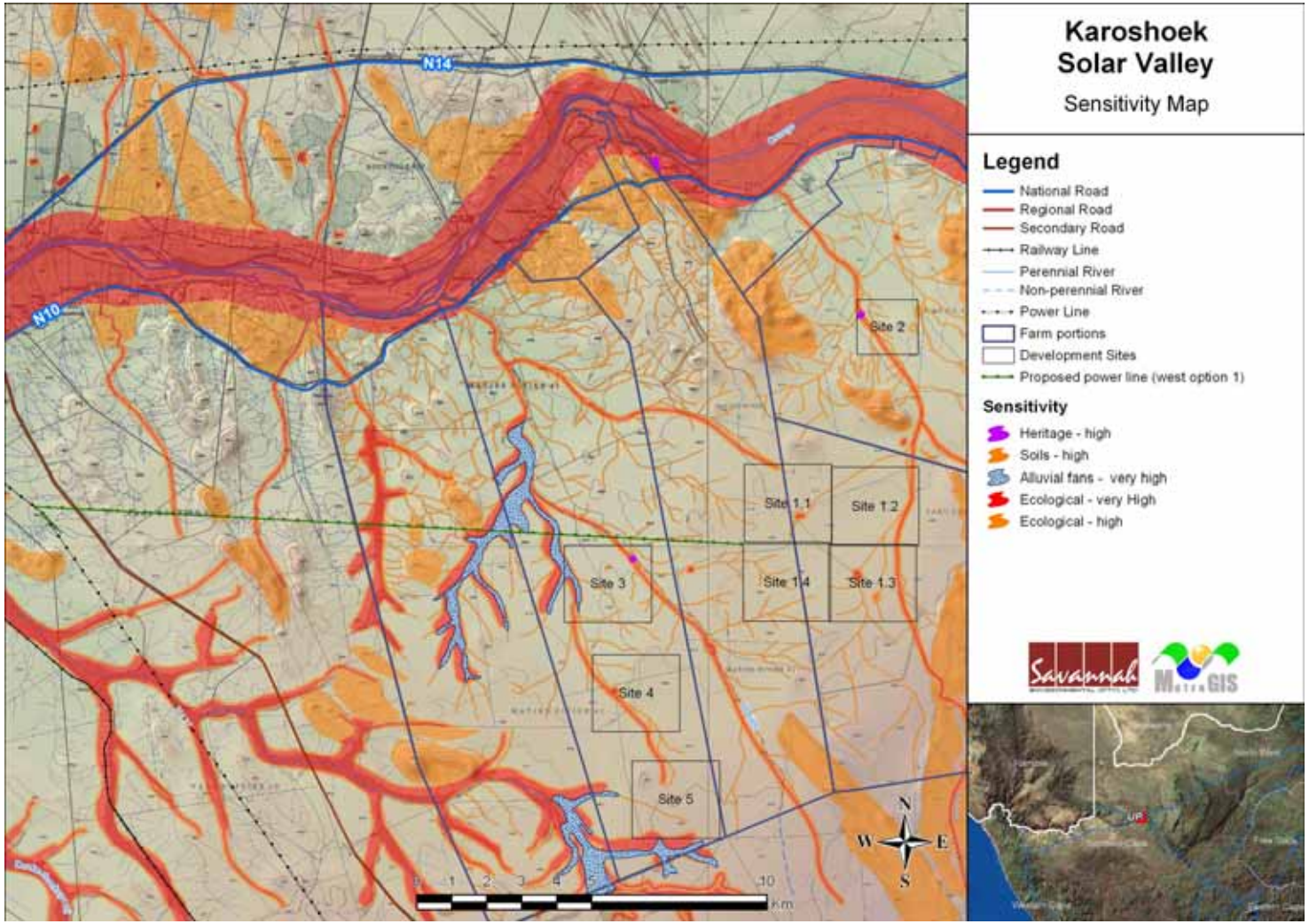


Figure 8.2: Sensitivity map illustrating those sensitive areas across the broader site, in relation to the proposed layout for the LF facility on **site 1.1** as part of the larger Karoshoek Solar Valley Development

» *Areas of high agricultural potential* – the northern portion of the site (i.e. south of the N10[38]).
» *Areas with sensitive noise receptors* – several rural settlements located near the Orange River and the N10 and any receptor located within 2 km of the facility.

The preliminary design of the proposed facility and associated infrastructure has considered these identified sensitive areas within the broader site. Site-specific sensitivities have been identified through this EIA process. Areas of sensitivity within Site 1.1 relate to pans (very high sensitivity) and drainage lines (high sensitivity) on site (refer to Figure 8.3). No other areas of sensitivity were identified.

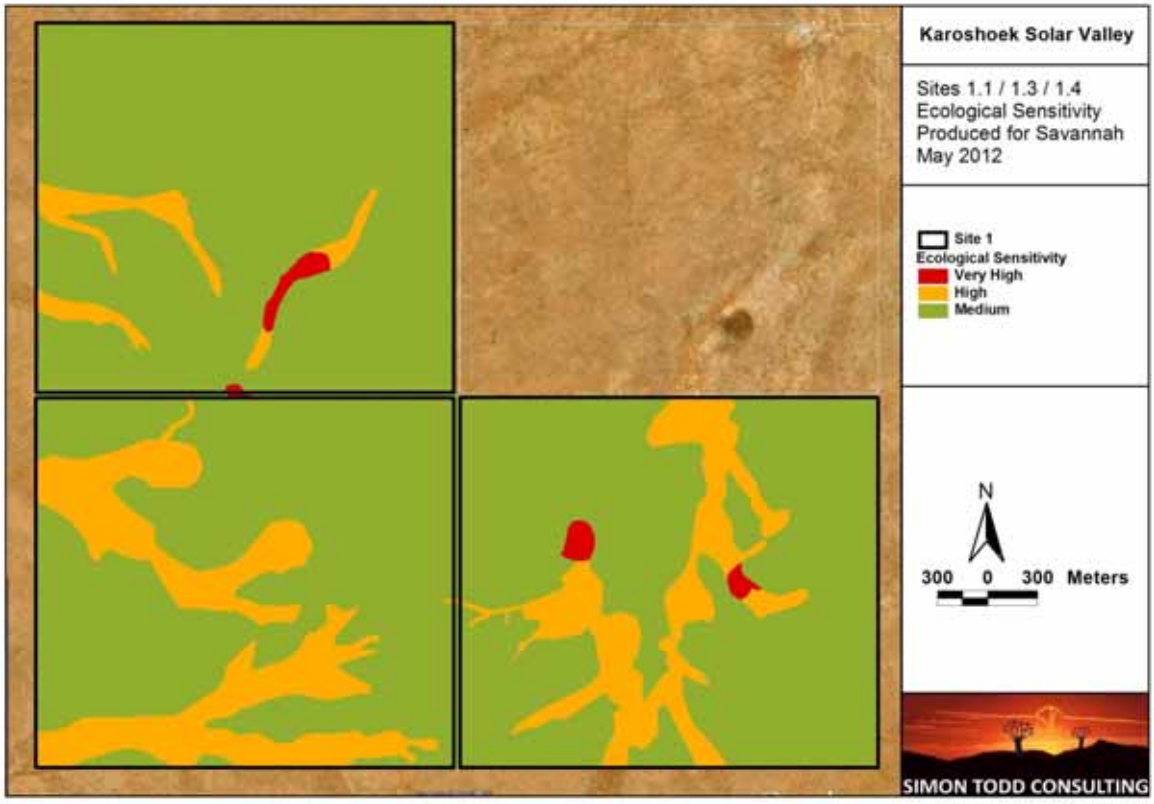


Figure 8.3: Ecological Sensitivity map of **Sites 1.1 (top left),** 1.3 (bottom right) and 1.4 (bottom left)

During the construction phase local site-specific impacts may occur because of physical disturbance/modification to the site. These include:

[38] The development of dry land cropping in these areas is limited by low rainfall, and lack of irrigation facilities.

» Impacts on biodiversity which includes any impacts on protected trees species (i.e. *Boscia albitrunca*; *Acacia erioloba* and *Aloe dichotoma*), and species of conservation concern (i.e. Largemouth Yellowfish, Namaqua Barb, Rock Catfish, Honey Badger, Littledale's Whistling Rat, Dassie Rat, Kori Bustard, Ludwig's Bustard, Martial Eagle, Secretarybird, Lanner Falcon, Sclater's Lark, and Giant Bullfrog), and on overall species richness.
» Impacts on sensitive habitats (i.e. drainage lines located across the site, reed bed wetland systems along the Orange River, and dunes primarily in the south-western quarter and in some northern parts of the site), that leads to direct or indirect loss of such habitat. These areas should be avoided as far as possible. If it is not possible to avoid them, then appropriate licenses must be obtained to impact on these features.
» Soil degradation, wind/water erosion and subsequent sedimentation of drainage lines and the Orange River.

These impacts will be associated with the establishment of project infrastructure and are expected at Site 1.1 and along the linear infrastructure (i.e. power lines, pipelines, and access road servitudes). These impacts are expected to be of moderate to low significance and can be mitigated to acceptable levels through the implementation of appropriate management measures.

8.4.2. Impacts on Water Resources

Water demand from the Orange River catchment is dominated by irrigation along the river, where approximately 1 800 million m^3 is used per year. Although the volume required by the proposed development is relatively small in a regional context (i.e. 224 110 m^3/a), the cumulative impact due to other proposed solar facilities as well as the NamPower Lower Orange Hydroelectrical Power Scheme will be exacerbated by the abstractions for this project. The Lower Orange River Management Strategy (2005) study found that the overall present state of the Lower Orange River (i.e. the stretch of the Orange River between the Orange-Vaal confluence and Alexander Bay or Oranjemund) is in a *D category*, i.e. largely modified.

Impacts on water resources associated with the proposed facility relate largely to the abstraction of water from the Orange River System, as well as potential impacts on the water quality of the river due to sedimentation and/or contamination. However, the majority of impacts can be reduced to low significance with the implementation of appropriate mitigation measures, and the proposed development should, therefore, have limited impact on the overall status of the riparian systems within the region. Impacts on the Orange River

system due to water abstraction, and site-specific impacts on in-stream biota are difficult to quantify due to the highly regulated nature of the system.

The only significant risk to the project is the water use license not being granted by the Department of Water Affairs. Although dry cooling will be practiced which will reduce water requirements, the Orange River system is under pressure in terms of water requirements.

8.4.3. Impacts on the Social Environment

The proposed development site is located within a rural setting and is removed from settlements and homesteads. Impacts on the social environment are expected during both the construction phase and the operational phase of the solar energy facility. Impacts are expected at both a local and regional scale. Impacts on the social environment as a result of the construction of the solar energy facility can be mitigated to impacts of low significance or can be enhanced to be of positive significance to the region.

The LF facility at Site 1.1 would involve a maximum of six hundred (600) workers over the course of the construction phase, and forty permanent jobs during operation, and would be an approximate R5 to R6 billion economic injection into the area. Positive impacts associated with the project are largely due to job creation opportunities, business opportunities for local companies, skills development, and training. The proposed project could assist in alleviating poverty amongst some individuals in the study area through the provision of permanent employment opportunities. Should all proposed facilities within the Karoshoek Solar Valley Site be developed, the cumulative positive impacts would be of great value to the communities in the area.

The development of a renewable energy facility of this nature will have a positive impact at a national and international level through the generation of “green energy” which would lessen South Africa’s dependency on coal generated energy and the impact of such energy sources on the bio-physical environment. The proposed project would fit in with the government’s aim to implement renewable energy projects as part of the country’s energy generation mix over the next 20 years as detailed in the Integrated Resource Plan (IRP).

Potential negative impacts which require mitigation relate to an influx of workers and jobseekers to an area (whether locals are employed or outsiders are employed) and an associated perceived risk of an increase in crime in the area, and intrusion influences during construction. As a limited number of workers are proposed to be housed on site, certain impacts could arise as a result of worker

conduct at this site. Stringent mitigation is required to be implemented to reduce these impacts to acceptable levels.

Impacts on farming activities may occur as a result of the proposed development. However, due to the limited agricultural potential of the proposed development site (Site 1.1), and the low rainfall in the area, the impact on agricultural potential as a result of the loss of land associated with the development is not expected to be significant. In fact, the proposed development may present opportunities for additional agriculture on the site and surrounds in that the water supply infrastructure could be utilised to transport water to irrigate crops within these areas. This would be a positive impact.

8.5. Overall Conclusion (Impact Statement)

Global climate change is widely recognised as being one of the greatest environmental challenges facing the world today. How we source our energy plays a big part in tackling climate change. As a net off-setter of carbon, renewable energy technologies assist in reducing carbon emissions, and can play a big part in ensuring security of energy supply, as other sources of energy are depleted or become less accessible. With the aim of reducing South Africa's dependency on coal generated energy, and to address climate change concerns, the South African Government has set a target, through the Integrated Resource Plan (IRP) for electricity to develop 17.8 GW of renewables (including 8,4GW solar) within the period 2010 – 2030.

The technical viability of establishing a CSP facility with a generating capacity of 100 MW on a site near Upington has been established by FG Emvelo. The positive implications of establishing a solar energy facility on the identified site within the Northern Cape include:

» The potential to harness and utilise solar energy resources, which are known to be significant within the Northern Cape.
» The project would assist the South African government in reaching their set targets for renewable energy.
» The project would assist the South African government on the implementation of its green growth strategy and job creation targets.
» The National electricity grid in the Northern Cape would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Positive impacts on the tourism economy of the area
» Creation of local employment, business opportunities and skills development for the area

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated from the proposed project conclude that there are **no environmental fatal flaws** that should prevent the proposed facility from proceeding. The majority of impacts identified are of moderate to low significance and can be successfully mitigated to acceptable levels, provided the specifications as detailed within the Environmental Management Programme (EMP) for the project are implemented. With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

8.6. Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the application for the proposed LF facility on site 1.1 as part of the broader Karoshoek Solar Valley Development can be mitigated to an acceptable level, and therefore that the application for the proposed solar energy facility and associated infrastructure as detailed within this EIA Report be authorised by DEA. The following conditions of this recommendation must be included within the authorisation issued:

» As far as possible, any component of the facility which could potentially affect sensitive areas (i.e. pans and primary drainage lines) should be shifted in order to avoid these areas of high sensitivity (i.e. best practice is impact avoidance). Where this is not possible, alternative mitigation measures as detailed in this report must be implemented.
» The final alignment of the water supply pipeline from the on-site reservoir to the facility and location of internal access roads must be informed by surveys undertaken by an ecological and heritage specialist. The EMP for construction must be updated to include site-specific information and specifications resulting from the final walk-though surveys. This EMP must be submitted to DEA for approval prior to the commencement of construction.
» Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
» An independent Environmental Control Officer (ECO) should be appointed to monitor compliance with the specifications of the EMP for the duration of the construction period.

- The EMP as contained within Appendix M of this report should form part of the contract with the EPC Contractor appointed to construct the proposed solar energy facility, and must be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered key in achieving the appropriate environmental management standards as detailed in this report.
- All relevant practical and reasonable mitigation measures detailed within this report and the specialist reports contained within Appendices F to K must be implemented.
- During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
- Disturbed areas should be rehabilitated as quickly as possible once construction is completed in an area, and an on-going monitoring programme should be established to detect, quantify, and manage any alien species.
- A comprehensive stormwater management plan should be compiled and implemented for the developmental footprint prior to construction.
- Applications for all other relevant and required permits required to be obtained by FG Emvelo must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to heritage sites, disturbance of protected vegetation, and disturbance to any drainage lines or riparian vegetation.

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