ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

DRAFT SCOPING REPORT

PROPOSED ESTABLISHMENT OF THE ILANGA CSP 4 PROJECT, NEAR UPINGTON, NORTHERN CAPE PROVINCE

DRAFT FOR PUBLIC REVIEW

13 November 2015 -14 December 2015

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PURPOSE OF THIS DRAFT SCOPING REPORT

FG Emvelo (Pty) Ltd, an independent power developer of concentrating solar power (CSP) plants in South Africa, is proposing the development an additional Concentrated Solar Power (CSP) Facility and associated infrastructure adjacent to the authorised CSP site (Karoshoek LFTT 2 (1 x 100 MW Parabolic Trough) Site 5 - DEA Ref No.: 14/12/16/3/3/2/295) within the Karoshoek Solar Valley Development on a site located approximately 30 km east of Upington within the Khara Hais Local Municipality in the Northern Cape Province. The proposed project is to be known as the **Ilanga CSP 4** Project.

This Draft Scoping Report documents the evaluation of the potential environmental impacts of each proposed solar energy facility and forms part of the EIA process. The Scoping Phase was conducted in accordance with the requirements of the EIA Regulations in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

FG Emvelo (Pty) Ltd appointed Savannah Environmental as independent environmental consultants to undertake the requisite Environmental Impact Assessment (EIA) Process. The EIA process is being undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

This Scoping Phase aims to:

» Identify and evaluate potential environmental (biophysical and social) impacts and benefits of all phases of the proposed development (including design, construction, operation and decommissioning) within the broader study area through a desk-top review of existing baseline data and specialist studies.
» Identify potentially sensitive environmental features and areas on the site to inform the preliminary design process of the three facilities.
» Define the scope of studies to be undertaken within the EIA process.
» Provide the authorities with sufficient information in order to make a decision regarding the scope of issues to be addressed in the EIA process, as well as regarding the scope and extent of specialist studies that will be required to be undertaken as part of the EIA Phase of the process.

Within this context, the objectives of this Scoping Phase are to, through a consultative process:

» identify the relevant policies and legislation relevant to the project;
» motivate the need and desirability of the proposed project, including the need and desirability of the activity in the context of the preferred location;

» identify and confirm the preferred project and technology alternative through an impact and risk assessment and ranking process;
» identify and confirm the preferred site, through a detailed site selection process, which includes an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified alternatives focusing on the geographical, physical, biological, social, economic, and cultural aspects of the environment;
» identify the key issues to be addressed in the EIA phase;
» agree on the level of assessment to be undertaken, including the methodology to be applied, the expertise required as well as the extent of further consultation to be undertaken to determine the impacts and risks the project will impose on the preferred site through the life of the project, including the nature, significance, consequence, extent, duration and probability of the impacts to inform the location of the development footprint within the preferred site; and identify suitable measures to avoid, manage or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored

This Draft Scoping Report consists of 9 sections:

» **Chapter 1** provides background to the proposed project and the environmental impact assessment.
» **Chapter 2** provides the regulatory and planning context for energy projects within South Africa.
» **Chapter 3** describes the activities associated with the project (project scope) and provides insight of the available technologies.
» **Chapter 4** outlines the process which was followed during the Scoping Phase of the EIA process, including the consultation programme that was undertaken and input received from interested and affected parties.
» **Chapter 5** describes the existing biophysical and socio-economic environment.
» **Chapter 6** provides an identification and evaluation of the potential issues associated with the proposed Ilanga CSP 4 Project.
» **Chapter 7** presents the conclusions of the scoping evaluation for the proposed Ilanga CSP 4 Project.
» **Chapter 8** describes the Plan of Study for EIA.
» **Chapter 9** provides references used to compile the Draft Scoping Report.

LEGAL REQUIREMENTS IN TERMS OF THE EIA REGULATIONS

Table 1 below details how the legal requirements of Appendix 2 and Regulation 21(1) of the 2014 EIA Regulations have been addressed within this report.

Table 1: Legal requirements in terms of the EIA regulations

EIA REGULATIONS 2014 GNR 982: Appendix 2 CONTENT OF THE DRAFT SCOPING REPORT	**Cross-reference in this Draft Scoping Report**
A Draft Scoping Report must contain all the information that is necessary for a proper understanding of the nature of issues identified during scoping, and includes -	
(a) details of— (i) the EAP who prepared the report; and (ii) the expertise of the EAP to carry out scoping procedures; including a curriculum vitae	Chapter 1 Section 1.4
(b) the location of the activity, including— (i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; (iii) where the required information in items (i) and (iv) is not available, the coordinates of the boundary of the property or properties;	Chapter 1 Section 1.2, Table 1.1
(c) a plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is— (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Chapter 1 Section 1.2 and 1.3
(d) a description of the scope of the proposed activity, including— (i) all listed and specified activities triggered; (ii) a description of the activities to be undertaken, including associated structures and infrastructure;	Chapter 3 Section 3.2 Chapter 4 Section 4.2
(e) a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process;	Chapter 2
(f) a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	Chapter 3 Section 3.3
(g) Missing as per the EIA REGULATIONS 2014 GNR 982: Appendix 2; pg 58	

(h) a full description of the process followed to reach the proposed preferred activity, site and location within the site, including—	
(i) details of all the alternatives considered;	Chapter 3 Section 3.4
(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Chapter 4 Appendix C
(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Chapter 4 To be included in the final Draft Scoping Report
(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Chapter 5
(v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts—	
(aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	Chapter 6
(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	Chapter 8
(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Chapter 6
(viii) the possible mitigation measures that could be applied and level of residual risk;	Chapter 6
(ix) the outcome of the site selection matrix;	Chapter 3 Section 3.3.1
(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such and	Chapter 3 Section 3.4
(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity	Chapter 2 Section 2.5
(i) a plan of study for undertaking the environmental impact assessment process to be undertaken	Chapter 8
(j) an undertaking under oath or affirmation by the EAP in relation to— (i) the correctness of the information provided in the report; (ii) the inclusion of comments and inputs from	Appendix M

stakeholders and interested and affected parties; and (iii) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	
(k) an undertaking under oath or affirmation by the EAP in relation to the level of agreement between the EAP and interested and affected parties on the plan of study for undertaking the environmental impact assessment;	Appendix M
(l) where applicable, any specific information required by the competent authority.	To be included in the final Draft Scoping Report

INVITATION TO COMMENT ON THE DRAFT SCOPING REPORT

This **Draft Scoping Report** has been made available for public review at the following places, which lie in the vicinity of the proposed project area from **13 November 2015 – 14 December 2015:**

» Upington Public Library

The report is also available for download on:

» www.savannahSA.com

Please submit your comments to
Gabriele of **Savannah Environmental** PO Box 148, Sunninghill, 2157 Tel: 011 656 3237 Fax: 086 684 0547 Email: gabriele@savannahsa.com
The due date for comments on the Draft Scoping Report is **14 December 2015**

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

EXECUTIVE SUMMARY

Background and Project Overview

FG Emvelo (Pty) Ltd, an independent power developer of concentrating solar power (CSP) plants in South Africa, is proposing the development an additional Concentrated Solar Power (CSP) Facility and associated infrastructure adjacent to the authorised CSP site (Karoshoek LFTT 2 (1 x 100 MW Parabolic Trough) Site 5 - DEA Ref No.: 14/12/16/3/3/2/295) within the Karoshoek Solar Valley Development on a site located approximately 30 km east of Upington within the Khara Hais Local Municipality in the Northern Cape Province. (Refer to **Figure 1**). The proposed project is to be known as the **Ilanga CSP 4** Project.

The **Ilanga CSP 4** Project[1] under investigation through this Draft Scoping Report is proposed to generate up to 50MW in capacity and will be constructed over an area of approximately 680ha in extent within the broader property.

The proposed site is located Portion 2 of the Farm Matjiesrivier 41 located approximately approximately 30 km east of Upington within the Khara Hais Local Municipality in the Northern Cape Province.

[1] Previously referred to as the additional CSP facility associated with authorised CSP sites 1.3

The Ilanga CSP 4 Facility is proposed to utilise the solar parabolic trough technology with a generation capacity of up to 150MW, and energy storage of up to 6 hours (using molten salts technology). The trough system will be comprised of parabolic collectors (i.e. trough-shaped reflectors which focus the solar radiation onto a receiver at its focal point), a receiver tube/heat collection element (i.e. a metal absorber containing the heat transfer fluid surrounded by a glass envelope which absorbs the solar energy received from the parabolic trough), a sun-tracking system (i.e. an electronic control system and associated mechanical drive system used to focus the reflector onto the sun), and support structure (i.e. holds the parabolic trough in accurate alignment with incoming solar radiation while resisting the effects of the wind). The collected heat energy in the heat transfer fluid is used to generate steam through a conventional heat exchanger system that is, in turn, used for electricity generation in a conventional steam turbine and generator.

The Ilanga CSP 4 will have a development footprint of up to 680 ha, to be placed within a broader site of ~14000ha and will include the following associated infrastructure:

» On-site substation and associated 132kV power line linking the facility to the national electricity grid;
» Access roads (main and internal access roads);

» A water pipeline from the Orange River (including water treatment and storage reservoirs).

The above infrastructure will be **shared infrastructure** for all the proposed projects within the Karoshoek Solar Valley Development. This infrastructure is to be assessed within a separate Basic Assessment process.

The overarching objective for the Ilanga CSP 4 Project is to maximise electricity production through exposure to the solar resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts. In order to meet these objectives, local level environmental and planning issues will be assessed through the EIA process, through site-specific studies in order to delineate areas of sensitivity within the broader site. This will serve to inform the design of the Ilanga CSP 4 Project. It is anticipated that the parabolic trough and the associated infrastructure can be appropriately placed within the boundaries of the broader site to avoid identified environmental sensitivities or constraints which will be identified through the EIA process.

This Draft Scoping Report is aimed at detailing the nature and extent of this facility, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. 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). In accordance with the requirements of the EIA Regulations, feasible project-specific alternatives (including the "do nothing" option) have been identified for consideration within the EIA process.

Evaluation of the Proposed Project

The main issues identified through this scoping study associated with the proposed CSP facility are summarised in **Table 1 and 2 below.**

As is evident from the Table below, the majority of potential impacts identified to be associated with the construction of Ilanga CSP 4 Project are anticipated to be localised and restricted to the proposed site itself while operation phase impacts range from local to regional. No environmental fatal flaws were identified to be associated with the site. Features within the larger site have, however, been identified as 'sensitive areas' or areas of high ecological visual archaeological sensitivities should be avoided by the development footprint.

The **potentially sensitive areas** which have been identified through the environmental scoping study are shown in **Figure 2**. The scoping phase sensitivity map provides an informed estimate of sensitivity on

the larger site. The detail is based on the desktop review of the available baseline information for the study area. During the ecological site survey, the site was well covered and the affected area was investigated in detail in order to provide definitive insight into the potential for constraining factors for the site. The sensitivity map is intended to inform the location/layout of the facility proposed for the site, and must be used as a tool by the developer to avoid those areas flagged to be of potential high sensitivity.

Table 1: Summary of the extent of the potential impacts associated with the Ilanga CSP 4 Project, as identified at the scoping phase

Construction / Decommissioning Impacts	Extent
Disturbance to and loss of indigenous natural vegetation	L
Disturbance or loss of threatened / protected plants	L
Loss of protected trees	L
Loss of habitat for fauna species of conservation concern	L
Impacts on depressions and ephemeral drainage lines	L-R
Establishment and spread of declared weeds and alien invader plants.	L-R
Habitat destruction within the CSP heliostat array footprint	S
Abstraction of water may result in modification of instream habitats	L-R
Abstraction of water may result in modification of instream habitats	L-R
Impact on flow depth and velocity	L-R
Impact on flow duration	L-R
Changes in sediment regime	L-R
Impacts on downstream users	L-R
Soil degradation during the construction phase	L
Loss of grazing land due to the direct impact by the infrastructure's footprint during all phases of the project	L
Loss of soil resources as a result of erosion during all phases of the project	L
Visual impact on surrounding areas as a result of construction activities	L
Potential impacts on general landscape character of the area and sense of place.	L
Direct employment opportunities and skills development	L
Impact: Economic multiplier effects	L-R
Safety and security impacts	L
Impacts on daily living and movement patterns	L
Pressure on economic and social infrastructure impacts from an in-migration of people	L-R
Nuisance Impacts (noise & dust)	L
Disturbance and destruction of archaeological sites and graves	L
Loss of unique fossil heritage	L

Table 2: Summary of the extent of the potential impacts associated with the Ilanga CSP 4 Project, as identified at the scoping phase

Operational Impacts	Extent
Disturbance or loss of indigenous natural vegetation	L
Altered runoff patterns due to rainfall interception by panels and compacted areas	S-L
Disturbance to migration routes and associated impacts to species populations	S-L
Impacts on depressions and ephemeral drainage lines	L-R
Establishment and spread of declared weeds and alien invader plants	L-R
Incineration or feather singeing in solar flux	L
Collision with CSP troughs and infrastructure	L
Disturbance due to construction of troughs	L
Habitat destruction within the CSP heliostat array footprint	L
Potential visual impact on users of roads in close proximity to the proposed Ilanga CSKP 2 Project	L
Potential visual impact on residents of settlements and homesteads in close proximity to the proposed solar energy facilities	L
Potential visual impact on sensitive visual receptors within the region.	L
Potential visual impact of night lighting.	L
Potential impacts on general landscape character of the area and sense of place.	L
Ocular impacts associated with glint and glare.	L
Modification of aquatic faunal community including loss of species of conservation concern due to change in habitat	L-R
Modification of threatened floral community including loss of species of conservation concern due to change in habitat	L-R
Impact on flow depth and velocity.	L-R
Impact on flow duration.	L-R
Changes in sediment regime.	L-R
Impacts on downstream users.	L-R
Risk of limited, or no abstraction	L-R
Loss of grazing land due to the direct impact by the infrastructure's footprint	L
Loss of soil resources as a result of erosion	L
Direct employment opportunities and skills development	L-R
Socio-Economic Development (SED), Enterprise Development (ED) and share ownership in the project company with local communities:	L
Development of clean, renewable energy infrastructure	L-R
Visual impact and impacts on sense of place	L
Impacts associated with the loss of agricultural land	L

S	**Site**	L	**Local**	R	**Regional**	N	**National**	I	**International**

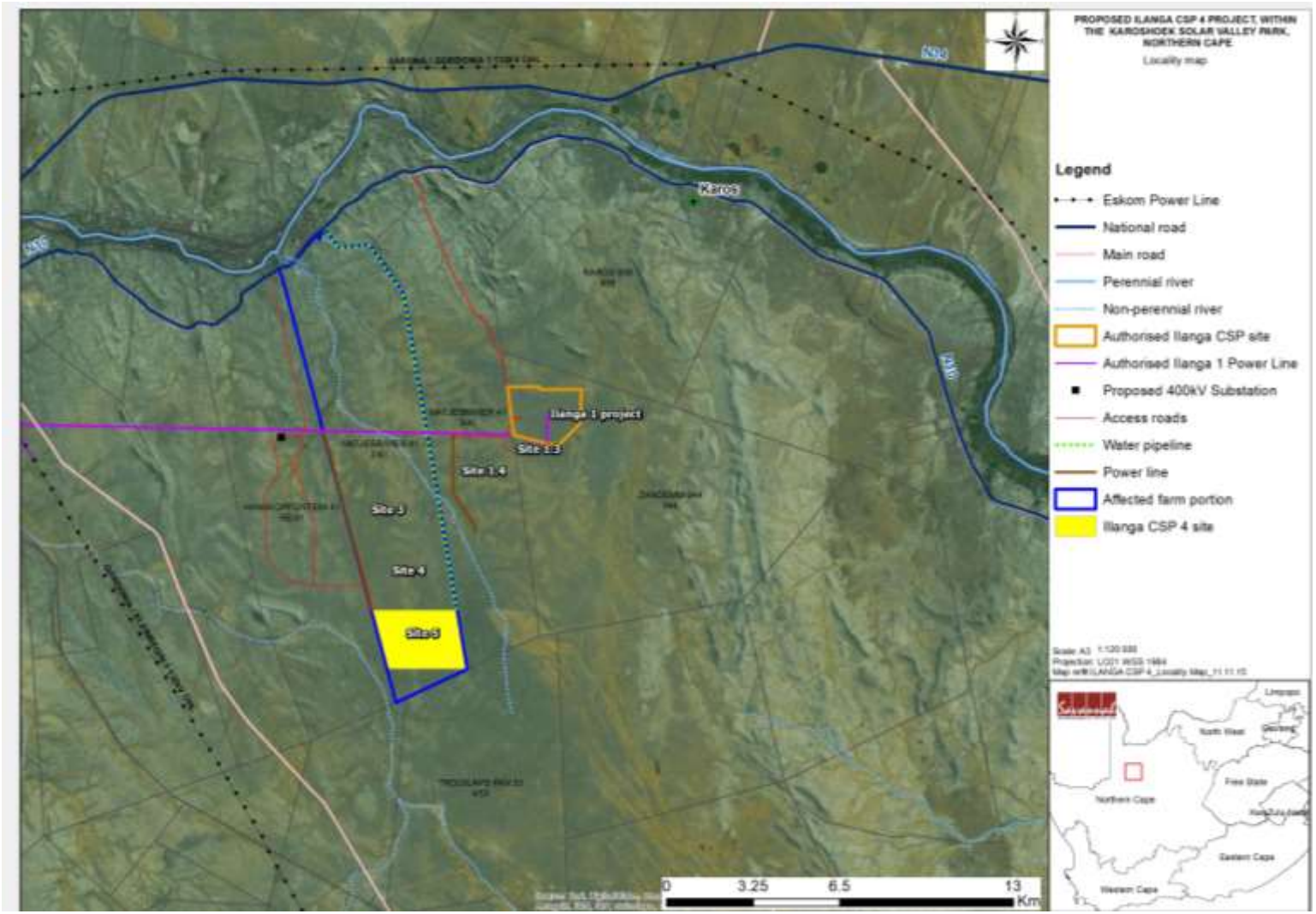

Figure 1: Locality Map of the proposed Ilanga CSP 4 Project(Refer to Appendix O A3 Maps)

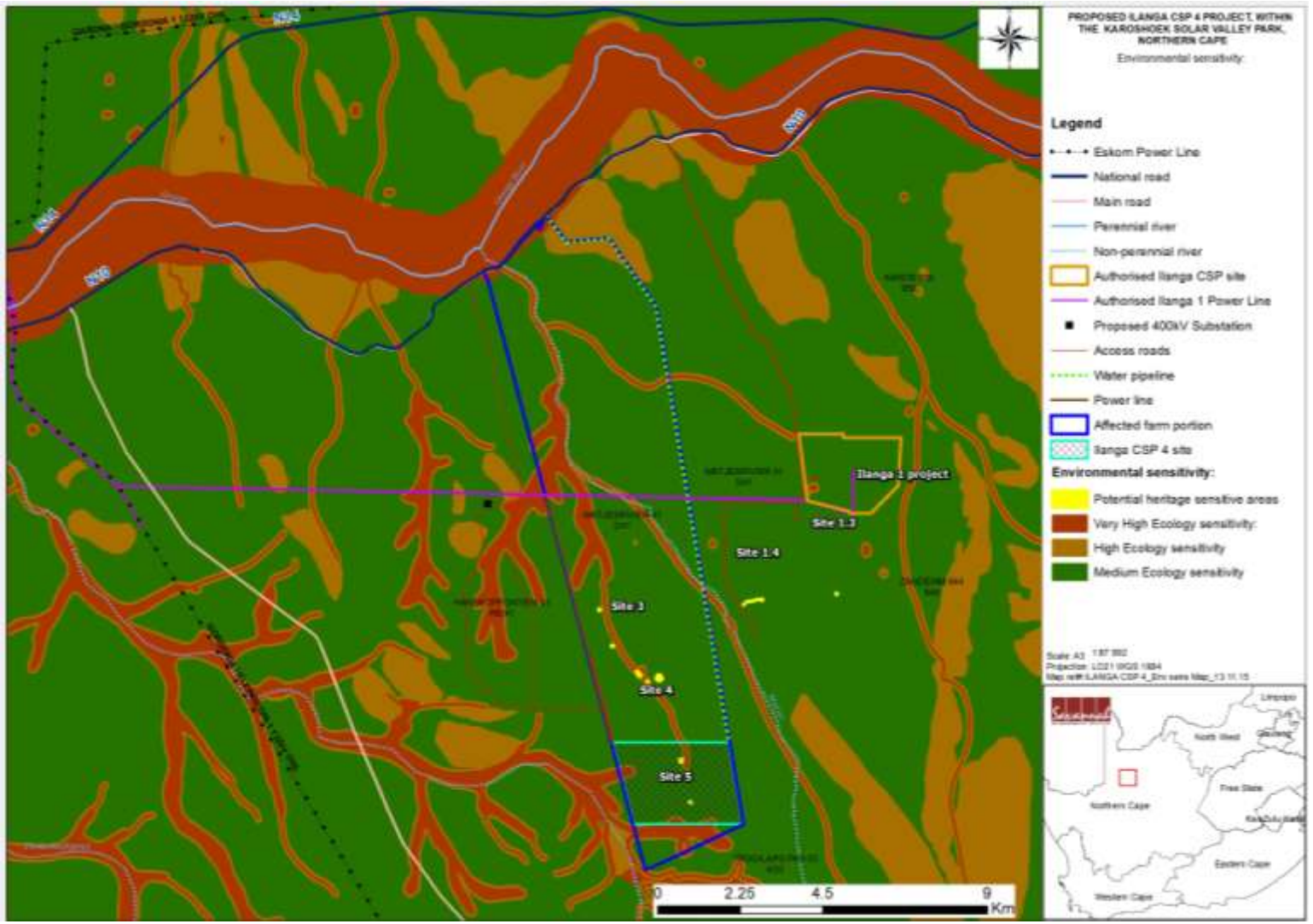

Figure 2: Environmental Sensitivity Map for the proposed Ilanga CSP 4 Project(Refer to Appendix O A3 Maps)

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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.

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.

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

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

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

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

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

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

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

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

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Emergency: An undesired/ unplanned event that results in a significant environmental impact and requires the notification of the relevant statutory body, such as a local authority.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

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

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

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

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

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

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

Hazardous waste: Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment (Van der Linde and Feris, 2010;pg 185).

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800

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

Interested and affected party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups, and the public.

Method statement: A written submission to the ECO and the site manager (or engineer) by the EPC Contractor in collaboration with his/her EO.

No-go areas: Areas of environmental sensitivity that should not be impacted on or utilised during the development of a project as identified in any environmental reports.

Pollution: A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.

Pre-construction: The period prior to the commencement of construction, this may include activities which do not require Environmental Authorisation (e.g. geotechnical surveys).

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

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

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

Waste: Any substance, whether or not that substance can be reduced re-used, recycled and recovered; that is surplus, unwanted, rejected, discarded, abandoned or disposed of which the generator has no further use for the purposes of production. Any product which must be treated and disposed of, that is identified as waste by the minister of Environmental affairs (by notice in the Gazette) and includes waste generated by the mining, medical or other sectors, but: A by-product is not considered waste, and portion of waste, once re-used, recycled and recovered, ceases to be waste (Van der Linde and Feris, 2010; p186).

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CBOs	Community Based Organisations
CDM	Clean Development Mechanism
CSIR	Council for Scientific and Industrial Research
CO_2	Carbon dioxide
D	Diameter of the rotor blades
DAFF	Department of Forestry and Fishery
DEA	National Department of Environmental Affairs
DENC	Department of Economic Development and Nature Conservation
DME	Department of Minerals and Energy
DOT	Department of Transport
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment

EMPr	Environmental Management Programme
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
Ha	Hectare
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Planning
km^2	Square kilometres
km/hr	Kilometres per hour
kV	Kilovolt
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
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SDF	Spatial Development Framework

INTRODUCTION *CHAPTER 1*

FG Emvelo (Pty) Ltd, an independent power developer of concentrating solar power (CSP) plants in South Africa, is proposing the development an additional Concentrated Solar Power (CSP) Facility and associated infrastructure adjacent to the authorised CSP site Karoshoek LFTT 2 (1 x 100 MW Parabolic Trough) Site 5, DEA Ref No.: 14/12/16/3/3/2/295) within the Karoshoek Solar Valley Development on site located approximately 30 km east of Upington within the Khara Hais Local Municipality in the Northern Cape. The proposed project is to be known as the **Ilanga CSP 4** Project. The **Ilanga CSP 4** Project is proposed to generate up to 50MW in capacity and will be constructed over an area of approximately 680ha in extent within the broader property.

The purpose of the additional CSP facility to be investigated is to facilitate the increase in capacity of the authorised facility to 150MW in order to meet the generating capacity thresholds specified by the Department of Energy (DoE) in its Expedited Bid Window of the Renewable Energy Independent Power Producers Procurement (REIPPP) Programme (Tender No: DOE/003/13/14 – as amended from time to time).

The project is being proposed in response to the requirement for additional electricity generation capacity at a national level and in response to identified objectives of the national and provincial government, and local and district municipalities to develop renewable energy facilities in this area. From a regional perspective, the greater Upington area is considered favourable for the development of commercial solar electricity generating facilities by virtue of the prevailing climatic conditions (primarily as the economic viability of a solar energy facility is directly dependent on the annual solar irradiation values for a particular area), relief and aspect, the extent of the site, and the availability of a direct grid connection (i.e. point of connection to the Eskom National grid). The area is designated as a Solar Corridor in terms of the Provincial Spatial Development Framework (PSDF) and has been classified as a Renewable Energy Development Zone (REDZ) for Solar Development through the Strategic Environmental Assessment (SEA) undertaken for renewable energy development by the Department of Environmental Affairs (DEA)[2].

It is the developer's intention to bid the Ilanga CSP 4 Project under the Department of Energy's (DoE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. The power generated from the Ilanga CSP 4 Project will be sold to Eskom and will feed into the national electricity grid. Ultimately, the project is intended to be a part of the renewable energy projects portfolio for South Africa, as contemplated in the Integrated Resource Plan 2030.

[2] It must be noted that the REDZ are expected to be promulgated in early 2016.

The nature and extent of the Ilanga CSP 4 Project, as well as potential environmental impacts associated with the construction, operation and decommissioning phases are explored in more detail in this Scoping Report.

This Scoping Report consists of the following sections:

» **Chapter 1** provides background to the proposed project and the environmental impact assessment.
» **Chapter 2** provides the regulatory and planning context for energy projects within South Africa.
» **Chapter 3** describes the activities associated with the project (project scope) and provides insight of the available technologies.
» **Chapter 4** outlines the process which was followed during the Scoping Phase of the EIA process, including the consultation programme that was undertaken and input received from interested and affected parties.
» **Chapter 5** describes the existing biophysical and socio-economic environment.
» **Chapter 6** provides an identification and evaluation of the potential issues associated with the proposed Ilanga CSP 4.
» **Chapter 7** presents the conclusions of the scoping evaluation for the proposed Ilanga CSP 4.
» **Chapter 8** describes the Plan of Study for EIA.
» **Chapter 9** provides references used to compile the Scoping Report.

1.1. Project Overview

FG Emvelo (Pty) Ltd is proposing the development of an additional Concentrated Solar Power (CSP) Facility and associated infrastructure adjacent to the authorised CSP site Karoshoek LFTT 2 (1 x 100 MW Parabolic Trough) Site 5, DEA Ref No.: 14/12/16/3/3/2/295) within the Karoshoek Solar Valley Development on Portion 2 of the Farm Matjiesrivier 41, located approximately 30 km east of Upington within the Khara Hais Local Municipality in the Northern Cape (refer to Table 1.1).

The Ilanga CSP 4 Project is proposed to generate up to 50MW in capacity and will be constructed over an area of approximately 680ha in extent within the broader property.

It is the intention of the developer to develop the above proposed project together with the already authorised project, i.e. the project is to be developed as a single 150MW facility in total.

The Ilanga CSP 4 Facility is proposed to utilise the solar parabolic trough technology with a generation capacity of up to 150MW, and energy storage of up to 6 hours

(using molten salts technology). The trough system will be comprised of parabolic collectors (i.e. trough-shaped reflectors which focus the solar radiation onto a receiver at its focal point), a receiver tube/heat collection element (i.e. a metal absorber containing the heat transfer fluid surrounded by a glass envelope which absorbs the solar energy received from the parabolic trough), a sun-tracking system (i.e. an electronic control system and associated mechanical drive system used to focus the reflector onto the sun), and support structure (i.e. holds the parabolic trough in accurate alignment with incoming solar radiation while resisting the effects of the wind). The collected heat energy in the heat transfer fluid is used to generate steam through a conventional heat exchanger system that is, in turn, used for electricity generation in a conventional steam turbine and generator.

The Ilanga CSP 4 will have a development footprint of up to 680 ha, to be placed within a broader site of ~6000ha and will include the following associated infrastructure:

» On-site substation and associated 132kV power line linking the facility to the national electricity grid;
» Access roads (main and internal access roads);
» A water pipeline from the Orange River (including water treatment and storage reservoirs).

The above infrastructure will be **shared infrastructure** for all the proposed projects within the Karoshoek Solar Valley Development. This infrastructure is to be assessed within a separate Basic Assessment process.

The overarching objective for the Ilanga CSP 4 Project is to maximise electricity production through exposure to the solar resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts. In order to meet these objectives, local level environmental and planning issues will be assessed through the EIA process, through site-specific studies in order to delineate areas of sensitivity within the broader site. This will serve to inform the design of the Ilanga CSP 3 Project. It is anticipated that the parabolic troughs and the associated infrastructure can be appropriately placed within the boundaries of the broader site to avoid identified environmental sensitivities or constraints which will be identified through the EIA process.

Table 1.1: A detailed description of the project

Province	**Northern Cape Province**
District Municipality	Mgcawu District (Siyanda) Municipality
Local Municipality	//Khara Hais Local Municipality
Ward number(s)	14
Nearest town(s)	Upington

Farm name(s) and number(s)	Matjiesrivier 41
Portion number(s)	2
	C03680000000004100002
Site Co-ordinates (centre of site)	Lat: 28°33'53.49"S Long: 21°29'8.57"E

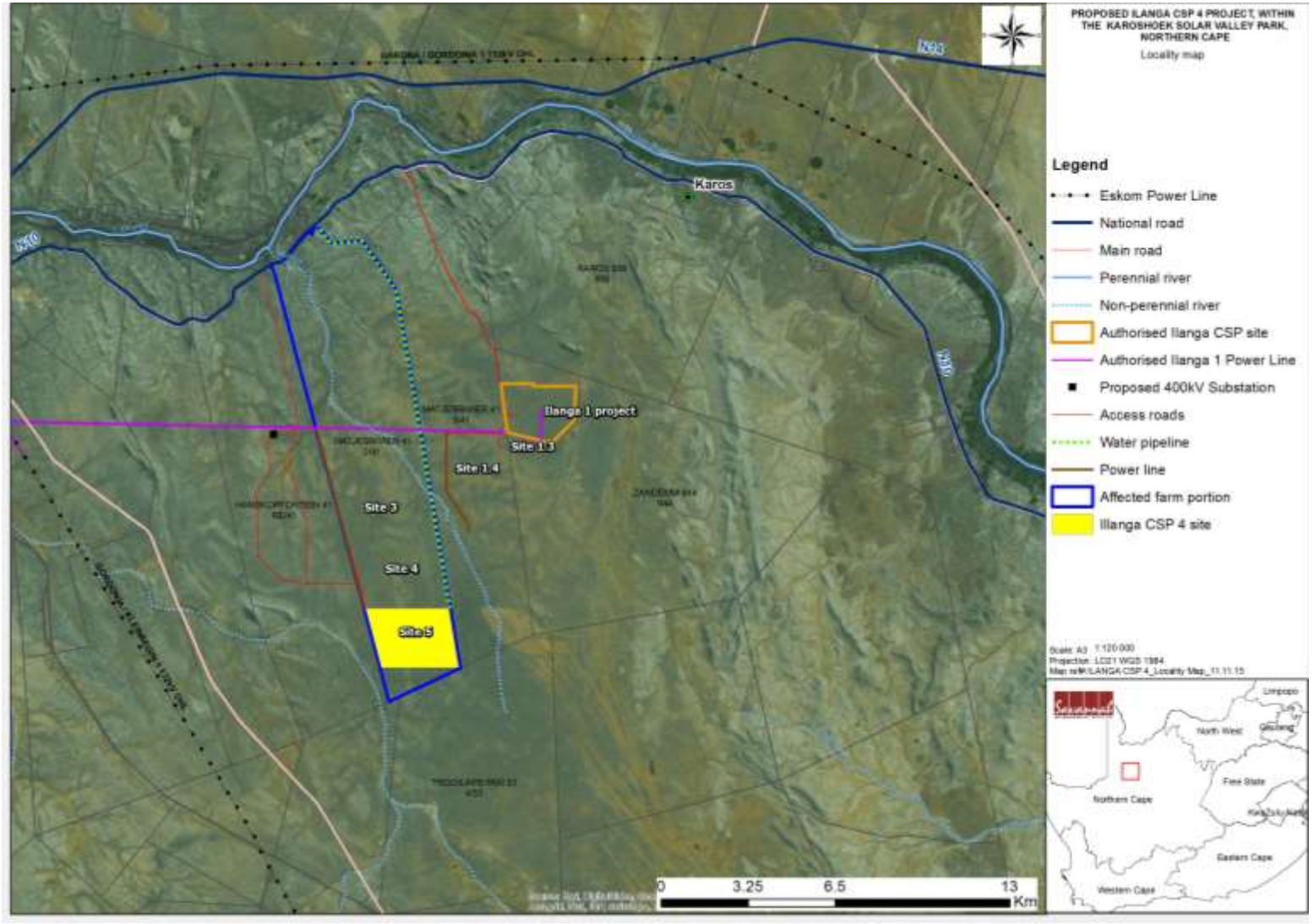

Figure 1.1: Locality map showing the proposed location of Ilanga CSP 4 Project within the extent of Portion 2 of the Farm Matjiesrivier 41 (Refer to Appendix O – Maps for A3)

1.2. Requirement for an Environmental Impact Assessment Process

The construction and operation of the proposed Ilanga CSP 4 Project is subject to the requirements of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA) 107 of 1998. This section provides a brief overview of the EIA Regulations and their application to this project.

NEMA is the national legislation that provides for the authorisation of 'listed activities'. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these activities must be considered, investigated, assessed and reported on to the competent authority that has been charged by NEMA with the responsibility of granting environmental authorisations. As this is a proposed electricity generation project and thereby considered to be of national importance, the National Department of Environmental Affairs (DEA) is the competent authority[3] and the Northern Cape Department of Environment and Nature Conservation (DENC) will act as a commenting authority.

The need to comply with the requirements of the EIA Regulations ensures that the competent authority is provided with the opportunity to consider the potential environmental impacts of a project early in the project development process and to assess if potential environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required in accordance with the EIA Regulations to provide the competent authority with sufficient information in order to make an informed decision. FG Emvelo (Pty) Ltd has appointed Savannah Environmental as the independent environmental consulting company to conduct an EIA process for the proposed project.

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

The EIA process comprises two phases – i.e. Scoping and Impact Assessment - and involves the identification and assessment of environmental impacts though specialist studies, as well as public participation. The process followed in these two phases is as follows:

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

» The **Scoping Phase** includes the identification of potential issues associated with the proposed project through a desktop study (considering existing information), limited field work and consultation with affected parties and key stakeholders. This phase considers the broader site in order to identify and delineate any environmental fatal flaws, no-go or sensitive areas. Following public review of the report, this phase culminates in the submission of a final Scoping Report and Plan of Study for EIA to the competent authority for acceptance.
» The **EIA Phase** involves a detailed assessment of potentially significant positive and negative impacts (direct, indirect, and cumulative) identified in the Scoping Phase. This phase considers a proposed development footprint and includes detailed specialist investigations and public consultation. Following a public review period of the EIA report, this phase culminates in the submission of a Final EIA Report and an Environmental Management Programme (EMPr), including recommendations of practical and achievable mitigation and management measures, to the competent authority for review and decision-making.

1.3. Details of the Environmental Assessment Practitioner

Savannah Environmental was contracted by FG Emvelo (Pty) Ltd as the independent environmental consulting company to undertake both Scoping and EIA Phases for the proposed Ilanga CSP 4. Neither Savannah Environmental nor any of its specialist sub-consultants on this project are subsidiaries of or are affiliated to FG Emvelo (Pty) Ltd in any way. Furthermore, Savannah Environmental does not have any interests in secondary developments that could arise out of the authorisation of the proposed projects.

Savannah Environmental is a specialist environmental consulting company providing holistic environmental management services, including environmental impact assessments and planning to ensure compliance and evaluate the risk of development, and the development and implementation of environmental management tools. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team.

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

» *Tebogo Mapinga* - is a Senior Environmental Consultant, holds a BSc degree with 8 years of experience in the environmental field in both public and private sectors. Her competencies lie in environmental impact assessments, compliance monitoring and public participation for small and large scale projects.
» *Sheila Muniongo* - holds an Honours Bachelor degree in Environmental Management and 4 years of experience in the environmental field. Her key focus is on environmental impact assessments, public participation, environmental management programmes, and mapping through ArcGIS for variety of environmental projects. She is currently involved in several EIAs for renewable energy projects EIAs across the country.
» *Gabriele Wood* - holds an Honours Degree in Anthropology, obtained from the University of Johannesburg. She has 6 years consulting experience in public participation and social research. Her experience includes the design and implementation of public participation programmes and stakeholder management strategies for numerous integrated development planning and infrastructure projects. Her work focuses on managing the public participation component of Environmental Impact Assessments and Basic Assessments undertaken by Savannah Environmental.
» *Jo-Anne Thomas* - a registered Professional Natural Scientist and holds a Master of Science degree. She has 17 years' experience consulting in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently involved in undertaking siting processes as well as EIAs for several renewable energy projects across the country.

In order to adequately identify and assess potential environmental impacts associated with the proposed project, the following specialist sub-consultants have provided input into this scoping report:

» Ecology (Flora and Fauna) – Gerhard Botha of Savannah Environmental
» Avifauna - Dr Rob Simmons of Bird and Bat Unlimited Environmental Consultants
» Soils and Agricultural Potential – Jaco Jansen of Savannah Environmental
» Heritage – Jaco van der Walt of HCAC Heritage Consultants
» Palaeontology – John Almond of Natura Viva cc
» Visual – John Marshall of Afzelia Environmental Consultants & Environmental Planning and Design

» Social – Candice Hunter of Savannah Environmental (with external review by Neville Bews)
» Aquatic – Peter Kimberg of the Biodiversity company
» Hydrology – Stuart Dunsmore of Fourth Element

Appendix A includes the curricula vitae for the environmental assessment practitioners from Savannah Environmental and the specialist consultants.

REGULATORY AND PLANNING CONTEXT CHAPTER 2

2.1. Strategic Electricity Planning in South Africa

The need to expand electricity generation capacity in South Africa is based on national policy and is informed by 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 CSP facilities is illustrated in Figure 2.1. 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 ILANGA CSP 4 Project.

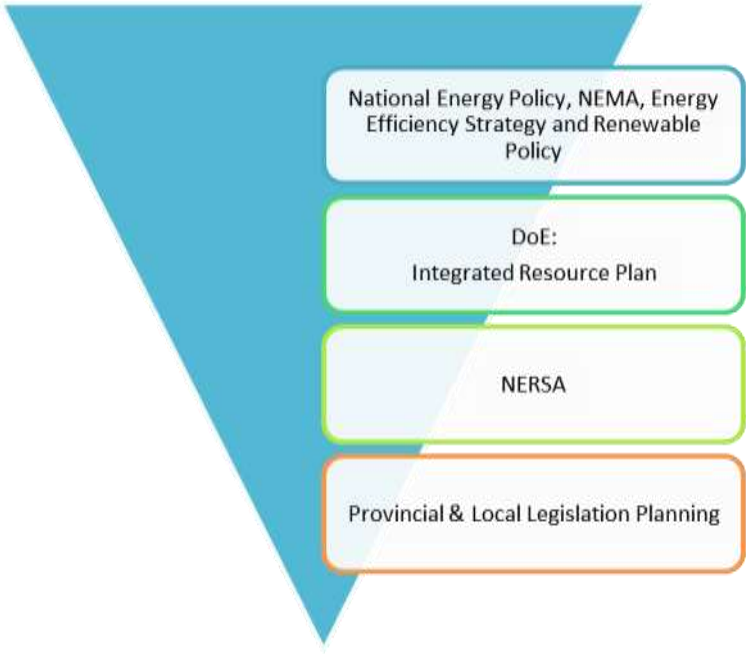

Figure 2.1: Hierarchy of electricity policy and planning documents

The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and Local levels.

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

» *Department of Energy (DoE)*: This Department is responsible for policy relating to all energy forms, including renewable energy, and is responsible for forming and approving the IRP (Integrated Resource Plan for Electricity).

» *National Energy Regulator of South Africa (NERSA):* This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for renewable energy developments to generate electricity.
» *Department of Environmental Affairs (DEA):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. The DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.
» *The South African Heritage Resources Agency (SAHRA):* SAHRA is a statutory organisation established under the National Heritage Resources Act, No 25 of 1999, as the national administrative body responsible for the protection of South Africa's cultural heritage.
» *Department of Transport – South African Civil Aviation Authority (SACAA):* This department is responsible for aircraft movements and radar, which are aspects that influence renewable energy development location and planning.
» *South African National Roads Agency Limited (SANRAL):* This Agency is responsible for the regulation and maintenance of all national routes.
» *Department of Water and Sanitation (DWS):* This Department is responsible for water resource protection, water use licensing and permits.
» *The Department of Agriculture, Forestry and Fisheries (DAFF):* This Department is 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. This Department is also responsible for the issuing of permits for impacts on protected tree species.
» *The Department of Science and Technology:* This department is the administrating authority for the Astronomy Geographical Advantage Act (Act 21 of 2007).

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

» *Provincial Government of the Northern Cape – Department of Environment and Nature Conservation (Northern Cape DENC).* This department is the commenting authority for this project as well as being responsible for issuing of other biodiversity and conservation-related permits.
» *Department of Transport and Public Works - Northern Cape.* This department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
» *Northern Cape Department of Agriculture and Rural Development:* This is the provincial authority responsible for matters affecting agricultural land.
» *Ngwao Boswa ya Kapa Bokone (Northern Cape Heritage Authority):* This body is responsible for commenting on heritage related issues in the Northern Cape Province.

At **Local Level** the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Northern Cape, the //Khara Hais Municipality and the ZF Mgcawu District Municipality play a role.

» In terms of the 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.
» *Namakwa District Biodiversity Sector Plan* (Desment & Marsh 2008) - 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.

2.2 National Policy and Planning

Further to the South African government's commitment in August 2011 to support the development of 3,725 MW of renewable energy capacity, the Department of Energy ("DoE") initiated the Renewable Energy Independent Power Producer Procurement Program ("REIPPPP") to procure renewable energy from the private sector in a series of rounds. To date, the DoE has managed to secure a total of 5,237 MW of renewable energy capacity across 4 bidding windows. An announcement was made in June 2015 by the DoE to procure a further 1,800 MW of renewable energy capacity (including 450 MW from CSP technology) in an Expedited round (Round 4.5).

2.2.1 The Kyoto Protocol, 1997

South Africa's electricity is mainly generated from coal-based technologies. South Africa accounts for ~38 % of Africa's CO_2 (a greenhouse gas contributing to climate change) from burning of fossil fuels and industrial processes. The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. South Africa ratified the Kyoto Protocol in 2002. The Kyoto Protocol requires developing countries to reduce its greenhouse gas emissions through actively cutting down on using fossil fuels, or by utilising more renewable resources. Therefore certain guidelines and policies (discussed further in the sections below) were put in place for the Government's plans to reduce greenhouse gas emissions. The development of renewable energy projects (such as the proposed CSP energy facility) is therefore in line with South Africa's

international obligations in terms of the Kyoto Protocol. A second commitment period commenced from 1 January 2013, and extends to 31 December 2020.

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

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

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

The White Paper on Renewable Energy sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. It also informs the public and the international community of the Government's vision, and how the Government intends to achieve these objectives; and informs Government agencies and organs of their roles in achieving the objectives.

South Africa relies heavily on coal to meet its energy needs because it is well-endowed with coal resources in particular. However South Africa is endowed with renewable energy resources that can be sustainable alternatives to fossil fuels, but which have so far remained largely untapped. This White Paper fosters the uptake of renewable energy in the economy and has a number of objectives that include:

- ensuring that equitable resources are invested in renewable technologies;
- directing public resources for implementation of renewable energy technologies;
- introducing suitable fiscal incentives for renewable energy and;
- creating an investment climate for the development of renewable energy sector.

The objectives of the White Paper are considered in six focal areas, namely: financial instruments, legal instruments, technology development, awareness raising, capacity building and education, and market based instruments and regulatory instruments. The policy supports the investment in renewable energy facilities as they contribute towards ensuring energy security through the diversification of energy supply, reducing GHG emissions and the promotion of renewable energy sources.

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

2.2.3. The National Energy Act (2008)

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

"*To ensure that diverse energy resources are available, in sustainable quantities, and at affordable prices, to the South African economy, in support of economic growth and poverty alleviation, taking into account environmental management requirements (…); to provide for (…) increased generation and consumption of renewable energies*…(Preamble)."

The National Energy Act aims to ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, taking into account environmental management requirements and interactions amongst economic sectors, as well as matters relating to renewable energy. The Act provides the legal framework which supports the development of renewable energy facilities for the greater environmental and social good.

2.2.4. Renewable Energy Policy in South Africa

Internationally there is increasing development of the use of renewable technologies for the generation of electricity due to concerns such as climate

change and exploitation of resources. In response, the South African government ratified the United Nations Framework Convention on Climate Change (UNFCCC) in August 1997 and acceded to the Kyoto Protocol, the enabling mechanism for the convention, in August 2002. In addition, national response strategies have been developed for both climate change and renewable energy.

Investment in renewable energy initiatives, such as the proposed ILANGA CSP 4 Project, is supported by the National Energy Policy (DME, 1998). This policy recognises that renewable energy applications have specific characteristics which need to be considered. The Energy Policy is "*based on the understanding that renewables are energy sources in their own right, and are not limited to small-scale and remote applications, and have significant medium- and long-term commercial potential*." In addition, the National Energy Policy states that "*Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future*".

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. In spite of this range of resources, the National Energy Policy acknowledges that the development and implementation of renewable energy applications has been neglected in South Africa.

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

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

2.2.5 National Development Plan

The National Development Plan (NDP) contains a plan aimed at eliminating poverty and reducing inequality by 2030. The NDP identifies 9 key challenges and associated remedial plans. Managing the transition towards a low carbon national economy is identified as one of the 9 key national challenges. Expansion and acceleration of commercial renewable energy is identified as a key intervention strategy.

The proposed project will support many of the objectives of the National Development Plan (NDP). Some of these objectives are listed below:

» Create 11 million jobs by 2030; and
» Procuring about 20 000MW of renewable electricity by 2030.

Infrastructure is a key priority of the NDP, which identifies the need for South Africa to invest in a strong network of economic infrastructure to support the country's medium- and long-term economic and social objectives. The NDP has been approved and adopted by government and has received strong endorsement from broader society. The plan sets out steps that aim to ensure that, in 20 years, South Africa's energy system looks very different to the current situation: coal will contribute proportionately less to primary-energy needs, while gas and renewable energy resources – especially wind, solar and imported hydroelectricity – will play a much larger role.

2.2.6. Integrated Energy Plan

The development of a national Integrated Energy Plan (IEP) was envisaged in the White Paper on Energy Policy of 1998 and the Minister of Energy, as entrenched in the National Energy Act of 2008, is mandated to develop and publish the IEP on an annual basis. The IEP takes existing policy into consideration and provides a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development.

The IEP takes into consideration the crucial role that energy plays in the entire economy of the country and is informed by the output of analyses founded on a solid fact base. It is a multi-faceted, long-term energy framework which has multiple aims, some of which include:

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

Eight key objectives for energy planning were identified:

» Objective 1: Ensure the security of supply
» Objective 2: Minimise the cost of energy
» Objective 3: Increase access to energy
» Objective 4: Diversify supply sources and primary sources of energy
» Objective 5: Minimise emissions from the energy sector
» Objective 6: Promote energy efficiency in the economy
» Objective 7: Promote localisation and technology transfer and the creation of jobs
» Objective 8: Promote the conservation of water

The IEP recognises the potential of renewable energy for power generation.

2.2.7. Final Integrated Resource Plan 2010 - 2030

The Integrated Resource Plan (IRP) 2010-30 was promulgated in March 2011. The primary objective of the IRP 2010 is to determine the long term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing and cost. However, the IRP 2010 also serves as input to other planning functions, *inter alia* economic development, and funding, environmental and social policy formulation. The accuracy of the IRP 2010 is to be improved by regular reviews and updates, and a draft revised Plan is currently available for public comment. The IRP 2010 projected that an additional capacity of up to 56 539MW of generation capacity will be required to support the country's economic development and ensure adequate reserves over the next twenty years. The required expansion is more than two times the size of the existing capacity of the system.

The current iteration of the Integrated Resource Plan (IRP) for South Africa, initiated by the Department of Energy (DoE) after a first round of public participation in June 2010, led to the Revised Balanced Scenario (RBS) that was published in October 2010. The document outlines the proposed generation new build fleet for South Africa for the period 2010 to 2030. This scenario was derived based on the cost-optimal solution for new build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures such as local job creation. In addition to all existing and committed power plants, the RBS included a nuclear fleet of 9.6 GW; 6.3 GW of coal; **17.8 GW of renewables** (including wind and solar); and 8.9 GW of other generation sources. This means that 75% of new generation capacity by 2030 will be derived from energy sources other than coal.

2.2.6 Strategic Integrated Projects

The South African Government adopted a National Infrastructure Plan in 2012 with the objective that government aims to transform South Africa's economic landscape whilst simultaneously creating significant numbers of new jobs, and strengthening the delivery of basic services. The plan also supports the integration of African economies. Socio-economic issues identified within the National Development Plan were placed under 18 different Strategic Integrated Projects (SIPs) to address the spatial imbalances of the past by addressing the needs of the poorer provinces and enabling socio-economic development. The SIPs cover social and economic infrastructure across all nine provinces (with an emphasis on lagging regions). The SIPs include catalytic projects that can fast-track development and growth.

Amongst these is SIP 8 - *Green energy in support of the South African economy).* This SIP aims at supporting sustainable green energy initiatives on national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP, 2010). The proposed ILANGA CSP 4 PROJECT falls within the ambit of this SIP.

2.2.7 Renewable Energy Development Zones (REDZs)

The DEA has been mandated to undertake a Strategic Environmental Assessment (SEA) process. The wind and solar photovoltaic SEAs are being undertaken in order to identify geographical areas most suitable for the rollout of wind and solar photovoltaic energy projects and the supporting electricity grid network. The DEA and CSIR have released a map with focus areas best suited for the roll-out of wind and solar photovoltaic energy projects in South Africa. The aim of the assessment is to designate renewable energy development zones (REDZs) within which such development will be incentivised and streamlined. The proposed Karoshoek CSP Trough Site 1 falls within the identified geographical areas / focus area most suitable for the rollout of the development of solar energy projects (called "Upington Solar priority area") within the Northern Cape Province, as shown in Figure 2.2.

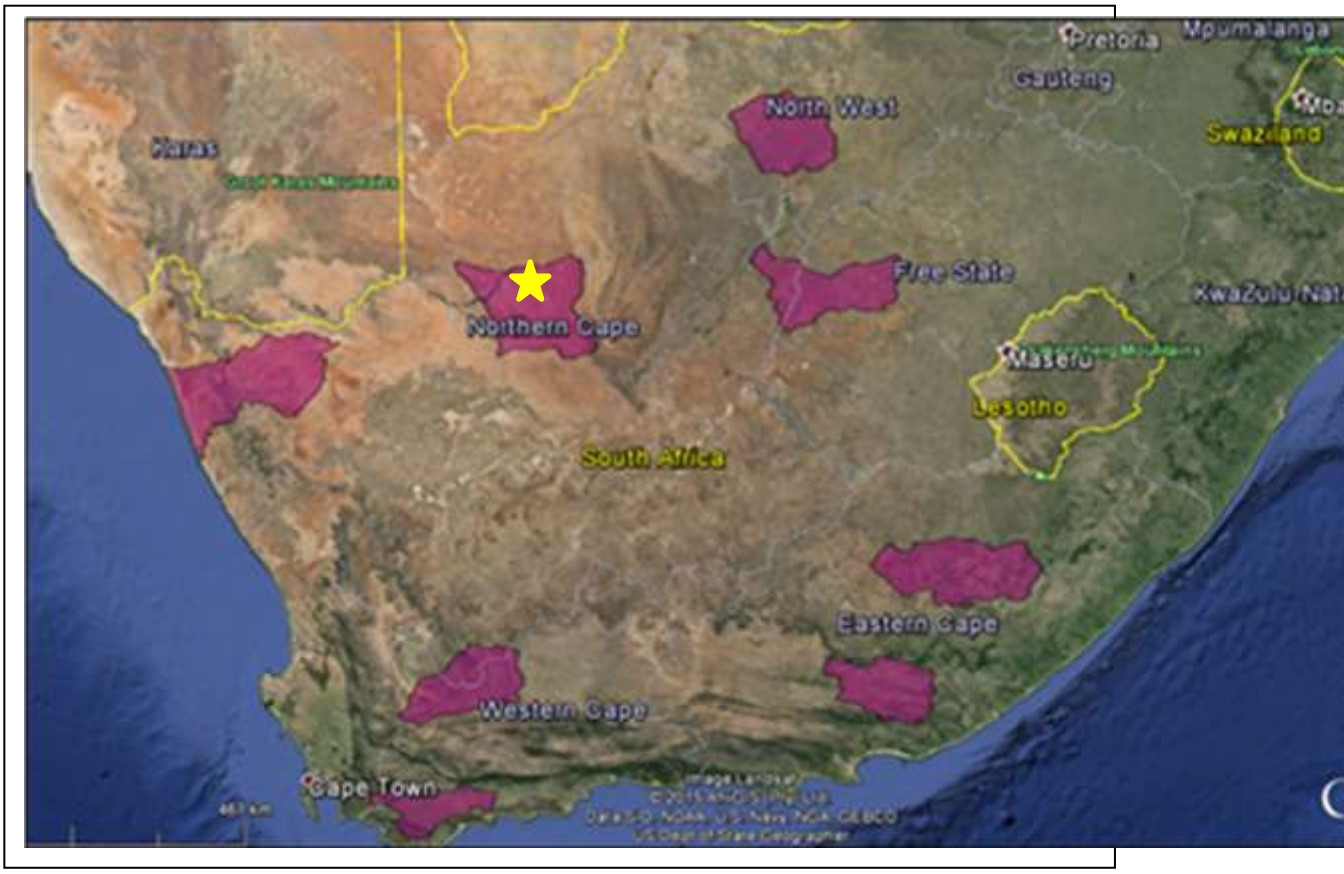

Figure 2.2: Renewable Energy Development Zones (REDZ) (CSIR 2014), Ilanga CSP 4 (shown by the yellow star) falls within REDZ 7.

2.3 Provincial and Local Level Developmental Policy

2.3.1 Northern Cape Province Provincial Growth and Development Strategy

The Northern Cape Provincial Growth and Development Strategy (PGDS) sets the tone for development planning and outlines the strategic planning direction in the province. Planning for the promotion of economic growth and social development lies at the core of the Government's responsibility to provide a better life for the nation. It is essential to ensure that planning is integrated across disciplines, coordinated within and between different planning jurisdictions and aligned with the budgeting processes of national, provincial and local government. The core purpose of the Northern Cape PGDS is to enable stakeholders from public and private sectors, together with labour and civil society, to determine a plan for sustainable growth and development of the Northern Cape. The main objectives set by the Northern Cape PGDS for development planning in the province are as follows:

» Promoting growth, diversification and transformation of the provincial economy
» Poverty reduction through social development
» 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

The Northern Cape PGDS aims at building a prosperous, sustainable, growing provincial economy to eradicate poverty and improve social development. The proposed solar energy facility will contribute to growth and development of the province by expanding the economic base, diversifying the economy and creating employment opportunities, which will contribute towards reducing poverty.

2.3.2 Northern Cape Provincial Local Economic Development (LED) Strategy (2009)

The Northern Cape Local Economic Development (LED) strategy is intended to build a shared understanding of LED in the province and put into context the role of local economies in the provincial economy. It seeks to mobilise local people and local resources in an effort to fight poverty. The Northern Cape LED strategy investigated the options and opportunities available to broaden the local economic base of the province in order to promote the creation of employment opportunities and the resultant spin-off effects throughout the local economy. Areas of opportunity include:

» Livestock products
» Game farming
» Horticulture
» Agriculture
» Ago-related industries
» Tourism
» Manganese and iron Ore
» Beneficiation of minerals
» Renewable energy

The purpose of the LED is to build up the economic capacity of a local area to improve its economic future and quality of life for all. The LED provides local municipalities with leadership and direction in policy making, in order to administer policy, programmes and projects, and to be the main initiator of economic development programmes through public spending. It is noted in the LED that renewable energy is an area of opportunity to broaden the local economic base and promote the creation of employment opportunities as well as local economy spin-off effects.

2.3.3. Northern Cape Provincial Development and Resource Management Plan / Provincial Spatial Development Framework (PSDF) (2012)

As part of the development planning process underlies the formulation of the Northern Cape Provincial Spatial Development Framework (PSDF). The PSDF not only gives effect to national spatial development priorities but it also sets out a series of provincial, district and local development priorities for the space economy of the Northern Cape.

The Northern Cape PSDF is premised upon and gives effect to the following five strategic objectives of the National Strategy for Sustainable Development (NSSD 2011-2014):

» Enhancing systems for integrated planning and implementation
» Sustaining our ecosystems and using natural resources efficiently
» Towards green economy
» Building sustainable communities
» Responding effectively to climate change

The PSDF makes reference to the need to ensure the availability of energy. Under the economic development profile of the Northern Cape PSDF, the White Paper on Renewable Energy Policy (2003) discussed a target of 10 000GWh of energy to be produced from renewable energy sources. It was also stated that the total area of high radiation in South Africa amounts to approximately 194 000km^2, of which the majority falls within the Northern Cape. It is estimated that, if the electricity production per km^2 of mirror surface in solar thermal power stations were 30.2MW and only 1% of the area of high radiation were available for solar generation, then generation potential would equate to approximately 64GW. A mere 1.25% of the area of high radiation could thus meet projected South African electricity demand in 2025 (80GW). It was also stated in the Northern Cape PSDF that the implementation of large Concentrating Solar Power (CSP) plants has been proposed as one of the main contributors to reducing greenhouse gas emission in South Africa. The Northern Cape PSDF also discusses economic development and that it typically responds to the availability of environmental capital (e.g. water, suitable agricultural soil, mining resources etc.) and infrastructural capital (e.g. roads, electricity, bulk engineering services etc.); over time this has resulted in the distinct development regions and corridors. The development corridors of the Northern Cape are demonstrated in Figure 2.4, with the Solar Corridor situated in the Northern Cape represented in yellow. One of the policies in the NC PSDF is for renewable energy sources (e.g. Wind, solar, biomass, and domestic hydro-electricity generation) to comprise 25% of the province's energy capacity by 2020; thereby the proposed development will assist in contributing to the province's renewable energy capacity.

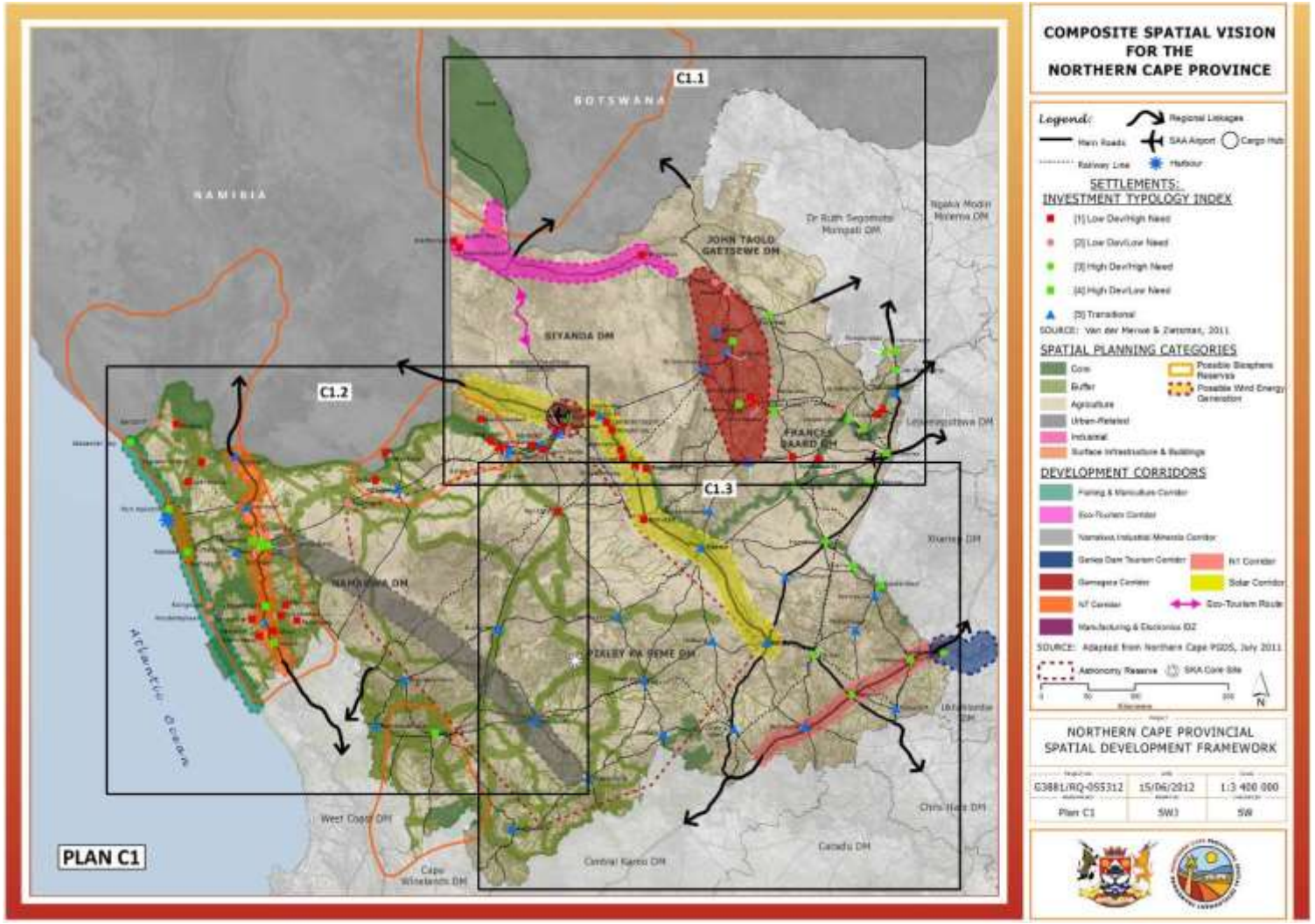

Figure 2.4: Development regions and corridors of the Northern Cape (Source: Northern Cape PSDF 2012)

2.4 District and Local Authority Level Developmental Policy

These strategic policies at the district and local level have similar objectives for the respective areas, namely to accelerate economic growth, create jobs, uplift communities and alleviate poverty. The proposed development is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor. The ZF Mgcawu District Municipality (ZFMDM) was previously known as Siyanda District Municipality (the name was changed on 1 July 2013, however the latest policies still refer to the ZFMDM as Siyanda District Municipality).

2.4.1 Siyanda (ZF Mgcawu) District Municipality Growth and Development Strategy (2007)

The Siyanda District Growth and Development Strategy (Siyanda DGDS) has a longer range planning horizon, and thus focusses on the short, medium and long term. The Siyanda DGDS emphasises development partnerships with other stakeholders, such as national, provincial government, the private sector, labour and the civil society, and it acts as a platform for targeted strategic interventions in terms of the following overarching strategic priorities/objectives/focus areas;

» To encourage economic growth and development, thereby making the economy of Siyanda nationally and globally competitive and more focused;
» To establish local government structures that will ensure democratic, responsible and equitable governance, as well as effective service delivery;
» To manage the physical integration of the constituent municipalities and their comprising towns;
» To ensure the communities well-being by addressing poverty and making essential services available, accessible and affordable;
» To ensure a safe and secure environment by making community safety services both available and accessible
» To enhance Siyanda's provincial and national status as the destination of choice for investment and access to Africa;
» To care for the natural and cultural resources by preserving, utilising and enhancing them.

The overarching direction of the Siyanda DGDS articulates a vision for economic growth and development, social and human development, justice and crime prevention as well as good governance. The proposed development will contribute to economic growth and development, which will in turn help eradicate poverty through job creations in the region, which is in line with the Siyanda DGDS.

2.4.2 Siyanda (ZF Mgcawu) District Municipality Integrated Development Plan (IDP) (2013-2014)

The Siyanda District Municipality IDP has a vision to provide basic services to all in the municipality. The main mission of the IDP is to enhance economic development for the benefit of the community of the district area. The strategic and development objectives of the IDP include:

» To monitor and determine the housing backlogs in the district as well as to inform the public on housing information;
» To assess and provide targeted support improving institutional capacity and service delivery capabilities of local municipalities;
» To promote environmental health and safety of communities in the district through the proactive prevention, mitigation, identification and management of environmental health services, fire and disaster risks;
» To promote safety of communities in the district through the proactive prevention, mitigation, identification and management of fire and disaster risks;
» To facilitate the development of sustainable regional land use, economic, spatial and environmental planning frameworks that will support and guide the development of a diversified, resilient and sustainable district economy.

The proposed development will contribute to employment creation and economic growth, which in turn will have a positive multiplier effect on the local area through income expenditure, therefore supporting the Siyanda IDP.

2.4.3 //Khara Hais Local Municipality Integrated Development Plan (IDP) (2012-2017)

Ten Key Priority Issues (KPIs) were identified based on the challenges faced by the municipality. These KPIs were linked to the municipality's eight Key Performance Areas (KPA's) that is in line with the six National Key Focal Areas and the development objectives of the municipality.

KPA 1: Economic Growth and Development (Focal Area 4: LED)
Development objective(s):

» Graduate people out of poverty by facilitating development and empowerment initiatives in order to create sustainable job opportunities
» Market, develop and co-ordinate tourism in //Khara Hais
» Create an environment for business establishment and support initiatives (i.e. increase in the number of businesses; entrepreneurial support)
» Promote external investment opportunities in sectoral development (i.e. investment activities; entrepreneurial business support program)

KPA 2: Social and Community Development (Focal Area 5: Good Governance: Public Participation, labour, IGR etc.)

Development objective(s):

- » Facilitate and ensure the development and empowerment of the poor and most vulnerable people through the implementation of special programmes (i.e. gender, elderly, youth and disabled)
- » Facilitate the development of sustainable land use, economic, spatial and environmental planning frameworks that will support and guide the development of a diversified, resilient and sustainable economy
- » Provision of sustainable human settlement (housing).
- » Provide equal access to sport, park, recreational facilities and other public amenities to all residents.

KPA 3: Physical Infrastructure and Energy Efficiency (Focal Area 3: Service Delivery and Infrastructure Planning)

Development objective(s):

- » Invest in new and existing infrastructure in order to extend the lifespan of municipal infrastructure (incl. roads; storm water, electricity; water; sanitation; public places, etc.)

KPA 4: Health, Safety and Environment (Focal Area 6: Institutional Arrangements)

Development objective(s):

- » Pro-active prevention, mitigation, identification and management of environmental health, fire and disaster risks.
- » Provide safety to communities through law enforcement services and through legislative requirements

KPA 5: Governance and Stakeholder Participation (Focal Area 5: Good Governance: Public Participation, labour, IGR etc. and Focal Area 6: Institutional Arrangements)

Development objective(s):

- » Promote stakeholder participation through regular interaction with Stakeholders (i.e. IDP/Budget/PM Representative Forum; Ward Committees; LED Forum; IGR Forum and other spheres of governance)
- » Facilitate the establishment of good governance practices (i.e. Audit Committee; Performance Audit Committee; Policies and By-laws; Oversight Committees – Internal and external)

KPA 6: Services and Customer Care (Focal Area 2: Financial Planning and Budgets; Focal Area 3: Service Delivery and Infrastructure Planning; Focal 5: Good Governance: Public Participation, labour, IGR etc. and Focal Area 6: Institutional Arrangements)

Development objective(s):

- » Promote and improve public relations through servicing customers with dignity and care.
- » Provide quality basic services to all communities within the municipality (i.e. electricity; water; sanitation; refuse)
- » Facilitate and ensure the development and empowerment of the poor and most vulnerable people through the implementation of special programmes (Gender, elderly, youth and disabled)

KPA 7: Institutional Transformation (Focal Area 6: Institutional Arrangement)

Development objective(s):

- » Aligning institutional arrangements in order to provide an effective and efficient support service in order to deliver on organisational objectives

KPA 8: Financial Sustainability (Focal Area 2: Financial Planning and Budgets)

Development objective(s):

- » Enable and improve financial viability and management through well-structured budget processes, financial systems, and MFMA compliance (i.e. promote good budget and fiscal management; unqualified audits, etc.)

Key constraints/problems/issues in terms of the development of //Khara Hais Municipality include a shortage of job opportunities and job creation in the area. The natural resource base and economy does not have the capacity to support the total population, forcing the labour force to seek employment opportunities outside of the Municipality (e.g. Kimberley), etc. Furthermore low levels of income obtained in the area imply low levels of buying power and, therefore, few opportunities for related activities such as trade. The proposed project will have minor benefits to the local area through economic benefits such as short term employment opportunities.

2.4.4 //Khara Hais Spatial Development Framework (SDF) 2009

The main access routes to //Khara Hais Municipality are the national roads (N14) via Pofadder/Kakamas in the west, the N10 via Prieska in the south and the N14 via Kuruman. Regional roads include the R27 via Kenhardt in the south and the R360 from the north via the Kgalagadi Transfrontier Park. One of the six primary spatial planning categories adopted for /Khara Hais that relates to the proposed project is Category F (Surface infrastructure and buildings)- All surface infrastructure and building including roads, railway lines, power lines, communication structures etc. Activity corridors are important structural elements focused on the:

(i) Promotion of social integration;
(ii) Increasing residential and business densities;
(iii) Enhancing accessibility of economic and social opportunities; and

(iv) Creating high-quality urban environments through urban renewal and intensive landscaping.

Policy guidelines for land use outside of the urban edge are described within Volume 2, pages 27-29 of the SDF, 2009:

Policy and standard application guidelines exist in respect of the rezoning of agricultural land. The key objective of these guidelines and policy is to prevent fragmentation of high potential agricultural land. This is also a fundamental objective of bioregional planning, which recognises that the protection and appropriate management of high potential agricultural land are imperative for sustainable development.

The SDF states that for //Khara Hais Municipality to consider non-agricultural development to be undertaken on SPC C areas (Agricultural land), applicants have to provide assurance that such development would not fragment high potential agricultural land and that it would significantly support the over-arching objective of environmental sustainability. The proposed development must, therefore, imply a direct, or indirect, positive impact on, for example, regional tourism, agriculture, environmental conservation and the interests of previously disadvantaged people.

The proposed development will have positive economic contributions in the form of employment opportunities that can be created for previously disadvantaged people within the local area during construction phase if the social environmental management programme (EMPr) is followed by EPC contractors and the proponent.

2.5 Relevant legislative permitting requirements

Table 2.1 overleaf provides an outline of the legislative permitting requirements applicable to the ILANGA CSP 4 PROJECT as identified at this stage in the project process.

Table 2.1: Relevant legislative permitting requirements applicable to the proposed ILANGA CSP 4 project

Legislation	Applicable Requirements
National Environmental Management Act (Act No 107 of 1998)	The EIA Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation. In terms of GN R982, R983, R984 and R985 of December 2014, a Scoping and EIA Process is required to be undertaken for the proposed project.
Environment Conservation Act (Act No 73 of 1989)	Developments are required to comply with the limits set within the National Noise Control Regulations (GN R154 dated 10 January 1992)
National Water Act (Act No 36 of 1998)	Water uses under Section 21 of the Act must be licensed, unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation (and then registration of the water use is required). Consumptive water uses may include the taking of water from a water resource and storage - Sections 21a and b. Non-consumptive water uses may include impeding or diverting of flow in a water course - Section 21c; and altering of bed, banks or characteristics of a watercourse - Section 21i.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. Requirements for Environmental Authorisation of mining related activities are as detailed within the NEMA EIA Regultions (GNR982 – 985). Section 53 Department of Mineral Resources: Approval from the Department of

Legislation	Applicable Requirements
	Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that might occur on site.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	No air emissions will result from the proposed project and therefore no air emissions license is required to be obtained. Reporting to the Air Emissions Licensing Authority (AELA) on emissions from small boilers (such as may be used for auxiliary power supply sources) would be required. Dust control Regulations have been promulgated under the Air Quality Act. In this regard, a dust monitoring plan may be required to be implemented if required by the AELA.
National Heritage Resources Act (Act No 25 of 1999)	This Act Provides for the protection of all archaeological and palaeontological sites, and meteorites (S35), the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority (S36), and lists activities which require developers any person who intends to undertake to notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of the proposed development (S38). A heritage permit is required should any sites of heritage significance be impacted by the proposed project.
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) » A list of threatened and protected species has been published in terms of S 56(1) - Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN

Legislation	Applicable Requirements
	R 152 (Threatened or Protected Species Regulations). » 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, GN 1002), 9 December 2011). » This Act also regulates alien and invader species. » A permit is required to be obtained to impact on any species listed in terms of this Act or associated Regulations.
Conservation of Agricultural Resources Act (Act No 43 of 1983)	» No permitting requirements in terms of this Act are applicable to the project under investigation. » Prohibition of the spreading of weeds (S5) » Classification of categories of weeds and invader plants (Regulation 15 of GN R1048) and restrictions in terms of where these species may occur. » Requirement and methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048).
National Forests Act (Act No. 84 of 1998)	» According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'. » A permit is required to be obtained to impact on any species listed in terms of this Act or associated Regulations.

Legislation	Applicable Requirements
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, cause extreme risk of injury etc., can be declared as Group I or Group II substance • Group IV: any electronic product; and • Group V: any radioactive material. The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. The Minister may amend the list by – » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of this Act (GN 921 of November 2013), a Basic Assessment or Environmental Impact Assessment is required to be

Legislation	Applicable Requirements
	undertaken for identified listed activities in support of an application for a waste license. Although no waste license is expected to be applicable to the project under investigation, one may be required should it be the intention of the developer to establish permanent spoil stockpile areas on the site. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in any other way rendered unlit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking. » The waste cannot be blown away. » Nuisances such as odour, visual impacts and breeding of vectors do not arise; and » Pollution of the environment and harm to health are prevented.
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 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

Legislation	Applicable Requirements
	National Road Traffic Act and the relevant Regulations. » A permit is required to be obtained for the transportation of abnormal loads.
Astronomy Geographic Advantage Act (Act No. 21 of 2007)	» The Astronomy Geographic Advantage Act (No. 21 of 2007) provides for the preservation and protection of areas within South Africa that are uniquely suited for optical and radio astronomy; for intergovernmental co-operation and public consultation on matters concerning nationally significant astronomy advantage areas and for matters connected thereto. » Chapter 2 of the act allows for the declaration of astronomy advantage areas while Chapter 3 pertains to the management and control of astronomy advantage areas. Management and control of astronomy advantage areas include, amongst others, the following: * Restrictions on use of radio frequency spectrum in astronomy advantage areas; * Declared activities in core or central astronomy advantage area; * Identified activities in coordinated astronomy advantage area; and * Authorisation to undertake identified activities.
Northern Cape Nature Conservation Act, Act No. 9 of 2009	This Act provides for the sustainable utilisation of wild animals, aquatic biota and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations, the following may apply to the current project: » Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property; » Aquatic habitats may not be destroyed or damaged; » The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species.

Legislation	Applicable Requirements
	» The Act provides lists of protected plant and animal species for the Province. » A permit is required to be obtained to impact on any species listed in terms of this Act or associated Regulations.

DESCRIPTION OF THE PROPOSED PROJECT CHAPTER 3

This chapter provides an overview of the Ilanga CSP 4 Project and details the project scope which includes the planning/design, construction, operation and decommissioning activities. This chapter also explores site and technology alternatives as well as the 'do nothing' option. An overview of the grid connection for the construction, operation and decommissioning activities are also discussed. Lastly, it explores the use of solar energy as a means of power generation.

3.1 Nature and extent of the Ilanga CSP 4 Project

The project is proposed to be developed on 3 of the Farm Matjiesrivier 41, located approximately 30 km east of Upington within the Khara Hais Local Municipality (ZF Mgcawu District Municipality) in the Northern Cape. This site is highly preferred by virtue of climatic conditions, relief and aspect, the availability of land, and proximity to a viable point of connection to the National grid through Eskom's Main Transmission Substation (MTS) Substation. The site is located immediately adjacent to authorised CSP sites (1.3, , 3, 4 & 5) and the Ilanga 1 Preferred Bidder Project which are located within the Karoshoek Solar Valley. In addition, the site falls within the Solar Development Corridor identified within the Northern Cape PSDF, as well as within Zone 7 of the REDZ. The site is therefore considered to be highly desirable for the proposed project.

3.1.1 Components of the Proposed Project

Solar power generating facilities use the energy from the sun to generate electricity. Concentrating Solar Power (CSP) collects the incoming solar radiation and concentrates it (focusing or combining it), on a single point, thereby increasing the potential electricity generation. The proposed Ilanga CSP 4 project will consist of parabolic trough technology with a heat transfer fluid (HTF), and a generation capacity of up to 150MW. Infrastructure associated with the facility includes:

» Parabolic troughs utilising a heat transfer fluid (HTF)
» Power Plant/Power Island: power island with steam turbine generator, auxiliary boilers, dry cooling and molten salt storage.
» Associated infrastructure: access roads, plant substation, power line, water abstraction point and supply pipeline, water storage tanks, packaged water treatment plant, lined evaporation ponds, and workshop and office buildings.

A parabolic trough system is comprised of two component groups, firstly a heat collection system and secondly a conventional generating plant portion. The heat collection system is comprised of **parabolic collectors** (i.e. trough-shaped reflectors which focus the solar radiation onto a receiver at its focal point), a **receiver tube/heat collection element** (i.e. a metal absorber containing the heat transfer fluid surrounded by a glass envelope (maintaining a vacuum), which absorbs the solar energy received from the parabolic trough), a **sun-tracking system** (i.e. an electronic control system and associated mechanical drive system used to focus the reflector onto the sun), and support structure (i.e. holds the parabolic trough in accurate alignment with incoming solar radiation while resisting the effects of the wind). The collected energy in the heat transfer fluid is used to generate steam through a conventional heat exchanger system that is in turn used for electricity generation in a conventional steam turbine and generator.

3.2 Need and Desirability of the Development at the Preferred Site Location

The area surrounding Upington in the Northern Cape has been earmarked as a hub for the development of solar energy projects due to the viability of the solar resource for the area, and this area is included in the solar corridor which has been identified by the Northern Cape Spatial Development Framework. At a national level, this area has been earmarked as a Renewable Energy Development Zone (REDZ) for solar development. The area is therefore considered to be highly desirable for the development of projects such as that being proposed.

The overarching objective for the Ilanga CSP 4 Project is to maximise electricity production through exposure to the solar resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts. From a regional site selection perspective, this region is considered to be preferred for solar energy development by virtue of its annual solar irradiation values (refer to Figure 3.1).

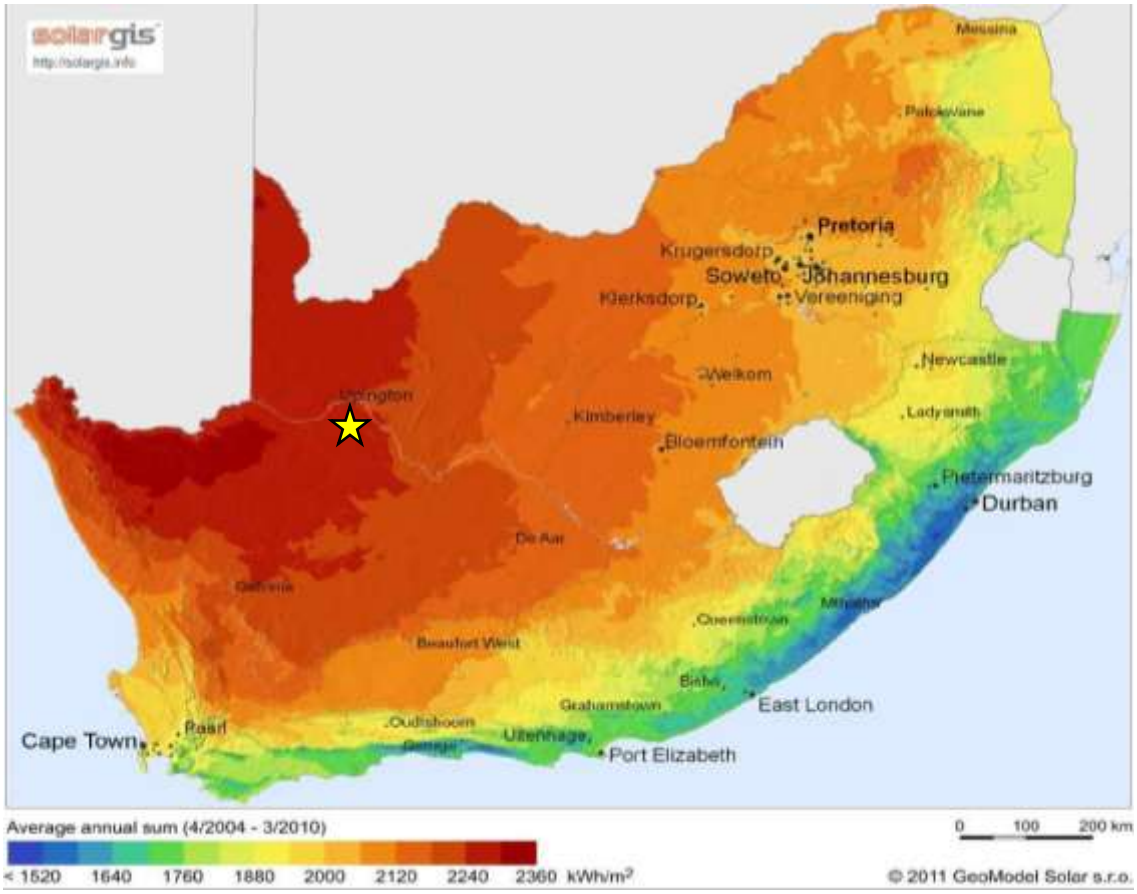

Figure 3.1: Solar irradiation map for South Africa; the proposed Ilanga CSP 4 Project position is shown by the yellow star on the map. (Source: adapted from GeoModel Solar, 2011).

From a local perspective, the site has specifically been identified by FG Emvelo (Pty) Ltd as being highly desirable for the development of a CSP Project due to its suitable topography (i.e. in terms of slope and local topography), site access (i.e. to facilitate the movement of machinery during the construction phase and operations staff in the long-term), land availability (i.e. the land is secured for the intended use), the extent of the site (i.e. the land parcel is able to accommodate the 680ha required for the facility), and enabling optimal placement of the infrastructure considering potential environmental sensitivities or technical constraints, as well as the consolidation of renewable projects within an already identified node. These favourable characteristics are further explored in the sections below.

At a Provincial level, the Northern Cape has been identified as the area with highest potential for solar renewable energy generation; with high solar radiation levels and the availability of vast tracts of land (refer to Chapter 3). There are already a number of CSP projects (and solar PV facilities) constructed and planned in the region. The development of another CSP project in the study area

will be in line with the objectives of the Khai-Ma Local Municipality Integrated Development Plan (IDP) (2012-2017) as well as the Namakwa District Municipality IDF (2012-2017), as the need for the development of the renewable sector has been identified in both Municipal plans. A more detailed description of the mandates set out by the Municipalities has been explained further in Chapter 2.

The Ilanga CSP 4 Project is proposed to be constructed outside of the Upington urban edge. Portion 2 of the Farm Matjiesrivier 41 itself has not been considered for an alternative land use such as urban development, nor is it currently extensively used for agriculture. The site is located within an area which has become a node for renewable energy projects, with the following preferred bidder projects (PB) located directly within a 30km radius from the project development site: Upington Airport Solar Energy Facility and the Ilanga Solar Thermal Power Plant to the east of the site (within the Karoshoek Solar Valley Development area).

The Ilanga CSP 4 Project will be located immediately adjacent to 5 authorised CSP sites (1.3, 1.4, 3, 4 & 5) and the Ilanga 1 preferred bidder project within the Karoshoek Solar Valley Development. Other authorised projects within 30km of the site include:

Project Name	DEA Ref. No	Location	Approximate distance from the Karoshoek Solar Valley Project development site	Project Status
Ilanga Solar Thermal Power Plant	12/12/20/2056	Lot 944 Karos Settlement	Within the Karoshoek Solar Valley development site	Preferred Bidder Round 3; under construction
Karoshoek Solar Valley Development	14/12/16/3/3/2/289 14/12/16/3/3/2/290 14/12/16/3/3/2/291 14/12/16/3/3/2/292 14/12/16/3/3/2/293 14/12/16/3/3/2/294 14/12/16/3/3/2/295 14/12/16/3/3/2/296 14/12/16/3/3/2/297 14/12/16/3/3/2/298	Matjesriver RE and 2/41, Matjesriver 3/41, Karos 956 and Lot 944 Karos Settlement	All within the Karoshoek Solar Valley development site	Received Authorisation

	14/12/16/3/3/2/299			
25MW Solar Energy Facility, North-East Of Upington, NC Province	12/12/20/2169	Remaining Extent of the Farm 418	20km north	Received Authorisation
Upington Airport PV Solar Energy Facility	12/12/20/2146	Upington International Airport	25km north west	Preferred Bidder Round 2; construction completed
Kheis Solar Phase 3 phases	14/12/16/3/3/2/569 14/12/16/3/3/2/570 14/12/16/3/3/2/571	Portion 7 and Portion 9 of the Farm Namakwari 656	30km south east	Received Authorisation
Albany Solar Energy Facility	14/12/16/3/3/2/639	Remainder of Farm Albany 405	25km north east	In Process
Avondale Solar Park 1	14/12/16/3/3/2/618	Portion 1 of the Farm Avondale No. 410	20km north	In Process

3.2.1 Receptiveness of the site to development of a CSP Project

FG Emvelo (Pty) Ltd considers this area and specifically the demarcated Portion 2of the Farm Matjiesrivier 41, to be highly preferred for the development of a concentrated solar power project from a technical perspective. This conclusion is based on the following considerations:

Extent of the site: Availability of relatively level land of sufficient extent can be a restraining factor to CSP development, as the proposed 50 MW solar systems and associated infrastructure requires up to 680 ha of land space. The larger farm portion is approximately 6800ha in extent, of which ~680 ha is allocated for the siting of the proposed Ilanga CSP 4 Project and associated infrastructure. This is approximately 15 % of the land surface area within the farm portion. The two authorised CSP projects (Site 3 and Site 4) located within the same farm portion occupy 1650ha collectively, with 4350 ha remaining for future development. This site is, therefore, considered sufficient for the installation of the Ilanga CSP 4 Project allowing for avoidance of sensitivities within the greater study

***Power transmission considerations*:** The future Eskom transmission substation on Eskom's CSP site west of Upington, known as the Upington MTS,

will have sufficient capacity for connecting the Ilanga CSP 4 Project. This distribution connection will be achieved via an on-site substation located at the project site or via a Karoshoek Solar Valley collector substation. The project site or the Karoshoek Solar Valley collector substation will connect back to back with the Upington MTS via a 132 kV line. Alternatively, this facility can connect to the Ilanga CSP1 substation located to the north-east of the site. This distribution connection will be achieved via an on-site substation located at the project site which will connect back to back with the Ilanga Substation using a 132 kV line. A power line of up to 400kV in capacity from the Karoshoek Solar Valley to Upington MTS has been authorised through a previous EIA process. This power line can loop-in and loop-out of the 400kV line linking the Upington MTS with Niewenhoop Substation. This will be achieved via a 400/132 kV substation located near the 400kV power line, and will connect back to back via 132kV lines that will connect to the Karoshoek Solar Valley collector substation. In addition, the proposed project site is situated within the proposed Central Corridor defined in terms of Eskom's Electricity Grid Infrastructure Strategic Environmental Assessment (SEA) conducted by the CSIR (refer to Figure 3.2.)[4].

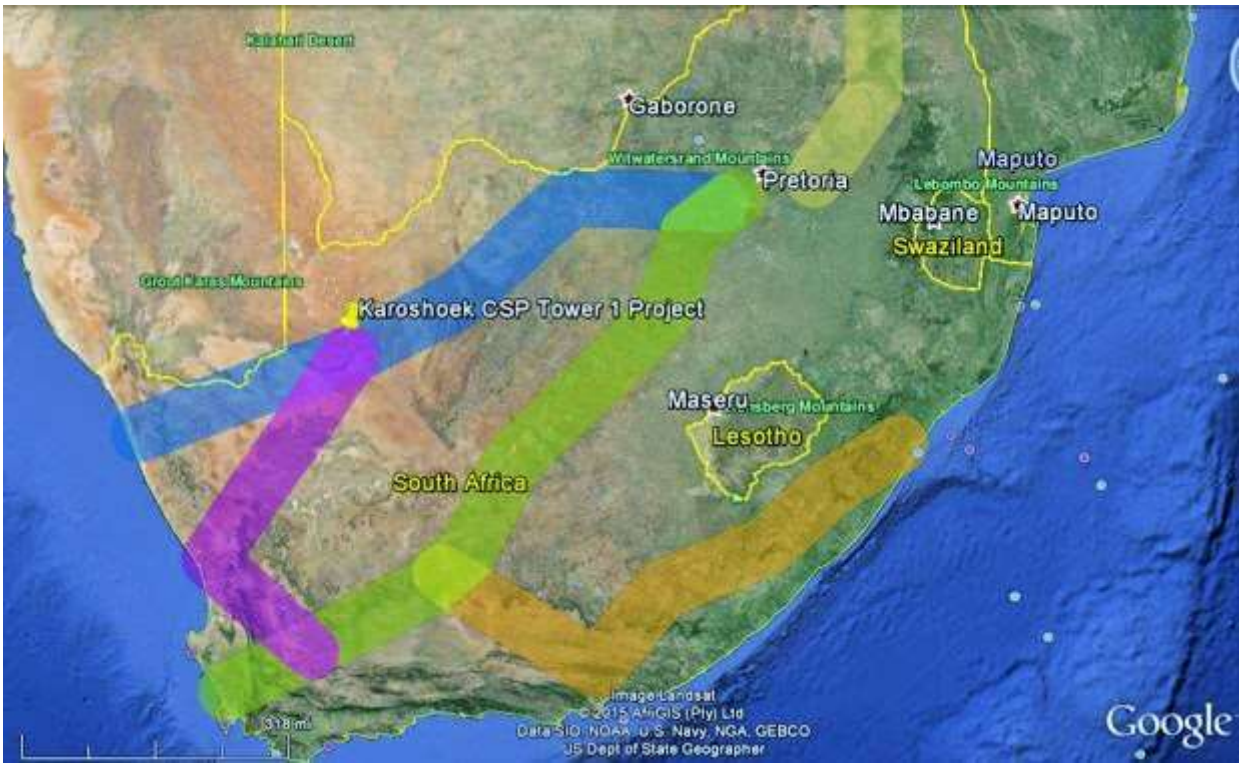

Figure 3.2: Eskom "Critical Power" Corridors as identified through the Eskom SEA. The Ilanga CSP 4 Project site is within the northern corridor as indicated on the map.

[4] These corridors are expected to be gazetted in early 2016.

***Site access*:** The study site is accessible via the N10 between Upington to Groblershoop. Access off the N10 will be via a gravel road located on Portion 2 of the Farm Matjiesrivier 41.

Current Land use considerations: The farm portion is currently used mainly for livestock farming. Cultivation is only undertaken in close proximity to the Orange River, approximately 8km to the north of the proposed development area. No significant portion of the vegetation has been transformed or altered to a semi-natural state. A few twin tracks and gravel farm roads traverse the study site.

Climatic conditions and Solar Irradiation: Climatic conditions determine the economic viability of a concentrated solar power project as it is directly dependent on the annual direct solar irradiation values for a particular area. The Northern Cape receives the highest average daily direct normal and global horizontal irradiation in South Africa which indicates that the regional location of the project is appropriate for a concentrated solar power project. . In addition, the area which lies to the east of Upington exhibits some of the best solar irradiation in South Africa and the world (refer to Figure 3.1). Global horizontal irradiation (GHI) for the Upington region varies between 2218 and 2282 kWh/m^2/annum. The GHI for the Ilanga CSP 4 Project site is in the region of approximately 2282 kWh/m^2/annum. Factors contributing to the preferred location of the project include the relatively high number of daylight hours and the low number of rainy days experienced in this region.

Topography: 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 area proposed for the CSP facility is however relatively flat. The elevation on the broader site varies from 820 to 950 m above sea level (amsl).

Proximity to Towns with a Need for Socio-Economic Upliftment

The Northern Cape Province, like most of South Africa, is marred by unemployment, inequalities and poverty. To this extent the Ilanga CSP 4 Project is situated in close proximity to the town of Upington and smaller settlements such as Dagbreek, Karos and Leerkrans and consequently, local labour would be easy to source, which fits in well with the REIPPPP economic development criteria for socio-economic upliftment. Currently, a large proportion of local labour is used in the mining and agricultural industry. A few negatives related to agricultural employment are that it is very seasonal and it is not always in close proximity to their homes, forcing workers to travel large distances on a daily basis to reach their place of employment. Owing to its proximity to preferred bidder projects, which are in various stages of the development and construction

cycles, the project would present a new opportunity for local labour skilled through previous work experience on the preferred bidder plants.

Proximity to Access Road for Transportation of Material and Components

The proximity of the site to the N10 decreases the impact on secondary roads from traffic during the construction and operation phases. As material and components would need to be transported to the project site during the construction phase of the project, the accessibility of the site was a key factor in determining the viability of the project, particularly taking transportation costs (direct and indirect) into consideration and the impact of this on project economics and therefore the ability to submit a competitive bid under the DoE's REIPPPP programme.

Environmental Sensitivity of the Site

As part of the EIA processes undertaken for the authorised sites within the Karoshoek Solar Valley Development, the sensitivity of the broader site was determined in order to inform the positioning of these facilities (refer to Figure 3.3). The areas within which these authorised facilities are planned do not infringe on any identified areas of high sensitivity. The siting of these facilities, and consequently that of the Ilanga CSP 4 Project is considered to be acceptable from an environmental perspective.

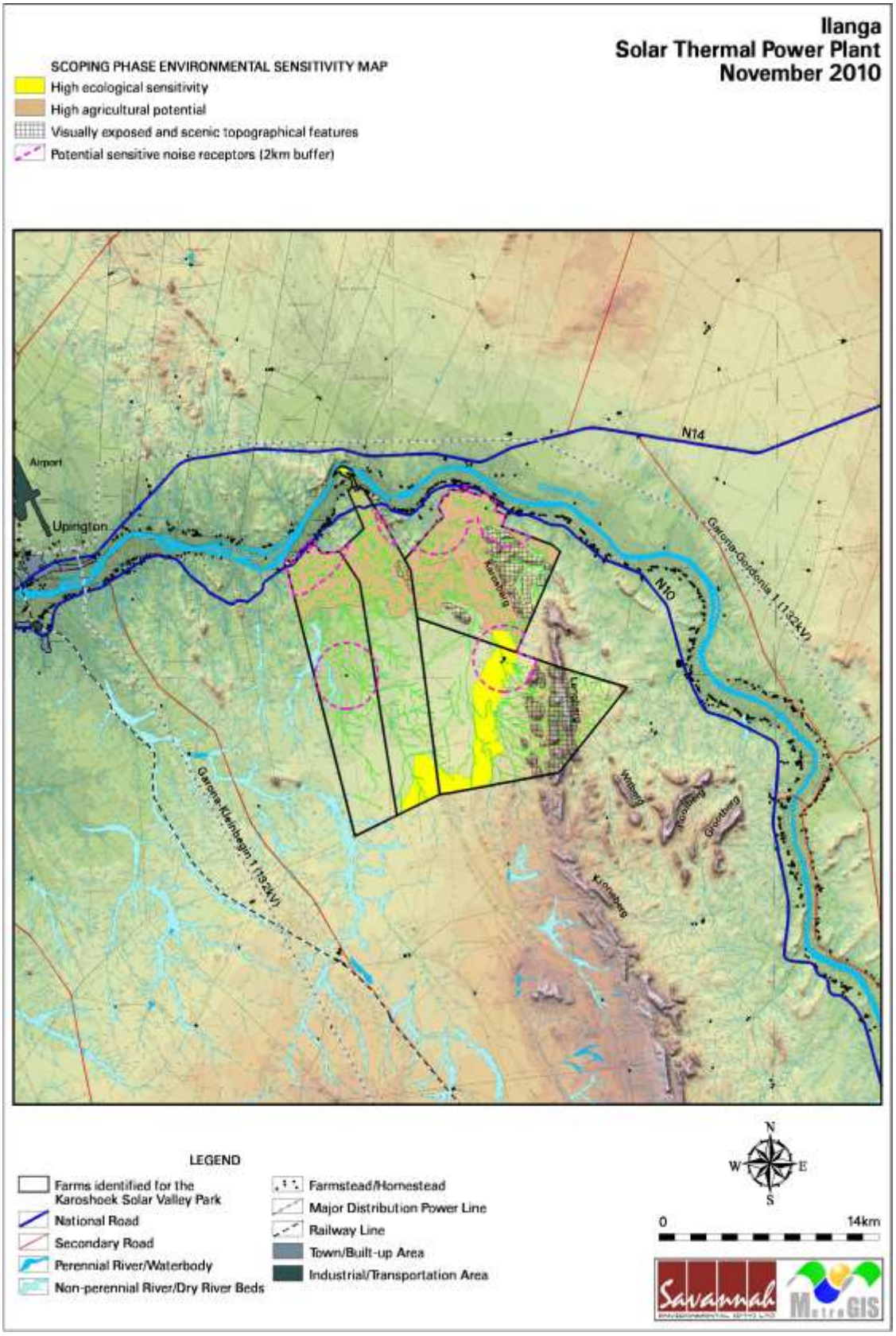

Figure 3.3: Environmental Sensitivity Map for the proposed Karoshoek Solar Valley Development east of Upington (Savannah Environmental, 2010).

3.2.2 Benefits of Renewable Energy

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

Increased energy security: The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a short timeframe and in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality in the short-term, while reducing expensive distribution losses. As a result of the power constraints in the first half of 2015, power generators meant to be the "barely-ever-used" safety net for the system (diesel-fired gas turbines) were running at > 30% average load factor in the first half of 2015. Load shedding occurred during 82 days in the first half of 2015 (out of 181 days). Results of a CSIR Energy Centre study for the period January to June 2015 (CSIR, August 2015), concluded that the already implemented renewable projects (wind and solar) within the country avoided 203 hours of so-called 'unserved energy'. During these hours the supply situation was so tight that some customers' energy supply would have had to be curtailed ('unserved') if it had not been for the renewables. The avoidance of unserved energy cumulated into the effect that during 15 days from January to June 2015 load shedding was avoided entirely, delayed, or a higher stage of load shedding prevented thanks to the contribution of the wind and PV projects (http://ntww1.csir.co.za/plsql/ptl0002/PTL0002_PGE157_MEDIA_REL?MEDIA_RELEASE_NO=7526896).

Resource saving: It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres per annum. As an already water-stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly due to the detrimental effects of climate change on water availability. Renewable energy also translates into revenue savings, as fuel for renewable energy facilities is free while compared to the continual purchase of fuel for conventional power stations. Results of a CSIR Energy Centre study for January – June 2015 (CSIR, August 2015) have quantified the contribution from renewable energy to the national power system and the economy over the first 6 months of 2015 compared to the 12 months of 2014:

2015 (6 months)	**2014 (12 months)**
R3.60 billion saving in diesel and coal fuel costs	R3.64 billion saving in diesel and coal fuel costs

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

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

Economics: As a result of the excellent solar resource within South Africa and competitive procurement processes, both concentrated solar power and solar PV power are now proven in South Africa as cheaper forms of energy generation than coal power. Renewables offer excellent value for money to the economy and citizens of South Africa.

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

Climate friendly development: The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be currently responsible for approximately 1% of global GHG emissions (and circa half of those for which Africa is responsible) and is currently ranked 9th worldwide in terms of per capita carbon dioxide emissions. The renewable energy sector saved South Africa 1.4 million tons of carbon emissions over the first 6 months of 2015 (http://www.iol.co.za/capetimes/renewable-energy-saving-sa-billions-csir-1.1903409#.VkNjdJq6FeU).

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

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

South African citizens including people from communities local to the IPP operations in the Northern Cape were 11 652 job years as at the end of June 2015 (Department of Energy. 2015).

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

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

Protecting the natural foundations of life for future generations: Actions to reduce the country's disproportionate carbon footprint can play an important part in ensuring our role in preventing dangerous anthropogenic climate change; thereby securing the natural foundations of life for generations to come. This is the basis of sustainable development.

3.3 Alternatives Considered in the Scoping Phase

In accordance with the requirements outlined in Appendix 2 of the EIA Regulations 2014, the consideration of alternatives including site and technology alternatives, as well as the "do-nothing" alternative should be undertaken. The follow sections address this requirement.

3.3.1 Site Alternatives

The siting of the initial facilities within the broader Karoshoek Solar Valley Development considered various critical criteria (as discussed in Section 3.2.1), including the sensitivity of the broader site in order to inform the positioning of these facilities (refer to Figure 3.3), as well as provincial and local planning in terms of renewable energy development. The areas within which these authorised facilities are planned do not infringe on any identified areas of high sensitivity. In addition, the broader site is located within the identified Solar Development Corridor as defined by the PSDF, as well as within a proposed REDZ for solar development. The siting of these facilities, and consequently that of the Ilanga CSP 4 Project is considered to be acceptable from an environmental perspective.

As the Ilanga CSP 4 Project is required to be located immediately adjacent to authorised Karoshoek LFTT 2 (1 x 100 MW Parabolic Trough)in order to facilitate

the development of a 150MW CSP facility (as required by the DoE), no feasible or reasonable site alternatives are available for consideration for this project.

3.3.2 Layout and Design Alternatives

A broader study area of approximately 6000ha is being considered, within which the development footprint for the Project of approximately 680 ha in extent would be appropriately located. The site can adequately accommodate the proposed CSP Project with a contracted capacity of 150 MW (proposed facility and authorised facility), as required under the DoE's REIPPPP programme. It is anticipated that the Project and its associated infrastructure (i.e. on-site substation and internal roads, etc.) can be appropriately positioned to avoid areas of environmental sensitivity. The development footprint of the Project would comprise 3% of the total extent of the farm portion. Therefore, the extent of the site allows for the identification of layout design and site-specific alternatives, should these be required.

The Scoping Phase aims to identify potentially environmentally sensitive areas on the site which should be avoided by the proposed development as far as possible. This is achieved through consideration of previous detailed investigations undertaken, desk-top studies for the proposed new project and limited field work. These areas will need to be considered in greater detail during the EIA Phase through site-specific specialist studies. The information from these studies will be used to inform the preferred layout for the proposed development site.

3.3.3 Technology Options

CSP technology was determined as the preferential technology for the proposed development site (i.e. over wind and photovoltaic (PV) technologies) based on the available resource and potential for power generation.

Trough technology has been identified as the preferred technology as this project will be constructed together with the adjacent site which has been authorised for trough technology, i.e. the same technology must be used. Therefore no technology alternatives will be considered.

3.3.4 Water source alternatives

The CSP technologies function through the generation of steam to drive a conventional steam turbine and generator. Therefore, suitable and sufficient water resources will be required over the life of the facility. During its operation the Ilanga CSP 4 Project will require 300 000m^3 - 400 000$m^3$of water per annum. During its 3 year construction phase 240 000m^3 per annum will be required. The

Department of Water and Sanitation (DWS) have confirmed in a letter dated 28 July 2015 that, after due consideration of the water resource availability in the catchment area, it was found the sufficient water is available to meet the water requirement of the project.

For the proposed project, FG Emvelo (Pty) Ltd will investigate abstraction from a point on the Orange River and conveyed via a water pipeline.

3.3.5 The 'Do-Nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the proposed Ilanga CSP 4 Project. Should this alternative be selected then the benefits of this renewable energy Project will not be realised, even though the generation of electricity from renewable energy resources offers a range of socio-economic and environmental benefits for South Africa.

The electricity demand in South Africa is placing increasing pressure on the country's existing power generation capacity and the resultant restrictions are severely damaging the economy. There is, therefore, a need for additional electricity generation options to be developed throughout the country. The 'do nothing' option in terms of implementing renewable energy projects results in a scenario where a fossil fuel or nuclear facility must rather be developed to provide the required energy demands. Environmental considerations aside, these have long lead times (considerably longer than the time required to implement renewable energy projects) and therefore the implementation of these options would result in delayed implementation and subsequent impacts on the South African economy and its citizens. Furthermore, the development of a renewable energy source, as promoted by the South African Government would also not be realised, and the reliance on fossil fuel energy sources would not be reduced, as has been committed to.

The purpose of the proposed Ilanga CSP 4 Project is to add new capacity for generation of renewable energy to the national electricity mix and to aid in achieving the goal of a 43% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE). It is fully aligned with government policy – aligns with policy at all three levels of government (see Chapter 2 of this Scoping Report) and for it not to be implemented is at odds with said policies.

The 'do-nothing' alternative would result in the additional power from this highly efficient and competitive renewable energy facility not being added to the electricity grid and for the associated socio-economic benefits not being available to enhance the lives of South Africans.

At this stage in the process, it is considered that the benefits of the proposed project would outweigh the costs. The EIA project team therefore concludes that there is no reason for the Ilanga CSP 4 Project not to be evaluated further and that its envisaged associated environmental and social impacts should be able to be satisfactorily mitigated to acceptable levels.

The "do nothing" option will be further assessed within the EIA phase of the process in order to confirm the above conclusion.

3.4 Concentrated Solar Power as a Power Generation Technology

3.4.1 What is a Parabolic Trough?

The pivotal component of this technology is the solar collector assembly (SCA) which consists of parabolic troughs (i.e. the reflectors) and cylindrical tubes (i.e. the receivers) which run in the focal line of the parabola (refer to Figure 3.4). The reflectors are made of mirrored glass panels which are supported by a truss system that gives the SCA its structural strength. Each SCA tracks the sun on a one-axis basis through an installed drive system thereby allowing for maximum generation capacity as the sun's trajectory changes on a daily and seasonal basis. The reflectors receive the incoming solar radiation and accurately concentrate it onto the receiver tube which is a highly efficient heat collection element. The heat is absorbed by the heat transfer fluid (HTF) (i.e. oil, or molten salt) which flows within the receivers and transfers the absorbed heat from the solar field to the power block of the solar facility in a closed circuit.

Figure 3.4: The top photograph illustrates the pipes conveying the heat transfer fluid and the bottom photograph illustrates the parabolic troughs together with the receiver tube (Source: Siemens AG)

3.4.2 Functionality of the proposed Parabolic Trough facility

The functionality of the proposed CSP facility is briefly discussed below as six steps (refer to Figure 3.6).

» *Step 1 - t*he solar radiation is concentrated by the mirrors onto the receiver tube (refer to Figure 3.4) which contains the heat transfer fluid. The solar collectors track the sun during the progression of the day in order to maximise the solar energy yield.
» *Step 2* - the HTF is heated and circulated through the solar field via a series of metal pipes which run aboveground (refer to Figure 3.5).

Figure 3.5: The pipes lain between the troughs convey the heat transfer fluid (Source: Siemens AG)

» *Step 3* - heat exchangers transfer the thermal energy from the HTF to the water steam cycle.
» *Step 4* - cooled HTF is returned to the solar field to repeat the cycle.
» *Step 5:* the water steam cycle transfers the thermal energy to the steam turbine generator which converts the thermal energy to electric power

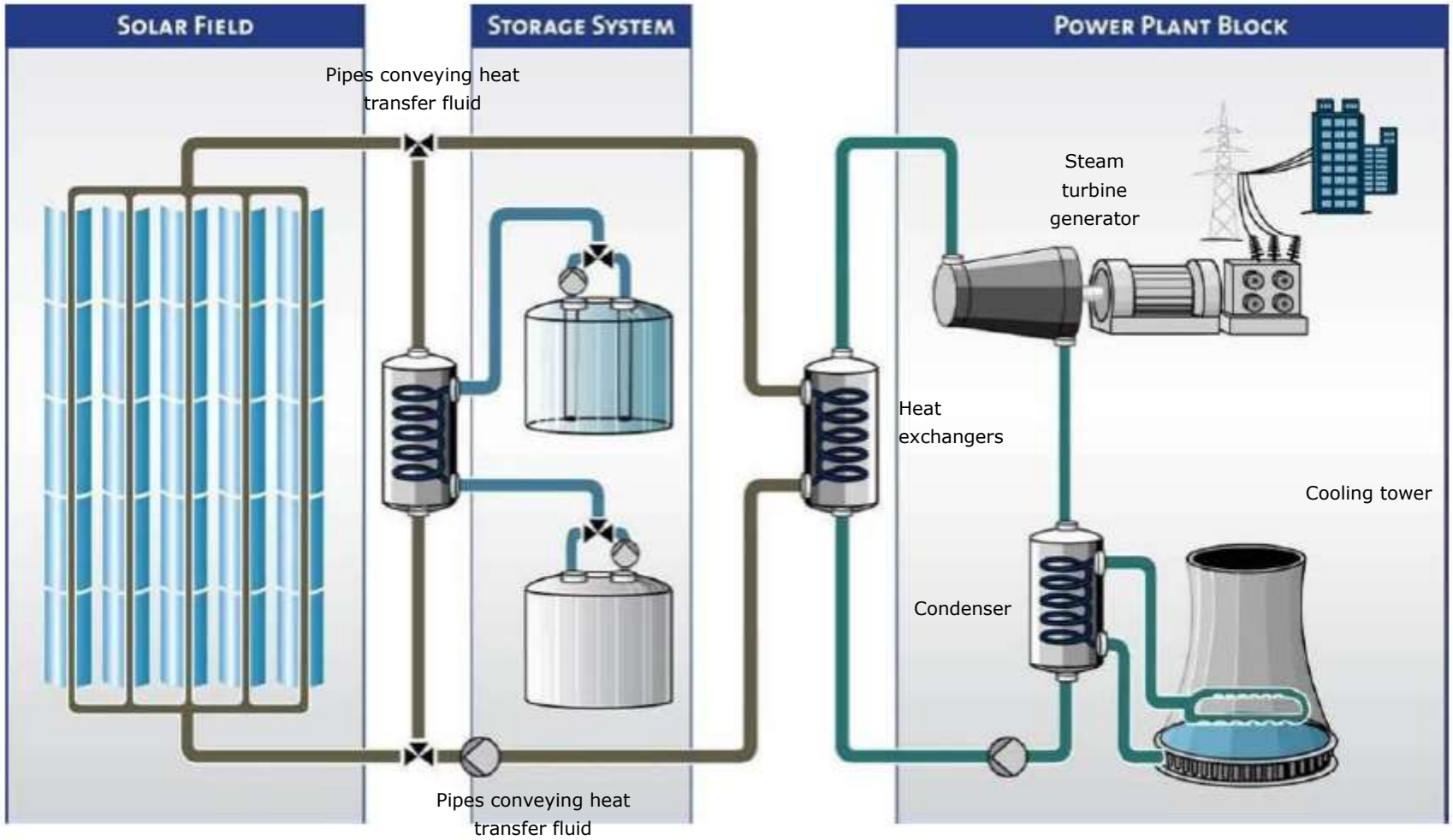

Figure 3.6: Schematic diagram of concentrating solar plant utilising parabolic trough technology with storage

» *Step 6* - dry cooling will be employed, whereby an air cooled condenser is used to condensate the exhaust steam from the steam turbine. The condensed water is then circulated back to the heat exchangers to repeat the water-steam-cycle. In terms of waste production there is no difference to a conventional power plant with dry cooling, except for the waste produced from the usage of fossil fuel.

» During sunlight hours the surplus heat of the solar field is charged into the hot molten salt tank. A partial mass flow of hot HTF coming from the solar field flows through the heat exchanger and transfers its heat to the so called "cold" molten salt until the salt reaches the "hot" tank temperature. Vice versa during the night or in low irradiation periods the stored hot molten salt is discharged, to heat up the cold HTF in order to supply the heat demand of the power plant's steam generator. In case that the incident irradiation on the solar field is not sufficient to provide enough heat for the steam generator and the hot storage tank is not fully discharged the plant would be operated in hybrid mode (solar field + TES). In this way short periods of non-stable irradiation (clouds) or other significant disturbances in the solar field can be compensated and constant electrical output from the power plant is assured.

3.4.3 Description of the Project Infrastructure

The proposed Ilanga CSP 4 Project is proposed to include several parabolic troughs with a generating capacity of up to 50 MW. A summary of the details and dimensions of the planned infrastructure associated with the Project is provided in Table 3.1.

Table 3.1: Details or dimensions of typical structures required for the Ilanga CSP 4 Project

Infrastructure	Footprint	Height
Parabolic troughs solar field and	up to 400 ha	6 m
Power island and steam turbine and generator	200m x 500m	30m
Molten salt storage tanks	4 tanks each 40 m diameter	30 m
Auxiliary boilers	10m x 10 m	5 m
Water storage reservoir and tanks (combined capacity up to 15 000m^3) and associated infrastructure	Tanks 15 to 20m diameter	Up to 20 m
Substation	50m x 50 m	30 m
132 kV power line	32 m servitude, 8 km in length	20-30 m towers
Workshop building (maintenance) and office buildings	20m x 50 m each	20 m

Infrastructure	Footprint	Height
Packaged waste treatment plant	30m x 30 m	10 m
Lined evaporation ponds	5 ha - 5 ponds 100m x 100m each	1.8 m deep
Mirror assembly facility	100m x 50m	20 m
Internal access roads	6m wide, 10 km in length	n/a
Water abstraction point located at the Gariep River, filter station	20m x 30m	1 storey
Water supply pipeline[5]	~14km in length	± 1m depth (where practical)
Temporary laydown area and construction camp.	200m x 200 m	10 m
Concrete batching plant	112m x 80 m	15 m

3.5 Proposed Activities during the Project Development Stages

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

3.5.1. Design and Pre-Construction Phase

Conduct Surveys

Prior to initiating construction, a number of surveys will be required including, but not limited to:

» Geotechnical survey - the geology and topography of the development footprint will be surveyed. The geotechnical study will focus on topographical constraints, foundation conditions, potential for excavations, and the availability of natural construction materials. The geotechnical examination will include surface and subsurface exploration, soil sampling and laboratory analysis.

» Site survey - will be done for the finalisation of the design layout of the solar arrays, and the other associated infrastructure. The micro-siting footprint will consider any environmental sensitivity identified during the EIA Phase investigations and will need to be confirmed in line with the Environmental Authorisation issued for the Project.

[5] To be assessed within separate Basic Assessment process.

3.5.2. Construction Phase

Establishment of Access Roads to the Site

The study site is accessible via the N10 from Upington to Groblershoop. Access to the site will be off the N10 located to the north of the site.

Depending on the technology choices there will be a 1.5 km internal tarred access road of approximately 8 m wide which will lead directly to the power island. Between the heliostats there will be a stabilised gravel track that would be used for maintenance purposes during the operational phase. The final layout of the access roads will be determined following the identification of site related sensitivities

Undertake Site Preparation

Site preparation activities will include clearance of vegetation at the footprint of each component and the establishment of internal access roads. These activities will require the stripping of topsoil which will need to be stockpiled, backfilled and/or spread on site.

Transport of Components and Equipment to Site

The components for the proposed Project will be transported to site in sections by road. Some of the Project components may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)[6] by virtue of the dimensional limitations (i.e. length and weight). Components of various specialised construction and lifting equipment are required (e.g. for the power tower) and will need to be transported to site. In addition to the specialised lifting equipment/cranes, the typical civil engineering construction equipment will need to be brought to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.) as well as components required for the establishment of the substation and power line.

The equipment will be transported to the site using appropriate National, Provincial and local roads, and then the dedicated access/haul road to the site itself. In some instances, the dimensional requirements of the loads to be transported during the construction phase (length/height) may require alterations to the existing road infrastructure (e.g. widening on corners), and protection of road-related structures (i.e. bridges, culverts, etc.) as a result of abnormal loading.

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

Establishment of Laydown and Assembly Areas on Site

Laydown and assembly (including the mirror assembly area) areas including storage areas of approximately 10ha will be required for the typical construction equipment which will be required on site. Hardstand areas will need to be established for operation of cranes used on the site.

Construct Power Island and Substation

A steam turbine and generator will be housed within a 2-storey building (power island). A generator transformer and a small substation will be established outside the building. The position of the power island and substation within the site footprint will be informed by the final positioning of the solar generating components.

The construction of the power island and substation would require a survey of the site, site clearing and levelling and construction of access road/s (where required), construction of a level terrace and foundations, assembly, erection, installation and connection of equipment, and rehabilitation of any disturbed areas and protection of erosion sensitive areas.

Establishment of Ancillary Infrastructure

Ancillary infrastructure includes water abstraction point and supply pipeline, packaged waste treatment plant, a water treatment plant and water storage facilities on the site, and a blow down or evaporation pond (for wastewater from the generation process). A, Heliostat assembly plant, temporary storage area, control room, office area, chemical storage area, security gate building, contractor's temporary offices, and critical staff accommodation, will also be required. The location and number will be determined during the EIA phase.

The establishment of these facilities/buildings will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction.

Water Usage Associated with the Ilanga CSP 4 Project[7]

Water treatment works will be required, as well as blow down brine handling. The water treatment works will include a primary treatment or basic sand filtration plant at the supply source, as well as a reverse osmosis and deionisation packaged water treatment plant at the site. A water supply pipeline will be established from the extraction point on the Orange River to the site. Abstracted water will be pumped to a holding reservoir for supply buffering. A second

[7] It should be noted that water usage associated with the proposed development will be assessed under a separate basic assessment process.

storage reservoir will be located on the identified site itself. The water use of the project will include (refer to Table 3.2):

» Makeup water for the steam generator
» Water for mirror washing
» Service water
» Potable water
» Fire protection water

Table 3.2: Estimated water consumption for one 150MW CSP Plant

Description: consumption	**Approximate annual use (m^3/year)**
Raw water consumption	Up to 400 000
Description: water uses	**Approximate annual use (m^3/year)**
Mirror washing	80 000
Boiler makeup	60 000
Potable and other	9 000
Evaporation losses	85 000
Wastewater to evaporation ponds	Up to 150 000

In order to reduce the overall water consumption and the requisite sizing of the evaporation ponds, service water will first be used as makeup. Water conditioning chemicals may be fed into the makeup water to minimise corrosion and to inhibit mineral scale formation. The blow down from the circulating water will be continually treated by lime-softening clarification and filtration processes and then delivered to a clear well where the water will be treated by reverse osmosis prior to being used for other plant requirements. Prior to the reverse osmosis process, ion-exchange softeners will be used to remove any dissolved hardness minerals that remain after the clarifier. The discard brine stream will be delivered to the evaporation ponds

Undertake Site Rehabilitation

Once construction is completed and once all construction equipment is removed, the site must be rehabilitated where practical and reasonable. On full commissioning of the Project, any access points to the site which are not required during the operational phase must be closed and prepared for rehabilitation.

Storage and Handling of Hazardous substances

The construction phase will require the handling and storage of materials including hydraulic oil, fuel, cement and fly ash (for use in concrete batching

plant) with an estimated volume of 300-400 m^3 (cubic meters) at any one time (mainly made up of the batching material).

3.5.3. Operational Phase

The proposed concentrated solar power project is expected to be operational for a minimum of 20 years. The project will operate continuously, 7 days a week, for up to 18 hours (as a result of storage). While the project will be largely self-sufficient upon completion of construction, monitoring and periodic, as needed maintenance activities will be required. Key elements of the Operation and Maintenance plan include monitoring and reporting the performance of the project, conducting preventative and corrective maintenance, receiving visitors, and maintaining security of the project.

The operational phase is discussed in more detail below. A simplified flow chart of the general operation of a CSP Plant showing inputs and outputs of the process is shown in the table below.

Table: 3.3: Process Flow For A Solar Thermal Plant – Operational Phase Only

INPUT	PROCESS	OUTPUT
Solar energy	**Solar thermal energy generation process**	*Positive outputs:* Energy / electricity
Water		*Negative outputs:* Wastewater
Fossil fuel to start up		*Negative outputs:* Limited exhaust fumes / CO_2
Dosing chemicals for water treatment plant		*Negative outputs:* Waste water / brine stream to evaporation ponds

Water use and treatment

A small water treatment works will be required, as well as blow down brine handling. The water treatment works will include a primary treatment or basic sand filtration plant at the supply source, as well as a reverse osmosis and deionisation packaged water treatment plant at the site.

Water for the proposed facilities will be stored in a holding reservoir. A second storage reservoir will be located on the identified site itself. It is estimated that 240 000m^3 of water will be required for the proposed project (150MW in total). The water use of the project will include:

» Makeup water for the steam generator
» Water for mirror washing
» Service water

» Potable water
» Fire protection water

Site Operation and Maintenance

It is anticipated that a full-time security, maintenance and control room staff will be required on site. Each component within the solar thermal plant will be operational except under circumstances of mechanical breakdown, unfavourable weather conditions or maintenance activities.

Non-hazardous solid wastes (maintenance-derived wastes) will be recycled to the extent practical. Those maintenance-derived wastes that cannot be recycled will be transported for disposal at an appropriate landfill.

Evaporation Ponds

Up to 5 evaporation ponds (5ha) will be required for the facility. The purpose of the evaporation ponds is to receive the water discard stream from the generation process. The evaporation ponds will be located on the site and within the development footprint. The proposed facility will be operated as a Zero Liquid Effluent Discharge (ZLED) facility; therefore no wastewater from the evaporation ponds will be permitted to be released into the environment or any water bodies. Each pond will have a surface area of approximately 1ha and be 1.8m deep including free board. A picture of a typical evaporation pond required for a CSP Plant is shown in Figure 3.7.

Figure 3.7 Photograph of a typical lined evaporation pond utilised for a CSP Plant

3.5.1 Decommissioning Phase

The CSP Project is expected to have a design lifespan of approximately 35 years (extendable with appropriate refurbishment), and the power plant infrastructure would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the Project discussed in this EIA would comprise the disassembly and replacement of the individual components with more appropriate technology/infrastructure available at that time.

The following decommissioning activities will form part of the project scope.

Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate the required equipment (e.g. lay down areas, construction platform) and the mobilisation of decommissioning equipment.

Disassemble and Replace Existing Components

When the project is ultimately decommissioned, the equipment to be removed will depend on the proposed land use for the site at that time. At this time, all above ground facilities that are not intended for future use at the site will be removed. Underground equipment (e.g. foundation, wiring) will be, and the surface restored to the original contours. Much of the above ground wire and steel, of which the system is comprised are recyclable materials and would be recycled to the extent feasible. The components of the plant would be deconstructed and recycled or disposed of in accordance with regulatory requirements. The site will be rehabilitated and can be returned to the agricultural or other beneficial land-use.

Future plans for the site and infrastructure after decommissioning

The plant capacity would degrade by approximately 15% over 20 years as a result of ageing infrastructure. The plant will have the opportunity to generate power for a Merchant Market operation (i.e. the client would sell power on bid basis to the market).

APPROACH TO UNDERTAKING THE SCOPING PHASE CHAPTER 4

An Environmental Impact Assessment (EIA) process refers to that process (in line with the EIA Regulations) which involves the identification of and assessment of direct, indirect, and cumulative environmental impacts associated with a proposed project/ activity. The EIA process comprises two main phases: i.e. **Scoping Phase** and **EIA Phase**. The EIA process culminates in the submission of an EIA Report (including an Environmental Management Programme (EMPr)) to the competent authority for decision-making. The EIA process is illustrated below:

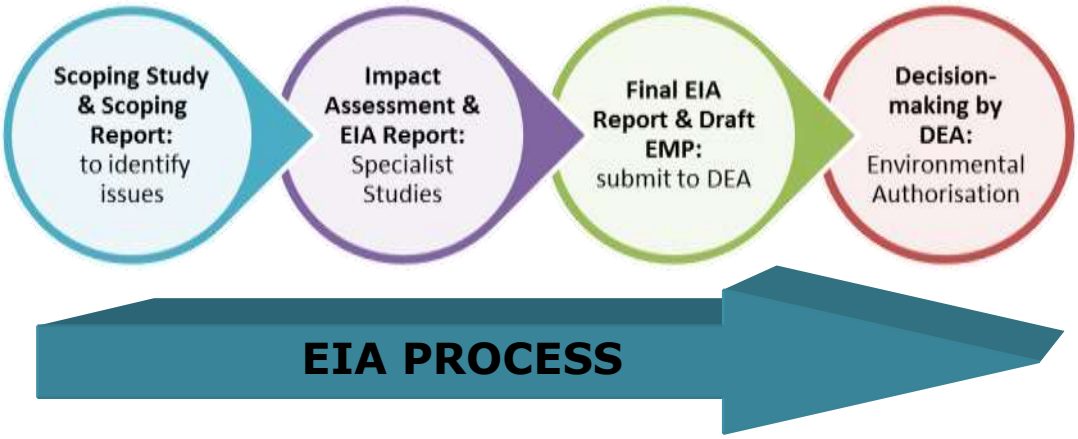

Figure 4.1: The Phases of an EIA Process

The Scoping Phase for the proposed Ilanga CSP 4 Project has been undertaken in accordance with the Section 24(5) of the National Environmental Management Act (No 107 of 1998). In terms of the EIA Regulations (2014) of GN R982, a Scoping and EIA Study are required to be undertaken for this proposed project. In accordance with these Regulations, this scoping process aimed at identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project involving consideration of previous assessments undertaken for the broader site, desk-top specialist studies, limited field surveys, as well as a consultation process with key stakeholders (including relevant government authorities) and interested and affected parties (I&APs). This chapter serves to outline the process which was followed during the Scoping Phase of the EIA process.

4.1. Relevant Listed Activities

In terms of the EIA Regulations, 2014 published within GN R983, GN R984 and GN R985; the following 'listed activities' are triggered by the proposed facility as shown in **Table 4.1** below.

Table 4.1: Listed activities triggered by the proposed Ilanga CSP 4 Project

Number and date of the relevant notice:	Activity No(s) (in terms of the relevant notice):	Description of each listed activity as per project description
GN 983, 08 December 2014	12 (xii)(a)(c)	The development of – (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.; ***infrastructure associated with the CSP facility will be constituted within or within 32 m of a non-perennial stream***
GN 983, 08 December 2014	19 (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 of more than 5 cubic metres from- (i) a watercourse. ***The facility and/or associated infrastructure will require the infilling or depositing of any material of more than 5 cubic metres into, or the excavation or moving of soil or rock of more than 5 cubic metres from a watercourse (ephemeral drainage lines).***
GN 983, 08 December 2014	28 (ii)	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare ***The development footprint for the proposed solar energy facility (infrastructure and associated areas) will cover an area greater than 1 hectare on land***

Number and date of the relevant notice:	Activity No(s) (in terms of the relevant notice):	Description of each listed activity as per project description
		currently zoned for agriculture.
GN 984, 08 December 2014	1	The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more; ***The Facility will consist of a CSP facility utilising trough technology with a generation capacity of up to 50MW.***
GN 984, 08 December 2014	6	The development of facilities or infrastructure for any process or activity which requires a permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent. ***A water use license will be required for the discharge of wastewater to the evaporation dams.***
GN 984, 08 December 2014	14	The development of facilities or infrastructure, for the storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres ***The facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good will be required. The storage containers will have a combined capacity of 80 but not exceeding 500 cubic metres***
GN 984, 08 December 2014	15	The clearance of an area of 20 hectares or more of indigenous vegetation ***The development footprint for the proposed CSP facility (infrastructure and associated areas) will require clearance of vegetation of an area greater than 20 hectares.***

On the basis of the above listed activities, a Scoping and an EIA Phase is required to be undertaken for the proposed project. This process is to be undertaken in two phases as follows:

» The Scoping Phase includes the identification of potential issues associated with the proposed project through a desktop study and consultation with affected parties and key stakeholders. Areas of sensitivity within the broader site are identified and delineated in order to identify any environmental fatal flaws, and sensitive or no go areas. Following a public review period of the

draft report, this phase culminates in the submission of a final Scoping Report and Plan of Study for EIA to the DEA.

» The EIA Phase involves a detailed assessment of potentially significant positive and negative impacts (direct, indirect, and cumulative) identified in the Scoping Phase. This phase includes consideration of a proposed facility layout through detailed specialist investigations and public consultation. Following a public review period of the draft report, this phase culminates in the submission of a Final EIA Report and an Environmental Management Programme (EMPr), including recommendations of practical and achievable mitigation and management measures, to DEA for review and decision-making.

4.2. Objectives of the Scoping Phase

This draft Scoping Report documents the evaluation of the potential environmental impacts of the wind energy facility and the associated infrastructure and forms part of the EIA process. The Scoping Phase was conducted in accordance with the requirements of the EIA Regulations in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

This Scoping Phase aims to:

» Identify and evaluate potential environmental (biophysical and social) impacts and benefits of the proposed development (including design, construction, operation and decommissioning) within the broader study area through a desk-top review of existing baseline data and specialist studies.
» Identify potentially sensitive environmental features and areas on the site to inform the preliminary design process of the wind energy facility.
» Define the scope of studies to be undertaken within the EIA process.
» Provide the authorities with sufficient information in order to make a decision regarding the scope of issues to be addressed in the EIA process, as well as regarding the scope and extent of specialist studies that will be required to be undertaken as part of the EIA Phase of the process.

Within this context, the objectives of this Scoping Phase are to, through a consultative process:

» Identify the relevant policies and legislation relevant to the project;
» Motivate the need and desirability of the proposed project, including the need and desirability of the activity in the context of the preferred location;
» Identify and confirm the preferred project and technology alternative;
» Identify and confirm the preferred site;

» Identify the key issues to be addressed in the EIA phase;
» Agree on the level of assessment to be undertaken, including the methodology to be applied, the expertise required as well as the extent of further consultation to be undertaken to determine the impacts and risks the project will impose on the preferred site through the life of the project, including the nature, significance, consequence, extent, duration and probability of the impacts to inform the location of the development footprint within the preferred site; and
» Identify suitable measures to avoid, manage or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

4.3. Overview of the Scoping Phase

The Scoping Phase has been undertaken in accordance with the EIA Regulations published in terms of NEMA in Government Notice 38282 of 4 December 2014 as amended. Key tasks undertaken within the scoping phase included:

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
» Submission of the completed application form for authorisation to the competent authority (DEA) in terms of Regulations 5 and 16 of Government Notice R982 of 2014.
» Undertaking a public involvement process throughout the Scoping process in accordance with Chapter 6 of Government Notice R982 of 2014 in order to identify issues and concerns associated with the proposed project.
» Undertaking of independent specialist studies in accordance with Appendix 6 of Government Notice R982 of 2014.
» Preparation of a Scoping Report and Plan of Study for EIA in accordance with the requirements of Appendix 2 of Government Notice No R982 of 2014.
» Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process.

The tasks are discussed in detail below.

4.3.1. Authority Consultation and Application for Authorisation in terms of GNR982 of 2014

As this is an energy generation project the National Department of Environmental Affairs (DEA) is the competent authority for this application. As the project falls within the Northern Cape, the Department of Environmental and Nature Conservation (DENC) acts as a commenting authority for the project.

Consultation with these authorities has been undertaken throughout the Scoping process. This consultation has included the following:

» Submission of the application for authorisation to DEA;
» Submission of the draft Scoping Report for review by I&APs, the Organs of State and the competent authority.

A record of all authority consultation undertaken prior to and within the Scoping Phase is included within **Appendix C**.

4.3.2. Public Participation

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

» All relevant stakeholders and I&APs are identified and consulted with.
» Information containing all relevant facts in respect of the application is made available to stakeholders and I&APs.
» Participation by stakeholders and I&APs is facilitated in such a manner that they are all provided with a reasonable opportunity to comment on the application.
» Comments received from stakeholders and I&APs are recorded and considered in the EIA process, where appropriate.

The following sections detail the tasks which were undertaken as part of the public participation process.

i. Stakeholder identification

The first step in the public involvement process was to initiate the identification of relevant stakeholders and interested and affected parties (I&APs). This process was undertaken through existing contacts and databases, as well as through the process of networking. Stakeholders identified are listed in **Table 4.2** below:

Table 4.2: List of Stakeholders identified during the Scoping Phase

Organs of State
National Government Departments
Department of Agriculture, Forestry and Fisheries (DAFF)
Department of Communications
Department of Energy (DoE)
Department of Mineral Resources (DMR)
Department of Public Works (DPW)
Department of Rural Development and Land Reform (DRDLR)

Department of Water and Sanitation (DWS)
Department of Science and Technology (DST)
Government Bodies and State Owned Companies
Eskom SOC Limited
National Energy Regulator of South Africa (NERSA)
Sentech
South African Civil Aviation Authority (SACAA)
South African Heritage Resources Agency (SAHRA)
South African National Roads Agency Limited (SANRAL)
Square Kilometre Array: Southern Africa
Telkom SA Ltd
Provincial Government Departments
Ngwao-Boswa Ya Kapa Bokone (Northern Cape Provincial Heritage Resources Authority)
Northern Cape Department of Agriculture, Land Reform and Rural Development
Northern Cape Department of Environment and Nature Conservation (DENC)
Northern Cape Department of Roads and Public Works
Local Government Departments
Khara Hais Local Municipality (KHLM)
ZF Mgcawu (previously Siyanda) District Municipality (ZF MDM)
Conservation Authorities
BirdLife South Africa
Wildlife and Environment Society of South Africa (WESSA)
Landowners
Affected landowners and tenants
Neighbouring landowners and tenants

ii. Stakeholder Database

All relevant stakeholder and I&AP information has been recorded within a database of interested and affected parties (refer to **Appendix C** for a listing of recorded parties). While I&APs have been encouraged to register their interest in the project from the start of the process, the identification and registration of I&APs will be on-going for the duration of the EIA process. The I&AP database will be updated throughout the EIA process, and will act as a record of the parties involved in the public involvement process.

iii. Adverts and Notifications

In order to notify and inform the public of the proposed project and invite members of the public to register as I&APs for the project and EIA process, an advert have been placed in the Gemsbok and the Volksblad newspapers which are read in the study area. The advertisements have been placed in both English and

Afrikaans in order to inform the wider community. The advert provides information on the following (in terms of Regulation 41):

» the details of the project; and
» the availability of the draft Scoping Report

Site notices (in English and Afrikaans) were placed at visible points along the N10 and at the boundary of the Remainder of the Farm Matjiesrivier 41 and Portion 2 of the Farm Matjiesrivier, in accordance with the requirements of the EIA Regulations. Further notices were placed at the Upington Public Library and at the Upington Police Station. In addition to the advertisements and site notices, key stakeholders and registered I&APs were notified in writing of the commencement of the EIA process and the availability of the draft Scoping Report. Copies of all the advertisements, site notices and written notifications are included within **Appendix C**.

iv. Public Involvement and Consultation

In order to provide information regarding the proposed project and the EIA process, a background information document (BID) for the project was compiled at the outset of the process (refer to **Appendix C**). The BID will be distributed to identified stakeholders and I&APs, additional copies will be made available at public venues within the broader study area, and it will be posted electronically on the Savannah Environmental website.

Through consultation with key stakeholders and I&APs, issues for inclusion within the issues-based scoping study will be identified and confirmed prior to the final submission of the report. In order to accommodate the varying needs of stakeholders and I&APs within the study area, as well as capture their views, issues and concerns regarding the project, various opportunities will be provided in order for I&APs to have their issues noted. I&APs will be consulted through one-on-one consultation meetings during the EIA Phase (for example with directly affected or surrounding landowners), telephonic consultation sessions, and written, faxed or e-mail correspondence.

4.3.3. Identification and Recording of Issues and Concerns

All comments received from stakeholders and I&APs on the proposed project will be included in the Final Scoping Report. A Comments and Response Report will be compiled to include all comments received during the scoping phase of the process, including those received in the public review period of the draft Scoping Report.

4.3.4. Public Review of Draft Scoping Report and Feedback Meeting

The Draft Scoping Report has been made available for public review from **13 November 2015 – 14 December 2013** at the following locations:

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

All registered I&APs have been notified of the availability of the draft Scoping Report via email and registered post at the commencement of the review period (refer to **Appendix C**).

4.3.5. Authority comments on the draft Scoping Report

Organs of State/Authorities who have jurisdiction over matters relating to the environment, as identified in Table 4.2, were invited to comment on the draft Scoping Report (refer to **Appendix C**).

4.3.6. Evaluation of Issues Identified through the Scoping Process

Issues (both direct and indirect environmental impacts) associated with the proposed project identified within the scoping process have been evaluated through desk-top studies. In evaluating potential impacts, Savannah Environmental has been assisted by the following specialist consultants:

Specialist	Area of Expertise	Refer Appendix
Gerhard Botha of Savannah Environmental	Ecology	Appendix D
Dr Rob Simmons of Bird and Bat Unlimited Environmental Consultants	Avifauna	Appendix E
Peter Kimberg of the Biodiversity company	Aquatics	Appendix F
Stuart Dunsmore of Fourth Element Consulting (Pty) Ltd	Hydrology	Appendix G
Jaco van der Walt of Heritage Contracts	Heritage	Appendix H
John Almond of Natura Viva cc	Palaeontology	Appendix I
Jaco Jansen of Savannah Environmental	Agricultural potential & Soils	Appendix J
Candice Hunter of Savannah Environmental	Social	Appendix K
Jon Marshall of Afzelia Environmental Consultants & Environmental Planning and Design	Visual	Appendix L

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

» Identify the **nature** of the potential impact, which includes a description of what causes the effect, what will be affected and how it will be affected
» Identify the **extent** of the potential impact, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development) or regional
» Identify **sensitive receptors** that may be impacted on by the proposed facility and the **types of impacts** that are most likely to occur.

» Evaluate the **significance** of potential impacts in terms of the requirements of the EIA Regulations.
» Identify the potential impacts that will be **considered further** in the EIA Phase.

Specialist Scoping Reports are contained within **Appendices D – L**.

4.3.7. Final Scoping Report

The final stage in the Scoping Phase includes the capturing of responses from stakeholders and I&APs on the Draft Scoping Report in order to refine the report. It is the final scoping report upon which the decision-making environmental Authorities provide comment, recommendations and acceptance to undertake the EIA Phase of the process.

DESCRIPTION OF THE RECEIVING ENVIRONMENT CHAPTER 5

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 D – L**.

5.1 Regional Setting: Location of the Study Area

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 ZF Mgcawu (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[8], 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 and solar energy facilities. 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.

Three major areas within the vicinity of the study area receive water directly from the Orange River, namely Upington (urban and surrounds), Upington Irrigation Scheme controlled by the Upington Irrigation Board, and Kakamas /Keimoes (urban & irrigation). Various canal schemes within the region are used to supply the irrigated areas.

5.2 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 5.1). 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.

[8] 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.

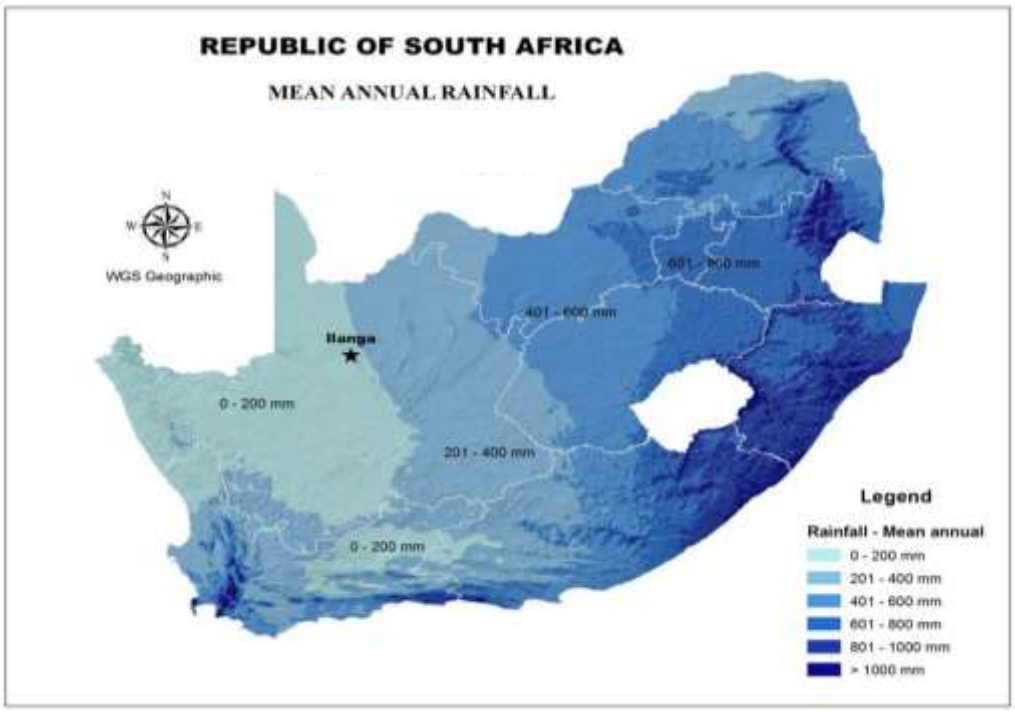

Figure 5.1: Rainfall map of South Africa indicating the survey site

5.3 Topographical Characteristics

There is a range of steep hills running in a north-south direction along the eastern part of the site and a series of scattered hills in the central northern part of the site. The elevation on site varies from 820 to 950 m above sea level on the plains over a distance of 18 km, a gradient of approximately 1:140. The hills peak at 1008 m above sea level (Karosberg) to 1127 m above sea level (Boesmansyfer). The site for the proposed development is relatively flat.

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. Mean annual precipitation for this region is less than 200mm and the annual potential evaporation is in excess of 2500mm.

5.4 Biophysical Characteristics of the Study Area

5.4.1 Aquatic Profile

The project area is situated in the Northern Cape Province east of Upington. The proposed development is situated to the south of the Orange River with a proposed abstraction point that is situated on the Orange River approximately 25 km upstream of Upington. The project area is situated in the Lower Orange Water Management Area (WMA) (refer to Figure 5.2).

The CSP facility overlaps 4 1:50000 topographical grid squares namely 2821AD, 2821BC, 2821CB and 2821DA. The proposed water abstraction point is situated in grid square 2821AD.

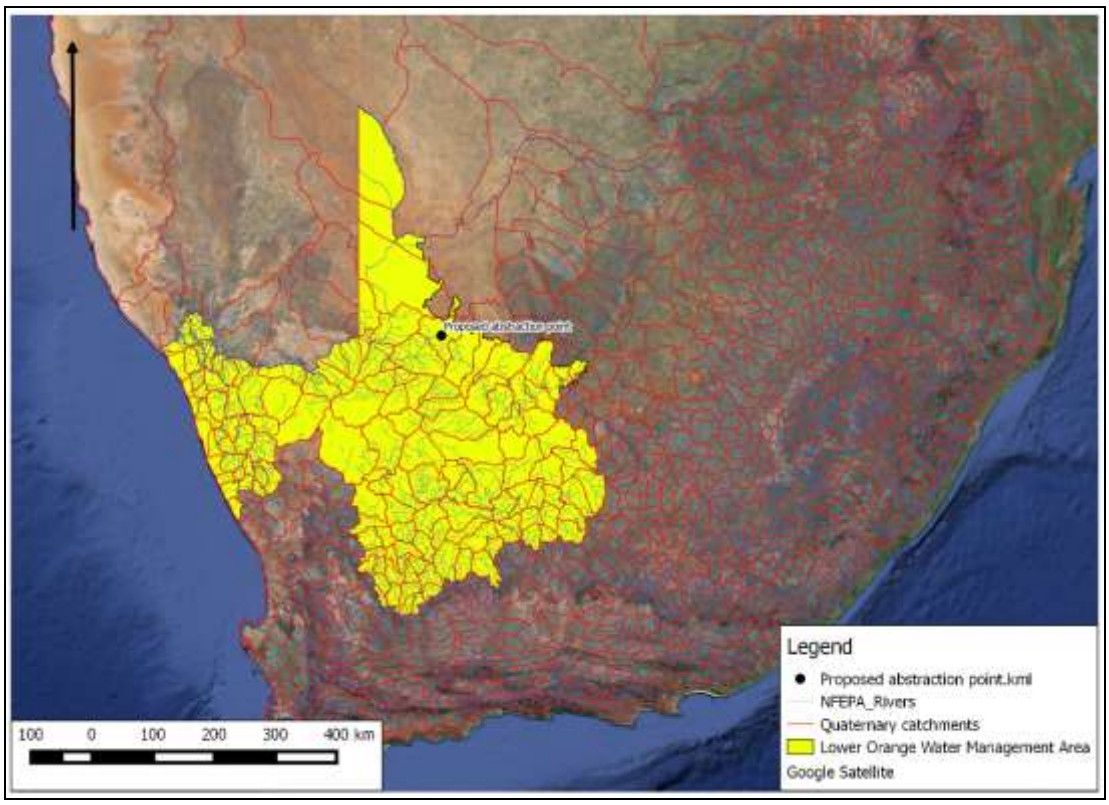

Figure 5.2: Map showing the regional location of the additional CSP facilities within the Karoshoek Solar in the Northern Cape and the Lower Orange Water Management Area

The project area is situated primarily in the Nama-Karoo Bioregion and the Nama Karoo Ecoregion. The project area overlaps with 4 vegetation units namely:

- Kalahari Karroid Shrubland (NKb 5);
- Bushmanland Arid Grassland (NKb 3);
- Gordonia Duneveld (SVkd 1); and
- Lower Gariep Broken Veld (NKb 1).

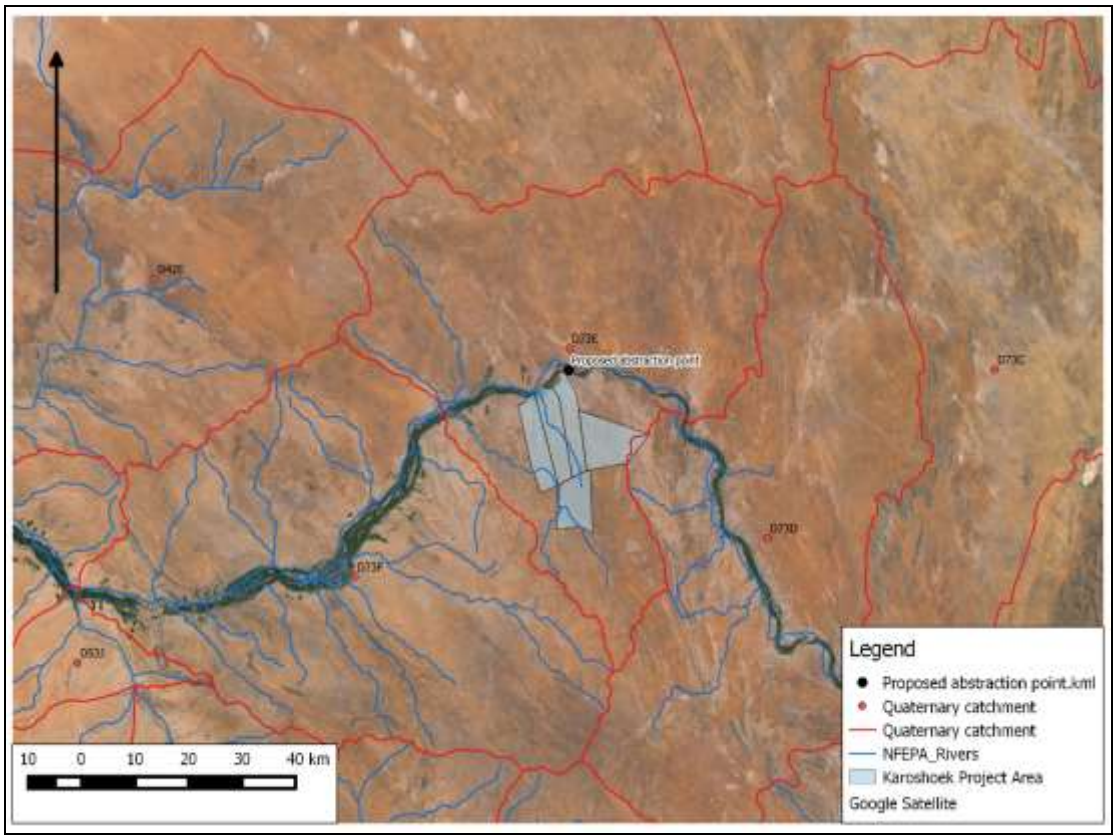

Figure 5.3: Proposed project area showing the location of the proposed abstraction point on the Orange River

The main drainage line associated with the Karoshoek CSP facility is the Orange River which is situated to the north of the project area (Refer to Figure 5.4). A proposed water abstraction point is situated in the Orange River. The Matjies River, a 1st order tributary of the Orange River, flows in a northerly direction down the centre of the proposed site whilst an unnamed tributary of the Orange River flows through the south western portion of the site. The Donkerhoekspruit, another 1st order tributary of the Orange River, is situated to the west of the project area and is unlikely to be impacted upon by the project.

Of all these rivers only the Orange River is perennial and the smaller tributaries are likely only to flow for brief periods after rainfall events.

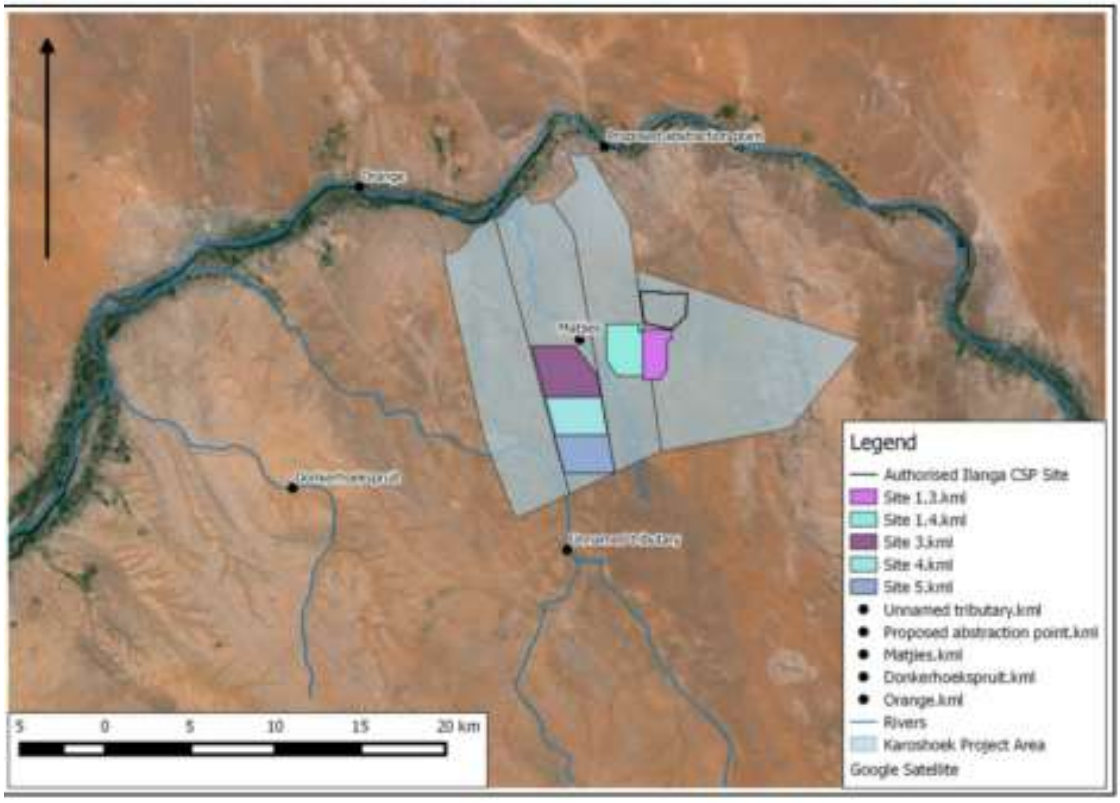

Figure 5.4: Map of the drainage line and rivers associated with the Karoshoek CSP project

5.4.2 Hydrology

The planned abstraction point is on the Lower Orange River is approximately 28km upstream of Upington. The Orange River is the largest catchment in South Africa (Figure 5.5) and at the site the catchment area is approximately 365 000 km^2, thought the effective area is around 275 000 km^2 after the deduction of endorheic areas.

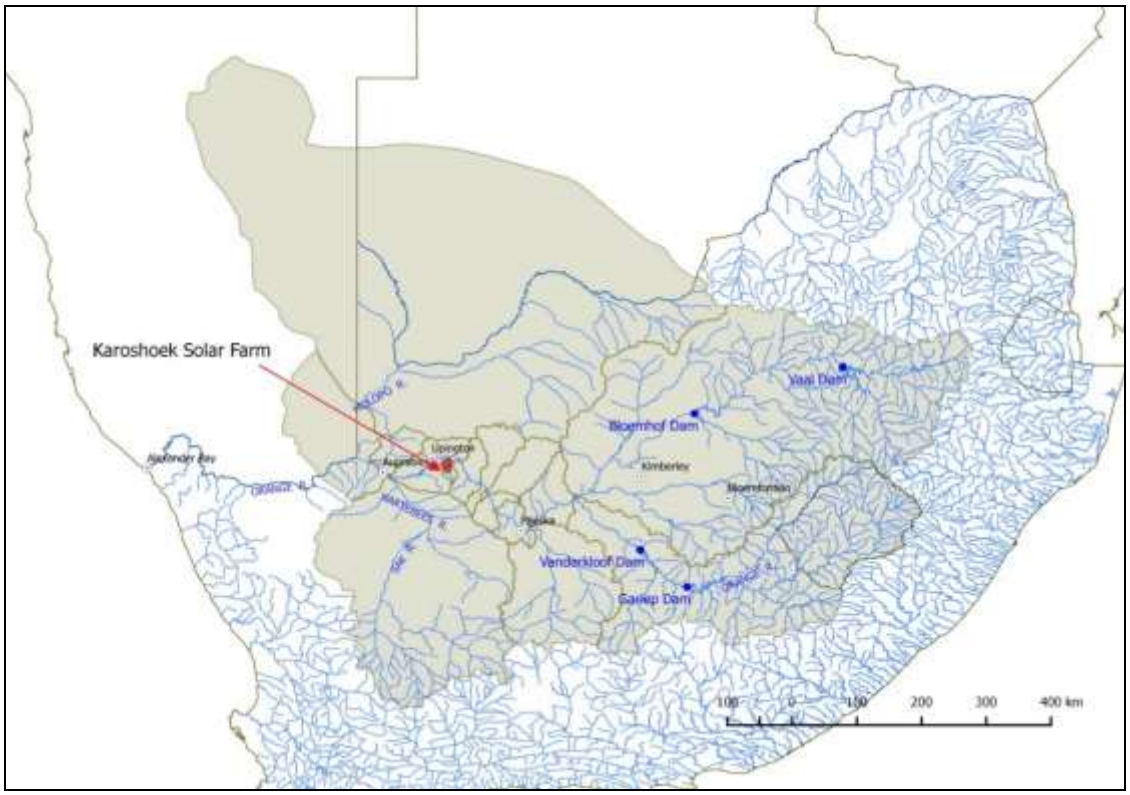

Figure 5.5: Catchment of the Lower Orange River

Normal flows in the Lower Orange River are regulated by a number of major dams upstream. The main dams are the Vaal and Bloemhof Dams on the Vaal River and the Gariep and Vanderkloof Dams on the Orange River above the confluence with the Vaal River (Figure 5.5). These have the effect of reducing normal flow variability, and particularly damping small floods. As a result the 2-year flood event at Upington (680 cumec) is less than half its natural value which would have been above 1500 cumec.

The location of the abstraction point is shown in Figures 5.6 and 5.7. Figure 5.6 provides an overview of the river system at this point. It is at a location where the main channel becomes increasingly more branched. Further upstream of the abstraction point the river is predominantly a single channel typically between 80 and 140m wide. There are locations where granite sills emerge to force the channel to break up but these are over relatively short distances. Below the abstraction point the morphology of the river changes substantially. The river branches into main sub-channels over large distances and major islands form.

Many of the islands are formed as a result of sediment deposition behind granite and gneiss outcrops and over time these alluvial plains have drawn the attention of farmers who saw potential in the fertile lands next to a reliable water source. With the development of agriculture into a major part of the economy of the region, the efforts to control floods increased. Many parts of the floodplain and

islands are now protected by flood levees which have an effect on the hydraulic behaviour of the river system. The result is deeper flows and higher velocities in the main channels during the smaller floods, and therefore a potential impact on the sediment movement within the river and on the ecology itself. Added to this the reduced opportunity for sediment deposition on the islands (except in the very large events), and the likely changing patterns of sediment loads with the regulated flows from the upstream dams, the potential effect on the instream ecology could be significant.

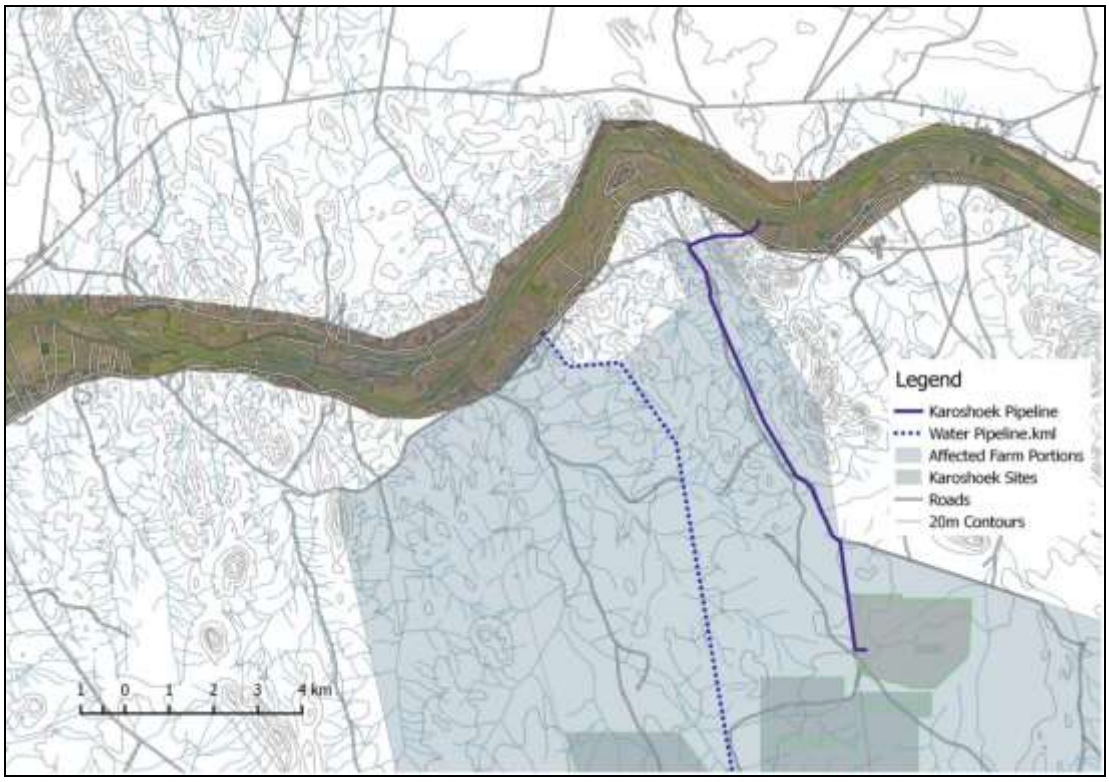

Figure 5.6: Overview of the river system at the site of the Karoshoek Solar Park

Figure 5.7: Location of the abstraction point on the Lower Orange River

5.4.3 Geological Profile

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. The details of the geological formations that occur within the study area are tabulated within the geological specialist report.

There are several geological faults traversing the study area which are indicated to occur in the area. The activity of these faults is considered dormant and the seismic activity of the area is considered low. The anticipated seismic activity is rated as V[9] 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.

[9] Movement felt by all, some damage to plaster, chimneys

Analysis of the aerial photography indicates that rock outcrops are likely to be concentrated in the northern and eastern portions of the study area. The sand cover is likely to be thickest in the southern lowland areas.

5.4.4 Soils and Agricultural Potential

There are a variety of land types within the study area, i.e. Ic, Ae, Af, and Ag land types. The most common land types in the study area are Ae and Ag (Land Type Survey Staff, 1987).

The A-group of land types refer to yellow and red soils without water tables belonging to one or more of the following soil forms: Inanda, Kranskop, Magwa, Hutton, Griffin, and Clovelly. The Ae land type consists of red, high base status, > 300 mm deep soils, and no dunes (MacVicar et al. 1974). These occur primarily in the northern half of the site and in a band down the western side of the chain of hills. The Af landtype, occurring in the south-central part of the site, consists of red, high base status, > 300 mm soils with dunes (MacVicar et al. 1974). There are high concentrations of dunes on site within this map unit. The Ag land type consists of red, high base status soils, < 300 mm deep (MacVicar et al. 1974). These occur primarily in the south-western quarter and in some northern parts of the site.

The soils contained within land types Ae, Af and Ag can be soils of **high agricultural potential** if irrigation water is available. The low rainfall, however, inhibits dry-land crop production.

The following two land types have been identified within the study area:

Land type Ag5 covers the largest area of the project site. Red and yellow well-drained sandy soil with high base status may occur in places. Deeper Hutton soil forms occur which are clearly distinct from Mispah.

Land type Af25 is found east of the site. This land type is very similar to **Ag5** with the only real difference being that it has a larger percentage of deeper soils when compared to **Ag5**.

5.4.5 Ecological Profile

<u>Vegetation</u>

According to the national vegetation map (Mucina & Rutherford 2006), there are six vegetation types within the broad area around the site, but only four of these

are likely to be potentially impacted by the development (refer to Figure 5.8). The basic statistics for these vegetation types are listed below in Table 5.1. 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 development which is 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 or mining across their distribution. 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.

Table 5.1: Vegetation types which occur in the broad vicinity of the Karoshoek Solar Valley development, with their basic conservation statics and status according to Mucina & Rutherford (2006) as well as the National List of Threatened Ecosystems (2009).

Name	Extent km2	Remaining	Conservation Target	Protected	Status
Kalahari Karroid Shrubland	8284	99.2%	21%	0.1%	Least threatened
Gordonia Duneveld	36772	99.8%	16%	14.2%	Least threatened
Lower Gariep Alluvial Vegetation	752	50.3%	31%	5.8%	Endangered
Lower Gariep Broken Veld	4538	99.5%	21%	3.9%	Least threatened
Bushmanland Arid Grassland	45479	99.4%	21%	0.4%	Least threatened

» **Kalahari Karroid Shrubland** - Some of the rocky areas and low ridges which occurred in some of the sites, 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*.

» **Bushmanland Arid Grassland** - According to the vegetation map of Mucina & Rutherford (2006), all the proposed development areas fall within Bushmanland Arid Grassland. Within the site, the areas of Bushmanland Arid Grassland are generally extensive open plains with greater or lesser amounts of scattered taller woody species and trees present. Typically, this vegetation unit is 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 are also rocky and stony outcrops within this vegetation unit that contain a greater number of woody shrubs and grass species not common in other areas. These areas are 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 contain some protected species not observed elsewhere on the site, such as *Adenium oleifolium, Aloe claviflora* and *Hoodia gordonii*. The drainage lines within this vegetation unit are generally broad and flat, often without a distinct drainage channel. These areas generally contain similar grass species to the surrounding plains but contain a greater proportion of woody trees and shrubs, particularly *Acacia erioloba, A.mellifera, Boscia albitrunca, B.foetida, Rhigozum trichotomum* and *Lycium oxycarpum*.

» **Gordonia Duneveld** - No areas of Gordonia Duneveld occur within the proposed 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*.

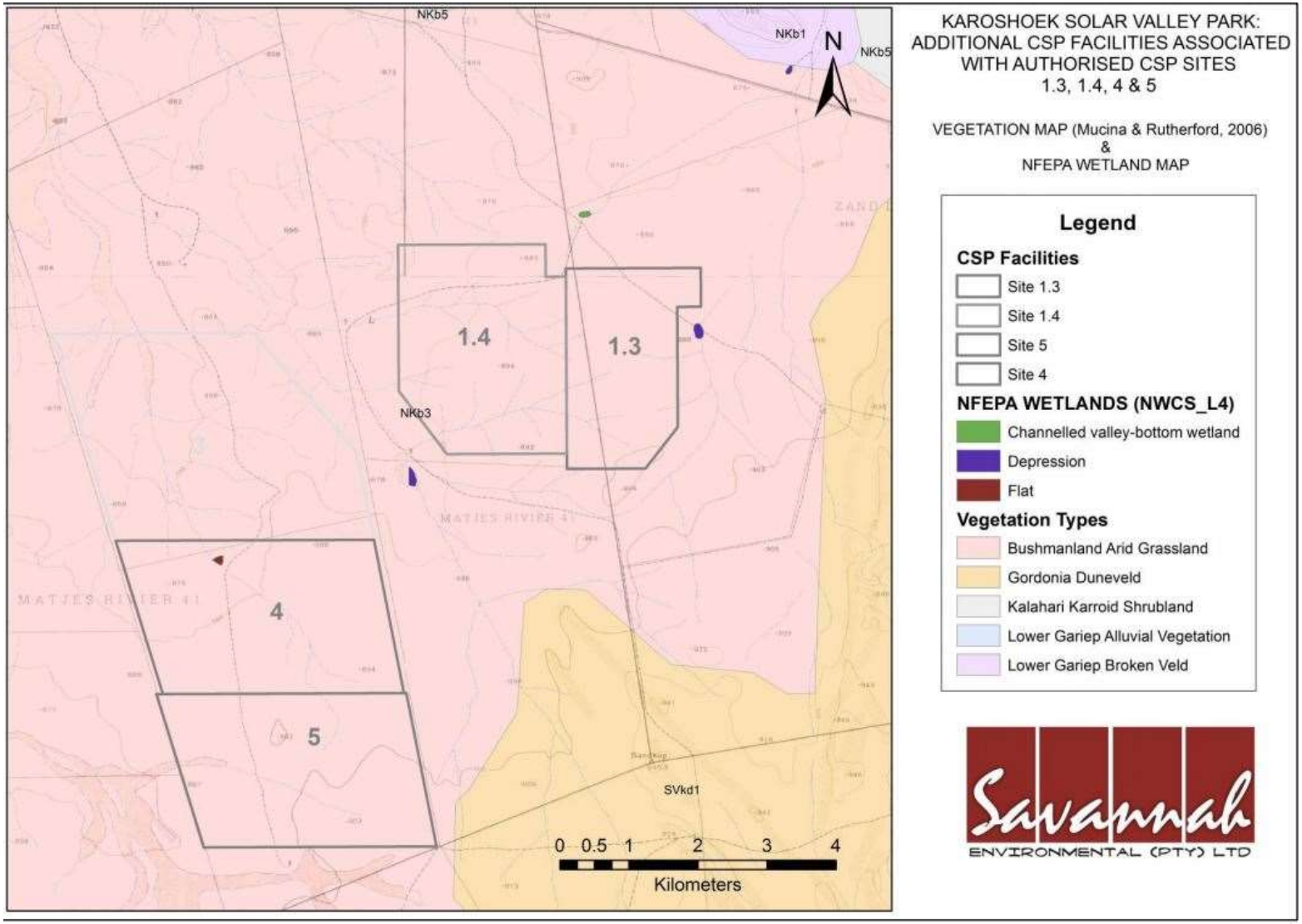

Figure 5.8: Vegetation types as classified by Mucina and Rutherford (2006) as well as NFEPA wetlands locate within the proposed footprint area as well as surroundings.

Protected and Listed Plant Species

A number of protected species were identified on site, which included the *Acacia erioloba*, which are common within some of the larger drainage lines, *Boscia albitrunca* are also widespread at the site and are also particularly common in drainage lines and in areas of red Kalahari sand. *Aloe clavifora* was identified to be common in areas of stony ground, calcrete and on gravel plains. *Adenium oleifolium* was observed to be common on some of the gravel and quartz outcrops. *Hoodia gordonii* was not common. 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).

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 been 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.

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. The affected habitats are widely available in the area, as well as at a broader scale.

Three listed terrestrial mammals may occur at the site, the Honey Badger *Mellivora capensis* (Endangered), Brown Hyaena *Hyaena brunnea* (Near

Threatened) and Black-footed cat *Felis nigripes* (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.

The development footprint areas 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 are likely to be low. Areas of higher activity are likely to be near the larger ridges of the area and the wooded drainage lines.

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 are no large rocky outcrops within the proposed development areas, species associated with rocky habitats are not likely to occur in these areas.

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 *Pyxicephalus adspersus* which is listed as Near Threatened. Some of the depression wetlands 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.

Avifauna Species

A total of 114 bird species were recorded on the 17 bird atlas cards from these and similar areas to the west submitted to the Animal Demography Unit from 2007 to 2015. Of these, 8 species were collision-prone as ranked by the BARESG (2011), and only 2 were red-listed (Kori Bustard and Lanner Falcon). However, three additional species were observed, the Black Harrier, the Booted Eagle, and a nesting Verreaux's Eagle. Therefore, a total of 11 collision-prone species potentially occur on the site.

Other species observed on site are the small and flocking Sociable Weavers. This species builds large grass nests (reputed to be the world's largest) in trees as well as on man-made structures (Spottiswoode 2005). While they are common, their propensity for building on man-made structures is well known and this includes pylons, power line poles, and telephone poles. The presence of heliostat mirrors offering support for their nests may entice flocks to build on structures associated with the mirrors or associated infrastructure.

5.5 Social Characteristics of the Study Area and Surrounds

The project site is located approximately 30 km east of Upington within the //Khara Hais Local Municipality (KHLM) which falls within the ZF Mgcawu District Municipality (ZFMDM) in the Northern Cape. The socio-economic profile of the ZFMDM and the KHLM, in the Northern Cape Province. The area was found to have the following general characteristics:

- The population of the ZFMDM in 2011 was approximately 236 783 people, of which 93 494 people reside in the KHLM.
- The majority of the local population belong to the Coloured group and the most spoken language is Afrikaans.
- 64.6% of the KHLM population comprise the Economically Active Population (EAP); this implies that there is a larger human resource base for development projects to involve the local population. The dependency ratio is high at 54.7.6% of the KHLM population (that is almost a third of the local population) which puts pressure the EAP and local municipalities.
- The female population is slightly more prominent in the KHLM comprising 50.7% of the population.
- More than half of the local population are semi- skilled or low skilled. This reflects the rural nature of the region and relatively poor education. The skills profile of the area indicates that the availability of local labour for the proposed project is largely limited to low-skilled construction workers and a small number of skilled workers.
- There is a high unemployment rate in the KHLM (22.1%) with a large economically active population seeking employment opportunities. Local workers should be utilised as much as possible for the proposed development in order to alleviate local unemployment.
- Higher unemployment and lower income levels in the study area demonstrate the need for job creation.
- The high demand for employment can be addressed (although marginally) through direct job creation during the construction and slightly for the operation phase of the proposed development
- Access to basic services is generally greater in the KHLM than at a district and provincial level demonstrating that service delivery is generally more accessible.

According to the //Khara Hais IDP 2012-2017 with regards to the socio-economic characteristics of the local population, the employment rate for the Municipality is relatively high, with as much as 75% of people of working age who are actively seeking employment. The majority of the employed population is found in elementary occupations, which require little or no skills. This is also reflected in the low education levels of the local population, with as much as 12% of the population aged 20 years and older having no form of education whatsoever. This, to some extent, constrains the development potential of the Municipality in the development of more advanced industries. The level of employment and type of occupations taken up by the population of the Municipality also directly affects their income levels.

5.5.1 Tourism in the Study Area

Upington is seen as the "gateway to the Green Kalahari." The main attractions and destinations in the area are the Augrabies Falls National Park, as well as the Kgalagadi Transfrontier Park. A small game farm, Spitskop, is situated approximately 13km to the north of Upington (//Khara Hais SDF, 2008).

Another tourist destination in Upington is Die Eiland Holiday Resort which is renowned for its palm tree avenue (200 trees) which was declared a national monument in 1982 (//Khara Hais SDF, 2008).

Some of the farms in the larger Upington area are also popular for game farming, agri-tourism and hunting. The Orange River Wine Route includes five wineries in Upington, Kakamas, Keimoes, Grootdrink, and Groblershoop respectively. This route thus provide visitors with regular wine tours and an experience of the wine industry in the larger Upington area (//Khara Hais SDF, 2008).

The //Khara Hais Municipality hosts a number of festivals throughout the year which attracts large numbers of tourists such as the Kalahari Kuierfees, the Upington Agricultural Show (Northern Cape Expo) and the Orange River Young Wine Show.

Tourism is acknowledged as an important economic sector and job creator and should be further developed within the larger area. A broad range of tourist amenities and opportunities occur, including:

» Agri-tourism opportunities providing insight into vineyard farming, processing of agricultural products, wine-making, and so forth;
» Conferencing;
» Culture tourism presented in Paballelo;

» Testing of vehicles within extreme conditions by car manufacturers in the area;
» Holiday accommodation (e.g. guest houses, bed-and-breakfast facilities, other types of over-night facilities, and hotels);
» River-based eco-opportunities;
» Game and eco-tourism opportunities as associated with various lodges outside of Upington; and
» Game and eco-tourism opportunities associated with the Spitskop Nature Reserve, Augrabies Falls National Park, as well as the Kgalagadi Transfrontier Park.

5.5.2 Land use characteristics of the broader study site

The Karoshoek Solar Valley Development and associated infrastructures (power line, access road & water pipeline) is located approximately 30 km east of Upington within the Khara Hais Local Municipality in the Northern Cape. Smaller settlements such as Dagbreek, Karos and Leerkrans are located near the study area. The 50W CSP through plant is proposed Portion 2 of Matjiesrivier 41.

The primary land use in the immediate local area is livestock farming which includes sheep farming, cattle farming and goat farming within the larger farms to the south of the N10, there is also intensive grape cultivation activities that take place along the banks of the Orange River. Livestock farming mainly takes place on the larger, privately owned farms. The majority of the area is sparsely populated and consists of wide-open landscapes. The study area has a rural character with little development outside of Upington. The population distribution is concentrated in and around small towns along the Orange River, other farming homesteads are scattered around the area. The authorised Ilanga CSP 1 Parabolic Trough plant is currently under construction adjacent to the proposed site on Lot 944 Karos Settlement.

Adjacent properties surrounding the proposed site are mainly privately owned farmlands. Livestock farming is the primary land use and majority of the area has a low number of farmsteads that are sparsely populated. Farmsteads occur within the surrounding area and adjacent farms, there are no farmsteads located in the impacted farms. There will be a designated area for livestock grazing on Portion 2 of Farm Matjiesrivier 41.

5.6 Heritage and *Palaeontology*

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
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	Yes	Likely

Landscape Type	Description	Occurrence still possible?	Likely occurrence?
	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.		
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 - Battle sites - Sites of displacement,	No	Unlikely
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	Yes,	Likely

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

SCOPING OF ISSUES ASSOCIATED WITH THE ILANGA CSP 4 PROJECT CHAPTER 6

This chapter serves to describe environmental issues and potential impacts (direct, indirect and cumulative impacts) that have been identified to be associated with the proposed Ilanga CSP 4 and associated infrastructure, and to make recommendations for further studies required to be undertaken in the EIA phase. The scoping process has involved review of existing information (including previous detailed studies undertaken), limited field work, input from the project proponent, stakeholders, and the public.

Environmental issues associated with **construction and decommissioning** activities associated with the Ilanga CSP 4 and associated infrastructure may include, among others, soil erosion, impacts on biodiversity, loss of habitat, and impacts on the social environment and current land use. Environmental issues specific to the **operation** of the Ilanga CSP 4 could include visual impacts, impact on land use and agricultural potential and disturbance to other faunal species.

The significance of impacts associated with the Ilanga CSP 4 Facility and its associated infrastructure is dependent on site-specific factors, and therefore impacts can be expected to vary significantly from site to site. Sections 6.4 and 6.5 provide a summary of the findings of the scoping study undertaken for the construction and operation phases of the proposed Ilanga CSP 4 Facility. Impacts of the proposed facility are described and evaluated, and recommendations are made regarding further studies required within the EIA Phase of the process.

Solar power generating facilities use the energy from the sun to generate electricity. Concentrating Solar Power (CSP) collects the incoming solar radiation and concentrates it (focusing or combining it), on a single point, thereby increasing the potential electricity generation. The proposed Ilanga CSP 4 project will consist of parabolic trough technology with a heat transfer fluid (HTF), and a total generation capacity of up to 150MW[10]. Infrastructure associated with the facility includes:

» Parabolic troughs utilising a heat transfer fluid (HTF)
» Power Plant/Power Island: power island with steam turbine generator, auxiliary boilers, dry cooling and molten salt storage.
» Associated infrastructure: access roads, plant substation, power line, water abstraction point and supply pipeline, water storage tanks, packaged water treatment plant, lined evaporation ponds, and workshop and office buildings.

[10] This will comprise the authorised 100MW facility on Site 5 as well as the proposed 50MW facility

An area within the study area of approximately 680 ha is proposed for the proposed project.

The **cumulative impacts** associated with the proposed facility are expected to be associated with the scale of the project together with other similar projects in the area. The potential cumulative impacts associated with the project are expected to be associated predominantly with the potential visual impact, potential impacts on ecology, avifauna (birds) in the surrounding area, and impacts on land use and the social environment within the vicinity of the project and the other similar developments within the region.

This chapter serves to describe the identified potential environmental impacts associated with the proposed project and to make recommendations for further studies required to be undertaken in the EIA phase, and/or recommendations for the management of these impacts for inclusion in the Environmental Management Programme (EMPr) to be prepared as part of the EIA Phase.

Specialist scoping reports are included within **Appendix D to L** wherein the potential issues relating to the project are identified. A discussion of the potential cumulative impacts associated with the proposed project at this stage of the process is presented in Section 6.6.

6.1 Legal Requirements as per the EIA Regulations, 2014

This chapter of the scoping report includes the following information required by Appendix 2: Content of the Scoping Report of the EIA Regulations, 2014 (GNR982):

Requirement	Relevant Section
(h)(v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts (aa) can be reversed (bb) may cause irreplaceable loss of resources and (cc) can be avoided, managed or mitigated.	The impacts and risks identified for both the construction and operation phases are included within the Tables 6.4-6.5.
(h)(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives	The methodology used for the assessment of potential impact and risks is detailed in Section 6.2.
(h)(vii) positive and negative impacts that the proposed activity and alternatives will	The impacts and risks identified for both the construction and operation phases is

Requirement	Relevant Section
have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects	included within the Tables 6.4-6.6.
(h)(viii) the possible mitigation measures that could be applied and level of residual risk	Possible mitigation measures and the level of residual risk associated with the impacts is included within the Tables 6.4-6.6.

6.2 Methodology for Impact and Risk Assessment during the Scoping Phase

The following methodology was used to describe and evaluate the main issues and potential risks and impacts associated with the proposed facility during the scoping phase:

» The identification of potential sensitive environments and receptors that may be impacted on by the proposed facilities and the types of impacts (i.e. direct, indirect and cumulative[11]) that are most likely to occur. This was achieved through a review of existing baseline information, previous studies undertaken, desk-top investigations and limited field work.
» Description of the nature, significance, consequence, extent, duration and probability of potential impacts, as well as the degree to which these impacts are reversible, may cause irreplaceable loss of resources and can be avoided, managed or mitigated during the construction and operation phases.
» The identification of potential risks to the development and the environment, and identification of 'No-Go' areas within the broader site, where applicable.
» The compilation of a summary of the potential impacts that will be considered further in the EIA Phase through specialist assessments.

6.3 Assumptions made during the Evaluation of Potential Impacts

While evaluating potential impacts associated with the development of the proposed facility, it was assumed that the development footprint (~680ha) (the area that will be affected during the operation phase) will include the footprints of the CSP components (i.e. Parabolic troughs and power island), associated infrastructure (i.e. internal access roads and evaporation dams).

[11] A cumulative impact refers to the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities (Environmental Impact Assessment Regulations, 2014).

6.4 Evaluation of potential impacts associated with the construction and decommissioning of the Ilanga CSP 4

6.4.1 Impact on Ecological

Impacts on vegetation and protected plant species

Expected impacts of the proposed development will be mostly on the vegetation and supporting substrate. Possible impacts could also be expected on bird species or small mammals and invertebrates. It is likely that the most significant impact will be on the vegetation. The proposed development may lead to direct loss of vegetation. Consequences of the impact occurring may include:

» general loss of habitat for sensitive species;
» loss in variation within sensitive habitat due to loss of portions of it;
» general reduction in biodiversity;
» increased fragmentation (depending on location of impact);
» disturbance to processes maintaining biodiversity and ecosystem goods and services; and
» loss of ecosystem goods and services

Several protected and red data species occur within the Quarter Degree Grid Squares (2821CB and 2821DA) encompassing the study site and there is a potential for these species as well as species protected within the relevant provincial and national legislations. Such species are especially vulnerable to infrastructure development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat. Threatened species (red data species) include those listed as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localized populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened plant species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possible extinction. This may arise if the proposed infrastructure is located where it will impact on such individual or populations. Consequences may include:

» fragmentation of populations of affected species;
» reduction in area of occupancy of affected species; and
» loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species' overall survival chances.

The impacts can be largely mitigated through avoidance of potential sensitive areas and listed species, by allowing a minimum clearance of vegetation (restricted to the absolute necessary areas) etc.

Direct Faunal impacts

Faunal species will primarily be affected by the overall loss of habitat. 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, while some slow-moving species and species confined and dependant on specified habitats would not be able to avoid the construction activities and might be killed. Some mammals and reptiles 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. This impact is highly likely to occur during the construction-phase and would also potential occur with resident fauna within the facility after construction.

Threatened species (red data species) include those listed as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localized populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened animal species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possible extinction. This may arise if the proposed infrastructure is located where it will impact on such individual or populations. Consequences may include:

- fragmentation of populations of affected species;
- reduction in area of occupancy of affected species; and
- loss of genetic variation within affected species

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species' overall survival chances.

Disturbance of faunal species can be maintained to a minimum and low significance by implanting effective mitigation measures.

Alien Plant Invasions

Major factors contributing to invasion by alien invader plants includes habitat disturbance and associated destruction of indigenous vegetation. Consequences of this may include:

» further loss and displacement of indigenous vegetation;
» change in vegetation structure leading to change in various habitat characteristics;
» change in plant species composition;
» change in soil chemistry properties;
» loss of sensitive habitats;
» loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
» fragmentation of sensitive habitats;
» change in flammability of vegetation, depending on alien species;
» hydrological impacts due to increased transpiration and runoff; and
» impairment of wetland function.

Although the potential severity of this impact may be high, it can be easily mitigated through regular alien control.

Impact: Impacts on Flora and fauna species and habitats			
Issue	**Nature of Impact during the Construction Phase**	**Extent of Impact**	**No-Go Areas**
Disturbance to and loss of indigenous natural vegetation	Construction of infrastructure will lead to direct loss of vegetation, causing a localised or more extensive reduction in the overall extent of vegetation. Consequences of the clearing and loss of indigenous natural vegetation occurring may include: » Increased vulnerability of remaining vegetation to future disturbance, including extreme climatic events; » General loss of habitat for sensitive fauna and flora species; » Loss in variation within sensitive habitats due to loss of portions of it; » General reduction in biodiversity;	Local	No No-Go areas have been identified to date. This must be verified during a detailed investigation as part of the EIA phase

	» Increased fragmentation (depending on the location of the impact) and associated reduced viability of species populations; » Alteration of the habitat suitable for plant populations by altering surface structure. This will change species composition and associated species interactions. » Disturbance to processes maintaining biodiversity and ecosystem goods and services; and » Loss of ecosystem goods and services.		
Description of expected significance of impact: The area seems to be generally homogenous and given the extensive amount of potentially intact vegetation in the area, there is likely to be little overall disruption to the broad-scale connectivity of the landscape (to be confirmed during the EIA phase). Given the large amount of development which is planned for the area, a significant local impact is likely to occur, but it is expected that there would remain sufficient intact habitat in the broader area to retain the overall ecological functioning of the landscape.			
Disturbance or loss of threatened / protected plants	Several red-data plant species could potentially occur in the study area. Flora is affected by overall loss or alteration of habitat and due to its limited ability to extend or change its distribution range. In the case of threatened plant species, a loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations. Consequences of this may include: » Fragmentation and decline of populations of affected species; » Reduction in area of occupancy of affected species; » Loss of genetic variation within affected species; » Alteration of the habitat suitable for plant associations by altering surface structure. This will change species composition and associated species interactions and species ability to persist; » Future extinction debt of particular species of flora and fauna. These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chance of survival of	Local	Several red-data species potentially occur within the study area; the issue requires further investigation in the EIA phase.

	the species.		
Description of expected significance of impact: The local impact on protected and listed plants can be regarded as significant due to the nature of the development which entails the clearance of vegetation from the development footprint area, leading to a localised loss of habitat as well as a loss of localised populations. Having said this, the extent, nature and subsequently the significance of this impact can be reduced with mitigation measures, including a vegetation rehabilitation plan, a search and rescue of protected and listed plants plan and avoidance were possible, in place. Furthermore, due to the extent and availability of habitat surrounding the proposed development areas, and with a protected species search and rescue plan in place where applicable, this localised impact will most likely not have a significant impact on the greater area of occupancy of affected species as well as a loss of genetic variation. Thus the significance regarding a potential change in status and/or the overall survival of the species can be regarded as low and unlikely.			
Loss of protected trees	According to the National Forests Act, no person may cut, disturb, damage or destroy any listed protected tree species. The loss of protected trees may have wider consequences than losing individuals of species of conservation concern: » The loss of mature, large trees can lead to a permanent loss of these trees and their ecosystem function from the environment, as trees grow slowly and recruitment events in the study area may be limited. » Some of the protected trees, if present, may be a food source for various fauna species in the area.	Site and surroundings	At this stage, it is expected that the presence of protected trees will be low, with only *Boscia albitrunca*, *Boscia foetida* and *Acacia erioloba* potentially occurring with the study area. Their presence and density needs to be confirmed during the EIA field study.
Description of expected significance of impact: The local impact on protected trees can be regarded as significant due to the nature of the development which entails the clearance of vegetation from the development footprint area, leading to a localised loss of habitat as well as a loss of localised populations. Having said this, the extent, nature and subsequently the significance of this impact can be reduced with mitigation measures, including a vegetation rehabilitation plan, a search and rescue of trees (*Boscia* species) and avoidance were possible, in place. Furthermore, due to the extent and availability of habitat surrounding the proposed development areas, and with a protected tree search and rescue plan in place where applicable, this localised impact will most likely not have a significant impact on the greater area of occupancy of affected species as well as a loss of genetic variation. Thus the significance regarding a potential change in status and/or the overall survival of the species can be regarded as low and unlikely.			
Loss of habitat for fauna species of conservation concern	Fauna species of conservation concern are indirectly affected primarily by loss of or alteration of habitat and associated resources. Animals are mobile and, in most cases, can move away from a potential threat, unless they are bound to a specific habitat that is also spatially limited and will be negatively impacted by a development. Nevertheless, the	Local	No No-Go areas have been identified to date. This must be verified during a detailed investigation as part of the EIA phase.

	proposed development will reduce the extent of habitat available to fauna. For any species, a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened animal species, loss of a suitable habitat, population, or individuals could lead to a direct change in the conservation status of the species. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations or the habitat that they depend on. Consequences may include: » Loss of populations of affected species; » Reduction in area of occupancy of affected species; » Loss of genetic variation within affected species; » Future extinction debt of a particular species. There are a number of red data species that have been recorded for the wider area within which the study area is located. Their presence and the necessity to keep their habitats intact in the study area need to be confirmed during a field survey.		
Description of expected significance of impact: Some habitat loss for faunal species is an inevitable consequence of the development but is not likely to be of broader significance (to be confirmed during EIA phase). 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.			
Impacts on depressions and ephemeral drainage lines	NFEPA Maps along with available Google imagery show that a number of wetlands and small ephemeral drainage lines may be present within the study area. » The nature of the site preparation and construction activities for the proposed development will change surface characteristics, rainfall interception patterns and runoff characteristics of the area; » This may affect the geohydrology, susceptibility to erosion and potential erosion rates of the landscape, which may lead to a	Local and potentially regional	No No-Go areas have been identified to date. Most of the ephemeral drainage lines and depression wetlands identified by NFEPA as well as by Todd (2012) is initially regarded as High Sensitive / Sensitive Areas and their status as

	significant alteration to or loss of habitat for fauna and flora species, especially those that depend on riparian and wetland habitats; » A decline in ecosystem functionality of smaller wetlands and riparian areas of smaller drainage lines will impact lower-lying larger wetlands, whilst also reducing the ability of the environment to buffer effects of » extreme climatic events.		such as well as potential No-go areas will be determined during the EIA phase.
Description of expected significance of impact: The proposed development will affect variously-sized ephemeral drainage line areas, which may slightly affect catchment integrity and functionality of surrounding ecosystems or ground water resources.			
Establishment and spread of declared weeds and alien invader plants.	Major factors contributing to invasion by alien invader plants include excessive disturbance to vegetation, creating a window of opportunity for the establishment of alien invasive species. In addition, regenerative material of alien invasive species may be introduced to the site by machinery traversing through areas with such plants or materials that may contain regenerative materials of such species. Consequences of the establishment and spread of invasive plants include: » Loss of indigenous vegetation; » Change in vegetation structure leading to change in or loss of various habitat characteristics; » Change in plant species composition; » Altered and reduced food resources for fauna; » Change in soil chemical properties; » Loss or disturbance to individuals of rare, endangered, endemic and/or protected species; » Fragmentation of sensitive habitats; » Change in flammability of vegetation, depending on alien species; » Hydrological impacts due to increased transpiration and runoff; » Increased production and associated dispersal potential of alien invasive plants, especially to lower-lying wetland areas, and » Impairment of wetland function.	Local and Regional	None identified at this stage, but the potential for alien invasive species present in or around the study area is regarded as high. A high number of alien invasive species has been recorded in the wider area according to the SANBI database. The extent to which the site contains alien plants will be determined in the EIA phase.
Description of expected significance of impact: With mitigation measures including regular monitoring and effective eradication and management			

methods in place the significance of Invasive Alien Plants is expected to be low and local. With the absence of these mitigation measures the significance of invasion of invasive alien plants may potentially be high and may furthermore extend outside the boundary of the development footprint area affecting natural vegetation. Although this is a potential worst case scenario in the absence of mitigation measures as mentioned.

Gaps in knowledge & recommendations for further study

» The initial desk-top investigation of the study area indicates that a few protected and red-data species as well as sensitive habitats potentially occur on the site. However, once the final layout has been designed in accordance to findings of a field investigation, the likelihood that the development will compromise the survival of any species of conservation concern is expected to be limited.
» **Plant species of conservation concern will only be identifiable during the growing season, thus any field survey of vegetation should only commence from November and be completed by April.**
» Although previous collection records from the specific Quarter Degree Grids exist, the study area itself may not have been previously surveyed and there may be additional species that have not yet been captured in the existing species databases for the area. A detailed ecological survey and sensitivity assessment will be undertaken during the EIA phase according to the methods outlined in section 4.

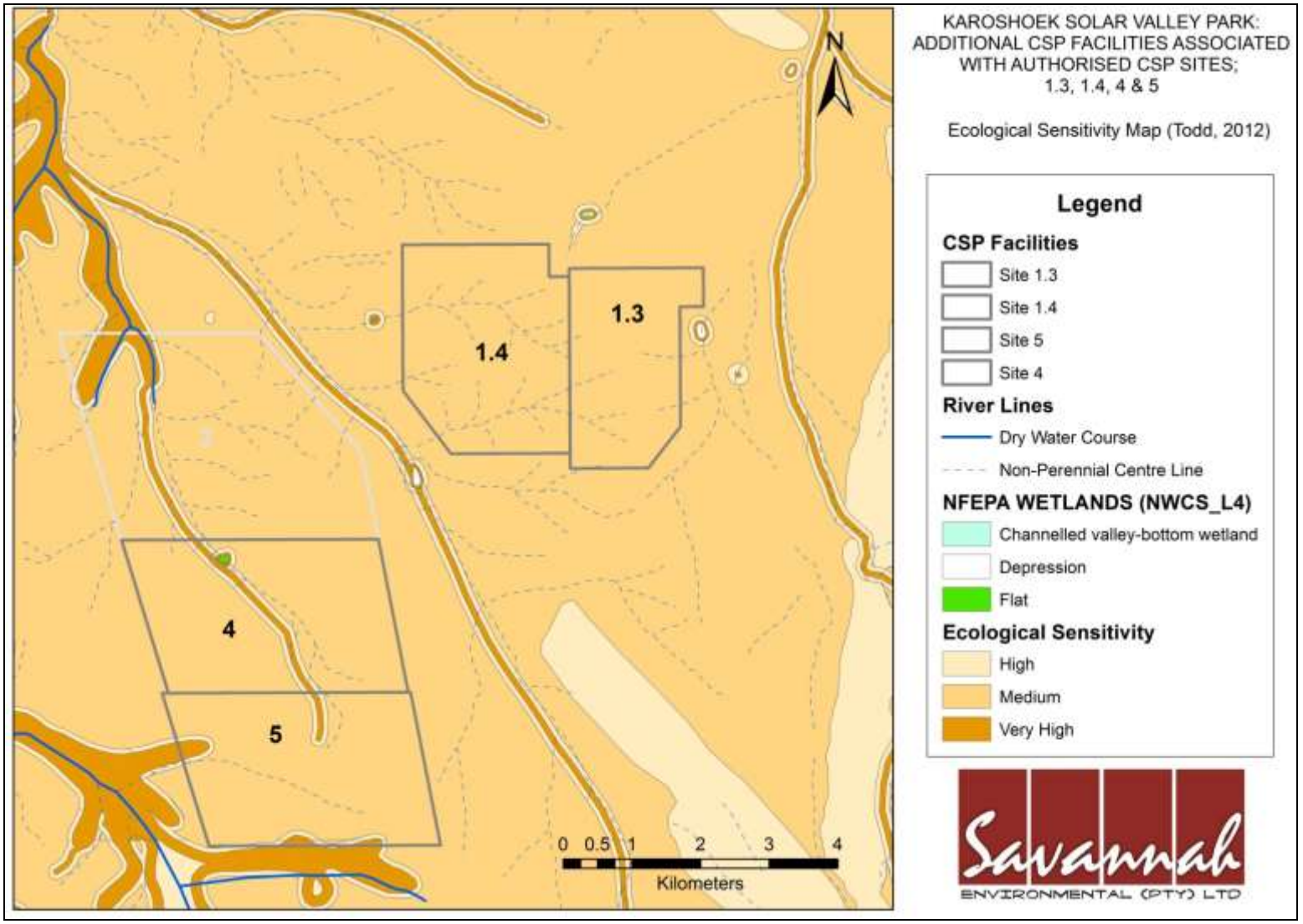

Figure 6.1: Scoping Ecological Sensitivity Map for the site proposed for the Ilanga CSP 4 Project (Site 5)

6.4.1 Impact on Avifauna

A total of 114 bird species were recorded on the 17 bird atlas cards from these and similar areas to the west submitted to the Animal Demography Unit from 2007 to 2015 (Appendix 1). Of these, 8 species were collision-prone as ranked by the BARESG (2011), and only 2 were red-listed (Kori Bustard and Lanner Falcon). However, we noted three additional species in our 3-day visit: a Black Harrier, a Booted Eagle, and a nesting Verreaux's Eagle. Therefore, a total of **11 collision-prone species** potentially occur on the site**.**

Other species of concern are the small and flocking Sociable Weavers. They are of concern because they build massive grass nests (reputed to be the world's largest) in trees as well as man-made structures (Spottiswoode 2005). While they are common their propensity for building on man-made structures is well known and this includes pylons, power poles, and telephone poles. The presence of parabolic mirrors offering support for their nests may entice flocks to build on structures associated with the parabolic mirrors or associated infrastructure.

Impact on Avifauna

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Disturbance due to construction of parabolic troughs at all four sites	Displacement caused by disturbance during construction	Confined to footprint of the troughs (kms unknown), but potentially lasting 10-12 years (BID)	Roost or nest areas of red data birds
Habitat destruction within the CSP trough footprint	Negative: displacement caused by destruction of habitat	Confined to footprint of the CSP trough (km unknown)	Roost or nest areas of red data birds

Description of expected significance of impact

Collision with CSP: The number of collisions with the parabolic mirrors is likely to be a function of the number of wetland birds passing through the air space overhead. The atlas data reveals at least 35 wetland birds that are common along the Orange River but few are expected over the CSP sites. The collisions with the mirrors may also vary seasonally as more collision-prone species enter the area with good rains. It may also vary with the flow of the Orange River as wetland birds look for other wetlands. The extent of the impact will likely to be confined to the CSP footprint itself and occur for the operational lifetime of the solar park. The expected significance is low but there is a vacuum of data on the topic.

Habitat destruction in footprint of CSP troughs: Resident species using the area ear-marked for CSP development will be displaced permanently by the development of the CSP troughs.

The magnitude of impact will vary directly with the size of the footprint because no vegetation remains under the parabolic mirrors. Potentially low significance because few birds are likely to be affected. The effect can be calculated based on the density of nationally important birds/ha.

Disturbance may have a greater impact on wildlife because of the length of time (10-12 years) construction is expected to take. Raptorial birds and bustards are often affected by disturbance and move away from an area either temporarily or permanently. Once construction in all areas is complete birds are likely to return to the unaffected portions of the solar farm.

Gaps in knowledge & recommendations for further study:

The bird atlas data for this area is very poor indeed and in some cases it is misleading. For example wetland birds from the Orange River are unlikely to traverse such an arid area when the corridor provided by the Orange River is available (Simmons and Allan 2002). Thus site surveys (e.g. 1 km transects, Vantage Point observations, breeding bird surveys) are urgently needed to obtain a true picture of the species composition likely in this arid area. This is required for both the dry and wet season and thus road and walking surveys should be designed to cover both seasons, and carried out by trained ornithologists/birders able to distinguish a Sabota Lark from a Spike-heeled Lark.

A survey of the use of the solar park area by collision-prone birds such as threatened bustards and raptors is also required to determine the *before* and *after* influence of a solar park in the area.

The usage of water by this solar park is in need of investigation because the cumulative impacts of potentially hundreds of similar solar parks along the Orange River may have a significant effect of the flow requirements of the Orange River. This should be undertaken by hydrologist with aquatic ecology training.

Given that the Ilanga CSP is already under construction, surveys of birds in the construction area, compared with numbers and species composition of birds in similar habitat unaffected by construction, will reveal which species are likely to be displaced in other CSP areas.

6.4.3 Impact on Aquatic Ecosystems

Potential impacts on aquatic ecosystems are primarily associated with the abstraction of water for the Ilanga CSP 4 Project from the Orange River. Abstraction of water during the construction phase may result in modification of instream habitats which may in turn result in changes to the aquatic fauna and flora communities which includes species and ecosystems of conservation importance.

Impacts on aquatic ecosystems			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Abstraction of water may result in modification of instream habitats	Negative: Modification of aquatic faunal community including loss of species of conservation concern due to change in habitat	Local to Regional	None identified at this stage
Abstraction of water may result in modification of instream habitats	Negative: Modification of threatened floral community including loss of species of conservation concern due to	Local to Regional	None identified at this stage
Description of expected significance of impact Changes in aquatic habitat due to abstraction, i.e. Reduction of flow, may result in changes in the aquatic faunal as well as riparian and wetland vegetation communities. Within the fish community this may include impacts on the Near Threatened (NT) fish species *L. kimberleyensis*. Increased abstraction may also result in changes to the riparian vegetation community. The Lower Gariep Alluvial Vegetation community that occurs along this section of the Orange River is currently listed as Endangered (EN). Impacts are expected to be moderate to high at a local to regional level, are likely to occur in the short-term (for duration of construction) and may not be reversible. Impacts can be minimised through the implementation of appropriate mitigation measures, to be determined during the EIA Phase.			
Gaps in knowledge & recommendations for further study Further studies need to focus on the degree of change in aquatic habitats associated with the proposed abstraction for the Ilanga CSP 4 facility. Based on this the potential impacts on aquatic fauna and flora needs to be extrapolated.			

6.4.4 Hydrological Impacts

The planned abstraction point is on the Lower Orange River approximately 28km upstream of Upington. The Orange River is the largest catchment in South Africa and at the site the catchment area is approximately 365 000 km^2, thought the effective area is around 275 000 km^2 after the deduction of endorheic areas. Abstraction of water for the proposed development from the Orange River could potentially have an impact on water availability for downstream users, flow depth and velocity and could result in the increase in sedimentation.

Impact on Aquatic Ecology: Hydraulic Aspects

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Impact on flow depth and velocity.	Depth and velocity patterns may change under conditions of abstraction, which in turn may affect the quality of aquatic habitat.	Downstream reaches, especially in branched reaches.	None identified at this stage
Impact on flow duration.	Abstraction during prolonged periods of low river flow, for example, may affect habitat sustainability.	Downstream reaches, especially in branched reaches.	None identified at this stage
Changes in sediment regime.	Changes in sediment movement (deposition and scour) may influence habitat conditions. *[This assessment will assess shear stress at the selected cross-section, and will therefore be indicative.]*	Downstream reaches, especially in branched reaches.	None identified at this stage
Impacts on downstream users.	Abstractions may affect water availability for downstream users, especially under low river flow conditions. This impact will not be analysed explicitly but will be inferred from the analysis of river flow patterns.	Downstream reaches, especially in branched reaches.	None identified at this stage
Risk of limited, or no abstraction	Assess the risk of abstraction limitations due to low flow, or aquatic ecology requirements (e.g. breeding patterns).	Downstream reaches, especially in branched reaches.	None identified at this stage
Other impacts	As may be determined during the site investigation and/or data analysis.	Downstream reaches, especially in branched reaches.	None identified at this stage

Description of expected significance of impact

These will be determined as part of the assessment and described in terms of significance, consequence, duration and probability of the impacts as well as degree to which these impacts:

» can be reversed;
» may cause irreplaceable loss of resources; and
» can be avoided, managed or mitigated

Gaps in knowledge & recommendations for further study

Further studies need to focus on the degree of change in aquatic habitats associated with the proposed abstraction for the Ilanga CSP 4 facility. Based on this the potential impacts on aquatic fauna and flora needs to be extrapolated.

6.4.5 Impact on Land Use, Soil and Agricultural Potential

The overall impacts of the proposed facility on agriculture and soil conditions will be low, principally because of the climatic conditions and the low agricultural and grazing potential of the site. There have never been any substantial farming practices (agriculture or grazing) on the property because of the dominant climatic conditions and prevailing soil conditions. Very low rainfall, along with other soil-related factors lead to low vegetative cover throughout the area. The soil and rock type properties tend to be very homogenous in the area and the whole site can be better utilised for power generation in comparison to any other practise. This project site is not regarded as a viable commercial farming site and would be suited to house the facilities.

There is the potential for the loss of soil resources through erosion, particularly during the construction phase. This impact can be effectively minimised through the implementation of appropriate mitigation measures including implementation of an appropriate stormwater management plan and regular monitoring of the occurrence, spread and potential cumulative effects of erosion.

Impact

Potential impacts associated with the proposed development include:

- Soil degradation during the construction phase
- Loss of grazing land due to the direct impact by the infrastructure's footprint during all phases of the project
- Loss of soil resources as a result of erosion during all phases of the project

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Soil degradation during the construction phase	Soil degradation is the negative alteration of the natural soil profile, usually directly or indirectly related to human activity. Soil degradation due to construction activity will negatively affect soil formation, natural weathering processes, moisture levels and soil stability. This will, in turn, affect biological processes operating in the soil. Soil degradation includes erosion (i.e. due to water and wind), soil removal, mixing, wetting, compaction, pollution, salinisation, crusting, and acidification. Impacts on soil degradation are primarily related to the	Local	None

	construction phase with insignificant impacts in the post construction and decommissioning phases.		
Loss of grazing land due to the direct impact by the infrastructure's footprint during all phases of the project	Although likely to occur at the extent of the development footprint, this impact is expected to be of low significance as a result of the limited agricultural potential of the site and limited usage for livestock grazing.	Local	None
Loss of soil resources as a result of erosion during all phases of the project	Soil erosion is a natural process whereby the ground level is lowered by wind or water action and may occur as a result of inter alia chemical processes and/or physical transport on the land surface. Accelerated erosion is a common occurrence on construction sites where soil is loosened and vegetation cover is stripped. This impact can be largely minimised through the implementation of appropriate mitigation measures.	Local	None
Description of expected significance of impact As a result of the limited agricultural potential of the site due largely to local climatic factors, the construction of the proposed projects are expected to be very unlikely to occur and will not result in the irreplaceable loss of resources. Impacts of the proposed projects on agricultural potential are expected to be of very low significance. No mitigation is required in this regard. There is the potential for the loss of soil resources through erosion, particularly during the construction phase. This impact can be effectively minimised through the implementation of appropriate mitigation measures including implementation of an appropriate stormwater management plan and regular monitoring of the occurrence, spread and potential cumulative effects of erosion. Impacts post-mitigation are expected to be of low significance.			
Gaps in knowledge & recommendations for further study None. As a result of the low significance of impacts, no further studies are required to be undertaken.			

6.4.6 Visual Impacts

Impact Visual impact on surrounding areas as a result of construction activities			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Visual impact during construction	The construction phase of the Ilanga CSP 4 Project will be 3-4 years in extent. 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.	Local	None
Discussion of expected significance: Given the nature of the adjacent road and the distance between the road and the developments, the significance of the possible impact is anticipated to be low. Mitigation is unlikely to be necessary. There will be no irreplaceable loss. The impact will reverse on decommissioning of the facility.			
Gaps in knowledge & recommendations for further study Minor undulations in landform and density of vegetation could have significant influence on the visibility and nature of views of the development. A site visit is required to assess this in detail.			

6.4.7 Heritage

An extensive range of Stone Age manifestations can be expected in the study area. Those that are most sensitive are the Later Stone Age (LSA) grave sites that may be recognised by variously shaped stone cairns. Where these have been disturbed/removed variations in the soil may include ashy or stony patches, and could signify the locations of ancient graves. Patches of soil, stained red with specularite or ochre, may also be an indication of the presence of a grave site. LSA artefact scatters can be expected around depressions that contain seasonal

water and stream bed margins that was utilised in the past (van Schalkwyk 2011, van der Walt 2014). Stone circles or ovals demarcating Later Stone Age living or activity sites, and engraved boulders or stones may occur throughout the area.

Concentrations of stone tools point to activities that took place at various stages over the past 1.5 million years, representing the different groups of people who inhabited or moved across the landscape over time.

Historical period

Historical finds include middens, structural remains and cultural landscape. The study area has been fallow for a number of years and no agricultural activities occurred on the farm. It is assumed that the farm was utilised for grazing in the past and features dating to this period associated with farming can occur but is doubtful to be older than 60 years.

Burials and Cemeteries

Graves and informal cemeteries can be expected anywhere on the landscape. Family cemeteries can be expected close to farmsteads while stone cairns could represent graves as recorded in the wider area (Dreyer & Meiring 1937, Morris 1995).

Impact on Heritage resources

The construction of the proposed projects could directly impact on graves, archaeological sites and historical sites.

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Disturbance and destruction of archaeological sites and graves.	Construction activities could result in irreversible damage or destroy heritage resources and depletion of the archaeological record of the area.	Low to Medium on a local scale.	None identified at this stage. To be confirmed through fieldwork

Description of expected significance of impact

Significance of sites, mitigation and significance of possible impact can only be determined after the field work has been conducted, but based on previous work in the area Stone Age sites of Medium to Medium high significance and grave sites can be expected. It should be able to mitigate impacts to sites by micro adjustments to the lay outs to preserve the sites. Alternatively grave sites can be relocated and stone age sites can be test excavated and mapped. All these mitigation measures will require adherence to the NHRA and the required permits from the SAHRA.

Gaps in knowledge & recommendations for further study

The study area has not been subjected to a cultural resource study and it is assumed that information obtained for the wider region is applicable to the study area. To address these gaps it is recommended that a field study should be conducted to confirm the presence of heritage resources after which mitigation

will be recommended.

6.4.8 Impact on Palaeontology

The study area for the proposed Karoshoek Solar Valley Park near Upington is largely underlain by unfossiliferous Precambrian basement rocks of the Namaqua-Natal Province as well as a range of unfosssiliferous to poorly-fossiliferous superficial sediments of Late Caenozoic age. The *construction phase* of the solar park will entail extensive surface clearance as well as shallow excavations into the superficial sediment cover (soils, alluvial gravels *etc.*) and locally also into the underlying bedrock. These excavations notably include site clearance activities as well as excavations for the parabolic mirror array, excavation for the power tower foundations, buried cables, new internal access roads, power line pylon footings, storm water infrastructure, as well as foundations for various buildings such control buildings. All these developments may adversely affect any fossil remains within the study area by destroying, disturbing or permanently sealing-in fossils at or below the ground surface that are then no longer available for scientific research or other public good. Once constructed however, the *operational and decommissioning phases* of the solar facilities will not involve potential further adverse impacts on palaeontological heritage.

In general, the destruction, damage or disturbance out of context of fossils preserved at the ground surface or below ground that may occur during construction represents a *negative* consequence. The palaeontological sensitivity of the bedrocks and superficial sediments within the study area is rated as low to very low (Section 5) and therefore the impact significance is rated as *Very low* (-). Negative impacts on fossil heritage resources can usually be mitigated but cannot be fully rectified or reversed; *i.e.* they are *permanent* in duration and *non-reversible*. Potential impacts are confined to the development footprint *i.e. very limited* in extent. No *no-go areas* of high palaeontological sensitivity were identified within the study area during the present desktop study.

Some of the superficial sedimentary formations represented within the study area – such as the Quaternary calcretes- contain fossils of some sort (*e.g.* trace fossils, microfossils, possible vertebrate remains). Low-level impacts on fossil heritage here are probable. However, the probability of *significant* impacts on palaeontological heritage is considered to be *low* because of (a) the generally very sparse occurrence of paleontologically valuable fossils (*i.e.* unusual fossils such as well-preserved vertebrate remains) within the superficial sediments, (b) the widespread occurrence of the most of the fossils concerned outside the study area (*i.e.* not unique).

While all fossils, once damaged or destroyed, are *irreplaceable*, this has to be seen in the context of the probable widespread occurrence of most fossil groups within the rock units concerned here (with the notable exception of any well-preserved vertebrate remains).

It is concluded that all five of the proposed new CSP facilities within the Karoshoek Solar Valley Development are unlikely to have significant negative impacts on local palaeontological heritage resources (impact significance: very low). No-go areas based on fossil heritage resources have not been identified within the study area. Anticipated cumulative impacts as a result of these five additional CSP facilities, as well as other solar facilities planned in the Upington region (including the already authorised facilities within the Karoshoek Solar Valley Development), are rated as low.

Impact on palaeontological heritage resources

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Loss of unique fossil heritage	Disturbance, damage or destruction or sealing-in of fossils, especially by ground-clearance and excavations during the construction phase	Restricted to the development footprint, construction phase	None identified

Description of expected significance of impact

- Impact significance: VERY LOW
- Consequence: negative (loss of local fossil heritage)
- Duration: permanent
- Probability: low
- Degree to which these impacts-
  can be reversed: non-reversible
  may cause irreplaceable loss of resources: unlikely
  can be avoided, managed or mitigated: high (see below)

Gaps in knowledge & recommendations for further study

» Little paleontological fieldwork has been carried out in the broader study region (esp. close to the Orange River)
» No further specialist palaeontological studies recommended, pending discovery of significant new fossil material on site during or before the construction phase.
» Monitoring of all substantial excavations into sedimentary bedrock by ECO. Reporting of chance fossil finds (*e.g.* vertebrate bones, teeth, shells, petrified wood) by ECO to SAHRA and professional palaeontologist for recording and collection.

6.4.9. Social Impacts

The potential positive impacts which could arise as a result of the construction activities include the following:

» Socio-economic benefits could accrue through job creation (primarily lower skilled levels) during the construction phase. The local community could thus benefit in this regard;
» It is anticipated that more skilled positions could be filled by individuals from around South Africa or internationally;
» Should employment be linked to training and capacity building it would further the positives in this regard;
» At this stage it is not anticipated that local procurement would be achievable for the technology requirements associated with a project of this nature. Local procurement would be more focused on the procurement of general construction materials, goods and services.

The potential negative impacts which could arise as a result of the construction activities include the following:

» A large number of construction vehicles utilising the N10, N14, local gravel roads and internal access roads for the duration of the construction phase for the CSP facility could add to the negative impact on the roads. Construction vehicles utilising these roads over the construction period with heavy construction vehicles could increase the wear and tear on the roads utilised, regional roads and internal access roads; also crossing over the roads to access the site could increase the risk of accidents;
» An influx of workers and jobseekers to an area (whether locals are employed or outsiders are employed) could increase the safety risks in the local area and have an impact on the local social dynamics. Should locals be employed it could minimise the perceived and actual risk in this regard;
» An influx of an outside workforce could put pressure on municipal services, as indicated from the baseline description of the local area. Therefore introducing an external workforce to the local area will put pressure on local services and local community. This would, however, also depend on the exact size of the workforce.
» There may be impacts for road users of the main access road whereby an increase in traffic and heavy vehicles could have a negative impact on regular daily living and movement patterns.
» During the construction phase adjacent landowners could be negatively affected by the dust, noise and negative aesthetics created as a result of the construction activities.

Impact:

Direct employment opportunities and skills development:

The construction of the proposed project will require a workforce and therefore direct employment will be generated. The proposed development will create employment opportunities for the local community. This is therefore a positive social impact. The proponent has indicated that training will be provided to employees associated with the proposed facility.

Desktop Sensitivity Analysis of the Site:

People from the KHLM and nearby towns / settlements are most likely going to benefit the most from this positive impact due to the requirements stipulated in the REIPPP programme.

Issue	Nature	Extent of Impact	No-Go Areas
Direct employment opportunities and skills development	The creation of employment opportunities and skills development opportunities during the construction phase for the country and local economy	Local-regional	None

Description of expected significance of impact

The potential impact is expected to be positive, probable, short term, with a low intensity and have a low - medium significance. This will be confirmed during the EIA phase following detailed investigations and assessment of impacts. In terms of reversibility of the impact and irreplaceable loss of resources, this is not applicable to this type of impact. The potential impact may be enhanced with possible enhancement measures which will be elaborated in the SIA EIA phase.

Gaps in knowledge & recommendations for further study

It is recommended that a detailed SIA is undertaken to determine actual impact of job creation and skills development.

Impact:

Economic multiplier effects:

There are likely to be opportunities for local businesses to provide services and materials for the construction phase of the facility. The local service sector will also benefit. The economic multiplier effects from the use of local goods and services opportunities will include, but is not limited to, construction materials and equipment and workforce essentials such as services, safety equipment, ablution, accommodation, transportation and other goods. In terms of business opportunities for local companies, expenditure during the construction phase will create business opportunities for the regional and local economy. Also the injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area.

Desktop Sensitivity Analysis of the Site:

The KHLM and nearby towns are most likely going to benefit the most from this positive impact due to the requirements stipulated in the REIPPP programme.

Issue	Nature	Extent of Impact	No-Go Areas

Economic multiplier effects	Significance of the impact from the economic multiplier effects from the use of local goods and services	Local-regional	None

Description of expected significance of impact

The potential impact is expected to be positive, probable, short term, with a minor intensity and have a low - medium significance. This will be confirmed during the EIA phase following detailed investigations and assessment of impacts. In terms of reversibility of the impact and irreplaceable loss of resources, this is not applicable to this type of impact. The potential impact may be enhanced with possible enhancement measures which will be elaborated in the SIA EIA phase.

Gaps in knowledge & recommendations for further study

It is recommended that this impact is further assessed in the EIA phase of the SIA.

Impact:

Safety and security impacts:

An increase in crime is often associated with construction activities. The perceived loss of security during the construction phase of the proposed project due to the influx of workers and/or outsiders to the area (as influxes of construction workers, newcomers or jobseekers are usually associated with an increase in crime), may have indirect effects, such as increased safety and security issues for neighbouring properties and damage to property, such as the risk of veld fire, stock theft, crime and so forth.

Desktop Sensitivity Analysis of the Site:

Areas of concern include the impacted farmland and adjacent farming areas where livestock farming occurs.

Issue	Nature	Extent of Impact	No-Go Areas
Safety and security impacts	Temporary increase in safety and security concerns associated with the influx of people in the study area during the construction phase	Local	None at this stage

Description of expected significance of impact

The potential impact is expected to be negative, improbable, short term, with a low intensity and have a low significance. This will be confirmed during the EIA phase following detailed investigations and assessment of impacts. The potential impact can be reversed and there is no irreplaceable loss of resources associated with the potential impact. The potential impact may be avoided with possible mitigation measures which will be elaborated in the SIA EIA phase.

Gaps in knowledge & recommendations for further study

A site visit and consultations with key stakeholders will need to take place in the EIA phase in order to determine the perceived safety and security risks

associated with the proposed developments.

Impact:

Impacts on daily living and movement patterns:

An increase in traffic due to heavy vehicles could create short-term disruptions and safety hazards for current road users. Transportation of project components and equipment to the proposed study area will be transported using vehicular / trucking transport. The access road will be off the N10.

Desktop Sensitivity Analysis of the Site:

Farmers/residents residing in the study area that currently utilize the N10, N14, local gravel roads and the access road off the N10 to access their farms.

Issue	Nature	Extent of Impact	No-Go Areas
Impacts on daily living and movement patterns	Temporary increase in traffic disruptions impacting local communities movement patterns and increased safety risks for road users	Local	None

Description of expected significance of impact

The potential impact is expected to be negative, probable, short term, with a moderate intensity and have a low significance. This will be confirmed during the EIA phase following detailed investigations and assessment of impacts. The potential impact can be reversed and there is no irreplaceable loss of resources associated with the potential impact. The potential impact may be mitigated with possible mitigation measures which will be elaborated in the SIA EIA phase.

Gaps in knowledge & recommendations for further study

Consultations with key stakeholders will need to take place in the EIA phase in order to determine the impact on daily living and movement patterns.

Impact:

Pressure on economic and social infrastructure impacts from an in-migration of people:

The in-migration of people to the area as either non-local workforce of construction workers and/or jobseekers could result in pressure on economic and social infrastructure (municipal services) due to in migration of construction workers and jobseekers and pressure on local population (rise in social conflicts and social dynamics). Influx of people into the area, especially by job seekers, could further lead to a temporary increase in the level of crime, cause social disruption and put pressure on municipal services.

Desktop Sensitivity Analysis of the Site:

Sensitive areas in the KHLM include nearby towns such as Upington.

Issue	Nature	Extent of Impact	No-Go Areas
Pressure on economic and social infrastructure impacts from an in-migration of people	Added pressure on economic and social infrastructure during construction phase as a result of in-migration of people	Local-regional	None

Description of expected significance of impact

The potential impact is expected to be negative, improbable, short term, with a low intensity and have a low significance. This will be confirmed during the EIA phase following detailed investigations and assessment of impacts. The potential impact can be reversed and there is no irreplaceable loss of resources associated with the potential impact. The potential impact may be mitigated with possible mitigation measures which will be elaborated in the SIA EIA phase.

Gaps in knowledge & recommendations for further study

Consultations with key stakeholders (ward councillor and municipalities) will need to take place in the EIA phase.

Impact:

Nuisance Impacts (noise & dust):

Impacts associated with construction related activities include noise, dust and disruption to adjacent properties is a potential issue.

Desktop Sensitivity Analysis of the Site:

Areas of concern include the impacted farmland and adjacent farming areas where farming communities may be living.

Issue	Nature	Extent of Impact	No-Go Areas
Nuisance Impacts (noise & dust)	Nuisance impacts in terms of temporary increase in noise and dust, on site and on farm roads for access to the site	Local	None

Description of expected significance of impact

The potential impact is expected to be negative, probable, short term, with a moderate intensity and have a low significance. This will be confirmed during the EIA phase following detailed investigations and assessment of impacts. The potential impact can be reversed and there is no irreplaceable loss of resources associated with the potential impact. The potential impact may be mitigated with possible mitigation measures which will be elaborated in the SIA EIA phase.

Gaps in knowledge & recommendations for further study

A site visit and consultations with key stakeholders (impacted and adjacent landowners) will need to take place in the EIA phase in order to determine the extent of this impact.

6.5 Evaluation of potential impacts associated with the Operational Phase of the Ilanga CSP 4 Project

6.5.1 Ecological Impacts

Expected impacts during operation relate mainly to disturbance of plant and animal species in the surrounding areas as a result of maintenance activities. In addition, the presence of alien plant species could potentially result in impacts on vegetation structure and composition if not suitably controlled.

Impact: Impacts on Flora and fauna species and habitats			
Issue	**Nature of Impact during the Operational Phase**	**Extent of Impact**	**No-Go Areas**
Disturbance or loss of indigenous natural vegetation	Troughs and other infrastructure create large areas of altered surface characteristics, rainfall interception patterns, and intensive shade that will not be tolerated by most of the species present on site, as these have evolved with a high daily irradiance. Consequently, it can be expected that within the Solar Energy Facility footprint, species composition and topsoil characteristics will change significantly. No equivalent experiments have been undertaken in similar environments up to date, thus the nature and density of vegetation that may persist cannot be predicted at this stage. A sparser or less stable vegetation beneath the panels and other infrastructure, together with the altered surface and runoff characteristics may lead to: » Increased vulnerability of remaining vegetation to future disturbance, including erosion; » General loss or significant alteration of habitats for sensitive species; » Loss in variation within sensitive habitats due to loss of portions of it; » General reduction in biodiversity;	Local	No No-Go areas have been identified to date. This must be verified during a detailed investigation as part of the EIA phase

	» Increased fragmentation (depending on location of impact); » Future extinction debt of a particular species; » Disturbance to processes maintaining biodiversity and ecosystem goods and services; and » Loss of ecosystem goods and services.		
Description of expected significance of impact: The area seems to be generally homogenous and given the extensive amount of potentially intact vegetation in the area, there is likely to be little overall disruption to the broad-scale connectivity of the landscape (to be confirmed during the EIA phase). Given the large amount of development which is planned for the area, a significant local impact is likely to occur, but it is expected that there would remain sufficient intact habitat in the broader area to retain the overall ecological functioning of the landscape.			
Altered runoff patterns due to rainfall interception by panels and compacted areas	The panels create large surfaces of rainfall interception, where rainfall is collected and concentrated at the edges from where it then moves onto the ground in larger, concentrated quantities opposed to small drops being directly intercepted and raindrop impact dispersed by vegetation, then absorbed by the ground. This may lead to a localised increase in runoff during rainfall events, which may result in localised accelerated erosion. Likewise, access roads and areas where soils have been compacted during construction will have a low rainfall infiltration rate, hence creating more localised runoff from those surfaces. This runoff will thus have to be monitored and channelled where necessary to prevent erosion over larger areas.	Site and surroundings	No No-Go areas have been identified to date. This must be verified during a detailed investigation as part of the EIA phase
Description of expected significance of impact: With management and eradication methods in place the significance of accelerated runoff and erosion is expected to be low.			
Disturbance to migration routes and associated impacts to species populations.	All components of the proposed development may interfere with current migration routes of especially fauna species. This may lead to: » Reduced ability of species to move between breeding an foraging grounds, reducing breeding success rates; » Increased mortality rates due to fatal collisions with infrastructure;	Site and surroundings	No No-Go areas have been identified to date. This must be verified during a detailed investigation as part of the EIA

	» Reduced genetic variation due to reduced ability of especially smaller organisms to have individual interaction; » Future extinction debt of a particular species.		phase
Description of expected significance of impact: Some habitat loss for faunal species is an inevitable consequence of the development but is not likely to be of broader significance (to be confirmed during EIA phase). From the desktop survey and the results from the previous ecological study done on the authorised sites no important faunal migratory routes (usually along extensive and well wooded valley floors and ephemeral streams) seem to be present within the development footprint areas, although this will be confirmed during the EIA phase. .			
Impacts on depressions and ephemeral drainage lines	NFEPA Maps and available Google imagery show that a number of wetlands and drainage lines may be present within the study area. » Accidental breakage of panels and accidental spills, if not contained and mitigated immediately, may result in harmful/toxic substances ending up in wetlands or polluting ground water resources. Whilst damages to small isolated pans may remain localised, spillage into larger drainage lines may result in adverse effects along the lower areas and associated ecosystems; » The nature of the proposed developments, especially the new hard surfaces, will change surface characteristics, rainfall interception patterns and hence runoff characteristics of the project area; » This may affect the geohydrology, susceptibility to erosion and potential erosion rates of the landscape, which may lead to a significant alteration to or loss of habitat for fauna and flora species that depend on riparian and wetland habitats; » Altered runoff patterns may influence infrequent filling of possible wetlands on site, which may eliminate localised populations of water-dwelling organisms such as the tadpole shrimp (*Triops* sp) that depend on occasional small areas of standing water to breed out and regenerate; » A decline in ecosystem functionality of smaller wetlands and riparian areas of smaller drainage lines will impact lower-lying areas	Local to regional	No No-Go areas have been identified to date. Most of the ephemeral drainage lines and depression wetlands identified by NFEPA as well as by Todd (2012) is initially regarded as High Sensitive / Sensitive Areas and their status as such as well as potential No-go areas will be determined during the EIA phase.
Description of expected significance of impact: The proposed development will affect variously-sized ephemeral drainage line areas, which may slightly affect catchment integrity and functionality of surrounding ecosystems or ground water resources.			
Establishment	The envisaged altered vegetation cover after construction and during the operation	Local to regional	None identified at

and spread of declared weeds and alien invader plants.	phase of the proposed development will create a window of opportunity for the establishment of alien invasive species. In addition, regenerative material of alien invasive species may be introduced to the site by machinery or persons traversing through areas with such plants or materials that may contain regenerative materials of such species. Consequences of the establishment and spread of invasive plants include: » Loss of indigenous vegetation or change in vegetation structure leading to an even more significant change in or loss of various habitat characteristics; » Loss of plant resources available to fauna; » Change in soil chemical properties; » Loss or fragmentation of sensitive or restricted habitats; » Loss or disturbance to individuals of rare, endangered, endemic and/or protected species; » Change in flammability of vegetation, depending on alien species; » Hydrological impacts due to increased transpiration and runoff; » Increased production and associated dispersal potential of alien invasive plants, especially to lower-lying wetland areas, and » Impairment of wetland function.		this stage, but the potential for alien invasive species present in or around the study area is regarded as high. A high number of alien invasive species has been recorded in the wider area according to the SANBI database. The extent to which the site contains alien plants will be determined in the EIA phase.
Description of expected significance of impact: With mitigation measures including regular monitoring and effective eradication and management methods in place the significance of Invasive Alien Plants is expected to be low and local. With the absence of these mitigation measures the significance of invasion of invasive alien plants may potentially be high and may furthermore extend outside the boundary of the development footprint area affecting natural vegetation. Although this is a potential worst case scenario in the absence of mitigation measures as mentioned.			
Gaps in knowledge & recommendations for further study » The largest opportunity for mitigating any negative impacts exists during the design phase, if layouts adhere to the findings and recommendations of detailed field studies carried out during the EIA phase » Limited knowledge does, however exist on the potential and ease with which vegetation can be re-established after construction given the variable rainfall regime of the region; which species would be able to persist in the altered environment on and around the proposed development; and what			

effect will this altered species composition and –density will have on ecosystem intactness and –functionality

» Regular monitoring of a minimum set of environmental parameters throughout the operational phase, coupled with an adaptive environmental management program, will thus be essential to prevent any environmental degradation and any cumulative effects of the development beyond its periphery

6.5.2 Impact on Avifauna

A total of 114 bird species were recorded on the 17 bird atlas cards from these and similar areas to the west submitted to the Animal Demography Unit from 2007 to 2015 (Appendix 1). Of these, 8 species were collision-prone as ranked by the BARESG (2011), and only 2 were red-listed (Kori Bustard and Lanner Falcon). However, we noted three additional species in our 3-day visit: a Black Harrier, a Booted Eagle, and a nesting Verreaux's Eagle. Therefore, a total of **11 collision-prone species** potentially occur on the site**.**

Other species of concern are the small and flocking Sociable Weavers. They are of concern because they build massive grass nests (reputed to be the world's largest) in trees as well as man-made structures (Spottiswoode 2005). While they are common their propensity for building on man-made structures is well known and this includes pylons, power poles, and telephone poles. The presence of parabolic mirrors offering support for their nests may entice flocks to build on structures associated with the parabolic mirrors or associated infrastructure.

Given the mortality numbers recorded in the USA (above) which has a relatively lower avian species richness than southern Africa, the number of species to be affected is likely to be greater. There are a number of wetland birds that are apparently attracted to the Ivanpah site too, despite it being some way from wetland sources. This is a great cause for concern along the Orange River with its large suite of wetland birds (35 are recorded) and the site's proximity to the Orange River that arcs around the site. The centre of the proposed site is exactly 10.0 km from the nearest point of the Orange River.

Three collision-prone red data species were recorded on site during a brief site visit, and eight other bird species that regularly collide with power lines have been recorded in the broader area. All 11 species may thus be impacted by the CSP trough and associated infrastructure. While these species were relatively uncommon in the study area, influxes can occur when good food conditions occur following rain. Bustards are the most commonly recorded species that collide with man-made structures (Shaw et al. 2015) with an estimated 46 000 birds killed per year in South Africa (Shaw 2013). Since Kori Bustards have been recorded on site they are the most likely species to be affected by collision.

Other species that may suffer collisions are Black Harrier that were recorded migrating through the area in June 2014 and are known to collide with other structures such as turbines (J Smallie, Wildskies and L Leeuwner, EWT, pers comm).

There are a suite of about 35 wetland species that are recorded close to the proposed sites but are not regular visitors. These are typically species associated with permanent wetlands and thus likely to occur along the Orange River. The importance of these species is their proximity to CSP sites that may appear to be "open water", and thus attract those birds traversing the arid landscape.

Impact on Avifauna

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Collision with CSP troughs	Negative, killing collision prone species such as bustards and wetland birds attracted by the "lake effect", ie the effect that open water is available in the arid landscape	Confined to the length of the CSP troughs	Areas closer to the Orange River and any habitat near natural pans. Wetland birds use these riverine corridors to commute.
Disturbance due to construction of parabolic troughs at all four sites	Displacement caused by disturbance during construction	Confined to footprint of the troughs (kms unknown), but potentially lasting 10-12 years (BID)	Roost or nest areas of red data birds
Habitat destruction within the CSP trough footprint	Negative: displacement caused by destruction of habitat	Confined to footprint of the CSP trough (kms unknown)	Roost or nest areas of red data birds

Description of expected significance of impact

Collision with CSP: The number of collisions with the parabolic mirrors is likely to be a function of the number of wetland birds passing through the air space overhead. The atlas data reveals at least 35 wetland birds that are common along the Orange River but few are expected over the CSP sites. The collisions with the mirrors may also vary seasonally as more collision-prone species enter the area with good rains. It may also vary with the flow of the Orange River as wetland birds look for other wetlands. The extent of the impact will likely to be confined to the CSP footprint itself and occur for the operational lifetime of the solar park. The expected significance is low but there is a vacuum of data on the topic.

Habitat destruction in footprint of CSP troughs: Resident species using the area ear-marked for CSP development will be displaced permanently by the development of the CSP troughs.

The magnitude of impact will vary directly with the size of the footprint because no vegetation remains under the parabolic mirrors. Potentially low significance because few birds are likely to be affected. The effect can be calculated based on the density of nationally important birds/ha.

Disturbance may have a greater impact on wildlife because of the length of time (10-12 years) construction is expected to take. Raptorial birds and bustards are often affected by disturbance and move away from an area either temporarily or permanently. Once construction in all areas is complete birds are likely to return to the unaffected portions of the solar farm.

Water usage: The use of spray water to clean the parabolic mirrors is expected to be of relatively low significance for individual solar parks such as Karoshoek. However, the Cumulative impact is expected to be many fold higher dependent on the number of solar farms abstracting water from the Orange. This will have effects away from the CSP solar farm and will add to the reduction in flow of the Orange, particularly in December, when flow is low anyway (Davies et al. 1993). This will occur for the operational lifetime of the project and have consequences removed from the solar park.

Gaps in knowledge & recommendations for further study:

The bird atlas data for this area is very poor indeed and in some cases it is misleading. For example wetland birds from the Orange River are unlikely to traverse such an arid area when the corridor provided by the Orange River is available (Simmons and Allan 2002). Thus site surveys (e.g. 1 km transects, Vantage Point observations, breeding bird surveys) are urgently needed to obtain a true picture of the species composition likely in this arid area. This is required for both the dry and wet season and thus road and walking surveys should be designed to cover both seasons, and carried out by trained ornithologists/birders able to distinguish a Sabota Lark from a Spike-heeled Lark.

A survey of the use of the solar park area by collision-prone birds such as threatened bustards and raptors is also required to determine the *before* and *after* influence of a solar park in the area.

Given that The Ilanga CSP facility is already under construction, surveys of birds in the construction area, compared with numbers and species composition of birds in similar habitat unaffected by construction, will reveal which species are likely to be displaced in other CSP areas.

6.5.3 Visual Impacts

Impacts could include general landscape change or change due to the proposed development that could detract from the existing character as well as change of view for affected people and / or activities:

- Generally landscape change or degradation. This is particularly important for protected areas where the landscape character might be deemed to be exceptional or rare. However it can also be important in non-protected areas particularly where landscape character is critical to a specific broad-scale use such as tourism, or simply for the general enjoyment of an area. This is generally assessed by the breaking down of a landscape into components that make up the overall character and understanding how proposed elements may change the balance of the various elements. The height, mass, form and colour of new elements all help to make new elements more or less obvious as does the structure of an existing landscape which can provide screening ability or texture that helps to assimilate new elements. This effect is known as visual absorption capacity (VAC).
- Change in specific views within the affected area from which the character of a view may be important for a specific use or enjoyment of the area.
  - Visual intrusion is a change in a view of a landscape that reduces the quality of the view. This can be a highly subjective judgement. Subjectivity has however been removed as far as is possible by classifying the landscape character of each area and providing a description of the change in the landscape that will occur due to the proposed development. The subjective part of the assessment is to define whether the impact is negative or positive. Again to make the assessment as objective as possible, the judgement is based on the level of dependency of the use in question on existing landscape characteristics.
  - Visual obstruction is the blocking of views or foreshortening of views. This can generally be measured in terms of extent.
  - Due to the nature of the proposed development, visual impacts are expected to relate largely to intrusion.

Impact Potential visual impact on users of roads in close proximity to the proposed Ilanga CSP 4 Project			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Industrialisation of a natural landscape as seen from the local road to the west and the N10 to the north	The assessment indicates that the proposed development could be visible from and therefore affect the character of the rural landscape surrounding them over an area of approximately 15km measured east to west and 24km measured north to south (approximately 360km^2).	This is likely to be a local impact.	A site visit is required to confirm the nature of the surrounding landscape and the existence or otherwise of sensitive uses.
Discussion of expected significance: Given these projects will be seen in the context the wider projects, the significance of this impact is likely to be low. Mitigation might include; » Colouring of the mirror backs			

» Minimizing clearance » Maintaining natural vegetation within and below troughs » Protection of boundary vegetation. There will be no irreplaceable loss. The impact will reverse on decommissioning of the facility.
Cumulative Impacts. The development of the proposed additional CSP facilities within the Karoshoek Solar Valley Development will not significantly alter the visual impact associated with the development of parabolic trough facilities on each of the already authorized sites. The visibility of development on the extended sites will be similar in extent to the visibility of development on the already authorised sites. The area around Upington has been identified by the Department of Environmental Affairs as a Renewable Energy Development Zone (REDZ 7). These zones have been put forward in order to focus development and inform planning. In the Upington area this has resulted in numerous renewable energy project applications. This focus is likely to transform the landscape character of the area.
Gaps in knowledge & recommendations for further study The proposed layout of the additional projects in relation to the authorised projects. The nature of the surrounding landscape, possible sensitive uses and protected areas needs to be confirmed through a site visit.

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

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Industrialisation of a natural landscape as seen from local homesteads	The assessment indicates that there are approximately 55 homesteads within the approximate limit of visibility. The majority of these are within the Orange River Corridor (closest 8km to the north). Only two homesteads have been identified outside the Orange River Corridor, one ~ 3.6km to the north east and one ~ 7.8km to the west. All identified homesteads with the exception of the homestead 3.6km to the north east of the site appear to be within areas from which the development is unlikely to be	This is likely to be a local impact.	From the desk top scoping assessment it does not appear that there are any no-go areas. A site visit is however required to confirm this.

	visible. The possible affected homestead to the north east appears to be at a slightly lower elevation than the site. This means that views over the development are unlikely. Only the closest edge of development is likely to be visible and if there is any VAC provided by the terrain or vegetation, this is likely to soften and break views of the development. Given that the homestead is to the north of the development, reflections from mirrored surfaces are unlikely to be obvious from this point.		

Discussion of expected significance:

Given the likely nature of the homesteads with a focus on agriculture and the distance between the homesteads and the developments, the significance of the possible impact is anticipated to be low.

Mitigation is unlikely to be necessary.

There will be no irreplaceable loss.

The impact will reverse on decommissioning of the facility.

Cumulative Impacts.

The development of the proposed Ilanga 2 CSP facility within the Karoshoek Solar Valley Development will not significantly alter the visual impact associated with the development of parabolic trough facilities on each of the already authorized sites. The visibility of development on the extended sites will be similar in extent to the visibility of development on the already authorised sites.

The area around Upington has been identified by the Department of Environmental Affairs as a Renewable Energy Development Zone (REDZ 7). These zones have been put forward in order to focus development and inform planning. In the Upington area this has resulted in numerous renewable energy project applications. This focus is likely to transform the landscape character of the area.

Gaps in knowledge & recommendations for further study

Minor undulations in landform and density of vegetation could have significant influence on the visibility and nature of views of the development. A site visit is required to assess this in detail.

Impact

Potential visual impact on sensitive visual receptors within the region.

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Industrialisation of a natural landscape as seen from sensitive uses.	Sensitive visual receptors are likely to largely include roads and homesteads. From knowledge of the area there appears to be little tourism related development other than FM Safaris that is located to the ~30km north west of the proposed development. This facility is outside the approximate limit of visibility and is unlikely to be impacted.	This is likely to be a local impact.	From the desk top scoping assessment it does not appear that there are any no-go areas. A site visit is however required to confirm this.

Discussion of expected significance:

Given distance between the identified sensitive receptor and the developments, the significance of the possible impact is anticipated to be negligible.
There will be no irreplaceable loss.
The impact will reverse on decommissioning of the facility.

Cumulative Impacts.

The development of the proposed additional CSP facility within the Karoshoek Solar Valley Development will not significantly alter the visual impact associated with the development of parabolic trough facilities on each of the already authorized sites. The visibility of development on the extended sites will be similar in extent to the visibility of development on the already authorised sites.

The area around Upington has been identified by the Department of Environmental Affairs as a Renewable Energy Development Zone (REDZ 7). These zones have been put forward in order to focus development and inform planning. In the Upington area this has resulted in numerous renewable energy project applications. This focus is likely to transform the landscape character of the area.

Gaps in knowledge & recommendations for further study

Minor undulations in landform and density of vegetation could have significant influence on the visibility and nature of views of the development. A site visit is required to assess this in detail.

Impact

Potential visual impact of night lighting.

Issue	Nature of Impact	Extent of Impact	No-Go Areas

Industrialisation of a natural landscape as seen at night	All large scale solar facilities are capable of causing offsite glare that may cause annoyance and visual discomfort. Typically the main risk of glint and glare associated with linear collectors such as parabolic troughs occur from; » Specular reflections from the mirrors when they are moving from stowed to tracking. » Specular reflections off the ends of the trough or mirrors when the sun has a low elevation angle (e.g., reflections from the north end of a north-south field when the sun is low in the southern horizon). » Diffuse and specular reflections from receiver tubes	This is likely to be a local impact.	From the desk top scoping assessment it does not appear that there are any no-go areas. A site visit is however required to confirm this.

Discussion of expected significance:

Given that lighting associated with these projects will be seen in the context of lighting associated with the wider project, the significance of this impact is likely to be low.

Mitigation might include;

- Use of infra-red systems;
- Control of lighting so that it is split into sectors and only activated during inspections / alarm activations;
- Choice of light fittings to minimize spread of light outside the facility.

There will be no irreplaceable loss.

The impact will reverse on decommissioning of the facility.

Cumulative Impacts:

The development of the proposed additional CSP facilities within the Karoshoek Solar Valley Development will not significantly alter the visual impact associated with the development of parabolic trough facilities on each of the already authorized sites. The visibility of development on the extended sites will be similar in extent to the visibility of development on the already authorised sites.

The area around Upington has been identified by the Department of Environmental Affairs as a Renewable Energy Development Zone (REDZ 7). These zones have been put forward in order to focus development and inform planning. In the Upington area this has resulted in numerous renewable energy project applications. This focus is likely to transform the landscape character of the area.

Gaps in knowledge & recommendations for further study

Minor undulations in landform and density of vegetation could have significant influence on the visibility and nature of views of the development. A site visit is required to assess this in detail.

Impact

Potential impacts on general landscape character of the area and sense of place.

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Industrialisation of general landscape character.	The assessment indicates that the proposed extended development is likely to be visible and therefore influence landscape character over a slightly larger area than the original proposal. However these additional impact areas are either likely to be close to the limit of visibility or the impact will be partially moderated by landform. The additional impact is therefore is likely to be small.	This is likely to be a local impact.	A site visit is required to confirm the nature of the surrounding landscape and the existence or otherwise of sensitive uses.

Discussion of expected significance:

Given these projects will be seen in the context the wider projects, the significance of this impact is likely to be low.

Mitigation might include;

- » Colouring of the mirror backs
- » Minimizing clearance
- » Maintaining natural vegetation within and below troughs
- » Protection of boundary vegetation.

There will be no irreplaceable loss.

The impact will reverse on decommissioning of the facility.

Cumulative Impacts:

The development of the proposed additional CSP facilities within the Karoshoek Solar Valley Development will not significantly alter the visual impact associated with the development of parabolic trough facilities on each of the already authorized sites. The visibility of development on the extended sites will be similar in extent to the visibility of development on the already authorised sites.

The area around Upington has been identified by the Department of Environmental Affairs as a Renewable Energy Development Zone (REDZ 7). These zones have been put forward in order to focus development and inform planning. In the Upington area this has resulted in numerous renewable energy project applications. This focus is likely to transform the landscape character of the area.

Gaps in knowledge & recommendations for further study

The proposed layout of the additional projects in relation to the authorised projects.

The nature of the surrounding landscape, possible sensitive uses and protected areas needs to be confirmed through a site visit.

6.5.4 Impact on Aquatic Ecosystems

Potential impacts on aquatic ecosystems are primarily associated with the abstraction of water for the Ilanga CSP 4 Project from the Orange River. Abstraction of water may result in modification of instream habitats which may in turn result in changes to the aquatic fauna and flora communities which includes species and ecosystems of conservation importance.

Impacts on aquatic ecosystems			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Abstraction of water may result in modification of instream habitats	Negative: Modification of aquatic faunal community including loss of species of conservation concern due to change in habitat	Local to Regional	None identified at this stage
Abstraction of water may result in modification of instream habitats	Negative: Modification of threatened floral community including loss of species of conservation concern due to	Local to Regional	None identified at this stage
Description of expected significance of impact Changes in aquatic habitat due to abstraction, i.e. Reduction of flow, may result in changes in the aquatic faunal as well as riparian and wetland vegetation communities. Within the fish community this may include impacts on the Near Threatened (NT) fish species *L. kimberleyensis*. Increased abstraction may also result in changes to the riparian vegetation community. The Lower Gariep Alluvial Vegetation community that occurs along this section of the Orange River is currently listed as Endangered (EN). Impacts are expected to be moderate to high at a local to regional level, are likely to occur in the short-term (for duration of construction) and may not be reversible. Impacts can be minimised through the implementation of appropriate mitigation measures, to be determined during the EIA Phase.			
Gaps in knowledge & recommendations for further study Further studies need to focus on the degree of change in aquatic habitats associated with the proposed abstraction for the Ilanga CSP 4 facility. Based on this the potential impacts on aquatic fauna and flora needs to be extrapolated.			

6.5.4 Hydrological Impacts

The planned abstraction point is on the Lower Orange River approximately 28km upstream of Upington. The Orange River is the largest catchment in South Africa and at the site the catchment area is approximately 365 000 km^2, thought the effective area is around 275 000 km^2 after the deduction of endorheic areas. Abstractions of water from the proposed development from the Orange River could potentially have an impact on water availability for downstream users, flow depth and velocity and could result in the increase in sedimentation.

Impact on Aquatic Ecology: Hydraulic Aspects			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Impact on flow depth and velocity.	Depth and velocity patterns may change under conditions of abstraction, which in turn may affect the quality of aquatic habitat.	Downstream reaches, especially in branched reaches.	None identified at this stage
Impact on flow duration.	Abstraction during prolonged periods of low river flow, for example, may affect habitat sustainability.	Downstream reaches, especially in branched reaches.	None identified at this stage
Changes in sediment regime.	Changes in sediment movement (deposition and scour) may influence habitat conditions. *[This assessment will assess shear stress at the selected cross-section, and will therefore be indicative.]*	Downstream reaches, especially in branched reaches.	None identified at this stage
Impacts on downstream users.	Abstractions may affect water availability for downstream users, especially under low river flow conditions. This impact will not be analysed explicitly but will be inferred from the analysis of river flow patterns.	Downstream reaches, especially in branched reaches.	None identified at this stage
Risk of limited, or no abstraction	Assess the risk of abstraction limitations due to low flow, or aquatic ecology requirements (e.g. breeding patterns).	Downstream reaches, especially in branched reaches.	None identified at this stage
Other impacts	As may be determined during the site investigation and/or data analysis.	Downstream reaches, especially in branched reaches.	None identified at this stage
Description of expected significance of impact These will be determined as part of the assessment and described in terms of significance, consequence, duration and probability of the impacts as well as degree to which these impacts:			

- can be reversed;
- may cause irreplaceable loss of resources; and
- can be avoided, managed or mitigated

Gaps in knowledge & recommendations for further study

Further studies need to focus on the degree of change in aquatic habitats associated with the proposed abstraction for the Ilanga CSP 4 facility. Based on this the potential impacts on aquatic fauna and flora needs to be extrapolated.

Impact on Land Use, Soil and Agricultural Potential

Impact

Potential impacts associated with operation of the proposed development include loss of soil resources as a result of erosion

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Loss of soil resources as a result of erosion during all phases of the project	Soil erosion is a natural process whereby the ground level is lowered by wind or water action and may occur as a result of inter alia chemical processes and/or physical transport on the land surface. Accelerated erosion is a common occurrence on construction sites where soil is loosened and vegetation cover is stripped. This impact can be largely minimised through the implementation of appropriate mitigation measures.	Local	None

Description of expected significance of impact

As a result of the limited agricultural potential of the site due largely to local climatic factors, the construction of the proposed projects are expected to be very unlikely to occur and will not result in the irreplaceable loss of resources. Impacts of the proposed projects on agricultural potential are expected to be of very low significance. No mitigation is required in this regard.

There is the potential for the loss of soil resources through erosion, particularly during the construction phase. This impact can be effectively minimised through the implementation of appropriate mitigation measures including implementation of an appropriate stormwater management plan and regular monitoring of the occurrence, spread and potential cumulative effects of erosion. Impacts post-mitigation are expected to be of low significance.

Gaps in knowledge & recommendations for further study

None. As a result of the low significance of impacts, no further studies are required to be undertaken.

6.5.5 Social Impacts

The potential positive impacts which could arise as a result of the operation phase include the following:

» During the operational phase employment opportunities would be created which could result in benefits to unemployed individuals within the local communities.
» Capacity building and skills development throughout the life of the facility could be to the benefit of the employees and could assist them in obtaining transferable skills.
» During the operational phase local procurement for general materials, goods and services (e.g. transport, catering and security) and other spin-off benefits could materialise.
» The presence of permanent security personnel at the facility could be beneficial to the overall security measures implemented in the area.
» The proposed project could assist in 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 project thereby providing clean, renewable energy supply.

The potential negative impacts which could arise as a result of the operation phase include the following:
» The permanent visual impact associated the solar energy facility (solar facility, power line, access roads, firebreaks, etc.) would alter the landscape. Perceptions with regards to the intensity of such an impact are expected to differ among landowners, stakeholders and other individuals. It is anticipated that each person would experience such an impact in a different way depending on their perception of the CSP facility itself, the activities undertaken on the surrounding area, their interest in the project and their exposure to the project on a daily basis. The proposed facility is located in a rural area so the visual implications could have a further negative impact on the area's sense of place.
» Direct occupation of land by the CSP facility has the effect of taking the impacted land out of agricultural production, through the occupation of the site by the footprint of the facility.

Impact: Direct employment opportunities and skills development
The operation phase (20-25 years) of the proposed development will require a workforce and therefore direct employment will be generated. Primarily skilled and high skilled personal will be required during the operation phase. The proponent has also indicated that training will be provided for employees

during the operation phase.

Desktop Sensitivity Analysis of the Site:
A limited number of local community members are likely going to benefit from this positive impact.

Issue	Nature	Extent of Impact	No-Go Areas
Direct employment opportunities and skills development	The creation of long term employment opportunities and skills development opportunities during the operation phase for the country and local economy	Local-regional	None

Description of expected significance of impact
The potential impact is expected to be positive, probable, long term, with a minor intensity and have a low - medium significance. This will be confirmed during the EIA phase following detailed investigations and assessment of impacts. In terms of reversibility of the impact and irreplaceable loss of resources, this is not applicable to this type of impact. The potential impact may be enhanced with possible enhancement measures which will be elaborated in the SIA EIA phase.

Gaps in knowledge & recommendations for further study
It is recommended that a detailed SIA is undertaken to determine actual impact of job creation and skills development opportunities during the operation phase.

Impact: Economic multiplier effects
There are likely to be opportunities for local businesses to provide services and materials for the operation phase of the development. The local service sector will also benefit from the proposed development. In terms of business opportunities for local companies, expenditure during the operation phase will create business opportunities for the regional and local economy. Also the injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area.

Desktop Sensitivity Analysis of the Site:
The KHLM, nearby towns and local community members are most likely going to benefit from this positive impact.

Issue	Nature	Extent of Impact	No-Go Areas
Economic multiplier effects	Significance of the impact from the economic multiplier effects from the use of local goods and services	Local-regional	None

Description of expected significance of impact
The potential impact is expected to be positive, probable, long term, with a minor intensity and have a low significance. This will be confirmed during the

EIA phase following detailed investigations and assessment of impacts. In terms of reversibility of the impact and irreplaceable loss of resources, this is not applicable to this type of impact. The potential impact may be enhanced with possible enhancement measures which will be elaborated in the SIA EIA phase.

Gaps in knowledge & recommendations for further study

It is recommended that this impact is further assessed in the EIA phase of the SIA.

Impact: Socio-Economic Development (SED), Enterprise Development (ED) and share ownership in the project company with local communities:

Renewable energy projects under the Renewable Energy Independent Power Producer Procurement (REIPPP) programme are obliged to make a real contribution to local economic development in the area. Awarded projects are required to spend a certain amount of their generated revenue on SED and ED and share ownership in the project company with local communities. These criteria, as well as the creation of a specific number of jobs, are incentivised through awarding higher scoring to projects that realise such criteria within a 50km radius to the project site during the evaluation process. Additionally, projects add value to the local economy through targeted procurement from local businesses. Job creation requirements target national and local citizens. Between 12% and 20% of the people employed on each project have to be residents of local communities.

Desktop Sensitivity Analysis of the Site:

The KHLM and local people from the nearby towns are most likely going to benefit from job opportunities and SED/ ED.

Issue	Nature	Extent of Impact	No-Go Areas
SED, ED and share ownership in the project company with local communities	Positive long-term impact from SED, ED and local share ownership in the project company	Local	None

Description of expected significance of impact

The potential impact is expected to be positive, probable, long term, with a moderate intensity and have a medium significance. This will be confirmed during the EIA phase following detailed investigations and assessment of impacts. The potential impact can be reversed and there is no irreplaceable loss of resources associated with the potential impact. The potential impact may be enhanced with possible enhancement measures which will be elaborated on in the SIA EIA phase.

Gaps in knowledge & recommendations for further study

An additional in-depth community needs assessment (CNA) will need to be carried out at a later stage to make sure that the real needs of communities are addressed (in line with the local government) by development programmes in order to significantly contribute towards local economic growth, SED and ED. A detailed SIA is also recommended to determine the actual impact of these benefits.

Impact:

Development of clean, renewable energy infrastructure:

The use of solar radiation for power generation is considered a non-consumptive use of a natural resource which produces zero greenhouse gas emissions. The generation of renewable energy will contribute to South Africa's electricity market. The advancement of renewable energy is a priority for South Africa. Bringing in the renewable energy sector to the local economy may contribute to the diversification of the local economy and provide greater economic stability.

Desktop Sensitivity Analysis of the Site:

N/A

Issue	Nature	Extent of Impact	No-Go Areas
Development of clean, renewable energy infrastructure	Positive long-term impacts from the generation of renewable energy	Local-regional-national	None

Description of expected significance of impact

The potential impact is expected to be positive, probable, long term, with a moderate intensity and have a medium significance. This will be confirmed during the EIA phase following detailed investigations and assessment of impacts. The potential impact can be reversed and there is no irreplaceable loss of resources associated with the potential impact.

Gaps in knowledge & recommendations for further study

None at this stage in the process.

Impact:

Visual impact and impacts on sense of place:

The sense of place is developed over time as the community embraces the surrounding environment, becomes familiar with its physical properties, and creates its own history. The sense of place is created through the interaction of various characteristics of the environment, including atmosphere, visual resources, aesthetics, climate, lifestyle, culture and heritage. Importantly though it is a subjective matter and is dependent on the demographics of the population that resides in the area and their perceptions regarding trade-offs. An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light. The social impacts associated with the impact on sense of place relate to the change in the landscape character and visual impact from the proposed CSP facility.

Desktop Sensitivity Analysis of the Site:

Sensitive receptors include the immediate area of influence; landowners in the study area and commuters utilising the N10.

Issue	Nature	Extent of Impact	No-Go Areas
Visual impact and impacts on sense of place	Visual impacts and sense of place impacts associated with the operation phase of the project	Local	None

Description of expected significance of impact

The potential impact is expected to be negative, probable, long term, with a moderate intensity and have a low-medium significance. This will be confirmed during the EIA phase following detailed investigations and assessment of impacts. The potential impact can be reversed and there is no irreplaceable loss of resources associated with the potential impact. The potential impact may be mitigated with possible mitigation measures which will be elaborated in the SIA EIA phase.

Gaps in knowledge & recommendations for further study

A visual impact assessment will need to be undertaken to determine the exact visual impacts associated with the proposed facility.

Impact:

Impacts associated with the loss of agricultural land:

The activities associated with the operation phase of the CSP facility will result in a loss of farmland available for grazing and potential loss of agricultural production for the operation period of 20-25 years. The proposed site is located within an area of low agricultural potential as a result of climactic constraints.

Desktop Sensitivity Analysis of the Site:

Sensitive areas include the proposed sites and development footprint area.

Issue	Nature	Extent of Impact	No-Go Areas
Impacts associated with the loss of agricultural land	Impacts associated with loss of farmland available for agricultural use due to occupation of land by the CSP facility for 20-25 years	Local (Site)	None

Description of expected significance of impact

The potential impact is expected to be negative, probable, long term, with a low intensity and have a low-medium significance. This will be confirmed during the EIA phase following detailed investigations and assessment of impacts. The potential impact can be reversed and there is no irreplaceable loss of resources associated with the potential impact. The potential impact may be mitigated with possible mitigation measures which will be elaborated on in the SIA EIA phase.

Gaps in knowledge & recommendations for further study

The agricultural potential study states that no detailed study is required as a result of the low impact expected.

6.6 Evaluation of potential Cumulative impacts associated with the Ilanga CSP 4 and Other Solar Projects in the Area

Cumulative impacts, in relation to an activity, refer 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 activities or undertakings in the area. For cumulative effects analysis to help the decision-maker and inform interested parties, it must be limited to effects that can be evaluated meaningfully (DEAT, 2004). Boundaries must be set so analysts are not attempted to measure effects on everything. Therefore, the cumulative impacts associated with the proposed Ilanga CSP 4 Project have been viewed from two perspectives within this report:

» Cumulative impacts associated with the scale of the project i.e. 150MW trough facility in close proximity to other authorised projects of a similar nature (i.e. projects within the Karoshoek Solar Valley Development);
» Cumulative impacts associated with other relevant approved or existing CSP developments within a 30 km radius of the proposed site.

Cumulative effects are commonly understood as the impacts which combine from different projects and which result in significant change, which is larger than the sum of all the impacts (DEAT, 2004). The complicating factor is that the projects that need to be considered are from past, present and reasonably foreseeable future development. Cumulative effects can be characterised according to the pathway they follow. One pathway could be the persistent additions from one process. Another pathway could be the compounding effect from one or more processes. Cumulative effects can therefore occur when impacts are:

» additive (incremental);
» interactive;
» sequential; or
» synergistic.

Canter and Sadler (1997) describe a three step process for addressing cumulative effects in an EIA:

» delineating potential sources of cumulative change (i.e. GIS to map the relevant renewable energy facilities in close proximity to one another).
» identifying the pathways of possible change (direct impacts)
» indirect, non-linear or synergistic processes; and
» Classification of resultant cumulative changes

The Ilanga CSP 4 Project is proposed to be located Portion 2 of the Farm Matjiesrivier 41, approximately 30 km east of Upington within the Khara Hais Local Municipality in the Northern Cape Province. **Table 6.1** below shows the known solar projects in the

broader area (at least 14 other facilities, 2 of which are preferred bidder projects) as well as Figure 6.2.

Table 6.1: Other projects/ developments within 30km from the Ilanga CSP 4 Project site

Project Name	DEA Ref. No	Location	Approximate distance from the Karoshoek Solar Valley Project development site	Project Status
Ilanga Solar Thermal Power Plant	12/12/20/2056	Lot 944 Karos Settlement	Within the Karoshoek Solar Valley development site	Preferred Bidder Round 3; under construction
Karoshoek Solar Valley Development	14/12/16/3/3/2/289 14/12/16/3/3/2/290 14/12/16/3/3/2/291 14/12/16/3/3/2/292 14/12/16/3/3/2/293 14/12/16/3/3/2/294 14/12/16/3/3/2/295 14/12/16/3/3/2/296 14/12/16/3/3/2/297 14/12/16/3/3/2/298 14/12/16/3/3/2/299	Matjesriver RE and 2/41, Matjesriver 3/41, Karos 956 and Lot 944 Karos Settlement	All within the Karoshoek Solar Valley development site	Received Authorisation
25MW Solar Energy Facility, North-East Of Upington, NC Province	12/12/20/2169	Remaining Extent of the Farm 418	20km north	Received Authorisation
Upington Airport PV Solar Energy Facility	12/12/20/2146	Upington International Airport	25km north west	Preferred Bidder Round 2; construction completed
Kheis Solar Phase 3 phases	14/12/16/3/3/2/569 14/12/16/3/3/2/570 14/12/16/3/3/2/571	Portion 7 and Portion 9 of the Farm Namakwari 656	30km south east	Received Authorisation
Albany Solar Energy Facility	14/12/16/3/3/2/639	Remainder of Farm Albany 405	25km north east	In Process

Project Name	DEA Ref. No	Location	Approximate distance from the Karoshoek Solar Valley Project development site	Project Status
Avondale Solar Park 1	14/12/16/3/3/2/618	Portion 1 of the Farm Avondale No. 410	20km north	In Process

The impact of Ilanga CSP 4 Project on the landscape is considered likely to be a key issue in certain parts of South Africa where there is a growing number of solar energy facility applications. Cumulative impacts are expected to be associated with the following:

» Impacts on ecology (Fauna and Flora);
» Impact on avifauna;
» Aquatic Impacts;
» Hydrological impacts;
» Impacts on soil resources, land use and agricultural potential;
» Loss of heritage and archaeological resources;
» Visual impacts; and
» Impacts on the social environment (both positive and negative).

Potential cumulative impacts associated with numerous solar energy developments within the study area are also positive and these too need to be considered, for instance:

» 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 be in line 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 committed to by government and as detailed in the Integrated Resource Plan (IRP), *inter alia*.
» The development of renewable energy facilities will have a positive impact at a regional and local level through increased work and skills development opportunities and the associated reduced poverty levels.
» More projects within a single area will enhance the shareholding benefits that flow to the local community and will create cumulative positive impacts via the increased socio-economic and enterprise obligations that benefit the local community.

» Renewable energy, specifically solar energy, is the cheapest form of energy available to the country and hence the exploitation of high solar resource areas so as to reduce electricity tariffs is of direct benefit to the national economy and all South Africa's citizens.

Cumulative impacts will be fully assessed in the EIA phase. Each specialist study will consider and assess the cumulative impacts of proposed, approved and authorised renewable projects in the area.

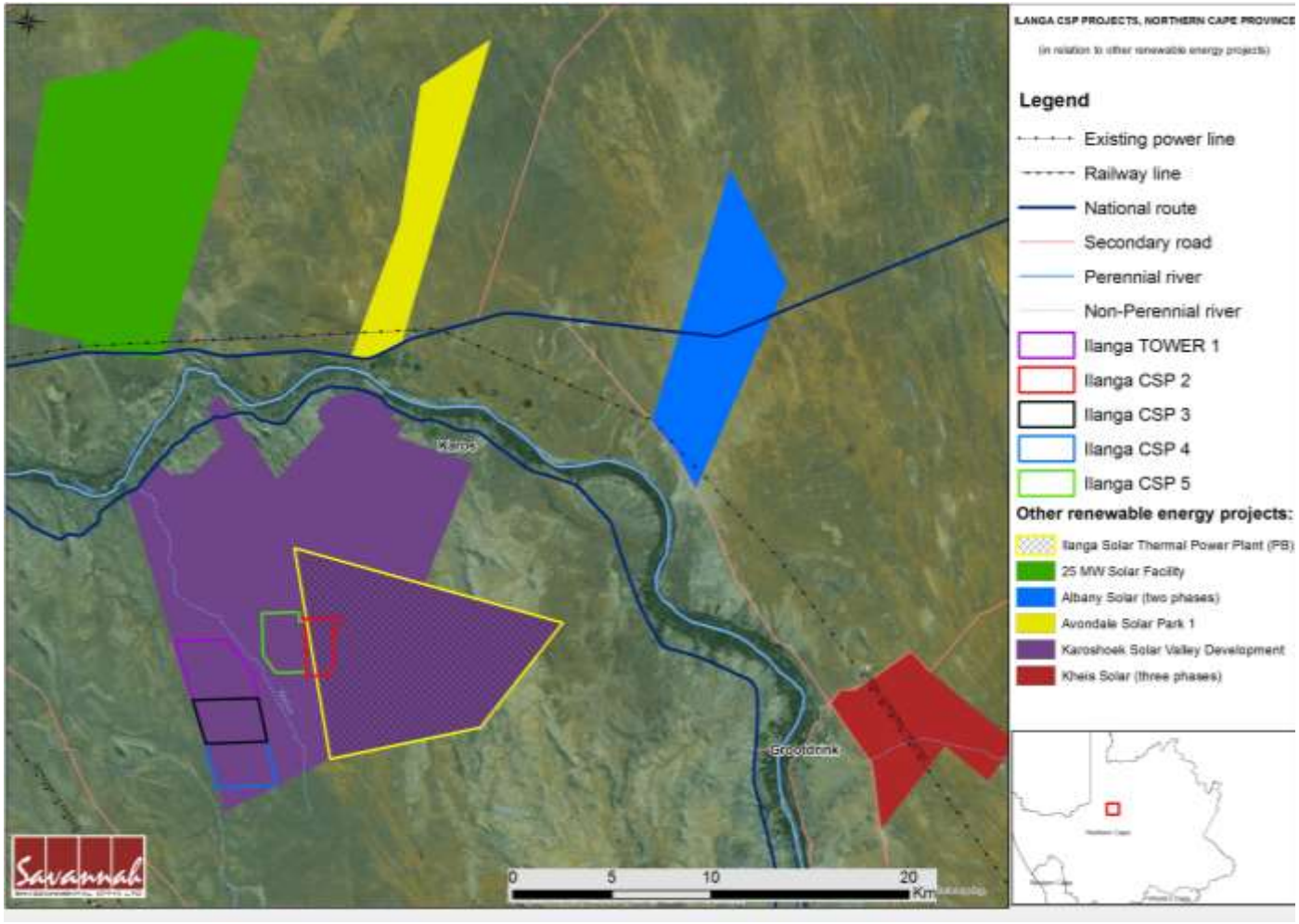

Figure 6.2: Map showing other projects in the study area. These projects were identified using the Department of Environmental Affairs Geographic Information System digital data developed by the CSIR

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CONCLUSIONS CHAPTER 7

FG Emvelo (Pty) Ltd, an independent power developer of concentrating solar power (CSP) plants in South Africa, is proposing the development an additional Concentrated Solar Power (CSP) Facility and associated infrastructure adjacent to the authorised CSP site (Karoshoek LFTT 2 (1 x 100 MW Parabolic Trough) Site 5 - DEA Ref No.: 14/12/16/3/3/2/295) within the Karoshoek Solar Valley Development on a site located approximately 30 km east of Upington within the Khara Hais Local Municipality in the Northern Cape Province. The proposed project is to be known as the **Ilanga CSP 4** Project. The **Ilanga CSP 4** Project under investigation through this scoping report is proposed to generate up to 50MW in capacity and will be constructed over an area of approximately 680ha in extent within the broader property.

The purpose of this proposed additional CSP facility is to facilitate the increase in capacity of the authorised facility to 150MW in order to meet the generating capacity thresholds specified by the Department of Energy (DoE) in its Expedited Bid Window of the Renewable Energy Independent Power Producers Procurement (REIPPP) Programme (Tender No: DOE/003/13/14 – as amended from time to time).

The Scoping Report for the proposed Ilanga CSP 4 Project has been undertaken in accordance with the EIA Regulations published in Government Notice 38282 of 4 December 2014, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

This Scoping Report is aimed at detailing the nature and extent of this facility, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders (including relevant government authorities) and interested and affected parties (I&APs). The public consultation process is extensive and on-going, and every effort is being made to include representatives of all stakeholder groupings in the study area and the Province. This chapter concludes the Scoping Report and provides an evaluation of the identified potential environmental risks and impacts associated with the construction and operation phases of the Ilanga CSP 4 Project. Recommendations regarding investigations required to be undertaken within the EIA are provided within the Plan of Study for EIA, contained within Chapter 8 of this scoping report.

The conclusions and recommendations of this Scoping Report are the result of the review of existing information (including previous detailed studies for the site), desk-top evaluations, on-site inspections of impacts identified by specialists and limited field work, with the aim of identifying risks and sensitivities on the proposed development site. The public consultation process is extensive and every effort is being made to include representatives of all stakeholder groupings in the study area and the Province.

7.1 Legal Requirements as per the EIA Regulations, 2014

This chapter of the scoping report includes the following information required in terms of Appendix 2: Content of the Scoping Report of the EIA Regulations, 2014:

Requirement	Relevant Section
(h)(xi) a concluding statement indicating the preferred alternatives, including the preferred location of the activity.	A concluding statement regarding the CSP facilities is included within this chapter as a whole.

7.2. Conclusions drawn from the Evaluation of the Proposed Ilanga CSP 4 Project

The Ilanga CSP 4 Project is proposed to generate up to 150MW in capacity (i.e. the combined capacity of the authorised facility and that considered within this report) and will be constructed over an area of approximately 680ha in extent within the broader property. The proposed Ilanga CSP 4 project will consist of parabolic trough technology with a heat transfer fluid (HTF).. Infrastructure associated[12] with the facility includes:

» Parabolic troughs utilising a heat transfer fluid (HTF)
» Power Plant/Power Island: power island with steam turbine generator, auxiliary boilers, dry cooling and molten salt storage.
» Associated infrastructure: access roads, plant substation, power line, water abstraction point and supply pipeline, water storage tanks, packaged water treatment plant, lined evaporation ponds, and workshop and office buildings.

The key issues and potential impacts identified through this scoping study associated with the Ilanga CSP 4 Project are summarised in **Table 7.1**.

[12] Note that associated infrastructure will be assessed through a separate Basic Assessment process

Table 7.1: Summary of the extent of the potential impacts associated with the Ilanga CSP 4 Project, as identified at the scoping phase

Construction / Decommissioning Impacts	Extent
Disturbance to and loss of indigenous natural vegetation	L
Disturbance or loss of threatened / protected plants	L
Loss of protected trees	L
Loss of habitat for fauna species of conservation concern	L
Impacts on depressions and ephemeral drainage lines	L-R
Establishment and spread of declared weeds and alien invader plants.	L-R
Habitat destruction within the CSP heliostat array footprint	S
Abstraction of water may result in modification of instream habitats	L-R
Abstraction of water may result in modification of instream habitats	L-R
Impact on flow depth and velocity	L-R
Impact on flow duration	L-R
Changes in sediment regime	L-R
Impacts on downstream users	L-R
Soil degradation during the construction phase	L
Loss of grazing land due to the direct impact by the infrastructure's footprint during all phases of the project	L
Loss of soil resources as a result of erosion during all phases of the project	L
Visual impact on surrounding areas as a result of construction activities	L
Potential impacts on general landscape character of the area and sense of place.	L
Direct employment opportunities and skills development	L
Impact: Economic multiplier effects	L-R
Safety and security impacts	L
Impacts on daily living and movement patterns	L
Pressure on economic and social infrastructure impacts from an in-migration of people	L-R
Nuisance Impacts (noise & dust)	L
Disturbance and destruction of archaeological sites and graves	L
Loss of unique fossil heritage	L

Operational Impacts	Extent
Disturbance or loss of indigenous natural vegetation	L
Altered runoff patterns due to rainfall interception by panels and compacted areas	S-L
Disturbance to migration routes and associated impacts to species populations	S-L
Impacts on depressions and ephemeral drainage lines	L-R
Establishment and spread of declared weeds and alien invader plants	L-R
Incineration or feather singeing in solar flux	L
Collision with parabolic troughs and infrastructure	L
Disturbance due to construction of the parabolic troughs and infrastructure	L
Habitat destruction within the CSP heliostat array footprint	L
Potential visual impact on users of roads in close proximity to the proposed Ilanga CSP 4 Project	L
Potential visual impact on residents of settlements and homesteads in close proximity to the proposed solar energy facilities	L
Potential visual impact on sensitive visual receptors within the region.	L
Potential visual impact of night lighting.	L
Potential impacts on general landscape character of the area and sense of place.	L
Ocular impacts associated with glint and glare.	L
Modification of aquatic faunal community including loss of species of conservation concern due to change in habitat	L-R
Modification of threatened floral community including loss of species of conservation concern due to change in habitat	L-R
Impact on flow depth and velocity.	L-R
Impact on flow duration.	L-R
Changes in sediment regime.	L-R
Impacts on downstream users.	L-R
Risk of limited, or no abstraction	L-R
Loss of grazing land due to the direct impact by the infrastructure's footprint	L
Loss of soil resources as a result of erosion	L
Direct employment opportunities and skills development	L-R
Socio-Economic Development (SED), Enterprise Development (ED) and share ownership in the project company with local communities:	L
Development of clean, renewable energy infrastructure	L-R
Visual impact and impacts on sense of place	L
Impacts associated with the loss of agricultural land	L

S	**Site**	L	**Local**	R	**Regional**	N	**National**	I	**International**

From this table it can be concluded that the majority of potential impacts identified to be associated with the construction of the proposed Ilanga CSP 4 Project are anticipated to be mostly localised with few impacts extending from a local to regional extent. From the specialist studies undertaken, the following expected significance is attributed to the identified impacts:

- Impacts on ecology – The impacts for the construction and operational phase range from local to regional level. The most significant potential impacts expected are:
  - Reduction of a stable vegetation cover and associated below-ground biomass that currently increases soil surface porosity, water infiltration rates and thus improves the soil moisture availability. Without this vegetation, the soil will be prone to extensive surface capping, leading to accelerated erosion and further loss of organic material and soil seed reserves from the local environment.
  - A loss of portions of potential sensitive habitats, should the ecological state and conservation value of the vegetation, as well as the presence of protected plant species be found to be significant.
  - Disturbed vegetation in the study area carries a high risk of invasion by alien invasive plants.
- Hydrological Impacts - The impacts for the construction and operational phase range from local to regional level. The most significant potential impacts expected are:
  - Impact on flow depth and velocity - Depth and velocity patterns may change under conditions of abstraction, which in turn may affect the quality of aquatic habitat.
  - Impact on flow duration - Abstraction during prolonged periods of low river flow, for example, may affect habitat sustainability.
  - Changes in sediment regime - Changes in sediment movement (deposition and scour) may influence habitat conditions.
  - Impacts on downstream users - Abstractions may affect water availability for downstream users, especially under low river flow conditions.
- Potential Impact on Aquatic Ecosystems - The impacts for the construction and operational phase range from local to regional level. The most significant potential impacts expected are:
  - Modification of aquatic faunal community including loss of species of conservation concern due to change in habitat.
  - Modification of threatened floral community including loss of species of conservation concern due to change in habitat.
- Potential Impact on Soil, Agricultural Potential and Land use capacity - The impacts for the construction and operational phase will be at a local level. The overall impacts of the proposed facility on agriculture and soil conditions will be low, principally because of the climatic conditions and the low agricultural

and grazing potential of the site. There is the potential for the loss of soil resources through erosion, particularly during the construction phase. The most significant potential impacts expected are:

- Soil degradation during the construction phase.
- Loss of grazing land due to the direct impact by the infrastructure's footprint during all phases of the project.
- Loss of soil resources as a result of erosion during all phases of the project.

» Potential Visual Impacts - The impacts for the construction and operational phase will be at a local level. The most significant potential impacts expected are:

- Potential visual impact on users of roads in close proximity to the proposed Karoshoek Solar Valley Development.
- Potential visual impact on residents of settlements and homesteads in close proximity to the proposed solar energy facilities.
- Potential visual impact on sensitive visual receptors within the region.
- Potential lighting impacts.
- Potential impacts on general landscape character of the area.
- Ocular impacts associated with glint and glare.

» Potential Impacts on Heritage Resources - The construction of the project could have a low impact on a local scale. The most significant potential impact expected is:

- Disturbance and destruction of archaeological sites and graves.

» Potential Impacts on Paleontological Resources - The impacts for the construction phase have an impact on a local level (Restricted to the development footprint). The most significant potential impact expected is:

- Loss of unique fossil heritage- mainly due to Disturbance, damage or destruction or sealing-in of fossils, especially by ground-clearance and excavations during the construction phase.

» Potential Social Impacts - The impacts for the construction and operational phase range from local to regional level. The most important potential social benefits associated with the construction and operation of the proposed project includes job opportunities and possible socio-economic spin-offs created. The most significant negative potential impacts expected are:

- Safety and security impacts.
- Pressure on economic and social infrastructure impacts from an in-migration of people.
- Visual impact and impacts on sense of place.

No environmental fatal flaws or impacts of very high significance were identified to be associated with the proposed project on the identified site at this stage in the process. This conclusion must however be confirmed through a detailed investigation of the development footprint within the EIA Phase of the process.

7.3 Risks Associated with the Proposed Project

The most significant risk associated with the development of the CSP facility will be potential conflict with the land-use of the area. As the land is currently primarily used for grazing the development of the facility will lead to a loss of space for the undertaking of this activity. The extent of this impact is expected to be limited as a result of the low potential of the site for agricultural activities. In addition, the site is located within the identified Solar Development Corridor (defined by the Provincial SDF) and is also located within a proposed REDZ for Solar Development (Zone 7). The proposed land use is therefore considered to be compatible with this planning. The risk in terms of conflicts with land use is therefore considered to be low.

Other risks associated with the project include those posed to sensitive environments within the site. The proposed site is adjacent to an authorised CSP facility which was sited taking the sensitivities of the broader site into consideration. The proposed site is therefore also located in an area removed from high sensitivity features. Areas of sensitivity which cannot be avoided include ephemeral drainage lines which cross the larger property. Impacts on these have however been minimised as far as possible through the careful placement of the proposed development area.

Due to the low rainfall in the study area, water availability for the potential CSP facility during construction and operation is considered to be a potential risk. Abstractions may affect water availability for downstream users, especially under low river flow conditions. A non-binding confirmation of water availability has been provided for the project from the Department of Water and Sanitation (refer to Appendix C6). This risk will need to be assessed in detail during the EIA Phase.

7.4 Sensitivity Analysis for the Study Site

The **potentially sensitive areas** which have been identified through the scoping study are listed below and summarised in **Figure 7.1** (Sensitivity Map). The scoping phase sensitivity map provides an informed illustration of sensitivity within and around the larger site. The detail is based on the desktop review of the available baseline information for the study area (including information from detailed studies previously undertaken for the property), as well as limited field surveys. The sensitivity map is intended to inform the location and layout of the CSP facility, and must be used as a tool by the developer to avoid those areas flagged to be of potential high sensitivity as far as possible. Specific sensitivities identified within the scoping study are summarised below.

Visual receptors

The desktop scoping assessment indicates that the development of the proposed project will impact to a limited extent on relatively natural areas surrounding the development area. The character of affected areas will change due to the extent of authorised solar power projects in the area. These will have the effect of industrialising the character of the landscape surrounding them. The assessment has indicated that the proposed new facility is unlikely to add significantly to the visual impact associated with the already authorised facilities.

Further, the natural bushveld that covers the majority of the affected area could provide significant screening effect particularly if trees and tall shrubs extend above eye level. The distance between possible sensitive receivers and the facility also means that intervening vegetation is likely to combine to provide a cumulative screening effect.

Archaeological resources

Archaeological sites are expected in the form of widespread stone artefact scatters mainly from the Middle Stone Age (MSA) and Later Stone Age (LSA), Early Stone Age (ESA) material is also recorded to the north west of the study area. Areas where granite outcrops occur with "pans" or shallow depressions that contain seasonal water, as well as areas along stream beds might contain sites. Farming infrastructure can occur throughout the study area but is not anticipated to be older than 60 years. No standing structures could be identified through this desk-top level study. Some stone cairns are recorded in the wider region and could be graves and similar occurrences can be expected in the study area. Family cemeteries might be found in association with farmsteads and labourer dwellings. Based on the current information obtained for the area at a desktop level it is anticipated that any sites that occur within the proposed development area will have a Generally Protected B (GP.B) field rating apart from graves and rock art that could have a Generally Protected A (GP.A) field rating and all sites should be mitigatable and no red flags are identified.

Ecological sensitive features

Ilanga CSP 4 site contains the upper reaches of drainage lines which were not well-developed and are not considered to be highly significant from an ecological perspective as these areas are not well differentiated from the surrounding vegetation. The vegetation is not highly sensitive and the only listed species observed in the area was *Boscia albitrunca*. *Hoodia gordonii* may however also occur in the area.

It is possible that this drainage lines and possibly the rocky outcropping will extend into the area for the proposed new facility. Furthermore, the above-

mentioned protected and listed species are likely to extend into the area for the proposed new facility. The extent and sensitivity of these areas will be confirmed during the EIA phase.

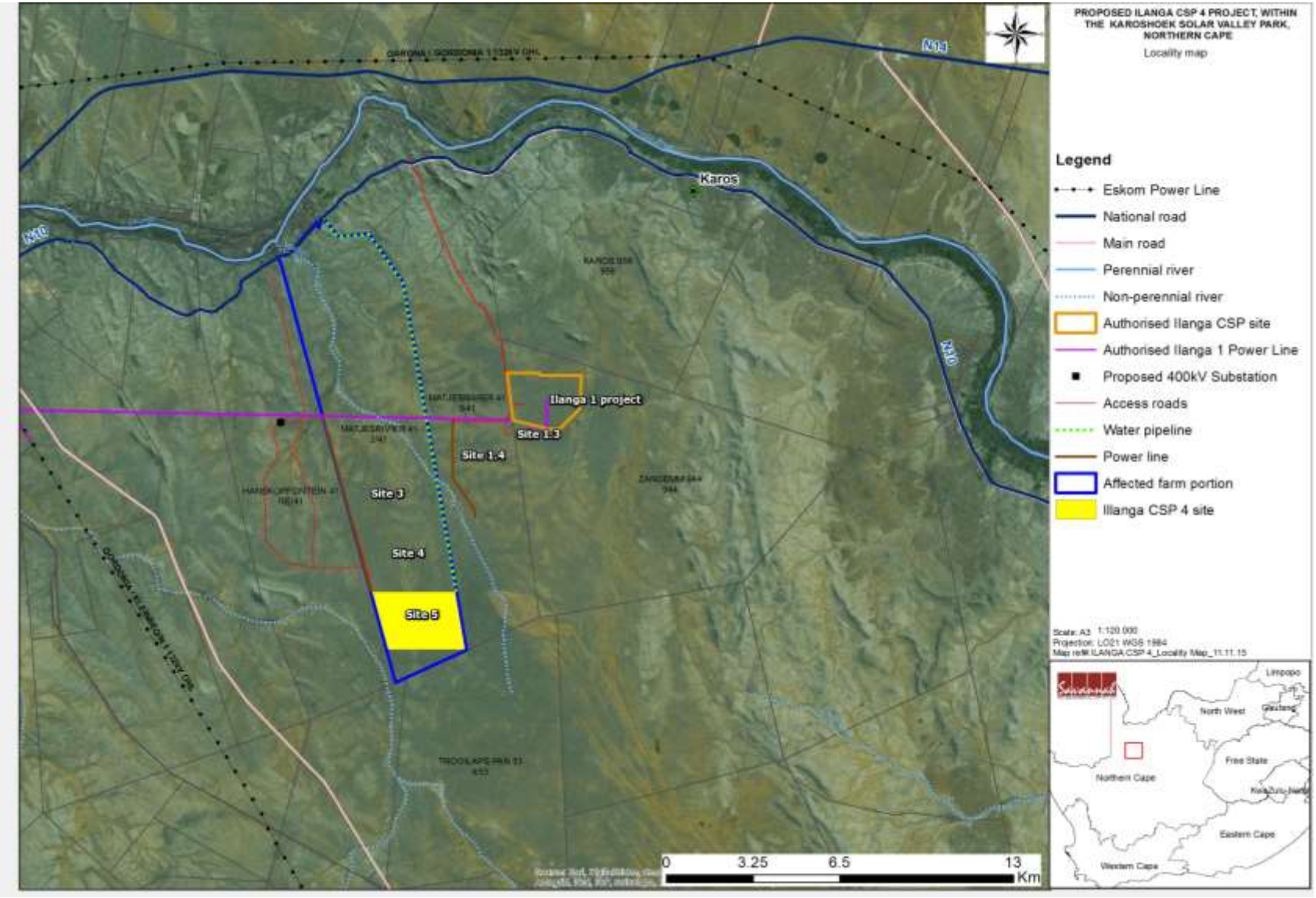

Figure 7.1: Environmental Sensitivity Map for the Proposed Ilanga CSP 4 Project (refer to Appendix O – A3 Maps)

The above mentioned sensitivities (visual, heritage and ecological) are illustrated within the overall sensitivity map in **Figure 7.1** below. Any portions of the site which are proposed to be used for development will be subject to survey and ground-truthing during the EIA phase of the project. The potentially sensitive areas identified to date will therefore be further investigated and assessed through detailed specialist studies (including field surveys) during the EIA phase of the process (refer to Chapter 8 for more details) and the sensitivity map will be further refined on the basis of these specialist studies, in order to provide an assessment of environmental acceptability and suitability of the final design of the facility.

7.5 Recommendations

At this stage in the process, there are no environmental fatal flaws associated with the Ilanga CSP 4 Project within Portion 2 of the Farm Matjiesrivier 41, and there is no reason for the Karoshoek CSP CSP 4 Project not to be evaluated further. It is however recommended that the focus areas for the development of the facility be considered outside of the identified areas of a high sensitivity as far as possible.

With an understanding of which areas within the site are considered sensitive to the development of the proposed facility, FG Emvelo (Pty) Ltd can prepare the detailed infrastructure layout for consideration within the EIA Phase. During the EIA phase more detailed environmental studies will be conducted in line with the Plan of Study contained in Chapter 8 of this report. These studies will consider the detailed layouts produced by the developer and make recommendations for the implementation of avoidance strategies (if required), mitigation and management measures to ensure that the final assessed layout retains an acceptable environmental impact.

REFERENCES CHAPTER 9

CSIR, August 2015. Financial benefits of renewables in South Africa in 2015. http://www.csir.co.za/media_releases/docs/Financial%20benefits%20of%20Wind%20and%20PV%202015.pdf

DoE, Natioanl Treasury and DBSA, June 2015. REIPPPP focus on Northern Cape

Ecology

Apps, P. (ed.). 2012. Smither's Mammals of Southern Africa. A field guide. Random House Struik, Cape Town, RSA

Alexander, G. & Marais, J. 2007. A Guide to the Reptiles of Southern Africa. Struik Nature, Cape Town.

Anhaeusser, C.R., Johnson, M.R., Thomas, R.J. (2008). The Geology of South Africa. Council for Geosciences.

Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J. & de Villiers, M. S. 2014. Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. Strelitzia 32. SANBI, Pretoria.

Branch W.R. 1998. Field guide to snakes and other reptiles of southern Africa. Struik, Cape Town.

Department of Environmental Affairs and Tourism, 2007. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Publication of lists of Critically Endangered, Endangered, Vulnerable and Protected Species. Government Gazette, Republic of South Africa

Du Preez, L. & Carruthers, V. 2009. A Complete Guide to the Frogs of Southern Africa. Struik Nature., Cape Town.

Friedmann, Y. & Daly, B. 2004. Red data book of the mammals of South Africa, a conservation assessment. Johannesburg, Endangered Wildlife Trust.

Marais, J. 2004. Complete Guide to the Snakes of Southern Africa. Struik Nature, Cape Town.

Mucina L. & Rutherford M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria

Minter LR, Burger M, Harrison JA, Braack HH, Bishop PJ & Kloepfer D (eds). 2004. Atlas and Red Data book of the frogs of South Africa, Lesotho and Swaziland. SI/MAB Series no. 9. Smithsonian Institution, Washington, D.C.

Raimondo, D., Von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C. Kamundi, D.A. & Manyama, P.A. (Eds.). 2009. Red list of South African plants 2009. Strelitzia 25:1-668

Skinner, J.D. & Chimimba, C.T. 2005. The mammals of the Southern African Subregion. Cambridge University Press, Cambridge.

Strohbach, M. 2013. Mitigation of ecological impacts of renewable energy facilities in South Africa. The Sustainable Energy Resource Handbook (Renewable Energy) South Africa 4: 41 – 47.

Strohbach, M. 2013. Savannah Environmental (2013) Ecological Draft Scoping Report: Proposed Gihon Solar Energy Facility South of Bela-Bela, Limpopo Province.

Todd, S. 2012. Simon Todd Consulting (2012). Terrestrial Fauna & Flora Specialist Impact Assessment: Proposed Karoshoek Solar Valley Development.

Avifauna

Allan DG 2005. Ludwig's Bustard *Neotis ludwigi.* In: Roberts' birds of southern Africa. VII. Hockey PAR, Dean WRJ, Ryan PG (eds). Pp 293-294. John Voelcker Bird book Fund, Cape Town.

Allan DG, Osborne TO. 2005. Kori Bustard *Ardeotis kori.* In: Roberts' birds of southern Africa. Hockey PAR, Dean WRJ, Ryan PG (eds). Pp 295-296. John Voelcker Bird book Fund, Cape Town.

Barnes, K.N. (ed.) 1998. The Important Bird Areas of southern Africa. BirdLife South Africa, Johannesburg.

Barnes, K.N. (ed.) 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg.

Davies, B.R., O'Keefe, J.H. & Snaddon, C.D. 1993. A synthesis of the ecological functioning, conservation and management of South African river ecosystems. Water Research Commission Report No. TT 62/93, Pretoria.

Dean W.R.J. 2004. Nomadic Desert Birds. Adaptations of Desert Organisms series. Springer Verlag, Berlin, Heidelberg, New York

Harvey HT and Associates 2015. Ivanpah Solar Electric Generating System Avian & Bat Monitoring Plan -

2013-2014 Annual Report (Revised). 29 October 2013 - 20 October 2014 - Report prepared by H.T. Harvey & Associates. California Energy Commission.

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V & Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1&2. BirdLife South Africa, Johannesburg.

Hockey, P.A.R., Dean, W.R.J., Ryan, P.G. (Eds) 2005. Roberts – Birds of Southern Africa, VIIth ed. The rustees of the John Voelcker Bird Book Fund, Cape Town.

Jenkins J, Simmons RE, Curtis O, Atyeo M, Raimondo D, Jenkins AR. 2012. The value of the Black Harrier (Circus maurus) as a predictor of biodiversity in the plant-rich Cape Floral Kingdom, South Africa. Bird Conservation International 1-12. DOI: http://dx.doi.org /10.1017/S0959270911000323

Jenkins, A.R., Smallie, J.J. & Diamond, M. 2011. South African perspectives on a global search for ways to prevent avian collisions with overhead lines. Bird Conservation International.

Jenkins AR. 2005. Lesser Kestrel *Falco naumanni.* In: Roberts' birds of southern Africa. VII. Hockey PAR, Dean WRJ, Ryan PG (eds). Pp. John Voelcker Bird book Fund, Cape Town.

Mucina. L. & Rutherford, M.C. (Eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Shaw, J., Jenkins, A.R. Allan D & Ryan, P.G. 2015. Population size and trends of Ludwig's Bustard Neotis ludwigii and other large terrestrial birds. In the Karoo, South Africa. Bird Conservation International, page 1 of 18

Simmons, R.E. & Allan, D.G. 2002. The Orange River avifauna: abundance, richness and comparisons. Ostrich 73: 92-99.

Spottiswoode C. 2005. Sociable Weaver In: Hockey, P.A.R., Dean, W.R.J., Ryan, P.G. (Eds) 2005. Roberts – Birds of Southern Africa, VIIth ed. The Trustees of the John Voelcker Bird Book Fund, Cape Town.

Taylor M, Peacock F, Wanless R. (eds.) 2015. The Eskom red data book of birds of South Africa, Lesotho and Swaziland. Birdlife South Africa.

Young, D.J., Harrison, J.A., Navarro, R.A., Anderson, M.D. & Colahan, B.D. (eds). 2003. Big birds on farms: Mazda CAR report 1993-2001. Avian Demography Unit, Cape Town.

Aquatic

Darwall WRT, Smith KG, Tweddle D and Skelton P. (eds) (2009). The Status and Distribution of Freshwater Biodiversity in Southern Africa. Gland, Switzerland: IUCN and Grahamstown, South Africa: SAIAB. viii+120pp.

Davis TJ (ed.) 1994. The Ramsar Convention Manual: A Guide to the Convention on Wetlands of International Importance especially as Waterfowl Habitat. Ramsar Convention Bureau, Gland, Switzerland.

Department of Water Affairs and Forestry (DWAF) 2005. Final draft: A practical field procedure for identification and delineation of wetlands and Riparian areas.

Driver, A., J.L. Nel, K. Snaddon, K. Murray, D.J. Roux, L. Hill, E.R. Swartz, J. Manual, and N. Funke. 2011. Implementation manual for freshwater ecosystem priority areas. WRC Report No. 1801/1/11. Pretoria: Water Research Commission

DWS (2014) A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for

Secondary Catchments in South Africa. Secondary: [B1] Compiled by RQIS-RDM:
https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx [Accessed on 1st September 2015]

GDARD (2014): Technical Report for the Gauteng Conservation Plan (Gauteng C-Plan v3.3). Gauteng Department of Agriculture and Rural Development: Nature Conservation Directorate. 60 pages.

Imperata Consulting. (2010). Surface Watercourse Assessment: Proposed R5 Rand Water Pipeline between Rietvlei N.R. and Mamelodi (Gauteng), EIA Study Report

IUCN (2015) Redlist of Threatened Species [Online] Available from: http://www.iucnredlist.org [Accessed: 1st September 2015]

Kleynhans CJ, Thirion C and Moolman J. (2005). A Level 1 Ecoregion Classification System for South Africa, Lesotho and Swaziland. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria.

Mucina, L. & Rutherford, M.C. (eds) 2010. (CD Set). The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19.South African National Biodiversity Institute, Pretoria.

Nel JL, Murray KM, Maherry AM, Petersen CP, Roux DJ, Driver A, Hill L, Van Deventer H, Funke N, Swartz ER, Smith-Adao LB, Mbona N, Downsborough L and Nienaber S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

Ollis DJ, Snaddon CD, Job NM, and Mbona N. (2013). Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria.

SANBI. (2009). Further Development of a Proposed National Wetland Classification System for South Africa. Primary Project Report. Prepared by the Freshwater Consulting Group (FCG) for the South African National Biodiversity Institute (SANBI).

SANBI (2015) Biodiversity GIS [Online] Available from: http://bgis.sanbi.org [Accessed: 1st September 2015]

SANBI (2015) Plants of southern Africa: an online checklist 3.0 [Online] Available from: http://posa.sanbi.org [Accessed: 1st September 2015]

SANBI (2015) Red List of South African Plants [Online] Available from: http://redlist.sanbi.org [Accessed: 1st September 2015]

Soil, Land Type and Agricultural Potential

AGIS, 2007. Agricultural Geo-Referenced Information System, accessed from www.agis.agric.za on 1 to 2 June 2014.

Fey, M. (2010). *Soils of South Africa*. Cambridge University Press, Cape Town

Land Type Survey Staff (1972-2006). 1:250 000 scale Land Type Survey of South Africa. ARC-Institute for Soil, Climate and Water, Pretoria.

Mucina L. & Rutherford M.C. (eds) 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

National Energy Act (2008)

National Environmental Management Act 107 of 1998 (NEMA)

Outeniqua Geotechnical Services cc (2012). Specialist input for the Environmental Impact Assessment for the proposed various concentrating solar power components (CSP) as part of the future Karoshoek Solar Valley Park, near Upington, Northern Cape Province, South Africa

Schulze, B.R. (1965). Climate of South Africa. Part 8. General Survey S. Afr. Weather Bureau Publ.: 28.

Soil Classification Working Group (1991). Soil classification: a taxonomic system for South Africa. *Memoirs on the Agricultural Natural Resources of South Africa* No. 15. SIRI, D.A.T.S., Pretoria.

Visual

Guidelines for involving visual and aesthetic specialists in EIA processes,

Author; Bernard Oberhozer. Published by the Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning, 2005

Guidelines for landscape and visual impact assessment (third edition), authors; the Landscape Institute and Institute of Environmental Assessment and Management, published by E & FN Spon, 2013.

Manual of Environmental Appraisal, UK Department of Transport, 1992

Visual Impact Assessment Guidebook, Second Edition. Province of British Colombia. January 2001.

Vegetation of South Africa, Lesotho and Swaziland. Edited by A. B Low and A. G Rebelo, Department of Environmental Affairs and Tourism 1996.

Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM Administered Lands, United States Department of Interior, Bureau of Land Management (BLM), first edition, 2013,

Journal of Solar Energy Engineering August 2011, Vol. 133. Clifford K. Ho of the Concentrating Solar Technologies Department, Sandia National Laboratories.

Solar PACES, Berlin, September 15-18. 2009. Conference paper by Clifford Ho, Cheryl Ghanbari, Richard Diver.

Heritage

Archaeological Database Wits University 2009

Beaumont, P.B., Smith, A.B. & Vogel, J.C. 1995. Before the Einiqua: the archaeology of the frontier zone. In: Smith, A.B. (ed.) Einiqualand: Studies of the Orange River Frontier: 236-264. Cape Town: UCT Press.

Beaumont, P.B. 2005. Archaeological Impact Assessment at and in the Vicinity of a Quartzite Quarry on Portion 4 of the Farm Droogehout 442 near Upington.

Beaumont, P.B. 2008. Phase 1 Heritage Impact Assessment Report on a Portion of the Farm Keboes 37, near Kanoneiland, Siyanda District Municipality, Northern Cape Province.

Deacon, H.J. & Deacon, J. 1999. Human Beginnings in South Africa: Uncovering the Secrets of the Stone Age. Cape Town: David Phillips Publishers.

Deacon, J. 1986. 'My place the Bitterputs': the home territory of Bleek anf Lloyd's/Xam San informants. African Studies 45: 135-155.

Deacon, J. 1988. The power of a place in the understanding of southern San rock engravings. World Archaeology 20: 129-140.

De Beer, M.1992. *Keimoes en omgewing: 'n kultuurhistoriese verkenning.* Keimoes, 1992.

De Klerk, D. *Raming van die ekonomiese bedrywighede en totale bevolking van die Upington-streek vir 1985*. Pretoria, 1979

Dreyer, C. 2006. First Phase Archaeological and Cultural Heritage Assessment of the Proposed Concentrated Solar Thermal Plant (Csp) at the Farms Olyvenhouts Drift, Upington, Bokpoort 390 and Tampansrus 294/295, Groblershoop, Northern Cape.

Gaigher, S.2012. Herritage Impact Assessment, Basic assessment report for the proposed establishment of the grid integration infrastructure for sites 1.1, 1.2, 1.3 and 2, as part of the larger Karoshoek Valley Solar Park, on a site located 30 km East of Upington, Northern Cape Province. Unpublished report for Savannah Environmental (Pty) Ltd.

Jacobs, Z., Roberts, R.G., Galbraith, R.F., Barré, M., Deacon, H.J., Mackay, A., Mitchell, P.J., Vogelsang, R., & Wadley, L. 2008. Ages for Middle Stone Age innovations in southern Africa: implications for modern human behavior and dispersal. Science 322: 733-735.

Jacobson, L. 2005. Comments on stone circles in the Bloubos landscape, Northern Cape. Southern African Humanities 17: 153-154.

Legassick, M., "The will of Abraham and Elizabeth September: the struggle for land in Gordonia, 1898-1995" in The Journal of African History, (37)3, 1996, pp. 371-418.

Lombard, M. 2011. Background to the stone age of the Kakamas/Keimoes area for CRM purposes. Unpublished report.

Lombard, M. & Parsons, I. 2008. Blade and bladelet function and variability in risk management during the last 2000 Years in the Northern Cape. South African Archaeological Bulletin 63: 18-27.

Lombard, M., Wadley, L., Jacobs, Z., Mohapi, M. & Roberts, R.G. 2010. Still Bay and serrated points from Umhlatuzana Rock Shelter, Kwazulu-Natal, South Africa. Journal of Archaeological Science 37: 1773-1784.

Mitchell, P. 2002. The Archaeology of Southern Africa. Cambridge: Cambridge University Press.

Moolman, J.H., "The Orange River, South Africa" in *Geographical review*, 36(4), (Oct. 1946), pp. 653-674.

Morris, A. G. *The skeletons of contact: a study of protohistoric burials from the lower Orange River valley, South Africa.* Johannesburg, 1992.

Morris, A.G. 1995a. The Einiqua: an analysis of the Kakamas skeletons. In: Smith, A.B. (ed.) Einiqualand: Studies of the Orange River Frontier: 110-164. Cape Town: UCT Press.

Morris, D. & Beaumont, P., "!Nawabdanas: Archaeological Sites at Renosterkop Kakamas District, Northern Cape" in *The South African Archeological Bulletin*, 46(154), Dec 1991, pp. 115-124.

National Heritage Resources Act NHRA of 1999 (Act 25 of 1999)

Naudé, C. P. *Fertilizer and irrigation experiments at the Upington agricultural research*

Parsons. I. 2004. Stone circles in the Bloubos landscape, Northern Cape. Southern African Humanities 16: 59-69.

Parsons, I. 2008. Five Later Stone Age artefact assemblages from the interior Northern Cape Province. South African Archaeological Bulletin 63: 51-60.

Rossouw, P. J. *Die Arbeidskolonie Kakamas*. Stellenbosch, 1939.

SAHRA Report Mapping Project Version 1.0, 2009

SAHRIS (referenced 2013)

Skead, C. J. *Historical plant incidence in southern Africa.* Pretoria, 2009.

Smith, A.B. 1995. Archaeological observations along the Orange River and its hinterland. In: Smith, A.B. (ed.) Einiqualand: Studies of the Orange River Frontier: 110-164. Cape Town: UCT Press.

South Africa. Commission of Enquiry Kakamas Labour Colony. *Report of the Commission of Enquiry Kakamas Labour Colony.* Cape Town, 1680.

South Africa. Railways and Harbours Board. *Report of the Board of the South African Railways and Harbours on a proposed line of railway from Prieska to Upington.* Cape Town, 1914.

Thompson, E., Williams, H.M. & Minichillo, T. 2010. Middle and late Pleistocene Middle Stone Age (MSA) lithic technology from Pinnacle Point 13B, Mossel Bay, Western Cape Province, South Africa. Journal of Human Evolution 59: 358-377.

South Africa. Commission of enquiry Kakamas labour colony. *Report of the Commission of Enquiry Kakamas Labour Colony.* Cape Town, 1680.

Van Der Walt, J. 2014. AIA for Karoshoek Powerline. Unpublished report.

Van Ryneveld, K. 2007a. Phase 1 Archaeological Impact Assessment -Portion of the Farm Cnydas East 439, Upington District, Northern Cape,South Africa.

Van Ryneveld, K. 2007b. Phase 1 Archaeological Impact Assessment -Portion of the Farm Boksputs 118, Groblershoop District, Northern Cape, South Africa.

Van Schalkwyk, J.2011. AIA for Karoshoek Solar Park. Unpublished report.

Wadley, L. 2005. A typological study of the final Middle Stone Age stone tools from Sibudu Cave, KwaZulu-Natal. South African Archaeological Bulletin 60: 51-63.

Wadley, L. 2007. The Middle Stone Age and Later Stone Age. In: Bonner, P., Esterhuysen, A. & Jenkins, T. (eds) Origins: Science, History and South Africa's 'Cradle of Humankind': 122-135. Johannesburg: Wits University Press.

Wadley, L., 2010. Cemented ash as receptacle or work surface for ochre powder production at Sibudu, South Africa, 58,000 years ago. Journal of Archaeological Science 37: 2397-2406.

Palaeontology

ALMOND, J.E. 2008. Fossil record of the Loeriesfontein sheet area (1: 250 000 geological sheet 3018). Unpublished report for the Council for Geoscience, Pretoria, 32 pp.

ALMOND, J.E. 2014. Proposed Joram Solar development on the Remainder of Portion 62 of the Farm Vaal Koppies 40, Upington, ZF Mgcawu District, Northern Cape. Recommended exemption from further palaeontological studies, 6 pp.

ALMOND, J.E. 2015. Proposed Ephraim Sun Solar PV Facility on the Remainder of Portion 62 (portion of Portion 9) (Vryheid) of Farm Vaalkoppies No 40, Upington, ZF Mgcawu District, Northern Cape. Recommended exemption from further palaeontological studies, 6 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. & PETHER, J. 2008. Palaeontological heritage of the Northern Cape. Interim SAHRA technical report, 124 pp. Natura Viva cc., Cape Town.

CORNELL, D.H., THOMAS, R.J., MOEN, H.F.G., REID, D.L., MOORE, J.M. & GIBSON, R.L. 2006. The Namaqua-Natal Province. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 461-499. Geological Society of South Africa, Marshalltown.

DINGLE, R.V., SIESSER, W.G. & NEWTON, A.R. 1983. Mesozoic and Tertiary geology of southern Africa. viii + 375 pp. Balkema, Rotterdam.

HADDON, I.G. 2000. Kalahari Group sediments. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of southern Africa, pp. 173-181. Oxford University Press, Oxford.

McCARTHY, T. & RUBIDGE, B. 2005. The story of Earth and life: a southern African perspective on a 4.6-billion-year journey. 334pp. Struik, Cape Town.

MOEN, H.F.G. 2007. The geology of the Upington area. Explanation to 1: 250 000 geology Sheet 2820 Upington, 160 pp. Council for Geoscience, Pretoria.

PARTRIDGE, T.C., BOTHA, G.A. & HADDON, I.G. 2006. Cenozoic deposits of the interior. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 585-604. Geological Society of South Africa, Marshalltown.

SAHRA 2013. Minimum standards: palaeontological component of heritage impact assessment reports, 15 pp. South African Heritage Resources Agency, Cape Town.

THOMAS, M.J. 1981. The geology of the Kalahari in the Northern Cape Province (Areas 2620 and 2720). Unpublished MSc thesis, University of the Orange Free State, Bloemfontein, 138 pp.

THOMAS, D.S.G. & SHAW, P.A. 1991. The Kalahari environment, 284 pp. Cambridge University Press, Cambridge.

Websites:

AGIS, 2007. Agricultural Geo-Referenced Information System, accessed from www.agis.agric.za

ADU, 2012. Animal Demography Unit, Department of Zoology, University of Cape Town. http://www.adu.org.za

BGIS: http://bgis.sanbi.org/website.asp

SANBI databases:

http://posa.sanbi.org/searchspp.php

http://SIBIS.sanbi.org

Climate:

http://en.climate-data.org/location/10658/