



Environmental Impact Assessment Study for the proposed Concentrated Solar Power Plant (Parabolic Trough) on the farm Sand Draai 391, Northern Cape – Environmental Scoping Report

A Report for Solafrica

14/12/16/3/3/3/203 – Parabolic Trough



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Compiled by:

Johan Blignaut

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Woodmead

Review: Prashika Reddy & Malcolm Roods

Approval: Malcolm Roods



Signature

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Glossary

Activity (Development)	An action either planned or existing that may result in environmental impacts through pollution or resource use. For the purpose of this report, the terms 'activity' and 'development' are freely interchanged.
Alternatives	Different means of meeting the general purpose and requirements of the activity, which may include site or location alternatives; alternatives to the type of activity being undertaken; the design or layout of the activity; the technology to be used in the activity and the operational aspects of the activity.
Applicant	The project proponent or developer responsible for submitting an environmental application to the relevant environmental authority for environmental authorisation.
Biodiversity	The diversity of animals, plants and other organisms found within and between ecosystems, habitats, and the ecological complexes.
Construction	The building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity but excludes any modification, alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint.
Cumulative impact	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.
Decommissioning	The demolition of a building, facility, structure or infrastructure.
Direct Impact	Impacts that are caused directly by the activity and generally occur at the same time and at the same place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally quantifiable.
Ecological Reserve	The water that is necessary to protect the water ecosystems of the water resource. It must be safeguarded and not used for other purposes. The Ecological Reserve specifies both the quantity and quality of water that must be left in the national water resource. The Ecological Reserve is determined for all major water resources in the different water management areas to ensure sustainable development.
Ecosystem	A dynamic system of plant, animal (including humans) and micro-organism communities and their non-living physical environment interacting as a functional unit. The basic structural unit of the biosphere, ecosystems are characterised by interdependent interaction between the component species and their physical surroundings. Each ecosystem occupies a space in which macro-scale conditions and interactions are relatively homogenous.
Environment	In terms of the National Environmental Management Act (NEMA) (No 107 of 1998)(as amended), "Environment" means the surroundings within which humans exist and that are made up of: <ul style="list-style-type: none">a) the land, water and atmosphere of the earth;b) micro-organisms, plants and animal life;

- c) any part or combination of (i) of (ii) and the interrelationships among and between them; and
- d) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.

Environmental Assessment	The generic term for all forms of environmental assessment for projects, plans, programmes or policies and includes methodologies or tools such as environmental impact assessments, strategic environmental assessments and risk assessments.
Environmental Authorisation	An authorisation issued by the competent authority in respect of a listed activity, or an activity which takes place within a sensitive environment.
Environmental Assessment Practitioner (EAP)	The individual responsible for planning, management and coordination of environmental impact assessments, strategic environmental assessments, environmental management programmes or any other appropriate environmental instrument introduced through the EIA Regulations.
Environmental Impact	Change to the environment (biophysical, social and/ or economic), whether adverse or beneficial, wholly or partially, resulting from an organisation's activities, products or services.
Environmental Impact Assessment (EIA)	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 as defined in NEMA.
Environmental Issue	A concern raised by a stakeholder, interested or affected parties about an existing or perceived environmental impact of an activity.
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 (EMPr)	A detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive impacts and limiting or preventing negative environmental impacts are implemented during the life cycle of a project. This EMPr focuses on the construction phase, operation (maintenance) phase and decommissioning phase of the proposed project.
Fatal Flaw	An event or condition that could cause an unanticipated problem and/or conflict which will could result in a development being rejected or stopped.
General Waste	Means waste that does not pose an immediate hazard or threat to health or to the environment, and includes – <ul style="list-style-type: none"> (a) Domestic waste; (b) Building waste and demolition waste; (c) Business waste; (d) Inert waste; or (e) Any waste classified as non-hazardous waste in terms of the regulations made under section 69, <p>and includes non-hazardous substances, materials or objects within business, domestic, inert, building and demolition wastes as outlined in the National Environmental Management: Waste Amendment Act (No 26 of 2014) Schedule 3: Category B – General Waste.</p>

Groundwater	Water in the ground that is in the zone of saturation from which wells, springs, and groundwater run-off are supplied.
Hazardous Waste	Means 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 and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles as outlined in the National Environmental Management: Waste Amendment Act (No 26 of 2014).Schedule 3: Category A - Hazardous Waste.
Hydrology	The science encompassing the behaviour of water as it occurs in the atmosphere, on the surface of the ground, and underground.
Indirect Impacts	Indirect or induced changes that may occur as a result of the activity. These types of impacts include all of the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
Integrated Environmental Management	A philosophy that prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development and decision-making process. The IEM philosophy (and principles) is interpreted as applying to the planning, assessment, implementation and management of any proposal (project, plan, programme or policy) or activity - at local, national and international level - that has a potentially significant effect on the environment. Implementation of this philosophy relies on the selection and application of appropriate tools for a particular proposal or activity. These may include environmental assessment tools (such as strategic environmental assessment and risk assessment), environmental management tools (such as monitoring, auditing and reporting) and decision-making tools (such as multi-criteria decision support systems or advisory councils).
Interested and Affected Party (I&AP)	Any person, group of persons or organisation interested in or affected by an activity; and any organ of state that may have jurisdiction over any aspect of the activity.
Mitigate	The implementation of practical measures designed to avoid, reduce or remedy adverse impacts or enhance beneficial impacts of an action.
No-Go Option	In this instance the proposed activity would not take place, and the resulting environmental effects from taking no action are compared with the effects of permitting the proposed activity to go forward.
Overburden	Layers of soil and rock covering a coal seam. In surface mining operations, overburden is removed prior to mining using large equipment. When mining has been completed, it is either used to backfill the mined areas or is hauled to an external dumping and/or storage site.
Public Participation Process	A process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to, specific matters.
Rehabilitation	A measure aimed at reinstating an ecosystem to its original function and state (or as close as possible to its original function and state) following activities that have disrupted those functions.
Scoping	The process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addressed in an environmental assessment. The main purpose of scoping is to focus the environmental assessment on a manageable number of

important questions. Scoping should also ensure that only significant issues and reasonable alternatives are examined.

**Sensitive
Environments**

Any environment identified as being sensitive to the impacts of the development.

Significance

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

**Stakeholder
Engagement**

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

**Sustainable
Development**

According to World Commission on Environment and Development (1987), this is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Watercourse

Defined as:

- a) a river or spring;
- b) a natural channel or depression in which water flows regularly or intermittently;
- c) a wetland, lake or dam into which, or from which, water flows; and
- d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998) and a reference to a watercourse includes, where relevant, its bed and banks.

Wetland

Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

Acronyms

CER – Certified Emission Reduction

CDM – Clean Development Mechanism

CSP – Concentrated Solar Power

DEA – Department of Environmental Affairs

DOE – Department of Energy

DWS – Department of Water and Sanitation

EAP – Environmental Assessment Practitioner

EIA - Environmental Impact Assessment

EIAR – Environmental Impact Assessment Report

EMPr - Environmental Management Programme

ESR - Environmental Scoping Report

ESS - Environmental Scoping Study

GHG – Greenhouse Gas

GN – Government Notice

I&AP – Interested and Affected Party

IRP – Integrated Resource Plan

kWh – Kilowatt Hour

MW – Megawatts

NCDENC – Northern Cape Department of Environment and Nature Conservation

NDP – National Development Plan

NEMA – National Environmental Management Act (No 107 of 1998)

NERSA - National Energy Regulator of South Africa

PV – Photovoltaic

REIPPPP – Renewable Energy Independent Power Producer Programme

SADC – Southern Africa Development Community

SIP – Strategic Infrastructure Projects

1 INTRODUCTION

Increasing economic growth and social development within South Africa is placing a growing demand on energy supply. Coupled with the rapid advancement in economic and social development, is the growing awareness of environmental impact, climate change and the need for sustainable development.

Whilst South Africa relies heavily on coal to meet its energy needs, the country is well endowed with renewable energy resources that offer sustainable alternatives to fossil fuels. Renewable energy harnesses naturally occurring non-depletable sources of energy, such as solar, wind, biomass, hydro, tidal, wave, ocean current and geothermal, to produce electricity, gaseous and liquid fuels, heat or a combination of these energy types¹. The successful use of renewable energy technology in South Africa still requires extensive investigation, however, Concentrating Solar Power (CSP) and Photovoltaic (PV) technologies have been demonstrated to be economically and environmentally viable and capable of being employed on a large scale.

1.1 Background

Solafrica Energy (Pty) Ltd (Solafrica) is currently assessing the feasibility of constructing a CSP based on Parabolic Trough technology plant including all associated infrastructure with a maximum generation capacity of 150 MW. The proposed plant is required to be sited on a technically and environmentally feasible site and to this end, Solafrica has considered land availability, land use capability, fuel availability and costs, grid connection proximity, capacity and strengthening, and other aspects related to the feasibility of solar power sites. With consideration of the aforementioned aspects, Solafrica has identified a site in the Northern Cape Province that will suit the requirements for a power generating complex.

1.2 Need and Desirability

1.2.1 Renewable Energy Independent Power Producers Programme (REIPPPP) and Integrated Resource Plan (2010)

South Africa has a high level of renewable energy potential and to this end the South African Government has set a target of 10 000 GWh renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro. The renewable energy is to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. This relates to approximately 4% (1 667 MW) of the projected electricity demand for 2013 (41 539 MW)².

To contribute towards this target and towards socio-economic and environmentally sustainable growth, and kick start and stimulate the renewable energy industry in South Africa, the Renewable Energy Independent Power Producers Programme (REIPPPP) was initiated by the Department of

¹ Department of Minerals and Energy. 2003. *White Paper on Renewable Energy*.

² Department of Minerals and Energy. 2003. *White Paper on Renewable Energy*.

Energy (DoE) to facilitate the generation of 3 725 MW of renewable energy by 2016 by independent power producers (IPPs) as set out in the Integrated Resource Plan (IRP) 2010-2030.

Since the IRP was initiated in March 2010, the Department of Energy (DoE) has entered into 28 agreements under Bid Window 1 and 19 agreements under Bid Window 2. Two CSP plants were awarded in the first Bid Window i.e. Khi Solar One and the Kaxu Solar One (Abengoa Solar). The Bokpoort CSP is a concentrated solar power project (Solafrica + ACWA Power) that was selected as the only CSP plant in the second round of the REIPPPP. The plant will have a net generation capacity of 50 MW with 9.3 hours of thermal energy storage. Once completed it will have the longest amount of thermal storage of any parabolic trough CSP power plant in the world.

1.2.2 National Development Plan 2030

The country's National Development Plan (NDP) 2030 was adopted by Government in 2012. President Zuma in the State of the Nation address for 2013 stated that the NDP must underpin all government policies and be a guiding document for the country.

It advocates achieving the 'peak, plateau and decline trajectory' of greenhouse gas emissions for the country, and the concurrent need for a move to a less carbon intensive electricity sector through procuring 20 000 MW renewable electricity, as well as the need for demand side measures and 90% access to electricity by 2030. It advocates a greater share of natural gas in the energy mix, the need to revise the national electricity plan, and the ring fencing of the electricity distribution businesses of the 12 largest municipalities.

The proposed project involves diversification of electricity production fuel sources, improved efficiency in electricity production, a decrease in the quantity of fossil fuel burned, a decrease in greenhouse gas (GHG) emissions and a decrease in a number of other aerial pollutant emissions. This is in line with Government's commitment to reduce the country's emissions by 34% by 2020 and 42% by 2025 with financial and technical support from the international community. The project can therefore be seen as making a contribution to improving the sustainability of development in South Africa.

Hence, the proposed plant are likely to qualify for registration as a Clean Development Mechanism (CDM) project. This allows so-called carbon credits to be sold from the project. If the project is formally registered with the Executive Board of the CDM, managed by the United Nations Framework Convention on Climate Change, these reductions in GHGs can be registered as Certified Emission Reductions (CERs). CERs, the formal name for carbon credits, can then be sold to buyers who need these credits for compliance purposes in developed countries.

Solafrica intends to develop the project as a CDM project and to generate and sell CERs to support the financial viability of the project.

1.2.3 Strategic Infrastructure Projects (SIPs)

The South African Government adopted a National Infrastructure Plan in 2012 that is intended to transform the economic landscape of South Africa, create significant numbers of new jobs, and strengthen the delivery of basic services. It sets out the challenges and enablers which South Africa needs to respond to in the building and developing of infrastructure. The Presidential Infrastructure Coordinating Commission (PICC) is a body set up to integrate and coordinate the long-term infrastructure build.

Seventeen Strategic Infrastructure Projects (SIPs) have been developed and approved to support economic development and address service delivery in the poorest provinces. The proposed projects fall within Energy SIPs i.e. SIP 8: Green Energy in support of the South African Economy (Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the IRP 2010 and to support biofuel production facilities) and SIP 9: Electricity Generation to support socio-economic development (Accelerate the construction of new electricity generation capacity in accordance with the IRP 2010 to meet the needs of the economy and address historical imbalances).

1.2.4 Renewable Energy Development Zones (REDZ)

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. Although CSP technology has not been specifically considered in the SEA, it follows that all solar technologies would be focused in similar areas. The aim of the assessment is to designate renewable energy development zones (REDZs) within which such development will be incentivised and streamlined. The proposed facility 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.

Coupled to the Renewable Energy SEA, Eskom's Electricity Grid infrastructure Strategic Environmental Assessment (SEA) is also underway. The area where the facility is proposed is currently within the corridor planned to be strengthened by Eskom.

1.3 Project Overview

South Africa experiences some of the highest levels of solar radiation in the World. The average daily solar radiation in South Africa varies between 4.5 and 6.5 kWh/m² (16 and 23 MJ/m²)³, compared to about 3.6 kWh/m² for parts of the United States and about 2.5 kWh/m² for Europe and the United Kingdom. Figure 1 below shows the annual solar radiation (direct and diffuse) for South Africa, which reveals considerable solar resource potential for solar water heating applications, solar photovoltaic and solar thermal power generation.

In 2006, Eskom Holdings Limited conducted an Environmental Impact Assessment (EIA) Study for a pilot CSP plant with an installed capacity of approximately 100 MW. Through a series of feasibility and high-level screening studies undertaken by Eskom, the Northern Cape Province ranked as the most favourable area for the establishment of a new CSP plant. Within the Northern Cape Province, Upington and Groblershoop were identified as preferred sites for the establishment of the CSP plant. Subsequent to the Scoping and EIA studies, a northern portion of the farm Olyvenhouts Drift was

³ Stassen, G.1996. *Towards a Renewable Energy Strategy for South Africa*, unpublished PhD Thesis, University of Pretoria.

selected as the preferred site and with consideration of the site specific environmental sensitivities, a preferred location for the plant on the farm was selected.

Against the backdrop of the Eskom study, Solafrica proposed to construct CSP plants in the Northern Cape Province on either of the two alternative sites identified during the Eskom CSP EIA study. These two alternative sites included:

- Site 1: Olyvenhouts Drift (15 km west of Upington) – southerly portion; and
- Site 2: Bokpoort 390 (northwest of Groblershoop).

Refer to Figure 3 for the locality map.

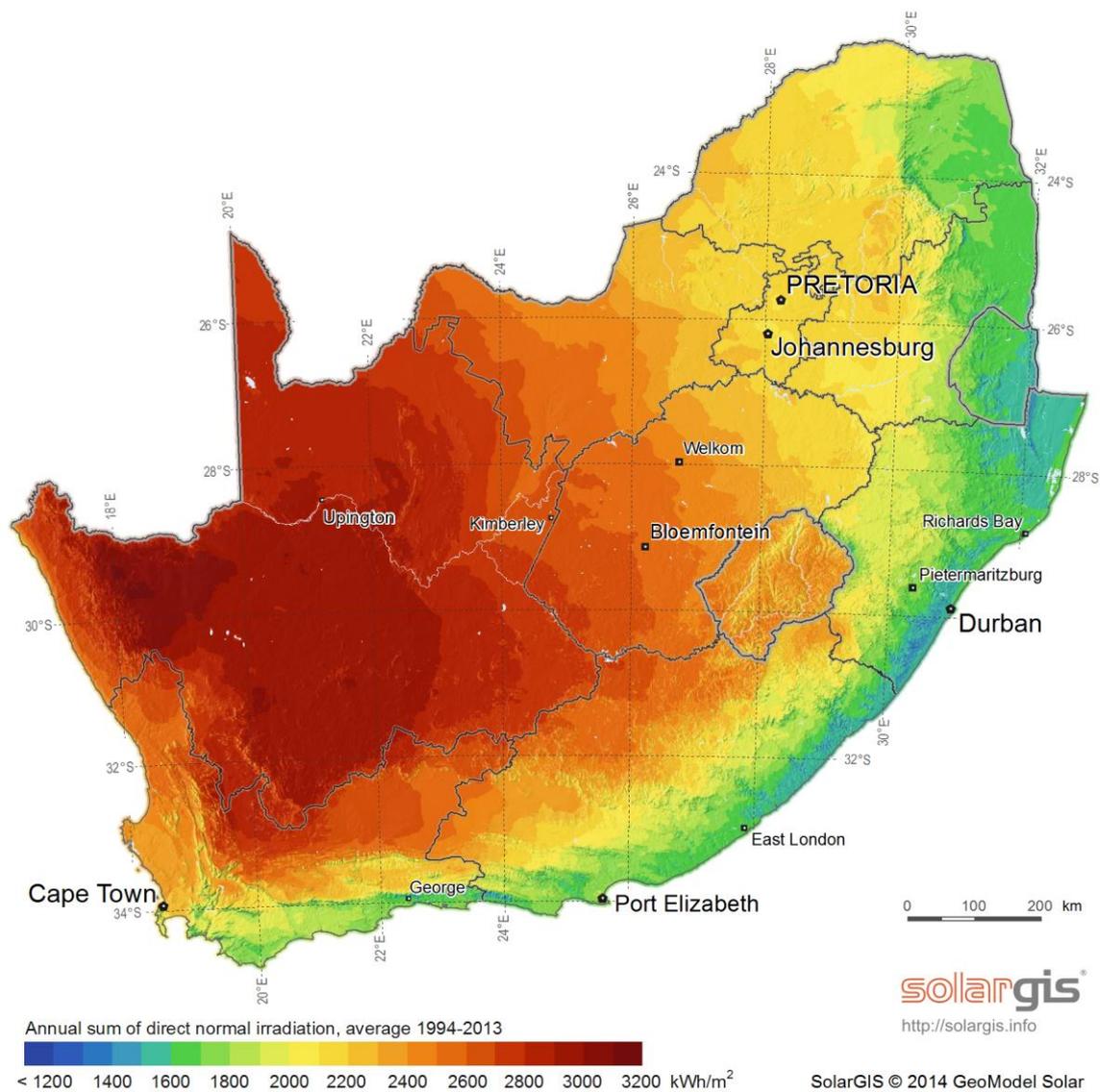


Figure 1: Annual incoming short wave radiation for South Africa (Courtesy: DME, Eskom, CSIR)

Solafrica subsequently pursued development on Bokpoort 390 and construction is currently underway.

In 2013 – 2014, the project proponent, embarked on a feasibility study to develop another Solar Thermal Farm in the Upington area. The development of two CSP plants (central receiver and parabolic trough technology) and a PV plant on the farm Sand Draai 391,(21°42'37"S; 21°57'31"E and SG 21 digit-C 0280 0000 0000391 00000) with an electricity generation capacity of between 125 and 150 MW each.

This Environmental Scoping Study (ESS) focuses on the construction of a CSP plant based on parabolic trough technology including all associated infrastructure with a maximum generation capacity of 150 MW on the farm Sand Draai (Figure 3). The PV plant (14/12/16/3/3/2/813) ESS and CSP plant (14/12/16/3/3/3/202 using central receiver technology ESS are subject to separate applications and are presented in separate Environmental Scoping Reports. The public participation process, for all three projects, has been combined to prevent I&AP and Stakeholder fatigue.

In addition to the power plant, associated infrastructure such as roads, water pipelines, electricity distribution lines, storerooms and temporary waste storage facilities may be required.

The parabolic trough CSP plant will consist of the following components:

- A solar field of parabolic troughs;
- A heat transfer fluid system;
- A power block (incl. steam cycle, steam generator, cooling system); and
- A thermal energy storage system.

1.4 Approach to the EIA Studies

The environmental impacts associated with the proposed project require investigation in compliance with the Environmental Impact Assessment Regulations (2014) and read with Section 24 (5) of the National Environmental Management Act - NEMA (Act No 107 of 1998) (as amended).

The required environmental studies include the undertaking of an Environmental Impact Assessment (EIA) process. An application for Integrated Environmental Authorisation has been lodged with the Department of Environmental Affairs. This process is being undertaken in two phases (Figure 2) that will ultimately allow the competent authorities (Department of Environmental Affairs) to make an informed decision:

- Phase 1 - Environmental Scoping Study (ESS) and Plan of Study for EIA; and
- Phase 2 - Environmental Impact Assessment (EIA) and Environmental Management Programme (EMPr).

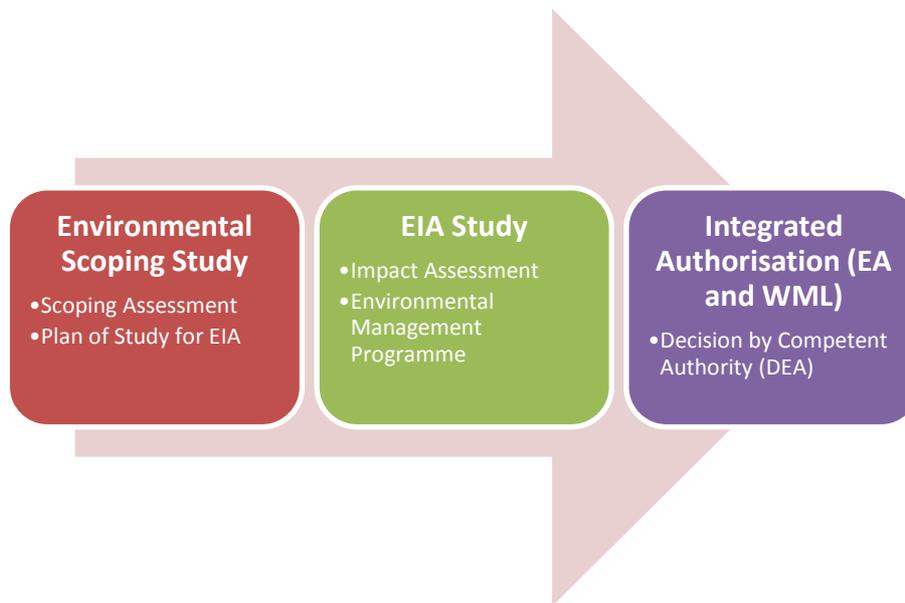


Figure 2: Environmental studies flowchart

This EIA study will also be used to support the Waste Use Licensing applications for the CSP plant project.

1.4.1 Environmental Scoping Study

The ESS provides a description of the receiving environment and how the environment may be affected by the development of the proposed project. Desktop studies making use of existing information, and ground-truthing by means of site visits, was used to highlight and assist in the identification of potential significant impacts (both social and biophysical) associated with the proposed project.

Additional issues for consideration will be extracted from feedback received during the public participation process, which commenced at the beginning of the Scoping phase and which will continue throughout the duration of the EIA project life cycle. All issues identified during this phase of the study will be documented within this Environmental Scoping Report.

The Scoping Study aims to address the following:

- Description of the site selected for the proposed CSP plant;
- Identification of potential significant positive and negative environmental (biophysical and social) impacts; and
- Undertaking of a fully inclusive public participation process to ensure that Interested and Affected Party (I&AP) issues and concerns are recorded and form part of the EIA process.

In addition the Scoping Study will identify any fatal flaws, site alternatives and mitigation alternatives to be evaluated and investigated during the EIA phase of the project. Impacts related to, amongst others, geohydrology, hydrology, biodiversity, avifauna, noise and visual have been investigated in this ESS (refer to Table 1).

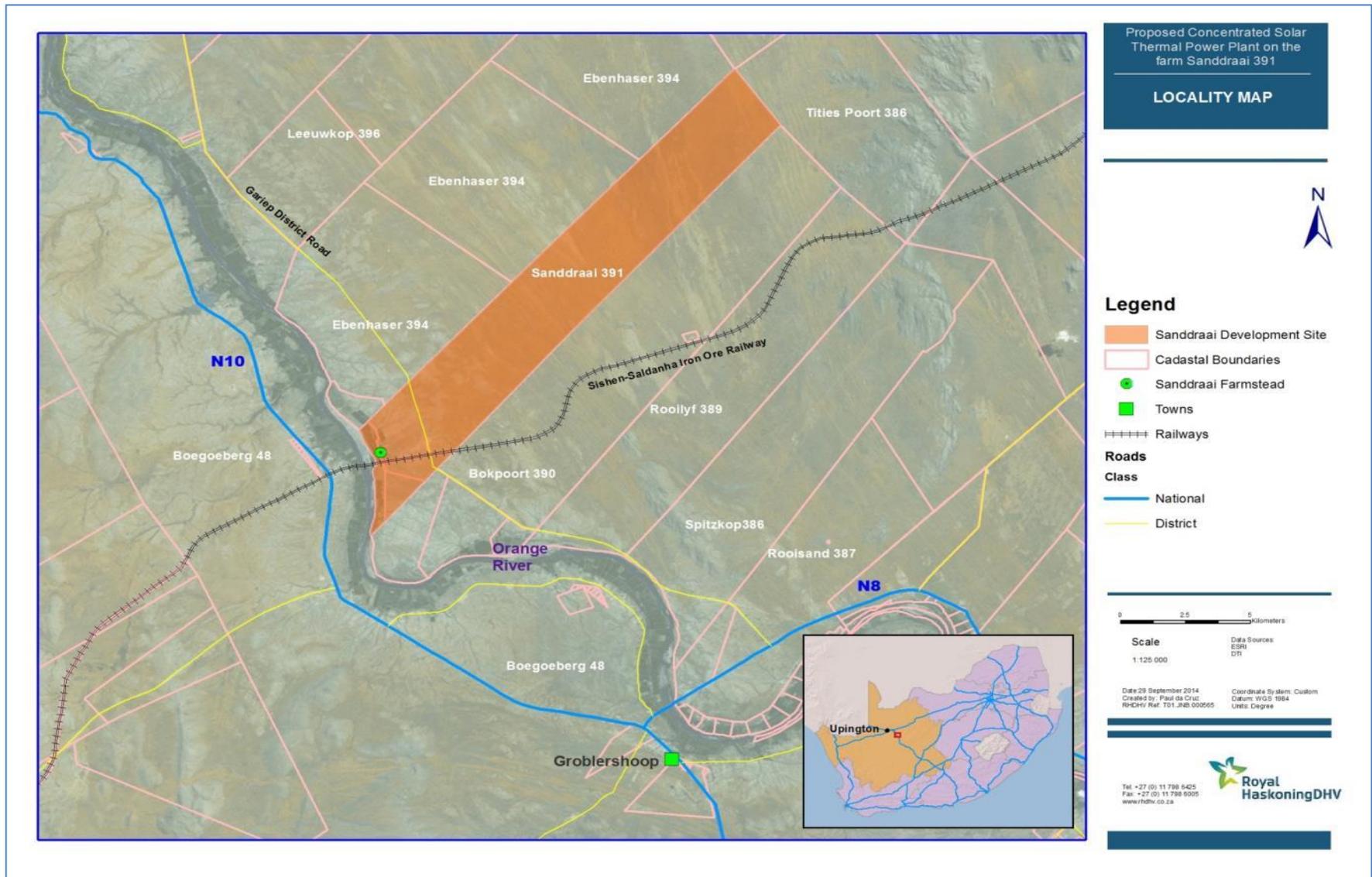


Figure 3: Locality map showing the farm, Sand Draai, considered for the construction of the proposed CSP plant

Issues that are considered to be of significance will be recommended for further investigation and assessment within the EIA phase of the project.

Table 1: Specialist studies undertaken as part of the Scoping Study

Specialist Field	Organisation
Avifauna Impact Assessment	Chris van Rooyen
Biodiversity Assessment	Clayton Cook & Prof. Leslie Brown
Geohydrology	Groundwater Consulting Services
Noise Impacts*	Lodewyk Jansen (Royal HaskoningDHV)
Visual Impact Assessment*	Paul da Cruz (Royal HaskoningDHV)
Heritage	Kobus Dreyer
Social Impact Assessment*	Kementthree Moonsamy (Royal HaskoningDHV)
Air Quality Impact Assessment*	Stuart Thompson (Royal HaskoningDHV)
Waste Impact Assessment*	Siva Chetty (Royal HaskoningDHV)
Surface Water* & Aquatic Impact Assessment	Paul da Cruz & Matthew Ross

* Independent reviews to be undertaken for these studies as required by DEA.

1.4.2 Environmental Impact Study

The Environmental Impact Assessment phase will aim to achieve the following:

- To provide an overall assessment of the social and biophysical environments of the affected area by the proposed CSP plant;
- To undertake a detailed assessment of the preferred site/s in terms of environmental criteria including the rating of significant impacts;
- To identify and recommend appropriate mitigation measures (to be included in an EMP) for potentially significant environmental impacts; and
- To undertake a fully inclusive public participation process to ensure that I&AP issues and concerns are recorded and commented on and addressed in the EIA process.

1.5 Details of Environmental Assessment Practitioner

The professional environmental team from Royal HaskoningDHV (Royal HaskoningDHV) has been appointed as the Environmental Assessment Practitioner (EAP) by Solafrica, to undertake the appropriate environmental studies for this proposed project. The professional team of Royal HaskoningDHV has considerable experience in the environmental management and EIA fields.

Royal HaskoningDHV has been involved in and/or managed numerous Environmental Impact Assessments and some of the largest, undertaken in South Africa to date. A specialist area of focus

is on assessment of multi-faceted projects, including the establishment of linear developments (national and provincial roads, and power lines), bulk infrastructure and supply (e.g. wastewater treatment works, pipelines, landfills), electricity generation and transmission, the mining industry, urban, rural and township developments, environmental aspects of Local Integrated Development Plans (LIDPs), as well as general environmental planning, development and management.

The particulars of the EAPs are presented in [Table 2](#) below:

Table 2: Details of the EAP

Consultant:	Royal HaskoningDHV
Contact Persons:	Johan Blignaut and Malcolm Roods
Postal Address:	PO Box 867 Gallo Manor 2052
Telephone:	011 798 6436 / 011 798 6442
Facsimile:	011 798 6010
E-mail:	johan.blignaut@rhdhv.com / malcolm.roods@rhdhv.com
Expertise:	<p>Malcolm Roods is a Principal at Royal HaskoningDHV specialising in Environmental Impact Assessments (EIA) for electricity supply (generation, transmission and distribution), road infrastructure, residential developments as well as water management projects. This builds on a broad government background, which has made him particularly flexible. His past experience includes 6 years public service which included policy development, environmental law reform and EIA reviews. His experience also includes 7 years of environmental consulting in the field of Impact Assessment and Authorisation Applications, with a focus on legislative requirements and business management.</p> <p>He has a HeD and a BA (Hons) in Geography and Environmental Management.</p> <p>Johan Blignaut is a Junior Environmental Consultant who is responsible for a number of duties, including monitoring the implementation of Environmental Authorisations (EAs) and the Environmental Management Programme (EMPr) during the construction phase of projects, serving as a liaison between property owners and contractors, writing of ECO, BA, EIA and EMPr reports and conducting of public participation processes.</p> <p>He has a BSc in Zoology, Geography and Tourism as well as a BSc (Hons) in Environmental Management.</p>

1.6 Structure of this Report

This ESR is being compiled according to the guidelines provided in Government Notice R.982 of the EIA Regulations (2014) – refer to Table 3.

Table 3: ESR requirements according to section 21(3) of GN R. 982

ESR Requirements according to Section 21(3) of GN R. 982	Section
(a) details of (i) the EAP who prepared the report; and (ii) the expertise of the EAP to carry out scoping procedures	Section 1.5
(b) the location of the activity, including – i. the 21 digit Surveyor General code of each cadastral and land parcel; ii. where available, the physical address and farm name; iii. where the required information on (i) and (ii) is not available, the coordinates of the boundary of the properties	Section 2
(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	Section 1.4
(d) a description of the scope of proposed activity, including – i. all listed and specified activities triggered; ii. a description of the activities to be undertaken, including associated structures and infrastructure	Section 4.2
(e) a description of the policy and legislative context within which the development is proposed including and 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	Section 4.2
(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	Section 1.2
(h) a full description of the process followed to reach the proposed preferred activity, site and location within the site, including – i. details of the alternatives considered; ii. details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; iii. a summary of the issues raised by I&AP, and an indication of the manner in which the issues were	Section 1.5, 6.1 & 7

ESR Requirements according to Section 21(3) of GN R. 982	Section
<p>incorporated, or the reasons for not including them;</p> <ul style="list-style-type: none"> iv. the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; 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 these impacts – <ul style="list-style-type: none"> aa) can be reversed; bb) may cause irreplaceable loss of resources; and cc) can be avoided, managed or mitigated; 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; 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; viii. the possible mitigation measures that could be applied and level of residual risk; ix. the outcome of the site selection matrix; x. if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and xi. a concluding statement indicating the preferred alternatives, including preferred location of the activity 	
<ul style="list-style-type: none"> (i) a plan of study for undertaking the environmental impact assessment process to be undertaken, including – <ul style="list-style-type: none"> i. a description of the alternatives to be considered and assessed within the preferred site, including the option of not proceeding with the activity; ii. a description of the aspects to be assessed as part of the environmental impact assessment process; iii. aspects to be assessed by specialists; iv. a description of the proposed method of assessing the environmental aspects, including a description of the proposed method of assessing the environmental aspects including aspects to be assessed by specialists; v. a description of the proposed method of assessing duration and significance; vi. an indication of the stages at which the competent 	Section 9

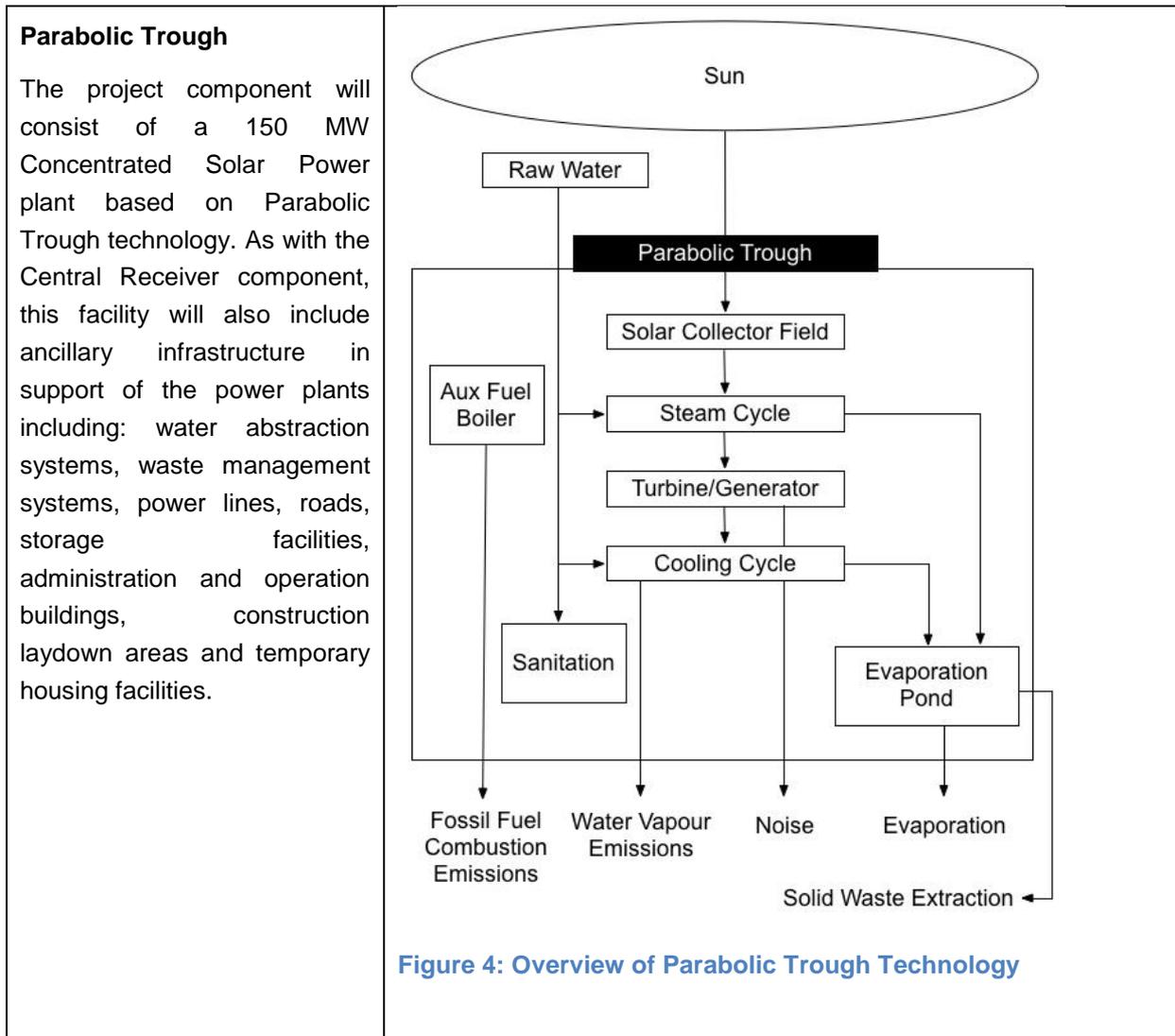
ESR Requirements according to Section 21(3) of GN R. 982	Section
<p>authority will be consulted</p> <ul style="list-style-type: none"> vii. particulars of the public participation process that will be conducted during the environmental impact assessment process; and viii. a description of the tasks that will be undertaken as part of the environmental impact assessment process; ix. identify suitable measures to avoid, reverse, mitigate or manage identified impacts and to determine the extent of the residual risks that need to be monitored. 	
<p>(j) An undertaking under oath or affirmation by the EAP in relation to –</p> <ul style="list-style-type: none"> i. The correctness of the information provided in the report; ii. The inclusion of comments and inputs from stakeholders and I&APs; and iii. Any information provided by the EAP to I&APs and any responses by the EAP to comments or inputs made by I&APs 	
<p>(k) An undertaking under oath or affirmation by the EAP in relation to the level of agreement between the EAP and I&APs on the plan of study for undertaking the environmental impact assessment</p>	Section 9.7
<p>(l) Where applicable, any specific information required by the competent authority; and</p>	
<p>(m) Any other matter required in terms of section 24 (4)(a) and (b) of the Act</p>	

2 PROJECT DESCRIPTION

2.1 The Proposed Concentrating Solar Power (CSP) Plant

Solafrica intends constructing a CSP plant and associated infrastructure with a maximum generation capacity of 150 MW per plant. The footprint of the proposed plant is approximately 800 ha in total and the components include:

Table 4: Project components for the proposed technology



2.2 Electricity Generation using Concentrating Solar Power (CSP) & Photovoltaic (PV) Technologies

The fundamental principle of CSP technologies is to collect the energy carried by sunrays, allowing a heat transfer fluid (HTF) to absorb the collected energy and thereby converting the thermal energy into further useful forms such as electricity. PV technologies also collect energy carried by sunrays,

absorbing the collected energy and converting it straight to electricity. This conversion process is made possible through the use of photovoltaic modules.

The process of energy conversion in a CSP plant is illustrated in Figure 5. Since a thermal intermediary is always involved, a conventional steam power turbine generator can be coupled for power generation. Energy storage is possible either in thermal form (e.g.: steam, molten salt) or as electrical energy (e.g. batteries). Losses occur throughout the energy conversion process.

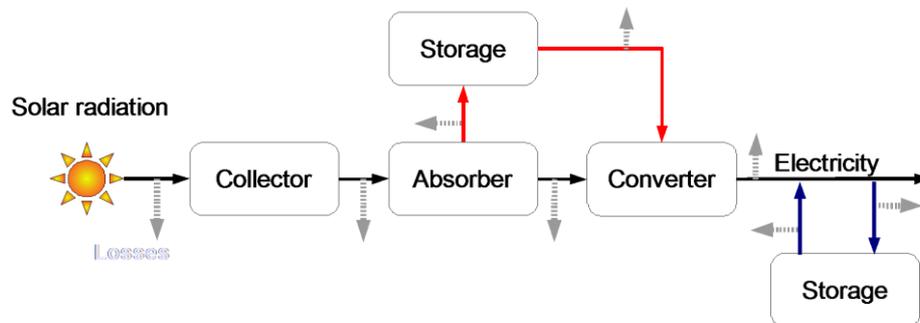


Figure 5: Schematic of the energy conversion in a CSP plant. Storage is optional (Red – thermal energy; Blue – electrical energy; Grey - losses)

2.3 Fundamental Terminology

2.3.1 Insulation, Irradiance and Irradiating

When considering CSP technology, it is important to understand the fundamental terminology.

Insolation is a portmanteau word for *incident solar radiation*. It is a measure of solar radiation energy received on a given surface during a given time, typically in kWh/m²/day or kWh/m²/year.

Sunrays can be scattered by vapour or dust particles in air before reaching the Earth's surface, this is known as diffuse irradiation. Only the parallel sunrays normal to the receiving surface can be concentrated, and this is the portion known as Direct Normal Irradiance (DNI), which has the SI unit of W/m². In the solar power industry, irradiation with a time duration (typically in the form of Wh/day or kWh/year per unit area) is often used interchangeably with irradiance.

For consistency to international preference, DNI in this document will refer to Direct Normal Irradiation, with the unit of kWh/m²/day or kWh/m²/year, the same with insolation for measuring energy. Figure 6 demonstrates that only parallel beams of sunrays can be concentrated. The diffuse or reflected portion cannot be concentrated.

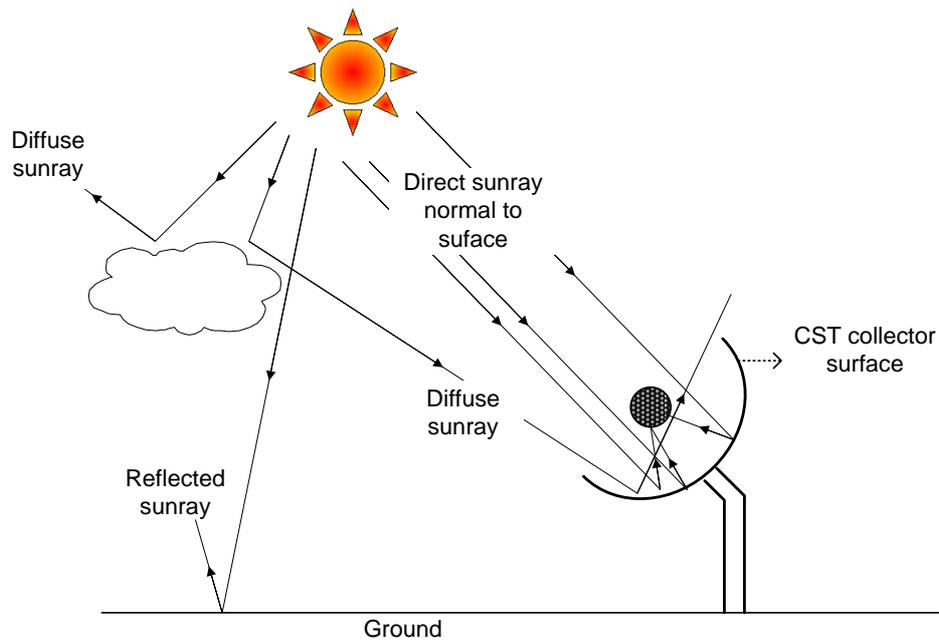


Figure 6: Directional property of sunrays

Because of the directional property of sunrays, concentrating technologies must track the sun's path to receive DNI. Suitable sites are those that receive high level of DNI, in locations known as the “sun belt”, which typically receives more than 1 800 kWh/m²/year of direct solar irradiation. Uppington has one of the higher DNI levels of approximately 2900 kWh/m² per year.

2.4 Concentrated Solar Power and Photovoltaic Technologies

2.4.1 CSP Technology

CSP technologies can be categorised by two concentrating methods according to the receiver types where sunrays are reflected to a line receiver as in parabolic trough (Figure 7) or linear fresnel (Figure 9) technology or to a point as in central receiver (Figure 8) or dish sterling technology.

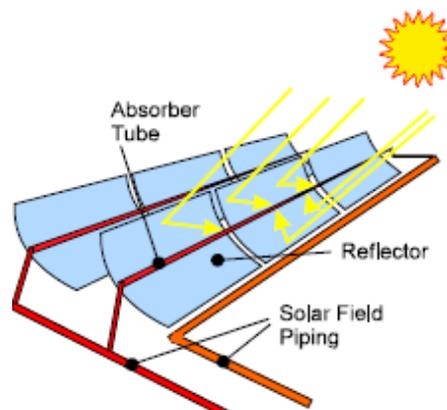


Figure 7: Parabolic trough system

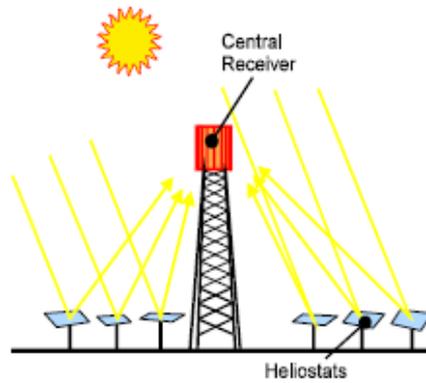


Figure 8: Central Receiver

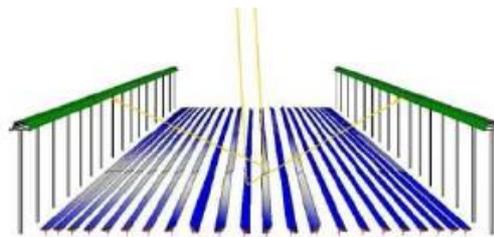


Figure 9: Linear Fresnel

The HTF may be thermal oil (parabolic trough), molten salt (parabolic trough/central receiver/linear fresnel) or direct steam (parabolic trough/central receiver/linear fresnel) for the transportation of thermal energy. A thermal oil application is more commonly found in existing parabolic trough plants, molten salt and direct steam solutions are used in existing central receiver plants, and direct steam is used in existing linear fresnel plants although molten salt examples are emerging. The receivers, reflectors, HTF and the associated supporting structures make up the solar field. The design of the solar field is the core to the CSP technology. It is also the differentiator amongst the vendor designs.

2.4.1.1 Parabolic Trough Technology

In parabolic trough technology, glass mirrors are most commonly shaped into the curved parabolic reflectors (troughs) (Figure 10). Parabolic troughs are usually designed to track the sun along one axis. An absorber tube containing HTF is situated along the focal line of the parabolic trough (Figure 11).



Figure 10: Photo of a trough system⁴



Figure 11: An absorber tube⁵

The configuration of a parabolic trough CSP plant with storage is shown in Figure 12 as an example. The oil is heated to approximately 390°C in the solar field and then circulated through a series of heat exchangers to produce steam (e.g.: 100 bar in Andasol-1, 50 MW, Spain). The steam is converted to electrical energy in the power block, which consists of a conventional steam turbine generator and its associated cooling mechanism.

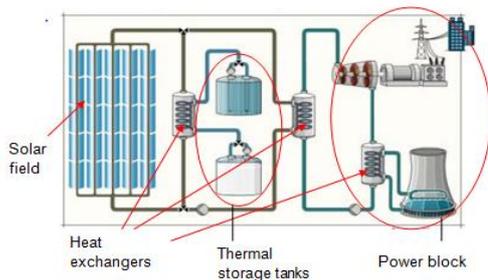


Figure 12: An example of a parabolic trough power plant with storage



Figure 13: Plant view of parabolic trough plant⁶

⁴ <http://www.energylan.sandia.gov>

⁵ TREE (Transfer Renewable Energy & Efficiency) seminar. (2009). Seminar material. March 18-20.

⁶ <http://www.renewables-made-in-germany.com/en/corporate-news/detail/article/ultimate-troughR-the-next-generation-collector-for-parabolic-trough-power-plants-first-demonstra.html>

2.4.1.2 Central Receiver Technology

In central receiver technology, sun-tracking mirrors called heliostats (glass mirrors) are mounted on a dual-tracking axis which reflects the sunlight to the central receiver (Figure 14 and Figure 15). Heliostats are typically arranged in an elliptical formation around the focal point with the majority of the reflective area focussed to the more effective side of the heliostat field. Other arrangements are also possible, with rectangular groups of mirrors focused on to a number of smaller central receivers in a modular formation.

In central receiver technology the central receiver (Figure 16) is situated on the top of the central tower. This receiver is a heat exchanger which absorbs the concentrated beam radiation, converts it to heat and transfers the heat to the working fluid (i.e. molten salt or water) which is in turn used to generate steam for conventional power generation.



Figure 14: Example of a heliostat⁷



Figure 15: Example of a heliostat⁸



Figure 16: Illustration of a central receiver⁹

⁷ http://www.brightsourceenergy.com/technology/how_lpt_works

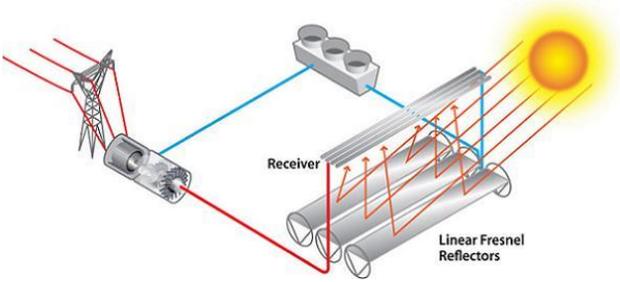
⁸ www.wikipedia.org

⁹ http://www.brightsourceenergy.com/technology/how_lpt_works.

2.4.1.3 Linear Fresnel Technology

Linear Fresnel is an advancement of the parabolic trough technology which uses flat glass mirrors in place of curved mirrors such as parabolic trough. Linear Fresnel reflectors use long, thin segments of mirrors to focus sunlight onto a fixed absorber located at a common focal point of the reflectors (Figure 19). This concentrated energy is transferred through the absorber into the thermal fluid. The fluid then goes through a heat exchanger to produce steam and then to power a steam turbine. Fresnel plants can be designed to incorporate thermal storage (Figure 18).

In addition, the underlying vegetation where the reflector rows are installed, although compacted by construction operations, shall not be removed and will be ripped on completion of construction, allowing restoration of the ecology of the site, which is currently classified as having low-medium significance.

	
<p>Figure 17: Example of a Linear Fresnel array¹⁰</p>	<p>Figure 18: Depiction of Linear Fresnel process¹¹</p>

2.4.2 Photovoltaic Technology

A photovoltaic plant is a large-scale photovoltaic system (PV) designed for the supply of merchant power into the electricity grid. They are differentiated from most building-mounted and other decentralised solar power applications because they supply power at the utility level, rather than to a local user or users. They are sometimes also referred to as solar farms or solar ranches, especially when sited in agricultural areas.

In photovoltaic technology the power conversion source is via photovoltaic modules that convert light directly to electricity. This differs from the other large-scale solar generation technology, concentrated solar power, which uses heat to drive a variety of conventional generator systems.

Solar panels produce direct current (DC) electricity, so solar parks need conversion equipment to convert this to alternating current (AC), which is the form transmitted by the electricity grid. This

¹⁰ <http://us.avevablog.com/2010/11/23/the-inside-scoop-on-solar-technology/>

¹¹ https://www.eeremultimedia.energy.gov/solar/graphics/linear_fresnel_power_plant_illustration

conversion is done by inverters. To maximise their efficiency, solar power plants also incorporate maximum power point trackers, either within the inverters or as separate units. These devices keep each solar array string close to its peak power point.

There are two primary alternatives for configuring this conversion equipment; centralised and string inverters, although in some cases individual, or micro-inverters are used. Single inverters allow optimizing the output of each panel, and multiple inverters increase the reliability by limiting the loss of output when an inverter fails.



Figure 19: Example of solar arrays¹²

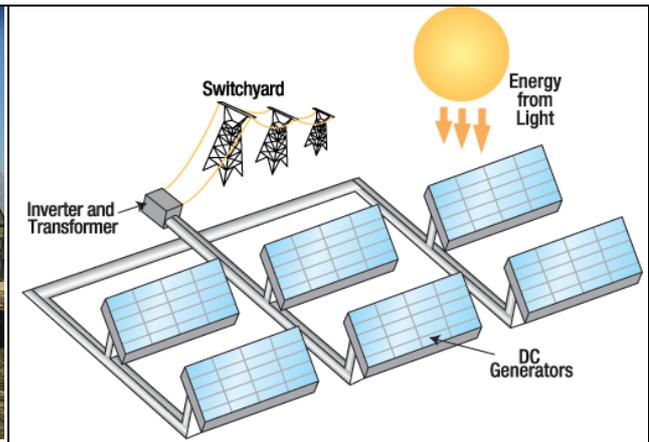


Figure 20: An example of a photovoltaic plant¹³

¹² www.wikipedia.org

¹³ www.holbert.faculty.asu.edu

3 PROJECT ALTERNATIVES

In terms of the EIA Regulations (2014), Section.21 (3) - Appendix 2 (h) feasible alternatives are required to be considered as part of the environmental investigations. In addition, the obligation that alternatives are investigated is also a requirement of Section 24(7) of the National Environmental Management Act (Act 107 of 1998, 'NEMA') (as amended). An alternative in relation to a proposed activity refers to the different means of meeting the general purpose and requirements of the activity (as defined in Government Notice R982 of the EIA Regulations, 2014), which may include alternatives to:

- a) The property on which or location where it is proposed to undertake the activity.
- b) The type of activity to be undertaken.
- c) The design or layout of the activity.
- d) The technology to be used in the activity.
- e) The operational aspects of the activity.

3.1 No-go Alternative

The 'do-nothing' alternative is the option of not establishing new concentrating solar power plant at the identified site in the Northern Cape Province.

South Africa currently relies almost completely on fossil fuels as a primary energy source (approximately 90%) with coal providing 75% of the fossil fuel based energy supply¹⁴. Coal combustion in South Africa is the main contributor to carbon dioxide emissions, which is the main greenhouse gas that has been linked to climate change.

An emphasis has therefore been placed on securing South Africa's future power supply through the diversification of power generation sources. Furthermore, South Africa would have to invest in a power generation mix, and not solely rely on coal-fired power generation, to honor its commitment made under the Copenhagen Accord and to mitigate climate change challenges. Under the Accord, the country committed to reduce its carbon dioxide emissions by 34% below the "business as usual" level by 2020.

With an increasing demand in energy predicted and growing environmental concerns about fossil fuel based energy systems, the development of large-scale renewable energy supply schemes such as Concentrating Solar Power is strategically important for increasing the diversity of domestic energy supplies and avoiding energy imports in the country.

Without the implementation of this project, the use of renewable options for power supply will be compromised in the future. This has potentially significant negative impacts on environmental and social well-being. Therefore, the no-go option is not considered as a feasible option on this proposed project.

¹⁴ Department of Minerals and Energy. 1999. *Digest of South African Energy Statistics*, compiled by CJ Cooper.

3.2 Site Alternatives

In determining the most appropriate sites for the establishment of the new concentrating solar power plant, various options were investigated. This site selection process considered the following criteria:

- The availability and accessibility of primary resources required for the operation of the power plant, such as sun (i.e. the required Direct Normal Insolation) and water;
- Availability of land to locate the site and associated infrastructure;
- The availability and accessibility of infrastructure for the provision of services, manpower and social structure for the construction and operation of the power plant;
- The ease of integration of the new power plant into the existing National Transmission network/grid and the environmental impacts associated with this integration; and
- General environmental acceptability in terms of social impacts, water utilisation, general ecology, etc.

Through a series of feasibility and high-level screening studies undertaken, the Northern Cape Province is ranked as the most favourable area for the establishment of the new concentrating solar power and photovoltaic plants.

3.2.1 Site Alternatives Identified within the Northern Cape Province for the Establishment of the new CSP Plant

A strategic analysis was undertaken in order to identify feasible alternative sites for the establishment of the proposed new power plant and associated infrastructure within the Northern Cape Province. This analysis considered technical, economic and environmental criteria. From the sensitivity analysis¹⁵ it was concluded that there was the potential to establish a new CSP plant in the Groblershoop area. In order to ensure the ease of integration of the new power plant into the existing National Transmission network/grid and considering the environmental impacts associated with this integration, it was determined that the most feasible site would be close to the existing power lines and water resources.

It must be noted that a combined sensitivity map (refer to Figure 34) was created by using data that was collected during each of the specialist assessments. The sensitivity map will be used to identify possible power block, supporting infrastructure (i.e. pipelines, roads, etc) alignment alternatives that will be assessed during the EIA phase.

3.3 Layout Alternatives

To date, no potential layouts have been proposed for the alternative sites as this would only be available during the EIA phase. Alternative power plant layouts will be informed by the findings and recommendations of the detailed specialist studies to be undertaken during the EIA phase of the project.

¹⁵ Bohlweki Environmental (on behalf of Eskom Holdings Limited). 2006. *Environmental Impact Assessment for the establishment of a New Concentrating Solar Power (CSP) plant and associated infrastructure in the Northern Cape Province.*

3.4 Technology Alternatives

The preceding Chapter (*Project Technologies*) provided a description of the types of technologies that exist i.e. parabolic trough, central receiver, linear fresnel and photovoltaic technologies. To reiterate:

1. *Parabolic Trough Technology* - Glass mirrors are most commonly shaped into the curved parabolic reflectors (troughs) and are usually designed to track the sun along one axis. Absorber tubes containing heat transfer fluid (HTF) are situated between reflectors. The HTF (i.e. thermal oil) is heated to approximately 390°C in the solar field and then circulated through a series of heat exchangers to produce steam. The steam is converted to electrical energy in the power block, which consists of a conventional steam turbine generator and its associated cooling mechanism.
2. *Central Receiver Technology* - Sun-tracking mirrors called heliostats (glass mirrors) are mounted on an axis which reflects the sunlight to a central receiver. The central receiver is situated on the top of a single central tower, or alternatively on a number of smaller central towers. This receiver is a heat exchanger which absorbs the concentrated beam radiation, converts it to heat and transfers the heat to the working fluid (i.e. molten salt or water) which is in turn used to generate steam for conventional power generation.
 -
3. *Linear Fresnel Technology* - modular flat reflectors are used to focus the sun's heat onto stationary receivers consisting of a system of water filled tubes. The concentrated sunlight boils the water, which generates high pressure steam without the need for costly heat exchangers or intermediate heat transfer fluids such as oil or salt. Linear Fresnel relies on water to generate steams for conventional power generation.
4. *Photovoltaic Technology* - Photovoltaic modules convert light directly to electricity. Solar panels produce direct current (DC) electricity, so solar parks need conversion equipment to convert this to alternating current (AC), which is the form transmitted by the electricity grid. This conversion is done by inverters. To maximise their efficiency, solar power plants also incorporate maximum power point trackers, either within the inverters or as separate units. These devices keep each solar array string close to its peak power point.

Some of the major advantages and disadvantages of the four types of technologies are provided in Table 5 below.

Table 5: Major advantages and disadvantages of the proposed CSP and PV technologies considered for the project

Technologies	Advantages	Disadvantages
<p>CSP - Parabolic Trough Technology</p> 	<ul style="list-style-type: none"> • Is the most proven CSP technology; • Over 30+ years of operating experience; • Energy storage is feasible and can be added. Therefore, the system could provide energy under cloudy conditions or at night; and • The cost, performance and risk of parabolic trough technology are well established with existing parabolic trough plants around the world. 	<ul style="list-style-type: none"> • Relatively low thermal efficiency; • Requires significant site grading with gradient <3%.
<p>CSP - Central Receiver Technology</p> 	<ul style="list-style-type: none"> • When using tower technology, <u>energy storage</u> could be added. Therefore, the system could provide energy, even in cloudy conditions or at night; • Requires minimum site grading (can tolerate gradients >5%); • Energy storage is feasible and can be added; and • The advantage of this design above the parabolic trough design is the higher temperature (up to 550°C compared to 400°C). Thermal energy at higher temperatures can be converted to electricity more efficiently and can be more cheaply stored for later use. 	<ul style="list-style-type: none"> • Central receiver technology needs to proceed from conceptual to demonstration to commercial development. Currently less experience with commercial deployment than trough technology; • Central receiver design is a challenge – specifically in seismic zones.

Technologies	Advantages	Disadvantages
<p>CSP – Linear Fresnel Technology</p> 	<ul style="list-style-type: none"> • Commercially proven technology albeit on a relatively small scale. Modular design allows for an easy scale-up of the plant capacity; • Storage can be added. Therefore, the system could provide energy under cloudy conditions or at night; and • Linear Fresnel technology has a relatively low footprint and therefore limits environmental disturbance. 	<ul style="list-style-type: none"> • Low thermal efficiency and relatively small install base. The technology has not benefitted from the same technology advancement as the other concentrated solar thermal technologies.
<p>Photovoltaic Technology</p> 	<ul style="list-style-type: none"> • PV panels provide clean – green energy. During electricity generation with PV panels there is no harmful greenhouse gas emissions thus solar PV is environmentally friendly; • PV cells have a very long lifespan that needs minimum upkeep; • PV is currently the lowest price solar technology due to the lower costs of PV panels; • Minimal operations and maintenance support staff required; • Require a minimal amount of water; and • Solar energy is a locally available renewable resource. It does not need to be imported from other regions of the country or across the world. This reduces environmental impacts associated with transportation and also reduces our dependence on imported oil. And, unlike fuels that are mined and harvested, when we use solar energy to produce electricity we do not deplete or 	<ul style="list-style-type: none"> • Some toxic chemicals, like cadmium and arsenic, are used in the PV production process. These environmental impacts are minor and can be easily controlled through recycling and proper disposal; • Solar energy is somewhat more expensive to produce than conventional sources of energy due in part to the cost of manufacturing PV devices and in part to the conversion efficiencies of the equipment. As the conversion efficiencies continue to increase and the manufacturing costs continue to come down, PV will become increasingly cost competitive with conventional fuels; • Energy storage options (batteries) are expensive; • Significant power output fluctuations due to no inertia in the system; • PV efficiency is significantly affected at high ambient temperatures; and

Technologies	Advantages	Disadvantages
	alter the resource.	<ul style="list-style-type: none">• Solar power is a variable energy source, with energy production dependent on the sun. Solar facilities may produce no power at all some of the time, which could lead to an energy shortage if too much of a region's power comes from solar power.

3.5 Water Supply Pipelines

The exact length and route of the alignment of the proposed pipeline/s is not known at this stage. A more detailed description and assessment of proposed alignments will follow in the EIA phase, in the form of corridors, from the sources of water to the point of usage.

3.6 Access Roads

Appropriate access roads (temporary and permanent) will be constructed to link the proposed power plants with the nearby existing roads network. These routes will be identified in the form of access roads corridors from which alignments may be designed. The corridors will cater for temporary (to be used during construction) and permanent (to be used during operation) access and site roads. All the corridors will be identified and studied in detail in the EIA phase of the process.

3.7 Transmission Lines

The exact length and route of the alignment of the proposed 132kv transmission lines is not known at this stage. A more detailed description and assessment of proposed alignments will follow in the EIA phase, in the form of corridors. The route of transmission lines will be largely informed by the layout of the proposed CSP plant.

3.8 Waste Storage Areas

The project will require raw water and waste water storage ponds for the provision of service water as well as the separation and treatment of contaminated water. The project will further require waste storage facilities that may cover an area in excess of 10 hectares collectively.

The location of these temporary waste storage areas have not been determined at this stage in the study but will be informed by the sensitivity analysis conducted in the EIA phase. Further attention will be provided to the waste storage areas during the waste application process.

3.9 Storeroom(s) and Construction Camps

The locations of the storeroom(s) and construction camp have not been determined at this stage in the study but will be informed by the sensitivity analysis conducted in the EIA phase.

4 LEGAL REQUIREMENTS

In order to protect the environment and ensure that this development is undertaken in an environmentally responsible manner, there are a number of significant pieces of legislation that will be consulted for this study. After a brief scoping of applicable legislation these include but may not be limited to the following:

4.1 The Constitution of South Africa

The Bill of Rights, in the Constitution of South Africa (No. 108 of 1996), states that everyone has a right to a non-threatening environment and requires that reasonable measures are applied to protect the environment. This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development. These principles are embraced in NEMA and given further expression.

4.2 National Legislation and Regulations

4.2.1 The National Environmental Management Act (No 107 of 1998)(as amended)

The National Environmental Management Act (NEMA) provides environmental governance by providing principles for decision-making on matters that affect the environment and defines the principles that apply to the organs of state involved in that decision-making. The Act sets out the legal and procedural requirements for environmental compliance. Regulations under the Act define activities that may not commence without prior approval from the competent authority. The Department of Environmental Affairs (DEA), is the competent authority for this EIA process and the development needs to be authorised by this Department in accordance with the NEMA (as amended).

The EIA Regulations (2014) under the NEMA consist of three (3) categories of activities namely: Listing Notice 1 Activities (GNR. 983 of 2014) which require a Basic Assessment study, Listing Notice 2 Activities (GNR. 984 of 2014) which require both a Scoping and an EIA study for authorisation and Listing Notice 3 Activities (GNR 985 of 2014) which requires a Basic Assessment study for specific activities in identified sensitive geographical areas. The DEA is responsible for the authorisation of these activities. The activities associated with this development, for which environmental authorisation is required are as follows:

Table 6: Listed Activities triggered according to the Listing Notices of the EIA Regulations (2014)

LISTED ACTIVITIES		
LISTING NOTICE 1 (GN R.983)		
Activity 9	A water supply pipeline will be associated with the proposed project	The development of infrastructure exceeding 1,000m in length for the bulk transportation of water or storm water— (i) with an internal diameter of 0.36m or more; or (ii) with a peak throughput of 120ℓ/s or more;

LISTED ACTIVITIES

Activity 11	A 132kV overhead power line/s is proposed to be constructed	The development of facilities or infrastructure for the transmission and distribution of electricity— (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275kV
Activity 12	The study area may contain drainage lines and/or watercourses which could be affected by the proposed project	The development of— (iii) bridges exceeding 100m ² in size; (vi) bulk storm water outlet structures exceeding 100m ² in size; (x) buildings exceeding 100m ² in size; (xii) infrastructure or structures with a physical footprint of 100m ² or more; where such development occurs— (a) within a watercourse; (b) in front of a development setback; or if no development setback exists, within 32m of a watercourse, measured from the edge of a watercourse
Activity 13	The project will require raw water and waste water storage ponds	The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50,000 cubic metres or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014.
Activity 19	The study area may contain drainage lines and/or watercourses which could be affected by the proposed project. Construction of roads across drainage line and/or the construction of infrastructure within drainage lines may require the removal of material.	The infilling or depositing of any material of more than 5m ³ into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5m ³ from— (i) a watercourse;
Activity 24	Access roads to the site and within the site will be required to be constructed	The development of— ii. a road with a reserve wider than 13.5m, or where no reserve exists where the road is wider than 8m
Activity 25	Construction of evaporation ponds for the recycling of contaminated water	The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of more than 2,000m ³ but less than 15,000m ³ .

LISTING NOTICE 2 (GN R.984)

LISTED ACTIVITIES		
Activity 1	The solar energy facilities would have a generating capacity in excess of 20MW	The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.
Activity 4	The project will require the storage and handling of dangerous goods (such as heat transfer liquid associated with the CSP facility)	The development of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500m ³ .
Activity 6	The project will possibly require a boiler with a size bigger than 50MW, that triggers an AEL	The development of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, excluding— (i) activities which are identified and included in Listing Notice 1 of 2014; (ii) activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; or (iii) the development of facilities or infrastructure for the treatment of effluent, wastewater or sewage where such
Activity 16	The project is likely to require a water storage facility with a wall in excess of 5 metres in height. The project will further require waste storage facilities that may cover an area in excess of 10 hectares collectively	The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5m or higher or where the high-water mark of the dam covers an area of 10ha or more.

4.2.2 The National Heritage Resources Act (No 25 of 1999)

In terms of section 38 (subject to the provisions of subsections (7), (8) and (9) of the Act), any person who intends to undertake a development categorised as:

- The construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
- The construction of a bridge or similar structure exceeding 50 m in length;
- Any development or other activity which will change the character of a site:
 - Exceeding 5 000 m² in extent;
 - Involving three or more existing erven or subdivisions thereof; or
 - Involving three or more erven or divisions thereof which have been consolidated within the past five years; or
 - The costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

- The re-zoning of a site exceeding 10 000 m² in extent; or
- Any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

The above provisions do not apply to the specified development if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act, 1989 (Act No. 73 of 1989), or the integrated environmental management guidelines issued by the Department of Environment Affairs and Tourism, or the Minerals Act, 1991 (Act No. 50 of 1991), or any other legislation and provided that the consenting authority must ensure that the evaluation fulfils the requirements of the relevant heritage resources authority and any comments and recommendations of the relevant heritage resources authority with regard to such development have been taken into account prior to the granting of the consent.

The provincial/national offices of the South African Heritage Resource Agency (SAHRA) will be provided with all relevant documentation, since they have a statutory role to play in the decision-making process, acting as commenting authorities.

4.2.3 The National Environmental Management: Waste Act (No 59 of 2008)

The National Environmental Management Waste Act (No 59 of 2008)(as amended) reforms the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management measures; to provide for the licensing and control of waste management activities; to provide for the remediation of contaminated land; to provide for the national waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith.

In November 2013, the Waste Regulations (Government Notice 718) went through an amendment process. Specific activities relating to the construction of facilities for the treatment of sewage, wastewater or effluent was removed from the NEM:WA and provided for in the EIA Regulations as amended in 2013. Government Notice No 921 was published on 29 November 2013 with a revised list of waste management activities that have, or are likely to have a detrimental effect on the environment. GN 921 makes reference to three categories of licensing i.e. Category A, B and C. Category A activities require a Basic Assessment, Category B activities require a full scoping and EIA. Category C activities do not require a Waste Management License but must be registered with the Competent Authority and must comply with relevant requirements or standards determined by the Minister.

This list of applicable waste activities requiring a Waste Management License for this project, in terms of the NEM:WA, is presented in Table 7 below.

Table 7: Activities applied for according to the NEM:WA

ACTIVITIES APPLIED FOR	
GN R.921 of 29 November 2013	
Category A (Activity 1)	The storage of general waste in lagoons
Category A (Activity 12)	The construction of a facility for a waste management activity listed in Category A of this Schedule (not in isolation to associated waste management activity)
Category B (Activity 1)	The storage of hazardous waste in lagoons excluding storage of effluent, wastewater and sewage
Category B (Activity 10)	The construction of facility for activities listed in Category B of this Schedule (not in isolation to associated activity)

4.2.4 The National Water Act (No 36 of 1998)

The purpose of the National Water Act No 36 of 1998 (“the National Water Act”)(as amended) is to provide for fundamental reform of the law relating to water resources; to repeal certain laws; and to provide for matters connected therewith.

In terms of section 21, the water uses that are recognised for purposes of the National Water Act include the following:

- **Water Uses**

- Section 21(a) – Taking water from a water resource;
- Section 21(b) – Storing water;
- Section 21(c) – Impeding or diverting the flow of water in a watercourse;
- Section 21(d) – Engaging in a stream flow reduction activity contemplated in section 36 (currently only the use of land for afforestation which has been or is being established for commercial purposes);
- Section 21(e) – Engaging in a controlled activity identified as such in section 37(1) (which includes the intentional recharging of an aquifer with any waste or water containing waste) or declared under section 38(1);
- Section 21(f) – Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
- Section 21(g) – Disposing of waste in a manner which may detrimentally impact on a water resource;
- Section 21(h) – Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
- Section 21(i) – Altering the bed, banks, course or characteristics of a watercourse;
- Section 21(j) – removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
- Section 21(k) – using water for recreational purposes.

In terms of the definitions contained in section 1 of the National Water Act, “water resource” includes a watercourse, surface water, estuary, or aquifer. “Aquifer” means a geological formation which has structures or textures that hold water or permit appreciable water movement through them.

“Watercourse” means a river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake or dam into which, or from which, water flows; and any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

Furthermore, in terms of the definitions contained in section 1 of the National Water Act, “waste” “includes any solid material or material that is suspended, dissolved or transported in water (including sediment) and which is spilled or deposited on land or into a water resource in such volume, composition or manner as to cause, or to be reasonably likely to cause, the water resource to be polluted”.

This EIA study will be used to support the Water Use Licensing Application Process.

- **Controlled Activities**

The Minister of Water and Environmental Affairs is allowed to regulate activities which have a detrimental impact on water resources by declaring them to be controlled activities. The following are considered to be controlled activities:

- Irrigation of any land with waste or water containing waste generated through any industrial activity or by a water work;
- An activity aimed at the modification of atmospheric precipitation;
- A power generation activity which alters the flow regime or a water resource;
- Intentional recharging of an aquifer with any waste or water containing waste; and
- An activity which has been declared as such under Section 38.

No person may undertake a controlled activity unless such person is authorised to do so by or under this Act. The Minister may, by notice in the Gazette, in general or specifically, declare an activity to be a controlled activity. Such notice might be for a specific activity on a specific site.

4.2.5 National Environmental Management: Air Quality Act 39 of 2004

The National Environmental Management: Air Quality Act 39 of 2004 has shifted the approach of air quality management from source-based control to receptor-based control. The main objectives of the Act are to:

- Give effect to everyone’s right ‘to an environment that is not harmful to their health and well-being’
- Protect the environment by providing reasonable legislative and other measures that (i) prevent pollution and ecological degradation, (ii) promote conservation and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development

The Act makes provision for the setting and formulation of national ambient air quality standards for ‘substances or mixtures of substances which present a threat to health, well-being or the environment’. More stringent standards can be established at the provincial and local levels.

The control and management of emissions in AQA relates to the listing of activities that are sources of emission and the issuing of emission licences. Listed activities are defined as activities which 'result in atmospheric emissions and are regarded to have a significant detrimental effect on the environment, including human health'. Listed activities have been identified by the minister of the Department of Environmental Affairs and atmospheric emission standards have been established for each of these activities. These listed activities now require an atmospheric emission licence to operate. The issuing of emission licences for Listed Activities is the responsibility of the metropolitan and district municipalities.

In addition, the minister may declare any substance contributing to air pollution as a priority pollutant. Any industries or industrial sectors that emit these priority pollutants will be required to implement a Pollution Prevention Plan. Municipalities are required to 'designate an air quality officer to be responsible for co-ordinating matters pertaining to air quality management in the Municipality'. The appointed Air Quality Officer is responsible for the issuing of atmospheric emission licences.

4.2.6 Hazardous Substance Act (No 15 of 1973) and Regulations

The purpose of the Act is:

- To provide for the control of substances which may cause injury or ill-health to or death of human beings by reason of their toxic, corrosive, irritant, strongly sensitizing or flammable nature or the generation of pressure thereby in certain circumstances, and for the control of certain electronic products;
- To provide for the division of such substances or products into groups in relation to the degree of danger;
- To provide for the prohibition and control of the importation, manufacture, sale, use, operation, application, modification, disposal or dumping of such substances and products; and
- To provide for matters connected therewith.

4.2.7 Legal Requirements in Terms of Other Acts

In addition to the above, the following Acts may have some bearing on the proposed activities:

Legislation	Relevant Sections	Relates To
		and duty of care relating to listed invasive species.
Occupational Health and Safety Act (No 85 of 1993) and Regulations	Section 8	General duties of employers to their employees.
	Section 9	General duties of employers and self employed persons to person other than their employees.
Road Transportation Act (No 74 of 1977)		
<i>National Environmental Management: Protected Areas Amendment Act (No 21 of 2014)</i>		
Relevant Municipal Bylaws		

In addition to the above, the following should also be taken note of:

- a) Northern Cape Provincial Growth and Development Strategy. 2004 – 2014;
- b) Siyanda District Municipality Integrated Development Plan 2011/2012 (5 Year Plan); and
- c) South African Millennium Development Goals
- d) Any IDPs and SDFs

5 PUBLIC PARTICIPATION PROCESS

5.1 Overview of the Public Participation Process Undertaken during the Scoping Phase

The primary aims of the public participation process during the Environmental Scoping Study are:

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

5.2 Identification of Key Stakeholders

The first step in the Public Participation Process (PPP) is to identify key stakeholders, including:

- National and Provincial Government Representatives:
 - Department of Environmental Affairs (DEA);
 - Department of Water & Sanitation (DWS);
 - Department of Agriculture;
 - Department of Public Enterprises;
 - Department of Trade and Industry (DTI);
 - Department of Energy (DoE);
 - Department of Minerals (DMR);
 - National Environmental Standards and Regulations Enforcement Agency (NESRA);
 - South African Heritage Resources Agency (SAHRA); and
 - Relevant Northern Cape Provincial Authorities (ex. Environment & Conservation, Agriculture).
- Relevant Local and District Municipalities:
 - Siyanda District Municipality; and
 - !Kheis Local Municipality.
- State-owned Entities (SoE) – Eskom;
- Affected and surrounding landowners;
- Environmental Non-Governmental Organizations (ex. Endangered Wildlife Trust, World Wildlife Fund); and
- Community based organisations.

All I&AP information (including contact details), together with dates and details of consultations and a record of all issues raised is recorded within a comprehensive project database. This

database will be updated on an on-going basis throughout the project, and will act as a record of the communication/public involvement process.

5.3 Advertising

In compliance with the EIA Regulations (2014), notification of the commencement of the ESS process for the project was advertised in a local newspaper, the project was advertised in the *Gemsbok* local newspaper in July 2015 in the predominant language of the area, Afrikaans. Only an advertisement in the *Gemsbok* newspaper was required as only the Groblershoop town will be located within the *Gemsbok's* distribution area.

The advertisement provided an abstract on key aspects of the CSP and PV projects (project description, location, applicable listed activities and contact details of the Environmental Assessment Practitioner). Furthermore the advertisement requested I&APs to register, and to become involved in the project by submitting comments and highlighting issues of concern to Royal HaskoningDHV. The primary aim of the newspaper advert is to ensure that the widest possible group of I&APs were informed of the project.

5.4 Briefing Paper

A briefing paper for the project has been compiled in English and Afrikaans. The aim of this document is to provide a brief outline of the proposed project, provide preliminary details regarding the EIA Process, and explain how I&APs could become involved in the project. The briefing paper, together with a comment sheet and relevant map, was distributed to identified stakeholders and I&APs via post or e-mail, inviting them to register for the proposed project and submit details of any issues and concerns that they may have.

Furthermore the briefing paper informed I&APs and Stakeholders of the prospective registration of the CSP plant as a Clean Development Mechanism (CDM) project and invited to comment on this aspect of the of the project, in addition to the EIA.

An introductory letter was sent to all I&APs and Stakeholders together with the briefing paper and comments sheet.

*Refer to **Appendix B** for copies of the briefing paper and comments sheet.*

5.5 Site Notices

Site notices were prepared according to the specifications set out in the EIA Regulations. The site notices included basic information regarding the proposed CSP project, the details of the public participation period, the listed activities applicable to the project and the contact details of the Environmental Assessment Practitioner. Six site notices were placed at the conspicuous points

- Entrance to the Groblershoop Post Office;

- Entrance to the !Kheis Municipal Offices;
- Access gate at the South Western region of the farm Sand Draai (-28.778723°, 21.902934°);
- At the contractors hut (-28.855260°, 22.020517°);
- At Groblershoop Police Station; and
- Inside the Groblershoop Magistrates Court building (notice board)

5.6 Pamphlets

The site notice and the registration and comment form was printed on A4 booklet sized paper (pamphlets) and distributed by the Post Office in Groblershoop, by placing a pamphlet in each of the 350 cubicles.

Refer to **Appendix C** for the *document and notices*.

5.7 Review of Environmental Scoping Report

5.7.1 Authority Review of Draft Environmental Scoping Report

The Consultation Environmental Scoping Report will be made available for review and comments for a period of 43-days, to the following authorities:

- The Department of Environmental Affairs (DEA); and
- The Northern Cape Department of Environment and Nature Conservation (NCDENC).

5.7.2 Public Review of Draft Environmental Scoping Report

The draft Environmental Scoping Report will be made available for review at the following public locations in close proximity to the study areas, which were identified as readily accessible to I&APs:

- !Kheis Public Library/Openbare Biblioteek (97 Oranje Street, Groblershoop);
- !Kheis Municipal Offices/Munisipale Kantore (97 Oranje Street, Groblershoop);
- //Khara Hais Public Library/Openbare Biblioteek (Market Street, Upington), and
- Royal HaskoningDHV's website <http://www.rhdhv.co.za>.

The availability of this draft report was advertised in the *Gemsbok* newspaper. A 30-day period was allowed for this review process from *July 2015* to *August 2015*. Stakeholders and I&APs on the project database were notified of the availability of this report by letter (via post or e-mail) as sent out in July 2015.

Refer to **Appendix A** for the *newspaper advertisement and notification letter to Stakeholders/I&APs*.

5.7.3 Final Environmental Scoping Report

The compilation of the Consultation Environmental Scoping Report entails the consideration and inclusion of all relevant comments received from the public during the review of the draft Environmental Scoping Report. The final document will be submitted to DEA as well as Northern Cape Department of Environment and Nature Conservation (NCDENC) for authority review and decision-making and/or comments.

5.8 Consultation and Public Involvement

Through consultations with I&APs and Stakeholders, issues for inclusion within the Environmental Scoping Report were identified and recorded.

A Stakeholder Focus Group Meetings (FGMs) with key strategic representatives of national, provincial and local authorities will be held at:

- !Kheis Local Municipality offices (97 Oranje Street, Groblershoop) in July 2015

The purpose of the FGM is to discuss the key findings of the Scoping phase and provide the representatives with an additional platform to provide input to the EIA process.

In addition to the Stakeholder FGM, one public meeting with I&APs will be scheduled during the public review period of the draft Environmental Scoping Report. The meeting will be held at:

- !Kheis Municipal Offices (97 Oranje Street, Groblershoop); in July 2015

The primary aim of this meeting is to:

- Disseminate background information regarding the proposed project to I&APs;
- Supply more information regarding the EIA process and the findings of the specialist studies undertaken during the Scoping phase;
- Answer questions regarding the project and the EIA process;
- Obtain feedback from I&APs with respect to the proposed project; and
- Receive input regarding the public participation process.

Stakeholders and I&APs were notified of the Stakeholder Focus Group/Public Meetings using the following methods:

- Invitation letter sent via e-mail, registered mail and/or fax;
- Telephonic dialogue with key Stakeholders;
- Distribution of pamphlets in the Groblershoop Communities; and
- Liaison with the relevant Ward Councillors and Ward Committee Representatives – the Ward Councillors assisted Royal HaskoningDHV by informing the relevant communities.

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

Refer to **Appendix D & F** for copies of the following:

- *Invitation letter;*
- *Pamphlet;*
- *Scoping phase presentation;*
- *Attendance registers; and*
- *Minutes of the meetings (for the Stakeholder Focus Group/Public Meetings).*

5.9 Social Issues Trail

Issues, concerns and comments (refer to **Appendix G**) raised during the Scoping phase Public Participation Process has been compiled into a Social Issues Trail (refer to **Appendix I**).

Refer to **Appendix H** for a complete register of Stakeholders and I&APs.

6 GENERAL DESCRIPTION OF THE STUDY AREA

The purpose of this chapter is to provide a general description of the study area environment suitable for the development of the CSP plant. The Northern Cape Province is a sparsely populated and a relatively isolated semi-desert area of South Africa. The area is therefore considered to be an area suitable for the establishment of solar energy infrastructure in South Africa. Suitable potential areas for the development of the CSP plant have been identified near Upington and Groblershoop.

6.1 Biophysical Environment

6.1.1 Locality

The study area is situated within the Siyanda District Municipality, in the Northern Cape Province adjacent to the Orange River. The Siyanda District Municipality covers an area of 103 771 square kilometres with its northern borders aligned with Botswana and Namibia. The district is traversed by the Orange River from the east to its west. Along the banks of the Orange River intensive agriculture has developed including vineyards and domestic food farms. Upington town is the main urban area for the region and serves as both an administrative and commercial centre as well as a stopover into the area's hinterland. This region attracts tourists travelling to Namibia and local reserves, such as Witsand (approximately 40 km north of Sand Draai) and the Augrabies National Park west of Upington.

The N14 and the N10 are the primary roads in the region and are the main link between the economic centres in Gauteng and Namibia. The population distribution is primarily concentrated in and around the small towns along the Orange River, and specifically in Upington. Other towns/settlements in relative close proximity to the proposed farms are, Keimoes, Kanoneiland, Louisvale, Oranjevallei, Klippunt, Grootdrink, Groblershoop, Hendriksdal and Boegoeberg.

The potential site (farm) that have been identified to establish the new CSP plant and associated infrastructure are: Sand Draai (S28°39'44.96", E22°0'6.88"). The site occurs within the !Kheis Local Municipality.

6.1.2 Climate

The climatic conditions of this region of the Northern Cape are typical of conditions characteristic of a semi-desert and the southern Kalahari. Upington is generally accepted as the hottest town in South Africa, with summer temperatures varying between 30°C and 40°C¹⁶.

The region is characterised by fluctuating temperatures, low and unpredictable rainfall and high evaporation rates. The low annual rainfall (average of 170 – 240 mm in Upington or even

¹⁶ <http://www.southafrica-travel.net/kalahari/e6kala01.htm>

lower in some surrounding areas) is significantly lower than the evaporation rate which creates the dry and arid environment. Rainfall usually occurs during the late spring and summer months with long and dry winters.

The area experiences high temperatures especially in the summer months, where daily maximums of >42°C are experienced. The annual evaporation in the area is high at approximately 2 281 mm. Winter temperatures can drop to below 4°C. Frost is rare, but occurs occasionally in most years, though usually not severely.

Weather data was received for the Uppington area for the time period 2009 – 2014. Table 9 gives an indication of the average monthly temperatures and humidity over the 5-year period.

Table 9: Average monthly temperatures and humidity for the Uppington area (2009 - 2014)

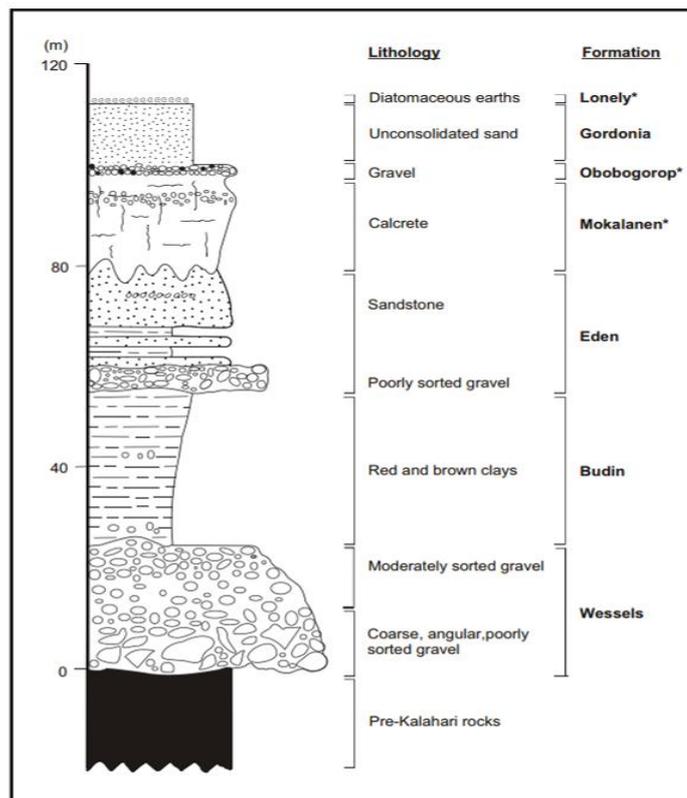
Month	Average Temperature (°C)	Maximum Temperature (°C)	Minimum Temperature (°C)	Humidity (%)
January	28.22	41.30	14.04	31.42
February	28.37	39.90	15.96	36.00
March	25.76	38.74	11.48	41.84
April	21.24	34.36	6.92	50.39
May	16.80	31.16	1.66	46.22
June	12.62	26.60	-2.78	47.97
July	12.42	27.26	-2.16	41.22
August	14.10	32.00	-2.10	38.96
September	18.64	36.38	2.42	32.95
October	22.95	38.32	6.00	30.07
November	25.45	39.14	10.72	32.27
December	27.41	40.16	14.04	26.65
Average	21.16	35.44	6.35	38.00

6.1.3 Geology

According to the 1:250 000 geological map sheet, Postmasburg (2822), the geology of the area is generally characterised by the metamorphosed sediments and volcanics intruded by granites and is known as the Namaqualand Metamorphic Province. The proposed CSP plant are sited on red, coarse grained brown windblown sands of the Gordonia Formation, Kalahari Group (refer to Figure 21). Dune ridges occur in the northern portions of the site and are characterised by NNW-SSE orientation. Quartz-muscovite schist, quartzite, quartz-amphibole schist and greenstone outcrops approximately 5km south west of the proposed plant area, as well as in the southern section of the site. Calcrete also outcrops in the southern section of the site approximately 8 km southwest from the proposed plant area (Figure 22).

6.1.4 Topography

The area is characterized by flat terrain and is, in general, an area of little topographical relief. Isolated hills and mountains can be found in the area. The area surrounding Upington can be described as large sandy plans with windblown sand dunes and low hills breaking the flat relief. The area to the south of Upington becomes more mountainous as one travels to Groblershoop.



* = Name not yet accepted by The South African Committee for Stratigraphy (SACS).

Figure 21: Schematic stratigraphy of the Kalahari Group in South Africa

FIGURE 5.2: GEOLOGY MAP

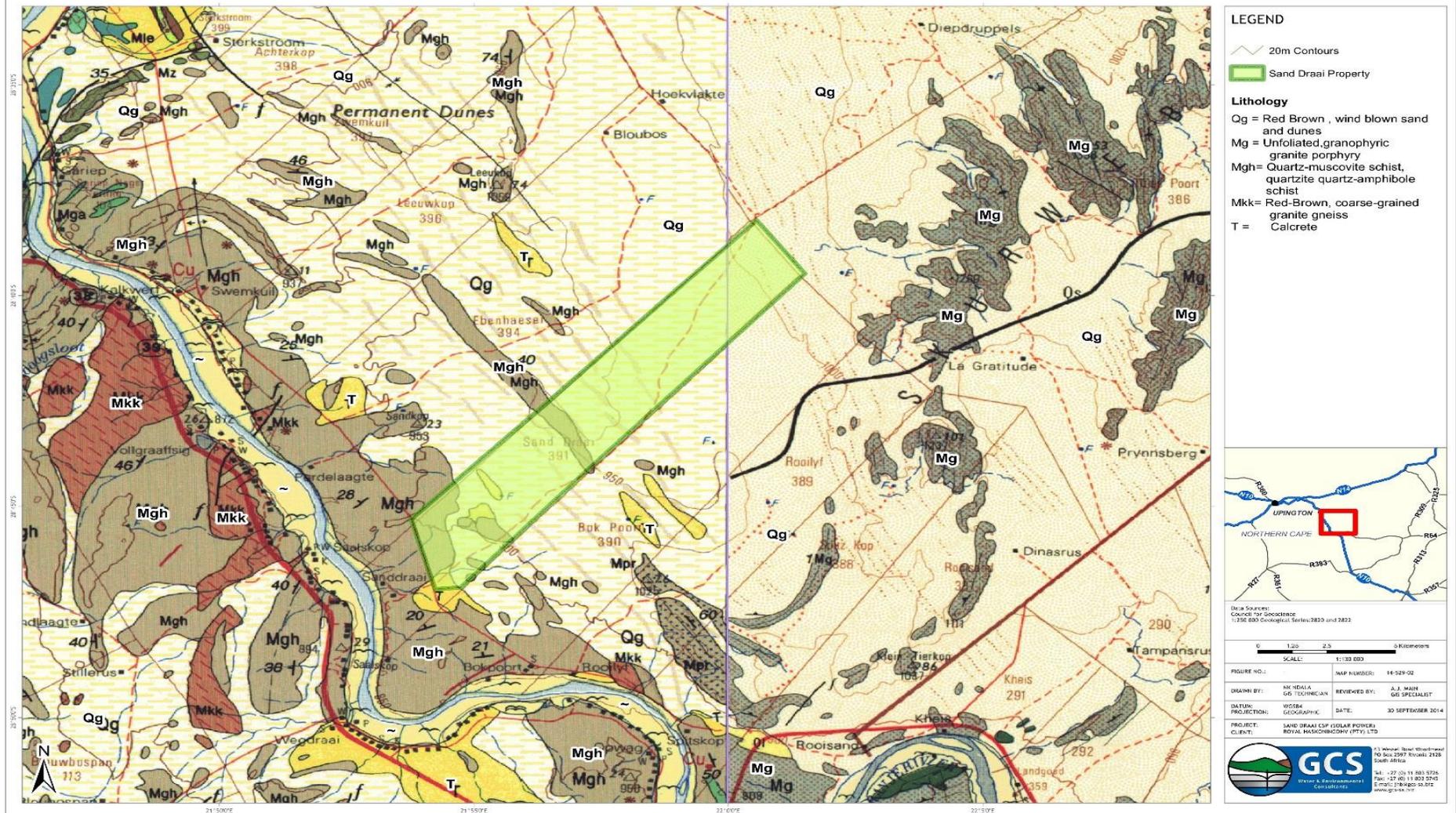


Figure 22: Geology Map

6.1.5 Agricultural Potential

Most areas in the study area have a low agricultural potential, except few portions in the alluvial zones close to the Orange River, where irrigation is practiced. In addition to the soil quality, there are severe climatic restrictions to agricultural potential. Rainfall is very low, while evaporation is extremely high, due to the high temperatures. For this reason, even the best soils are unsuited for dryland agriculture.

6.1.6 Groundwater Resources (Hydrogeological)

6.1.6.1 Site Specific Hydrogeology

According to the 1:500 000 Hydrogeological Map of Upington/Alexander Bay (2714), the proposed site is associated with fractured aquifers based on the geology. The average borehole yields associated with these aquifers, range from 0 to 0.2l/s.

It was indicated in the Environmental Impact Assessment report for the neighbouring Bokpoort site that water will be used for the operation of the proposed CSP plant for steam generation, cooling, the domestic needs of plant workers, and washing of the plant mirrors. These water volumes when applied over the estimated plant area may increase the groundwater recharge at the site, raising the local water table and mobilising any contaminants at the site into the groundwater.

6.1.6.2 Quaternary Catchment

Data from relevant hydrogeological databases including, the National Groundwater Archive (NGA) was obtained from the Department of Water Affairs. The proposed site area fall within quaternary catchment: D73D, as indicated in the table below.

Table 10: Summarized Quaternary Catchment Information (GRDM, 2010)

Quaternary Catchment	Total Area (km ²)	Recharge mm/a	Current use Mm ³ /a	Exploitation Potential Mm ³ /a	Rainfall mm/a
D73D	4290.4	0.45	0.05	8	185.2

6.1.6.3 Groundwater Levels

The farms abstract water from the Orange River for irrigation purposes, even though the river water requires some treatment before it is ready for domestic use. Groundwater use takes place on the farms located further away from the river. During a hydrocensus conducted by GCS in 2010, seven boreholes were identified within close proximity to the site. The majority of boreholes were equipped with wind pumps. As indicated in the Geohydrological Report¹⁷ for the Bokpoort CSP, the groundwater on these farms were mainly used for domestic purposes and livestock (cattle and sheep) farming. Water level measurements could not be taken from the farm boreholes.

Groundwater samples were collected from BH2, BH3 and BH5 during the previous hydrocensus. The pH and Total Dissolved Solids (TDS) recorded in BH2 and BH3 were 8.06 and 7.36 and 490mg/l and

¹⁷ Hydrogeological Baseline Assessment for the Proposed Thermal Solar Plants (May 2010)

420mg/l, respectively. Elevated Electrical Conductivity (EC), sodium, calcium, chloride and nitrate (NO₃) concentrations were recorded in BH2. BH5 indicated slightly elevated EC and nitrate (NO₃) concentrations.

The local aquifers can be classified as minor, according to Parsons Aquifer Classification system, due to the limited use of groundwater in the area.

6.1.6.4 National Groundwater Archive (NGA)

Borehole information derived from the Department of Water Affairs (DWA), National Groundwater Archive (NGA) allowed for an assessment of the hydrogeology, aquifers and water levels in the area.

Three NGA (National Groundwater Archive) boreholes are present within an 8 km radius of the site. Water level data and water use were not available for boreholes, BH1 and BH2. Groundwater levels were obtained for BH3 in 1978, 1982 and 1983 and ranged from 37 to 65 mbgl.

Borehole labelled BH2 is located within a 1 km radius of the site. Data regarding the use could not be obtained from the NGA database.

Table 11: NGA Borehole Data

ID	Geosite Info Identifier	Latitude	Longitude	Water Level Measurement Date	Water Level (mbgl)
BH1	2822CA00012	-28.68924	22.00993	-	-
BH2	2822CA00042	-28.65868	22.01048	-	-
BH3	2821DB00006	-28.6748	21.92763	20/06/1978	65
				25/03/1982	37
				18/08/1983	61

***Boreholes highlighted in red are located within a 1km radius of the site**

6.1.7 Surface Water

The project is located in the Northern Cape, a highly arid part of South Africa. In this context drainage systems and their associated riparian zones are highly sensitive and environmentally important. Although not typically characterised by active flow of water or the presence of hydric (wetland) soils, riparian zones of watercourses in this area are a critical component of the surface water drainage environment, as they are distinct from the surrounding Karoo veld in terms of their species composition and physical vegetative structure. In the context of a semi-arid environment, these riparian environments are extremely sensitive as they are typically characterised by relatively high levels of biodiversity and are critical for the sustaining of ecological processes as well as human livelihoods through the provision of water for drinking and other human uses.

The development site is uninhabited, with the only permanent human habitation being located along the Orange River corridor and its immediate surrounds, concentrated around the Sand Draai Farmstead. The Bokpoort Solar Power Plant is currently being constructed to the east of the northern part of the site, and represents a very large-scale development that is resulting in development of large-scale industrial infrastructure over a large footprint and the concomitant transformation of the affected area from a natural state.

A number of linear infrastructure features are however located in the vicinity of the development site; a district road – the Gariep Road – that runs from the N8 highway (located to the south of the development site), running east of the Orange River to the N14 highway bisects the development site. This road provides local access to properties on the eastern bank of the Orange River as it flows northwards towards Upington. The Sishen-Saldanha Iron-Ore Railway runs through part of the development site, crossing the Orange River close to the Sand Draai Farmstead. Lastly a 132 kV power line bisects the southern part of the development site, running in an east-west orientation.

6.1.8 Ecology and Biodiversity

Any areas of high biophysical sensitivity within the study area are mostly associated with wetland and riparian habitats and are closely linked to the Orange River located to the south of both sites. The exact location of the proposed CSP plant on the preferred site will be informed by the findings of the EIA phase and will avoid riparian habitats. The following vegetation types are situated within the respective study areas¹⁸:

- Bushmanland Arid Grassland;
- Gordonia Duneveld;
- Kalahari Karroid Shrubland; and
- Lower Gariep Alluvial Vegetation.

Of all the vegetation types only the Lower Gariep Alluvial Vegetation has a conservation status of Endangered and is therefore regarded to have a high biophysical sensitivity. This vegetation type is associated with the alluvial areas of the Orange River and is therefore under developmental pressure for use in agriculture.

The farm Sand Draai, comprises of different habitat types and characteristics, but exhibit similar ecological sensitivities. The farm is characterised by the presence of dune habitat and extensive rocky outcrops in the northern sections, representing the sensitive areas of this particular site, but also comprises riparian areas in the south.

6.1.9 Flora and Fauna

6.1.9.1 Flora

The vegetation comprises small trees/tall shrubs with the grass layer the most prominent. The dune areas have scattered small to medium-sized trees. The Bushmanland Arid Grassland, Gordonia

¹⁸ Mucina, L. and Rutherford, M.C. (editors), 2006. Vegetation map of South Africa, Lesotho and Swaziland: an illustrated guide. Strelitzia 19, South African National Biodiversity Institute, Pretoria.

Duneveld, and Kalahari Karroid Shrubland vegetation types are all three regarded as being “**least threatened**” in terms of the conservation of these vegetation types. The presence of protected tree species *Acacia erioloba*, *Acacia haematoxylon* and *Boscia albitrunca* have been confirmed in these vegetation types. The destruction of these species will therefore have to be prevented. These areas are regarded as having a moderate floristic status. The Lower Gariep Alluvial vegetation is structurally complex comprising dense riverine vegetation, short open grassland on floodplains, bare rocks in the riverbed and dense reed beds in some areas. This vegetation type is subject to large scale degradation and, as a result, is regarded as “**endangered**” and therefore has a **high conservation** status.

Further literature review, revealed the potential and confirmed presence of approximately 7 floral Red Data, protected species or regionally important species within the general region. Results of the investigation conducted revealed the possible presence of protected species, such as *Anacampseros scopata*, *Cleome conrathii*, *Gethyllis namaquensis*, *Dinteranthus pole-evansii*, *Dinteranthus wilmotianus* and *Felicia deserti*. It is furthermore extremely likely that species such as *Acacia erioloba* will occur on both these sites.

6.1.9.2 Fauna

The proposed sites are located within the Succulent-Karoo and Nama-Karoo Biomes.

- **Mammals**

The Nama-Karoo and Succulent Karoo, now almost devoid of large wild ungulates, holds some 10 million sheep (*Ovis aries*) and Goats (*Capra hircus*). The once plentiful and diverse set of nomadic herbivores has been replaced by large encamped herds of small livestock with specialist feeding habits. Prolonged heavy grazing is considered to suppress shoot/root formation and flowering in the Nama-Karoo and Succulent-Karoo flora, which leads to compositional changes and depletion and thinning out of the vegetation, particularly those components that the sheep find palatable.

- **Reptiles**

Reptiles are extremely secretive and difficult to observe even during intensive field surveys conducted over several seasons. The majority reptile species are sensitive to severe habitat alteration and fragmentation.

Rocky hills and rocky outcrops or koppies occur on and around the proposed Sand Draai site and provide favourable refuges for certain snake and lizard species (rupicolous species). Reptile species likely to occur within the rocky hills and koppies included Variegated Skink (*Trachylepis variegata*), Western Three-striped Skink (*Trachylepis occidentalis*), Western Rock Skink (*Trachylepis sulcata sulcata*), Southern Rock Agama (*Agama atra*) and Ancheita’s Agama (*Agama anchietae*). Suitable habitat occurs for the Karoo Girdled Lizard (*Karusasaurus polyzonus*) in the rocky hills and koppies, inhabiting fissures between rocks and under loosely embedded rocks.

Favourable habitat exists throughout most of the study area for various snake species. Indiscriminate killing of all snake species is likely to have resulted in the disappearance of the larger and the more sluggish snake species within the study area. The frequent burning of the site will have a high impact on remaining reptiles. Fires during the winter months will severely impact on reptiles undergoing brumation, and are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks.

- **Amphibians**

Breeding in African frogs is strongly dependent on rain, especially in the drier parts of the country where surface water only remains for a short duration. The majority of frog species in the Northern Cape Province can be classified as explosive breeders. Explosive breeding frogs utilise ephemeral or seasonally inundated grassy pans for their short duration reproductive cycles. The amphibians of the area belong to the Kalahari assemblage whose boundaries conform closely to those of the Kalahari savannas of the Northern Cape and North-West provinces. The Kalahari is distinguished especially by its deep sandy substrates, and this feature has a marked effect on the availability of surface water. This is likely to be the key factor in the biogeography of amphibians. It is significant that the sole listed indicator species is a terrestrial breeder namely the Bushveld Rain Frog (*Breviceps adspersus*). The Kalahari assemblage has low species richness, with total species accounts not exceeding 10 species per grid cell anywhere in the assemblage. Only one endemic species, the Karoo Toad *Vandijkophrynus (Bufo) gariepinus*, enters the assemblage peripherally, and no range restricted species present.

Only two frog species namely Guttural Toad (*Amietophrynus gutturalis*) and Bubbling Kassina (*Kassina senegalensis*) were recorded during the previous South African Frog Atlas Project. Both these species are common and have a wide distribution range. A probable amphibian species list is presented in the Ecological Assessment report.

6.1.10 Avifauna

An estimated 113 species could potentially occur in the study area. Of these, 9 are South African Red Data species, 14 are southern African endemics and 23 are near-endemics. This means that 8% of the species that occur could potentially occur in the study area are Red Data species, and almost 33% are southern African endemics of near-endemics. Overall, the study area potentially contains a total of 37 endemics and near-endemics, which is 23% of the total southern African endemics and near-endemics.

6.2 Social Environment

!Kheis Local Municipality falls within the Siyanda District Municipality in the Northern Cape province. !Kheis is a Khoi name meaning "a place where you live" or "your home". The !Kheis municipal area was initially inhabited by the Khoisan people, who were also the first permanent inhabitants of South Africa. The San, who lived a nomadic life, migrated through the area. !Kheis Municipality was established from the former Groblershoop Municipality, from settlements that were previously part of the ZF Mgcau (Siyanda) and Karoo District Municipalities. These municipalities administrated these settlements and provided them with services up until the demarcation in November 2000. Roads in the !Kheis municipal area are mainly gravel, although national roads also traverse the municipality, including the N8 and N10 which link Groblershoop to Griekwastad and Upington respectively. !Kheis Local Municipality was established from the former Groblershoop Municipality, including the following settlements: Boegoeberg, Gariep, Grootdrink, Kleinbegin, Opwag, Topline, and Wegdraai.

The proposed project will include the installation of solar electricity technology, namely Parabolic technology and the associated electricity, bulk water, and road access infrastructure. The footprint of the proposed development area is approximately 5200 hectares in extent, although it must be noted that only a small portion of this area will be developed. The proposed plant is located approximately 14 km northwest of the town of Groblershoop, within the Siyanda District Municipality, and the !Kheis Local Municipality of the Northern Cape province. The proposed development area also falls within the jurisdiction of Ward 3 of the !Kheis Local Municipality.

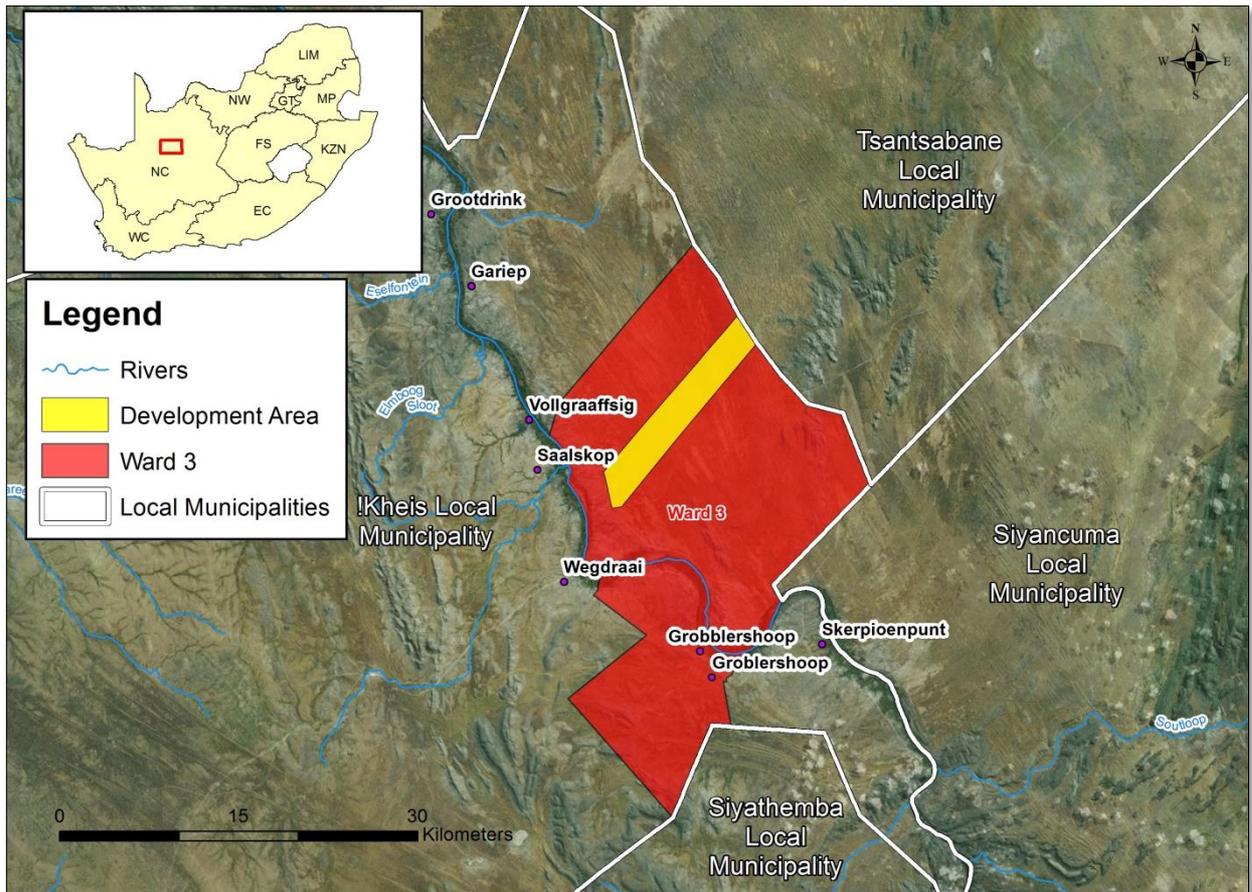
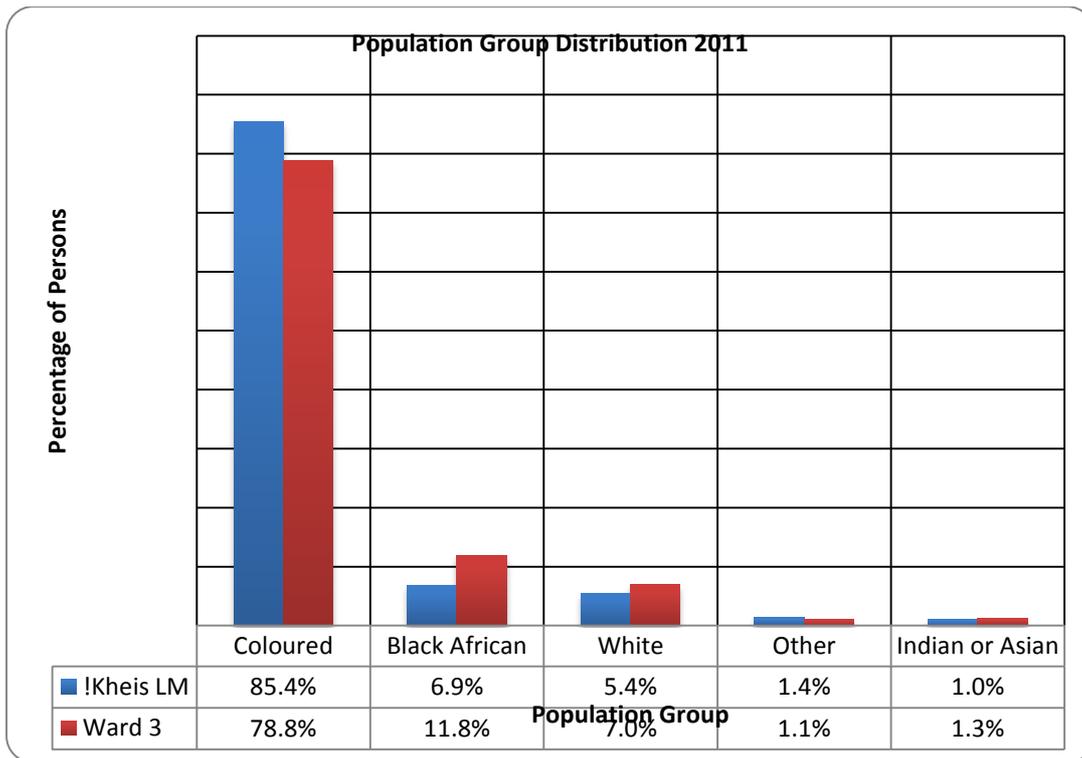


Figure 23: Site map

6.2.1 Population, Gender and Age

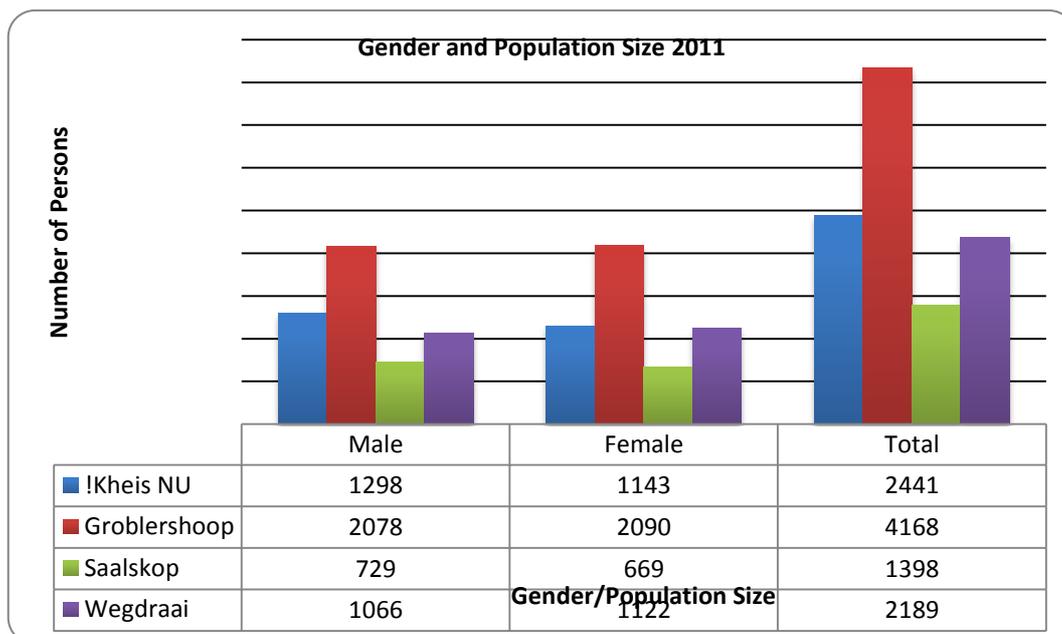
The majority population group within both Ward 3 and the !Kheis Local Municipality in 2011 was Coloured (85% and 78% respectively), followed by Black African (7% and 12% respectively), and White (5% and 7% respectively). 'Other' and Indian or Asian were minorities in both Ward 3 and the !Kheis Local Municipality in 2011 at approximately 1% each (Figure 24).



Source: Statistics South Africa Census 2011

Figure 24: Population groups in 2011 in !Kheis LM and Ward 3

The total male population is at 51% in these statistical areas, with females at 49% (Figure 25). Groblershoop supports at least 40% of the overall population due to its denser settlement pattern (as opposed to !Kheis non-urban (NU), Saalskop and Wegdraai.) Saalskop supports a mere 13% of the total population (10 196 people).



Source: Statistics South Africa Census 2011

Figure 25: Local areas gender and population size

Figure 26 shows age distribution and sex ratios for the !Kheis Local Municipality in 2011. The emergent trend in terms of age structure is that the municipality is dominated by a young population (0-19 years). The fact that persons aged 60 to 85+ accounted for a mere 7.9% of the total population in 2011 is indicative of a low life expectancy. Sex ratios within the municipality are uniform for the most part, with the exception of the 30-34 age group, where 4.2% of the male population occurred as opposed to 3.5% of the female population.

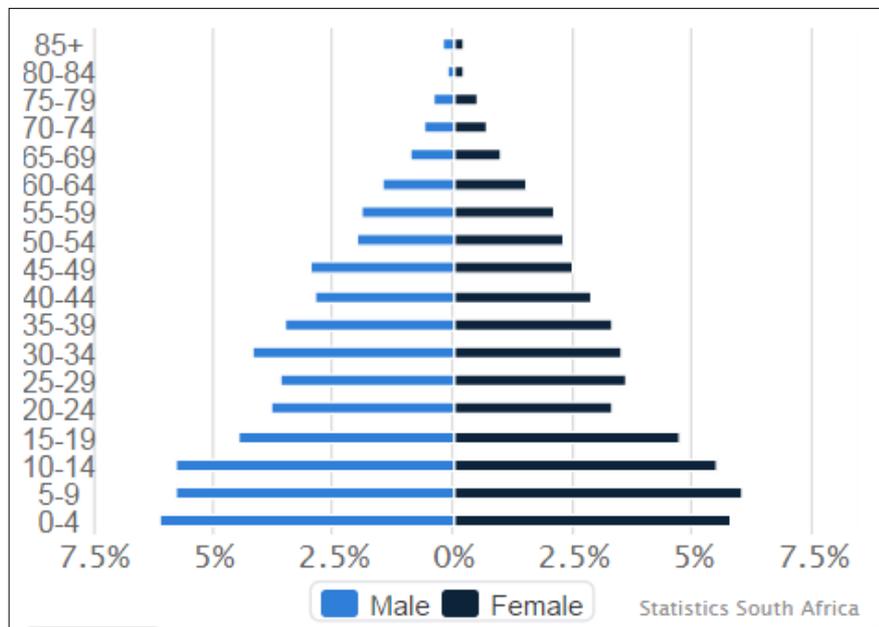


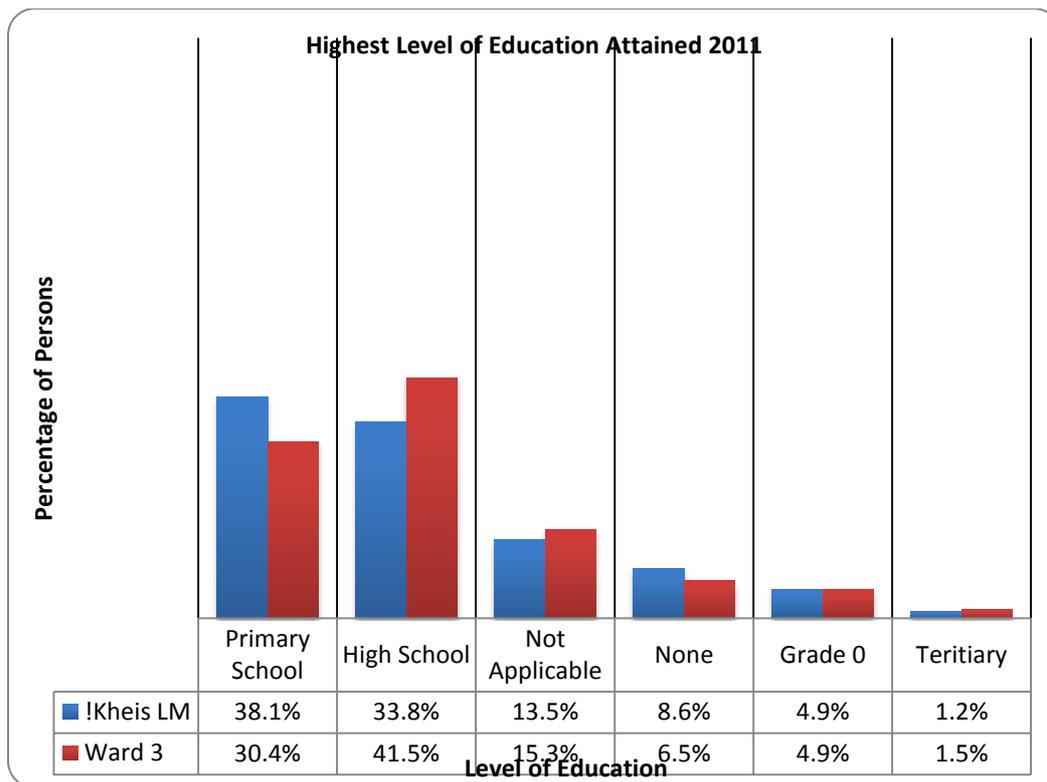
Figure 26: Age Distribution in !Kheis LM in 2011

The 0-19 year age category is typically reflective of the school going population, and are usually also identified as dependent populations as they are unable to generate an income due to not officially being part of the working population. The !Kheis NU shows that almost 37% of its entire population is in such a category, while Wegdraai shows a high number of ‘children,’ at almost 49%. Practically, a healthier economy is dominated by a larger number of people in the 20-64 year age category, which is also termed the ‘working age category.’ This is the case in !Kheis NU, which has almost a 60% working age category¹⁹. The 65 -120 year age category is also indicative of a dependent population. The Census data shows that the dependent population in this category remains between 4.3% and 5.3% across the four statistical areas.

6.2.2 Education

In terms of the highest level of education attained by people within Ward 3 and the !Kheis Local Municipality in 2011, the majority of respondents within Ward 3 finished high school (41%), while within the !Kheis Local Municipality as a whole, the majority indicated primary school as their highest level of education attained (Figure 27). The high percentage of ‘not applicable’ respondents as well as the low levels of tertiary education in both Ward 3 and the !Kheis Local Municipality is also noted.

¹⁹ The percentage within this category is by no means a reflection of the number of people that are actually employed.

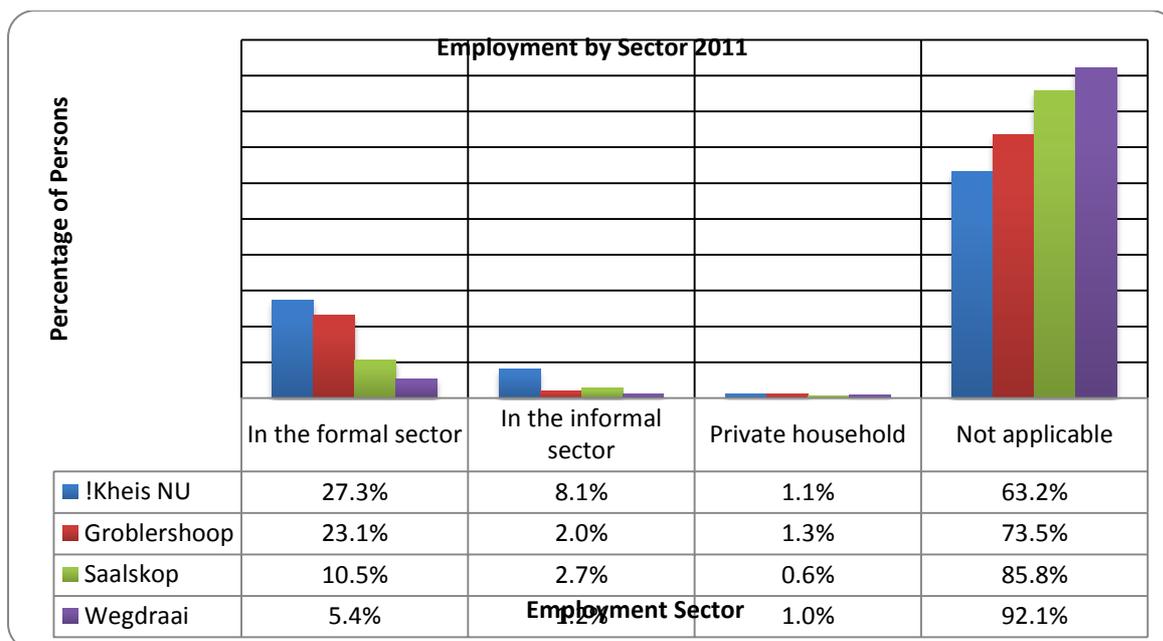


Source: Statistics South Africa Census 2011

Figure 27: Highest level of education attained in 2011 in the !Kheis LM and Ward 3

6.2.3 Employment

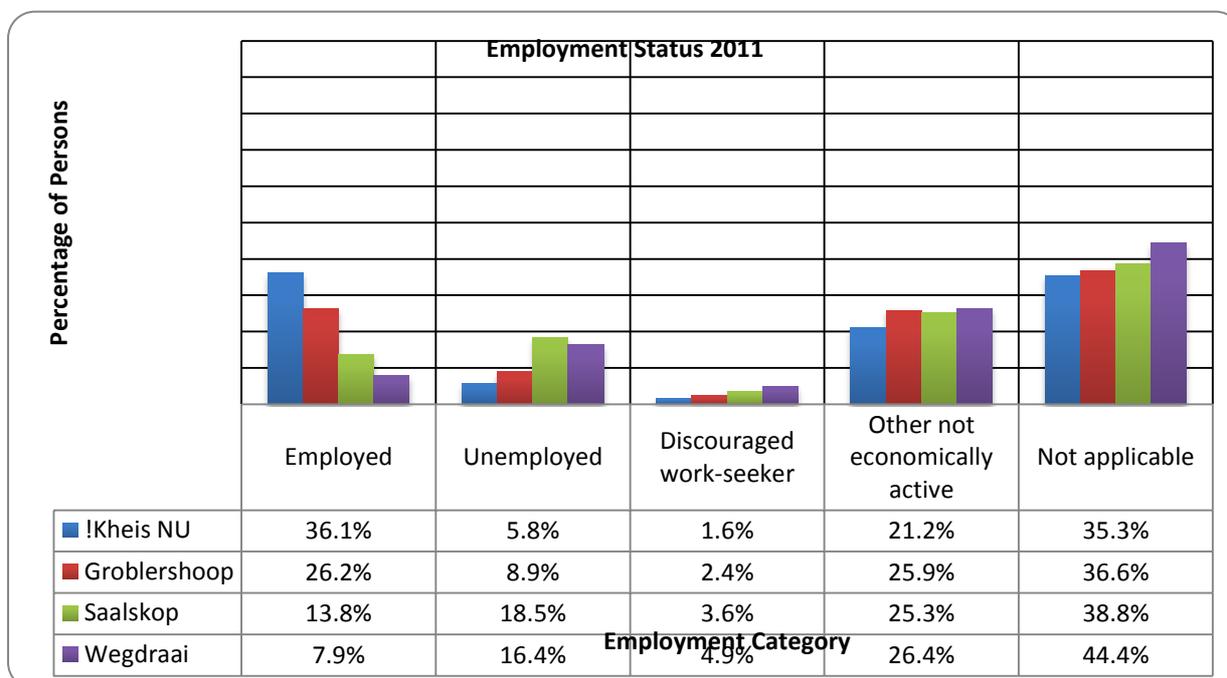
A mere 16.6% of the employable population are actually employed in the formal sector in the said statistical areas. 3.5 Percent are working in the informal sector and an overwhelming 79% have responded to the Census as 'not applicable.' This may denote these individuals do not see themselves as wanting to be part of the formal or informal employment sectors. See Figure 28, below.



Source: Statistics South Africa Census 2011

Figure 28: Local areas employment by the formal/ informal sector

Collectively 21% of all employable people, are actually employed. The remaining individuals that fall within the categories ‘unemployed, discouraged work seekers, and not economically active’ add up to a further 40%. This generally means that the 40% that could have been ‘providers’ in a home, have now become dependents, thus leading to the economic vulnerability of the household.

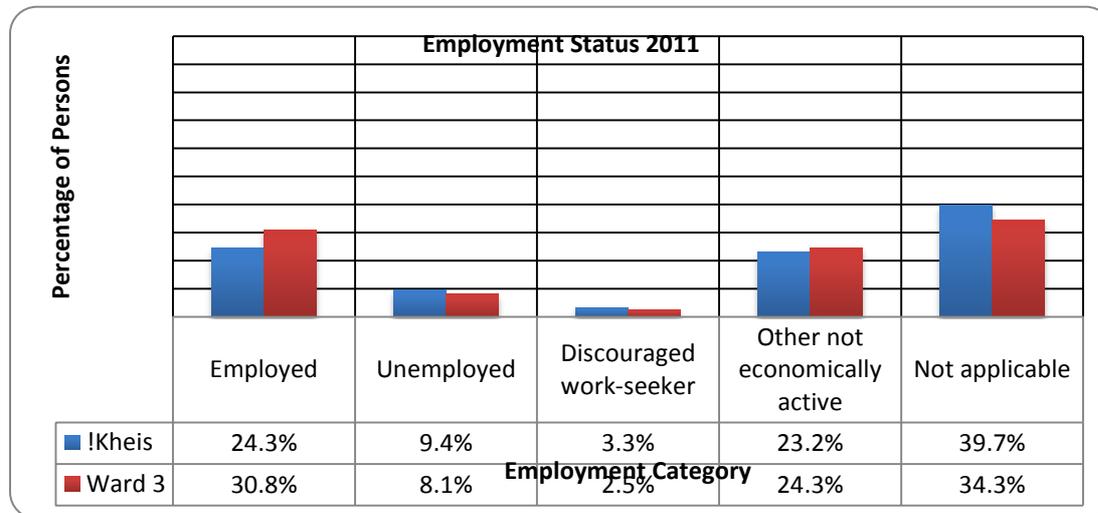


Source: Statistics South Africa Census 2011

Figure 29: Local areas employment status

The percentage of people employed within Ward 3 was higher than that of the !Kheis Local Municipality in 2011, as was the percentage of people who responded ‘other not economically active’ (Figure 29). This category (Other not economically active), typically points to those people that are

able and willing to work, but cannot find employment of any sort. Percentages of unemployed persons and discouraged work seekers were higher in the !Kheis Local Municipality than in Ward 3 in 2011.



Source: Statistics South Africa Census 2011

Figure 30: Employment by status in 2011 in the !KHEIS LM and Ward 3

6.3 Land Use

The area is predominantly agricultural. The main farming endeavour is sultana grapes. The vineyards are planted along both banks of the Orange River and are generally contained within an area close to the river (500 m to 1000 m). Other significant land uses in the area are:

- Residential:
 - The town of Groblershoop is located approximately 14 km south-east of the eastern boundary of the farm Sand Draai;
 - The urban settlement (township) of Wegdraai, which is located on the western side of the Orange River on the farm Boegoeberg 48;
 - Numerous farmhouses and farm labourer houses on the northern and southern banks of the Orange River. These are residences related mainly to the sultana grape farms;
 - The main farmhouse on Bokpoort is situated on a hill in the central portion of the farm; and
 - The main farmhouse on the farm La Gratitude is situated 5200 m east of the north-eastern corner boundary of Bokpoort.
- Educational: there is a school in Groblershoop and several farm schools in the area;
- Recreational: there is a golf course on the western side of Groblershoop; and
- Industrial: Eskom’s Garona substation is located on the eastern boundary of Bokpoort 1800 m north-east of the Rooilyf siding on the Saldanha-Sishen railway line.

6.4 Visual

The proposed development site is located within the central part of the Northern Cape Province, being located to the north-west of the town of Groblershoop and to the south-east of Upington in the !Kheis Local Municipality. The development site is rural in nature, with intensive cultivation occurring in a narrow strip alongside the Orange River that forms the south-western boundary of the site. The

remainder of the development site and surrounding area comprises of rangeland (used for rearing of livestock - sheep and cattle - and game) that consists of sparse natural semi-desert vegetation.

Most of the development site is uninhabited, with the only permanent human habitation being located along the Orange River corridor and its immediate surrounds, concentrated around the Sand Draai farmstead on the site. The Bokpoort Solar Power Plant is currently being constructed to the east of the northern part of the site, and represents a very large-scale development that is resulting in development of large-scale industrial infrastructure over a large footprint and the concomitant transformation of the affected area from a natural state.

6.5 Noise

- **Roads**

There are a number of major roads and relevant secondary roads servicing the area:

- National Route 10 (N10) – The road follows the Orange river from Upington to Groblershoop on the western bank of the river;
- National Route 8 (N8) – links the towns of Groblershoop with Griekwastad, the road passes through the southern section of the study area;
- District Gravel Road (*Gariiep Road – DS112256*) – travels along the northern bank of the Orange river, connecting R64 with the N14 located north from the study area.
- *Loop 16 Access Road* – following the railway line (Saldana-Sishen) which passes through the southern and eastern side of the study area.

- **Bokpoort CSP Plant**

The Bokpoort site is located on the adjacent farm to the south of Sand Draai and north from the local substation. Currently the site is under construction and thus the site does emit noise, the construction period is set to continue until December 2015. The site should be included in the investigation of the baseline noise climate of the region. Although the construction is a new and temporary activity, the activity will have an effect on the noise levels during the measurements.

The estimated noise level emitted from the construction are (during the time of measurement) is in the range of 40.8 – 65.9 dBA during the day, all construction is stopped during the night. The estimated sound power level of 90 dBA (distance corrected) will be used in the baseline noise model.

- **Railway Lines**

The Saldanha-Sishen railway line is aligned in a north-east to south-west direction through the southern section of the Sand Draai farm. There is a cross-over siding (Rooiluf) for ore-carrying trains. There are 3 trains per day.

6.6 Heritage and Historical Background

The //Khara Hais Municipality has a rich heritage and it encompasses the different cultures of the Nama, Koranna, settlers, missionaries, farmers, etc. The main town of Upington dates back to the mid-19th century. According to history, in those days the remote northern reaches of the Cape Colony were home to cattle rushers, gun-runners, river pirates and outlaws of all kinds. Among the most sought-after hideouts were the densely-wooded islands in the Gariiep River around the present-day

Upington. At the time of Reverend Schröder, the early settlement of Upington was known to the hunters and traders as Olyvenhoutsdrift because of the wild olive trees ('olienhoutbome') growing around the mission station and along the river²⁰.

The Kheis Municipal Area was initially inhabited by the Khoi-San people. The San, who lived a nomadic life, migrated through the area. The Korannas (Khoi group) arrived in the area during the 18th century. They were widely spread over the "Benede Oranje" area and consisted of various tribes, each with its own captain (leader). The groups who lived in the Kheis area, were under leadership of Captain Willem Bostander and Klaas Springbok. Many of their descendants still live in the area today. Other Khoi-groups, such as the Griekwas, also migrated through the area and intermarried with the Korannas. Later Coloured stock farmers, as well as white hunters and farmers arrived.

Compared to other parts of the Northern Cape, it seems that not much is known about the archaeology of the 18th and 19th century history of the Langeberg region. A number of heritage investigations refer to Stone Age material from the area (Groenewald 2013). Pelsler & Lombard (2013) mentions graves and lithic material at a site 15km north of Postmasburg and close to the Beeshoek mine on rocky ridges and on the flood plain along the Orange River. Rock engravings are also mentioned from both Beeshoek Mine and Paling farm. The Paling site is probably associated with a cave shown on a map dating from 1881.

A basic assessment along the Groblershoop - Marydale power line, revealed a single site of cultural heritage significance. A few other stone tools were also identified out of context (Van Vollenhoven 2014).

Beaumont and Boshier (1974) describe ancient specularite mines around Postmasburg and Beeshoek and refer particularly to finds at Doornfontein, 16km north-west of Postmasburg. The farm Paling is also mentioned as to have Stone Age material from all phases, mentioning artefacts such as core flakes, blades, segments and scrapers made out of Silcrete, jasper, quartzite, horn fells and banded iron stone (See also Thackeray et al. 1983).

²⁰ Erasmus, B.P.J. 2004. *On Route in South Africa*. Jonathan Ball Publishers: Cape Town.

7 POTENTIAL ENVIRONMENTAL IMPACTS

7.1 Construction Phase Impacts

These are impacts on the bio-physical and socio-economic environment that would occur during the construction phase of the proposed project. They are inherently temporary in duration, but may have longer lasting effects e.g. pollution of a sensitive area during construction, could have effects that may last long after construction is over. Construction phase impacts could potentially include:

- Impacts on water resources;
- Impact on agricultural potential and soils;
- Disturbance of flora and fauna;
- Impacts on avifauna;
- Increase in traffic volumes in the vicinity of the construction site;
- Windblown dust;
- Impact on heritage resources;
- Noise pollution;
- Litter/waste pollution; and
- Impact on tourism activities.

Based on the temporary duration of the construction phase and the fact that negative impacts of construction can be readily predicted and mitigated, generally speaking, more attention will be given to the operational phase impacts of the proposed CSP plant than to the construction phase impacts. However, wherever relevant, specialist studies would consider construction phase impacts, and in certain cases, would be focused on construction phase impacts e.g. impacts on flora and fauna are mainly construction phase impacts.

It should be noted that a comprehensive construction phase Environmental Management Programme (EMPr) would be developed and implemented to regulate and minimise the impacts during the construction phase.

7.2 Operational Phase Impacts

Given their long term nature, operational phase impacts will come under close scrutiny in the EIA phase. The specialist studies will identify and assess the implications of these impacts and include measures to minimise predicted impacts. The assessment of potential impacts will help to inform Solafrica's selection of preferred alternatives to be submitted to the Department of Environmental Affairs (DEA) for consideration and approval. In turn, DEA's decision on the environmental acceptability of the proposed project and the setting of any conditions will be informed by the specialist studies, amongst other information to be contained in the Environmental Impact Report.

It is normal practice that, should the proposed CSP plant and associated infrastructure be authorised, the development and implementation of an operational EMPr is required. The operational EMPr is designed to mitigate negative impacts associated with the operational phase of the project and will be informed by the mitigation measures proposed by the specialists and their feasibility.

7.3 Potential Avifaunal Impacts associated with CSP Plants

To date, only one published scientific study has been conducted on the direct impacts of solar facilities on avifauna, namely “Avian mortality at a solar energy power plant” by McCrary, McKernan, Schreiber, Wagner & Sciarrotta 1986. This describes the results of monitoring at the experimental Solar One solar power plant in southern California (now de-commissioned), which is a 10 megawatt, central receiver solar power plant consisting of a 32-ha field of 1818, 6.9 x 6.9 m mirrors (heliostats) which concentrates sunlight on a centrally located, tower-mounted boiler, 86 m in height. Since then, several much larger plants have been constructed in the Desert Southwest of the USA namely the 250MW, 1300ha California Valley Solar Ranch PV plant, the 377 MW, 1600 ha Ivanpah central receiver CSP plant, the 550MW, 1600 ha Desert Sunlight PV plant and the 250 MW, 1880 ha Genesis Solar Energy parabolic trough CSP plant. The full spectrum of impacts of solar facilities on birds is only now starting to emerge from compliance reports at these solar facilities. These can be summarised as follows:

- Collisions with the heliostats and/or solar panels and burning due to solar flux (CSP only).
- Temporary displacement due to disturbance associated with the construction of the plant.
- Permanent displacement due to habitat transformation.
- Collisions with the associated power lines.

- ***Collisions with heliostats/ solar panels and burning due to solar flux***

From existing evidence, it seems that these impacts are responsible for most mortalities at solar plants. Avian mortality due to solar flux has been previously reported at the experimental Solar One facility. Solar flux related injuries to birds have so far only been reported at CSP plants with central receiver technology. From the evidence examined, it seems that the mortality associated with solar flux results from the singeing of feathers. Severe singeing of flight feathers causes catastrophic loss of flight ability, leading to death by impact on the ground or other objects. Less severe singeing leads to impairment of flight abilities, reducing ability to forage, thermoregulate and evade predators, resulting in death by predation or starvation. Limited evidence of severe tissue burns were found and no eye damage was recorded, indicating that death by acute hyperthermia is a relatively rare occurrence. It has been postulated that CSP plants with central receiver technology might be functioning as ecological mega-traps in that they attract and kill species of multiple trophic layers. The strong light emitted by these facilities attract insects, which in turn attracts insect eating birds, which are incapacitated by solar flux injury, thus attracting predators and thus creating an entire food chain vulnerable to injury and death. The latter scenario is a distinct possibility at the Sand Draai facility, which could impact on several endemic and near-endemic species.

- ***Temporary displacement due to disturbance associated with the construction of the plant***

The activities listed below are typically associated with the construction and operation of solar facilities and could have direct impacts on avifauna:

- Preparation of solar panel/collector areas for installation, including vegetation clearing, grading, cut and fill.
- Excavation/trenching for water pipelines, cables, fibre-optic lines, and the septic system.
- Construction of piers and building foundations.
- Construction of new dirt or gravel roads and improvement of existing roads.

- Temporary stockpiling and side-casting of soil, construction materials, or other construction wastes.
- Soil compaction, dust, and water runoff from construction sites.
- Increased vehicle traffic.
- Short-term construction-related noise (from equipment) and visual disturbance.
- Degradation of water quality in drainages and other water bodies resulting from project runoff.
- Maintenance of fire breaks and roads.
- Weed removal, brush clearing, and similar land management activities related to ongoing operation of the project.

These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude through disturbance and transformation of habitat, which could result in temporary or permanent displacement.

- ***Permanent displacement due to habitat transformation***

At Ivanpah solar plant, in addition to the facility monitoring, avian point count surveys and large raptor surveys were conducted. Seven avian use surveys were conducted using variable-radius point counts at each of 80 survey points, including 40 points in heliostat arrays and 40 points in desert bajada habitats. Estimated avian densities were 2.1 birds/hectare in the heliostat units and 10.2 birds/hectare in the offsite desert bajada habitats. Thus, while the vegetation in the heliostat arrays does provide habitat for some birds, it is evidently not as suitable or preferable to birds as the surrounding desert vegetation. However, small birds are often capable of surviving in small pockets of suitable habitat, and are therefore generally less affected by habitat fragmentation than larger species. It is therefore likely that many smaller species will continue to use the habitat available within the solar facility albeit at lower densities. However, larger species which require contiguous, un-fragmented tracts of suitable habitat (e.g. large raptors, korhaans and bustards) are likely to be displaced in the area of the proposed plant.

- ***Collisions with the associated power lines***

Negative impacts on birds by electricity infrastructure generally take two forms namely electrocution and collisions. Birds also impact on the infrastructure through nesting and streamers, which can cause interruptions in the electricity supply.

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components. The electrocution risk is largely determined by the pole/tower design.

Collisions are probably the bigger threat posed by transmission lines to birds in southern Africa. Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines.

The most likely candidates for collision mortality on the proposed power line are Ludwig's Bustards followed by Kori Bustards. Ludwig's Bustard is highly vulnerable to power line collisions based on the species flight characteristics and tendency to fly long distances between foraging and roosting areas

and when migrating. Movements by this species are triggered by rainfall, and so are inherently erratic and unpredictable in this arid environment, where the quantity and timing of rains are highly variable between years. Hence, it is difficult to anticipate the extent to which Ludwig's Bustard may be exposed to collision risk, but the proposed alignments cross suitable habitat and the species is likely to be present in varying numbers, depending on foraging conditions. Kori Bustards could be at risk mostly in the Kalahari Savanna but also in Nama Karoo. Secretarybirds are also highly vulnerable to collisions. Water reservoirs are draw cards for a variety of birds, including raptors and vultures, and may therefore expose Red Data species i.e. Martial Eagles, Tawny Eagles and Lanner Falcons to collision risk if it is situated close to an alignment.

- **Other Impacts**

Sociable weavers may try to nest on the plant infrastructure e.g. heliostats and electricity poles. Experience in this arid region has shown that Sociable Weavers are quick to nest on any man-made infrastructure. It is hoped that the constant movement of the heliostats and regular cleaning and maintenance activities will prevent this from becoming a problem – but close monitoring will still be required. Cape Sparrows will very likely attempt to nest underneath heliostats and solar panels to take advantage of the shade, but this should not adversely affect the operation of the equipment.

7.4 Biodiversity (Flora and Fauna)

The following impacts on biodiversity could potentially occur:

- **Direct impacts:**

- Destruction of threatened flora species;
- Destruction of protected tree species;
- Direct impacts on threatened fauna species;
- Direct impacts on common fauna species; and
- Destruction of sensitive/ pristine regional habitat types.

- **Indirect Impacts:**

- Floristic species changes within the development area;
- Faunal interactions with structures, servitudes and personnel; and
- Impacts on surrounding habitat/ species.

Table 12: Potential floral and faunal impacts identified during the Ecological Survey

Classification of Impacts	Potential Impacts
<p><i>Direct</i></p> <p>Destruction of threatened flora species</p>	<p>This impact is regarded a direct impact as it results in the physical damage or destruction of Red Data or Threatened species or areas that are suitable for these species, representing a significant impact on the biodiversity of a region. Threatened species, in most cases, do not contribute significantly to the biodiversity of an area in terms of sheer numbers as there are generally few of them, but a high ecological value is placed on the presence of such species in an area as they are frequently an indication of pristine habitat conditions. Conversely, the presence of pristine habitat conditions can frequently be accepted as an indication of the potential presence of species of conservation importance.</p> <p>Red Data species are particularly sensitive to changes in their environment, having adapted to a narrow range of specific habitat requirements. Habitat changes, mostly a result of human interferences and activities, are one of the greatest reasons for these species having a threatened status. Surface transformation activities within habitat types that are occupied by flora species of conservation importance will definitely result in significant and permanent impacts on these species and their population dynamics. Effects of this impact are usually permanent and recovery or mitigation is generally not perceived as possible.</p> <p>One of the greatest drawbacks in terms of limiting this particular impact is that extremely little information is available in terms of the presence, distribution</p>

Classification of Impacts	Potential Impacts
	<p>patterns, population dynamics and habitat requirements of Red Data flora species in the study area. In order to assess this impact an approach it is therefore necessary to assess the presence/ distribution of habitats frequently associated with these species. Furthermore, by applying ecosystem conservation principles to this impact assessment and subsequent planning and development phases, resultant impacts will be limited to a large extent.</p>
<p>Destruction of protected tree species</p>	<p>Tree species included in the National List of Declared Protected trees (as promulgated by the National Forests Act, 1998 (No 84 of 1998)) are known to occur in the general region and impacts will be unavoidable, stemming from physical habitat disturbance. As a result of the distribution patterns of these species and their abundance in the study area, the level of impact on these species (in terms of conservation status) is not as severe as in the case of Red Data flora species. Cognisance of the presence of these species is taken during this phase of the project, but site specific actions will be recommended during the walk-through phase of the project.</p> <p>In order to assess this particular direct impact, the association of these species with pristine regional habitat is used as an indication of their presence, i.e. degraded and transformed habitat is assumed to have a lower abundance of these species compared to pristine regional habitat types.</p>
<p>Direct impacts on fauna species</p>	<p>Direct threats to threatened fauna species is regarded low in probability, mainly as a result of the ability of faunal species to migrate away from areas where impacts occur. Probably the only exception to this statement will be in the event where extremely localised habitat that are occupied by threatened fauna species are impacted by construction and operational activities to the extent that the habitat no longer satisfy the habitat requirements of the particular species, or</p>

Classification of Impacts	Potential Impacts
	<p>where an increase in the isolation and fragmentation factors renders the remaining habitat inadequate. It should also be noted that most of the threatened fauna species potentially occurring in the study area have relatively wide habitat preferences and ample suitable habitat is presently available throughout the study area. To place this aspect into context it is estimated that habitat loss and transformation resulting from non-invasive and often overlooked impacts, such as overgrazing, infestation by invasive shrubs and selective hunting probably are likely to contribute more to impacts on most threatened fauna species than power station developments.</p>
	<p>Direct impacts on common fauna species</p> <p>The likelihood of this impact occurring is relatively low as a result of the ability of animal species to migrate away from direct impacts. The tolerance levels of common animal species occurring in the study area is of such a nature that surrounding areas will suffice in habitat requirements of species forced to move from areas of impact. It is also unlikely that the conservation status of common animal species will be affected as a result of direct and indirect impacts of construction on these species and their habitat.</p>
	<p>Destruction of sensitive/pristine regional habitat types</p> <p>The loss of pristine natural regional habitat (primary vegetation) represents loss of habitat and biodiversity on a regional scale. Sensitive habitat types include mountains, ridges, koppies, wetlands, rivers, streams and localised habitat types of significant physiognomic variation and unique species composition. These areas represent centres of atypical habitat and contain biological attributes that are not frequently encountered in the greater surrounds. A high conservation value is attributed to the floristic communities and faunal assemblages of these areas as they contribute significantly to the biodiversity of a region.</p> <p>Furthermore, these habitat types are generally isolated and are frequently linear</p>

Classification of Impacts		Potential Impacts
		in nature, such as rivers and ridges. Any impact that disrupts this continuous linear nature will risk fragmentation and isolation of existing ecological units, affecting the migration potential of some fauna species adversely, pollinator species in particular.
<i>Indirect</i>	Floristic species changes within the development area	<p>The transformation of shrubland habitat during the construction process will inevitably result in the establishment of habitat types that are not considered representative of the region. As a result of the severity of habitat manipulation, development areas are frequently invaded by species that are not normally associated with the region (exotic and invasive species). In addition, many species that are not necessarily abundant in the region will increase in abundance as a result of more favourable habitat conditions being created as a result of habitat manipulation activities (encroacher species). This effect is more pronounced in the floristic component, but changed habitat conditions in the habitat will inevitably imply changes in the faunal component that occupies the habitat.</p> <p>If left unmitigated, this risk will result in decreased habitat, increased competition and lower numbers of endemic biota, the genetic pool of species might eventually be influenced by the introduction of non-endemic species. Different faunal assemblages and plant communities have developed separate gene structures as a result of habitat selection and geographical separation and the introduction of individuals of the same species that might be genetically dissimilar to the endemic species might lead to different genetic selection structures, eventually affecting the genetic structure of current populations and assemblages.</p>
	Faunal interactions with structures, servitudes	Alteration of habitat conditions within the development area does not necessarily imply a decrease in faunal habitation. These areas are frequently preferred by

Classification of Impacts	Potential Impacts
<p>and personnel</p>	<p>certain fauna species. The establishment of a dominant grass layer generally results in increased presence of grazer species, which might lead to an unlikely, but similar increase in predation within these areas.</p> <p>The presence of personnel within the servitude during construction and maintenance periods will inevitably result in contact with animals. While most of the larger animal species are likely to move away from human contact, dangerous encounters with snakes, scorpions and possibly larger predators always remain likely. Similarly, the presence of humans within areas of natural habitat could potentially result in killing of animals by means of snaring, poaching, road kills, poisoning, trapping, etc.</p>
<p>Impacts on surrounding habitat/species</p>	<p>Surrounding areas and species present in the direct vicinity of the study area could be affected by indirect impacts resulting from construction and operation activities. This indirect impact could potentially include all of the above impacts, depending on the sensitivity and status of surrounding habitat and species as well as the extent of impact activities.</p>

7.5 Geohydrology (Groundwater)

7.5.1 Site Impact Assessment

Most of the water that will be used by the solar power plant will be sourced from the Orange River.. Water will be pumped from the Orange River to the site and used for steam generation, cooling, washing of the plant mirrors and in the plant workers change rooms.

According to the Environmental Impact Assessment conducted for the Bokpoort site (Solafrica, 2011) the potential negative environmental impacts from this development include water and soil contamination resulting from liquid sodium/potassium nitrate salt used to collect heat from the boilers.

Pending confirmation from the detailed engineering design that will be conducted during the EIA phase, there is a strong likelihood that an auxiliary heating system as well as an auxiliary power plant may be used on-site - both using hydrocarbon fuel. Leakage of fuel from this plant into the subsurface may result in the contamination of groundwater resource. These can, however, be mitigated and could be considered acceptable with proper planning and management of the facilities.

According to the Environmental Impact Assessment report for the Bokpoort site (Solafrica, 2011) the following hazardous chemical substances and asphyxiants may typically be stored on-site:

- Nitrogen: Used for inertisation purposes (HTF expansion system);
- Turbine Oil;
- Mirror cleaning chemicals: Mirrors are cleaned with pressurised demineralised water;
- HTF (Heat Transfer Fluid): 1 950 000 kg contained within receiver tube system;
- Water treatment chemicals;
- Other solvents during maintenance

The potential impacts associated with the proposed development on the groundwater environment include potential contamination due to accidental spillage and the storage of heat transfer fluid which is a synthetic oil, hydrocarbon contamination leaks from heavy machinery used during the construction phase and contamination from spills or leaks of hazardous products stored on site.

As part of the detailed EIA investigation, a hydrocensus will be conducted to confirm groundwater users and groundwater samples will be collected to obtain baseline chemistry conditions. Based on the results of the field investigation may be required in the form of detailed geophysical investigations an form of drilling and construction of monitoring boreholes.

7.6 Hydrology (Surface Water)

The location (footprint) of the components of the solar power plant would have an important bearing on whether surface water features on the development site would be impacted or not. Under a worst case scenario, the footprint of the power plant could be developed over one or more of the surface water drainage features on the site (the expected footprint of these components is approximately 800ha). Under this scenario entire watercourses, or certain reaches of watercourses could be transformed, with resultant loss of riparian habitat. This could exert a localised, but important

cumulative impact on surface water features on the site, and hydrological and ecological functionality (ecosystem goods and services) associated with the affected watercourse would be lost or severely impaired.

The potential for this type of impact occurring is believed to be low. Most importantly, large parts of the development site have been identified to have no surface water, thus the solar power plant components could be easily developed on parts of the site in which no surface water features are present, thus resulting in no impact. At the time of writing the proponent has indicated that the proposed location of the solar power components is in the north-eastern-most part of the site – a part of the site in which no surface water features have been identified to exist. Furthermore, the parts of the site in which surface water drainage features are present (apart from the Orange River valley bottom which is assumed would not be developed due to the commercial value of agricultural operations in this area) is largely characterised by rugged terrain with outcropping of bedrock and the presence of sloping ground. It is also assumed that these parts of the site would not be technically preferred in comparison to the flatter and sandier parts of the site which would presumably be more cost effective to develop.

It is thus understood to be highly unlikely that the solar power plant would directly impact surface water features, and the potential impact of the proposed development relates more to the development of linear infrastructure. These potential impacts are:

1) Impacts related to Pipelines

a) Potential Impacts of pipeline on the Orange River Riparian zone

As described elsewhere in this report, the Orange River riparian zone is considered to be highly sensitive due to it forming part of the nationally-threatened Lower Gariep Alluvial Vegetation Type. The riparian corridor of the Orange River is subject to a number of impacts that threaten its integrity (all of which have been observed on the eastern bank of the river on the Sand Draai and Ebenhaeser properties), including physical disturbance and removal of indigenous riparian vegetation, invasion of the riparian corridor by alien invasive vegetation, and the burning of riparian vegetation. The riparian corridor of the river on the development site and its immediate surrounds is thus subject to areas of transformation with parts of the riparian zone being in a more intact state.

The location of the proposed abstraction point is thus an important factor in determining the nature of the impacts of the abstraction on the riparian corridor; if the abstraction is placed at a location in which there is an existing development (transformative) footprint on the riparian corridor, the impacts of the abstraction footprint would be much less than if the abstraction location were placed in a less impacted part of the riparian corridor. In the former case, the development of the abstraction point would constitute a consolidation of an existing impact on the riparian corridor, although the footprint of the impacted areas may need to be increased.

b) Potential Impact of pipeline in other watercourses

The primary impact associated with the proposed pipeline on other watercourses on the development site relates to the potential disturbance / impact on episodic watercourses located on parts of the development site. The most significant impact in this regard is the disturbance of watercourses and associated riparian zones through excavation of the pipeline. The pipeline will be buried, and thus a pipeline trench will need to be excavated across the affected watercourses. This will result in the

disturbance and potential erosion of substrate within and immediately adjacent to the watercourses. A trench line and adjacent working right of way will need to be established, thus vegetation in the riparian zone within the footprint of the works will need to be cleared. The creation of a working right of way for machinery and the excavation of a trench would result in the felling and removal of all vegetation, in particular woody vegetation.

2) Impacts related to access roads

Access roads, like pipelines could potentially also exert an impact on surface water features, as they would have a physical footprint within the surface water feature crossed. The potential impacts of access roads on the episodic watercourses on the site are similar to the impacts associated with pipelines, but the primary potential impacts related to access roads is the physical disturbance of substrate and vegetation, and the creation of a physical barrier across a drainage feature that could potentially affect the hydrological and ecological functionality of the surface water feature.

Roads can have a significant impact on surface water features, as depending on the design of the road crossing the surface water feature may be physically affected as the footprint of the road will affect the hydrology and habitat of the surface water feature to varying degrees. The degree of impact depends to a large degree on the type of the road crossing. Spanning a water feature by building a bridge or similar structure typically has much less of an impact than if the road structure is constructed into the surface water feature – i.e. the substrate of the road is constructed into and across the surface water feature and culvert structures are used to allow flow to underpass the road. A bridge structure typically has a much lesser physical footprint in the bed of the river, thus resulting in a lower loss of vegetation and disturbance of physical habitat. Conversely roads will tend to have a much greater physical footprint within a surface water feature in the latter case as foreign substrate will need to be laid and imported into the bed and banks of the feature.

3) Impacts related to power lines

Power lines are not typically associated with impacts on surface water resources, as the lines would not have a physical footprint over the length of the line other than the footprint of the each tower position. As the lines are strung above the ground and as the towers would be spaced at a certain distance apart, most linear surface water features are able to be 'spanned' by the lines and thus avoided from being physically affected. Power lines can however be associated with impacts on surface water resources if the towers are placed within a river or watercourse, or if the riparian vegetation within the power line servitude is felled. The process of constructing the power lines can also cause impacts on surface water resources, especially if certain mitigation measures and procedures are not followed.

4) Other Potential construction-related Impacts

The process of constructing the linear infrastructure through watercourses could potentially impact these features in other ways through a series of construction-related impacts. The following impacts on surface water features can result from construction activities along the servitude:

- The uncontrolled interaction of construction workers with watercourses that could lead to the pollution of these watercourses, e.g. dumping of construction material into the drainage system, washing of equipment (in the case of the Orange River) etc.
- The lack of provision of adequate sanitary facilities and ablutions on the servitude may lead to direct or indirect faecal pollution of surface water resources.
- Leakage of hazardous materials, including chemicals and hydrocarbons such as fuel, and oil, which could potentially enter nearby surface water resources through stormwater flows, or directly into the sandy soils within watercourses. This may arise from their incorrect use or incorrect storage. This is not only associated with a risk of pollution of surface water, but with a risk of the pollution of shallow groundwater within the riparian zone due to the presence of typically highly permeable alluvial substratum.
- The incorrect mixing (batching) of cement could lead to siltation and contamination of watercourses, as described above.
- Inadequate stormwater management and soil stabilisation measures in cleared areas could lead to erosion that could cause the loss of riparian vegetation and which would lead to siltation of nearby watercourses.

7.7 Noise

7.7.1 Potential Noise Source – Construction

As per this assessment, the following activities are viewed as construction activities, These activities can be investigated separately or combined for a process of period or scenario investigation.

- Earthworks: site clearing;
- Earthworks: site levelling;
- Earthworks: trench digging for laying of cables;
- Access road construction;
- Establishment and operating of site construction laydown area;
- Construction of buildings of any type (include the erection of solar panels);
- Transportation of construction workers and material;
- Construction camp;
- Water pipe line construction; and
- Transmission lines.

Blasting might be required during the site levelling and establishment of foundations for the tower or buildings. However the blasting noise impact is excluded from the final environmental noise impact assessment due to the following assumptions and justifications:

- Blasting might occur only during the construction phase and should only occur at the establishment of the base foundations for the CSP tower. Blasting will only occur over a very short time period and the impact will not last more than 1 minute;
- The nature of the project has no blasting in the operational phases;
- Blasting is highly regulated, controlled of blasting to protect human health, equipment and infrastructure will ensure that any blasts will use minimum explosives and will occur in a controlled manner.

People are generally more concerned over ground vibrations and air blast levels that might cause building damage than the impact caused by noise from the blast, this impact is also significantly reduced if the public is made aware of the time schedule blast would occur.

7.7.2 Potential Noise Source – Operational

As per this assessment, the following activities are characteristic to operational procedures of CSP's. These activities can be investigated individually, combined (for a process), time-period or scenario investigation.

- Boiler start-up and operating noises (all associated activities);
- Salt and water pumps;
- Cooling fans;
- Waste Water Treatment Works;
- Service trucks (cleaning mirrors and PV's);
- Transformer noises;
- Transmission line noises; and
- Workers commuting.

7.8 Visual

7.8.1 Generic features common to all types of solar power projects

It is important to note that the development and associated environmental assessment of solar power plants in South Africa is relatively new, and thus it is valuable to draw on international experience. Thus this section of the report draws on international literature and web material to describe the generic impacts associated with solar power.

In general, solar power generating facilities need to occupy a very large area in comparison to other types of power generation facilities relative to the level of power output generated. This is an important component of the visual aspect of solar power plants as they can occupy large parts of a landscape, especially when viewed from an elevated position.

The large size, strong regular geometry of solar facilities, and the use of mirrors or glass panels with metal supporting structures, may result in high visual contrast being created that is visible for long distances in many instances. In favourable viewing conditions, large facilities can be visible from a distance of 16km or greater; it should be noted however that viewed from such long distances, the facilities may not be recognisable as solar facilities. Built structures associated with solar power facilities would introduce complex, rectilinear geometric forms and lines and artificial looking textures and colours into the landscape; these would typically contrast markedly with natural appearing landscapes.

Previous studies have indicated that the ancillary infrastructure (in addition to the arrays of panels or mirrors) such as power blocks, substations, or cooling towers are also important in contributing towards observed visual contrasts and visual intrusion, particularly in the case of concentrating solar facilities. The visual impacts associated with this ancillary infrastructure is most pronounced in the case of views towards facilities from a low angle or low elevation, where the viewer is on the same, or

lower horizontal plane as the facility. From low viewing angles, taller structures such as cooling towers extend far above the much lower collector arrays, creating a vertical contrast, and being particularly prominent if they extend above the horizon. If metallic (or containing metallic components), these can also be associated with glinting or glare.

A commonly expressed concern is whether glint or glare would negatively affect aircraft flying above the facility. It should be noted that in recent times several large scale solar projects have been completed and constructed at or near certain major airports in the USA (such as Denver International Airport or the Oakland FedEx International Airport Hub) without any reports of such problems. It should be noted however that the solar power facilities at these airports are solar panel facilities that are typically low in reflectivity.

As most solar power plants tend to be located in vacant or uninhabited areas due to space availability, the landscape context is often natural; in this context the solar field could be considered to be a visual intrusion that possibly acts to alter the visual environment, especially if the pre-development visual context is natural. The level of visual exposure to the power plant (and potential visual intrusion of the facility) is dependent on the location of the solar fields in relation to receptor locations.

7.8.2 Parabolic Trough technology

Parabolic troughs differ from photovoltaic panels in that these are curved and reflective, directing light onto a central receiver. These structures rotate on an axis and can reach a height of 8m above the ground (approximate in height to 2½-storerooms of a building). The low profiles of these solar collector arrays of PV and parabolic trough facilities entail that these are typically able to be fully or partially screened by desert vegetation in flat landscapes where viewpoints are not elevated. Parabolic trough facilities however require very flat terrain and the solar field for these facilities is typically completely cleared and levelled; this relates to the clearing of vegetation as discussed below.

As discussed above for PV facilities, parabolic trough facilities can create visual contrast and increased visibility through geometric patterns of reflected light. In the case of parabolic troughs this could emanate from regularly spaced metal surfaces in the collector array. It should be noted that these may not necessarily cause discomfort to the viewer and may change dramatically as the observer moves.

Glare has been noted to be associated with parabolic troughs; a study of solar facilities in the south-western part of the USA identified glare sufficient to cause annoyance or discomfort during extended viewing, for some observers at a parabolic trough facility in Nevada. Glare was observed from the front, sides, and tops of the parabolic trough arrays in this instance and was observed from viewpoints approximately level with the facilities as well as from elevated viewpoints, creating strong glare "spots". Glare sources in this instance were associated with reflections from heat transfer fluid tubes and/or associated components attached to the tubes. Glare can also be associated with control buildings, stream turbine generators, and associated facilities. Glare would become significant if a solar facility were to cause unusually intense or prolonged glare that exceeded the amount of glare

commonly encountered in the existing environment (e.g. from corrugated iron roofs or structures such as windmills).

Even if glint or glare are not experienced, the presence of a very large number of mirrored surfaces (parabolic mirrors or heliostats) can reflect the sky, clouds or at certain angles even the ground or surrounding vegetation. If the colour or reflection differs greatly from the surrounding colours in the natural landscape (e.g. if the blue sky is reflected thus giving the concentration of mirrors a blue colour), this could create a significant area of colour contrast in the natural landscape, thus enhancing the visibility to the facility.

It should be noted that glare and colour differential (reflection of surrounding surfaces) may be transiently experienced if the observer moves, and especially if the observer is in a moving vehicle.



Figure 31 – Picture of a ‘glare spot’ at a parabolic trough facility in Nevada

Plumes from gas boilers and cooling towers may also contribute substantially to observed visual contrasts in some situations if wet cooling was to be used, especially as it would tend to rise vertically, being visible against a natural landscape. Dry cooling technology will be used at the facilities, which would not result in a vapour plume.

Buildings and other structures such as tanks would be of sufficient height to protrude above collector arrays as viewed from outside the facility and would likely contrast with the collector arrays in terms of form, line, and colour.

7.8.3 Vegetation clearing

One of the important potential indirect impacts of a solar power development relates to the clearing of natural vegetation. Clearing of vegetation could result in the potential loss of vegetative screening, which would result in the opening of views. Importantly in a visual contrast context the clearing of vegetation could result in the exposure of soils which could contrast with the colour of surrounding natural vegetation as well as potentially creating significant changes in form, line, colour, and texture

for viewers close to the solar field. Lastly (especially in arid settings in which solar power plants are often developed) vegetation removal could result in windblown dust which could constitute an indirect visual impact.

All of the above components of the proposed development will require the clearing of vegetation, to differing degrees. This clearing will be more intensive for CSP plants as the land will need to be graded and terraced where necessary, in order to provide a level surface for foundations. For CPV/PV plants only the taller vegetation will need to be cleared. This practice of clearing vegetation will intensify the visibility of the solar energy facility, particularly in locations where natural woody vegetation would exist, but to a lesser degree when the proposed facility is located on land where woody vegetation does not occur.

7.8.4 Lighting

Due to the nature of solar power plants which would primarily be operational during sunlit (daylight) hours, lighting (at night) is not a major operational component of such facilities. However solar power generation facilities would include exterior lighting around buildings, parking areas, and other work areas, as well as security and other lighting around and on support structures (e.g., the control building). In the context of a natural setting in which there would be little to no lighting, visible lighting at solar power generation facilities could constitute light pollution, especially in settings where landuses and activities (e.g. ecotourism establishments) which value the absence of lighting in a natural setting. Maintenance activities conducted at night, such as mirror or panel washing might require vehicle-mounted lights, which could also contribute to light pollution. Light pollution impacts associated with utility-scale solar facilities include sky glow, light trespass, and glare.

7.8.5 Access Roads

As part of the development new roads would need to be constructed and developed to run from the closest point of public access (it is assumed that the point of access to the site would be from the Gariiep District Road that bisects the development site onto the site). The exact alignment of roads will only be determined once the footprint of the proposed solar power facility has been finalised. However a primary access road would be likely to be aligned north-eastwards onto the site from the Gariiep District Road.

Roads can be associated with visual impacts, especially in the context of a road being constructed into a natural / rural visual context where there is no existing infrastructure. Viewed from a distance, roads can be responsible for creating an artificial “band” (a contrasting linear form with two roughly parallel edges dividing an area in two) in the landscape which draws the viewer’s attention and which may create a new visual contrast in the landscape. The traffic along the road could heighten the perceived visual impact, especially if traffic volumes along the road are high, if heavy vehicles travelling on a road create large amounts of dust which rise into the air and which can be highly visible, and if vehicles travel along the road at night when lighting may create visual intrusion and light pollution in an otherwise dark rural night-time context.

Although the road is proposed to be constructed into a largely natural context in which there is little existing infrastructure, the 'banding' effect of the road may not be associated with a significant visual intrusion factor, as the road may be shielded by surrounding vegetation, and as much of the road would not be visible from areas of human access / habitation in the study area

7.9 Heritage

At Sand Draai, cultural and historical remnants mainly revolve around human occupation. Archaeological remains in the form of flaked cores and core flakes were found previously and in the present case along the river at identified Points S1 to S4 (Figure 32).



Figure 32: Locality of Sand Draai with co-ordinate points S1 – S4

A farm yard consisting of a residential house and a well built kraal with a solar installation and water supply equipment, occur at Point 9 (Figure 33). The age of the buildings could not be ascertained. No graves were found there. The Bokpoort solar plant and Garona Sub-station along the Sishen-Saldanha railway line is visible from Point S10 on Sand Draai when facing south towards the Orange River.

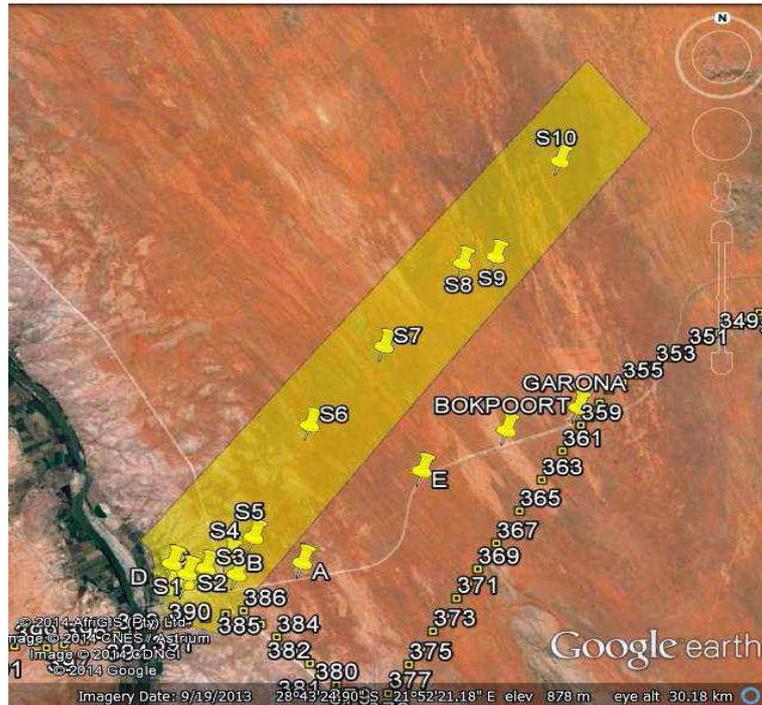


Figure 33: Sand Draai with Bokpoort PV Solar, Garona Sub-station & Co-ordinate points indicated.

A number of CRM projects have been undertaken between the Garona substation and the Orange River in recent years. These projects have identified temporary scatters of Middle Stone Age material across the landscape but concluded that the artefacts do not appear to be concentrated sufficiently to represent sites. They were rated to be of low significance and no mitigation was proposed.

A joint field survey was undertaken with staff from Landscape Dynamics, Eskom and other specialists in February 2013. Spot checks were made along the route to establish the potential impacts to heritage remains.

The fieldwork identified small scatters of Middle Stone Age material made on banded ironstone on both sides of the river. These scatters appear to be denser on small quartz koppies.

Sites comprising hornfels cobbles and quartz artefacts (which may represent later Stone Age sites), along the eastern banks of the Orange River.

Other aspects that were noted though out the proposed site include:

- A stone water reservoir dam was noted east of the power line near Garona.
- No cemeteries or graves were recorded.
- No buildings or structures older than 60 years will be impacted.
- The Cultural Landscape consists of intensive agriculture in a narrow belt along the Orange River surrounded by the red Aeolian sands of the Kalahari.
- During the present survey, scatters of worked stone artefacts were spotted at a number of places mainly in association with calcrete outcrops. The collections were widespread and no dense concentrations occurred.

- No other cultural or historical remains or graves were found along the proposed route.

Although the red sand dunes seem to be sterile, it is possible that the dune crests and streets between dunes could have been the activity and dwelling places during the Later Stone Age.

The proposed new solar plant developments will have no serious and destructive effect on any graves and other historical remains at Sand Draai.

During the present survey, scatters of worked stone artefacts were spotted at a number of places in association with calcrete outcrops. The collections were widespread and no dense concentrations occurred.

No other cultural or historical remains or graves were found on the farm. Mitigation measures will be necessary in case graves or other human skeletal or unidentified heritage resources are found during the construction phase.

7.10 Social

The BaselineReport present the various project anticipated impacts with consideration to the following:

- *Population and Politics*: this includes changes and impacts related to population structure, migration, welfare balances, and power and authority;
- *Economy and Work*: this context includes changes and impacts related to national and regional economic networks, entrepreneurial opportunities, tax income, employment levels and patterns, commercial and labour organization, access to jobs and employment equity, labour exploitation and household and community livelihoods;
- *Land and Resources*: this includes baseline changes and impacts related to the use of and access to natural resources such as land and water, and to location and settlement based on access to such resources;
- *Infrastructure and Social Services*: the social services context includes changes and impacts related to services infrastructure (water, energy, education, roads, and communication) and demand for these services. Health is considered under this heading, particularly in relation to demand for and access to health services;
- *Organisation and Community*: changes and impacts related to local government, crime, community organization, development planning, access to decision making, voluntary organizations (CBOs and NGOs), support networks, community stability, response to change, trust in political and social institutions, barriers to access (skills, literacy), household budgeting and use of income, and cultural resources and practices; and
- *Social Divisions*: this context focuses on changes and impacts around equity (for example the distribution and circulation of compensation), non-participation, unmet expectations, prevailing social tensions and divisions, the influx of newcomers, and the status of vulnerable groups such as the elderly, women, children and the disabled.

7.11 Waste

7.11.1 Solid and Non-Hazardous Waste

The CSP plant will produce maintenance and plant wastes typical of power generation operations. Generation plant wastes include: oily rags, broken and rusted metal and machine parts, defective or broken electrical materials, empty containers, and other miscellaneous solid wastes including the typical refuse generated by workers. These materials will be collected by a local waste disposal company and disposed at a landfill permitted to receive these wastes. Waste collection and disposal will be in accordance with applicable regulatory requirements to minimise health and safety effects

7.11.2 Hazardous Waste

A number of hazardous wastes may be generated during the operation of the facilities. These wastes include: spent HTF, used oil, spent oil filters, spent solvents, cleaning rags, old or out of date chemicals from the water treatment system, old paints, among others.

These wastes will be temporarily stored on-site in portable tanks and disposed of in permitted hazardous landfill sites. Sites under consideration are located in Johannesburg, Port Elizabeth, and Cape Town. The disposal of hazardous materials will be carried out by a chemical cleaning contractor in accordance with applicable regulatory requirements. Workers will be trained to handle all hazardous wastes generated at the site.

7.12 Air Quality

7.12.1 Potential Construction Impacts

Construction is a source of dust emission which has a temporary impact on the local air quality. Infrastructure and road construction are the two types of construction activity with high emission potentials. The emissions associated during the construction of a building or road can be associated with land clearing, drilling and blasting, ground excavation and depending on the level of activity, the specific operation and the prevailing meteorological conditions. It has been noted that large quantities of the emissions are generated due to the traffic movement of equipment across temporary roads and around the construction site.

The temporary nature of construction activities is what distinguishes it from other fugitive sources present within the locality. Emissions from construction activities are expected to have a definitive start and end period and will vary depending on the various construction phases. In contrast to other fugitive sources, here the emissions occur in a steady state or follow a discernible pattern. The quantity of dust emissions from construction activities is proportional to the area of land under construction.

The impact on air quality and air pollution of fugitive dust is dependent on the quantity and drift potential of the dust particles. Large particles settle out near the source causing a local nuisance problem. Fine particles can be dispersed over much greater distances. Fugitive dust may have significant adverse impacts such as reduced visibility, soiling of buildings and materials, reduced

growth and production in vegetation and may affect sensitive areas and aesthetics. Fugitive dust can also adversely affect human health.

The following components of the environment which may be impacted upon during the project construction phase:

- The ambient air quality
- Local residents, farms and neighbouring communities
- The surrounding environment and possibly the fauna and flora.

Because construction is of a temporary nature, it is recommended that mitigation/ control measures be put in place to limit the impacts on the local air quality. Wet suppression and wind speed reduction are common methods used to control open dust sources at construction sites.

7.12.2 Potential Operational Impacts

The EIA impact assessment modelling will aim to deal with the potential air quality impacts which could result due to the construction and operation of the concentrated solar power plant on the Sand Draai farm. The details regarding the source characteristics will be obtained from site layout plans and process specific information provided and a questionnaire filled in by the client. Such information relates to the type of activities and fuels utilised on site.

Once all site layout plans and final geotechnical works are complete, site specific information should then be sufficient for dispersion modelling simulations and will be included in the EIA report. More information pertaining to the operational impacts will be available at the EIA stage.

7.12.3 Potential Decommissioning Impacts

The decommissioning phase is associated with activities related to the demolition of infrastructure and the rehabilitation of disturbed areas. The total rehabilitation will ensure that the total area will be a free draining covered with topsoil and grassed. The following activities are associated with the decommissioning phase:

- Existing buildings and structures demolished, rubble removed and the area levelled;
- Remaining exposed excavated areas filled and levelled using overburden recovered from stockpiles;
- Topsoil replaced using topsoil recovered from stockpiles; and
- Land and permanent waste piles prepared for re-vegetation.

Possible sources of fugitive dust emission during the closure and post-closure phase include:

- Smoothing of stockpiles by bulldozer;
- Grading of sites;
- Transport and dumping of overburden for filling;
- Infrastructure demolition;
- Infrastructure rubble piles;
- Transport and dumping of building rubble;
- Transport and dumping of topsoil; and
- Preparation of soil for re-vegetation – ploughing and addition of fertiliser, compost etc.

Exposed soil is often prone to erosion by water. The erodability of soil depends on the amount of rainfall and its intensity, soil type and structure, slope of the terrain and the amount of vegetation cover.

8 CONCLUSION AND RECOMMENDATIONS

The Environmental Scoping Study for the proposed establishment of the Concentrating Solar Power (CSP) Plant using parabolic trough technology in the Northern Cape Province has been undertaken in accordance with the EIA Regulations published in Government Notice R982 to R985 of 4 December 2014, in terms of the National Environmental Management Act (No 107 of 1998)(as amended) and the National Environmental Management: Waste Act (No 59 of 2008)(as amended).

The Environmental Scoping Study aimed to identify and evaluate potential environmental impacts associated with all aspects of the proposed project, and provided for a sensitivity map (Figure 34 below) that will be used to inform the proposed alternatives for detailed study within the EIA phase. The conclusions and recommendations of this Scoping Study are the result of on-site inspections, the evaluation of impacts identified by specialists, and the parallel process of public participation.

The Scoping process has not revealed any environmental fatal flaws associated with the site under consideration.

Based on the assessment of the potentially significant environmental issues and specific technical considerations, it is recommended that a preferred layout options, as well as supporting infrastructure corridors be nominated during the EIA phase for further detailed investigations. The purpose of the detailed assessments will be to identify site specific environmental “opportunities and constraints” in order to finally inform the location of the placement of the plant and infrastructure on the preferred site.

Furthermore, to ensure that the required mitigation measures are implemented, it is recommended that an EMPr be compiled for the project, and attached to the final Environmental Impact Assessment Report, in order to transfer the findings of the environmental studies into practical measures. This EMPr should form part of the contract for the construction and operation of the proposed CSP plant.

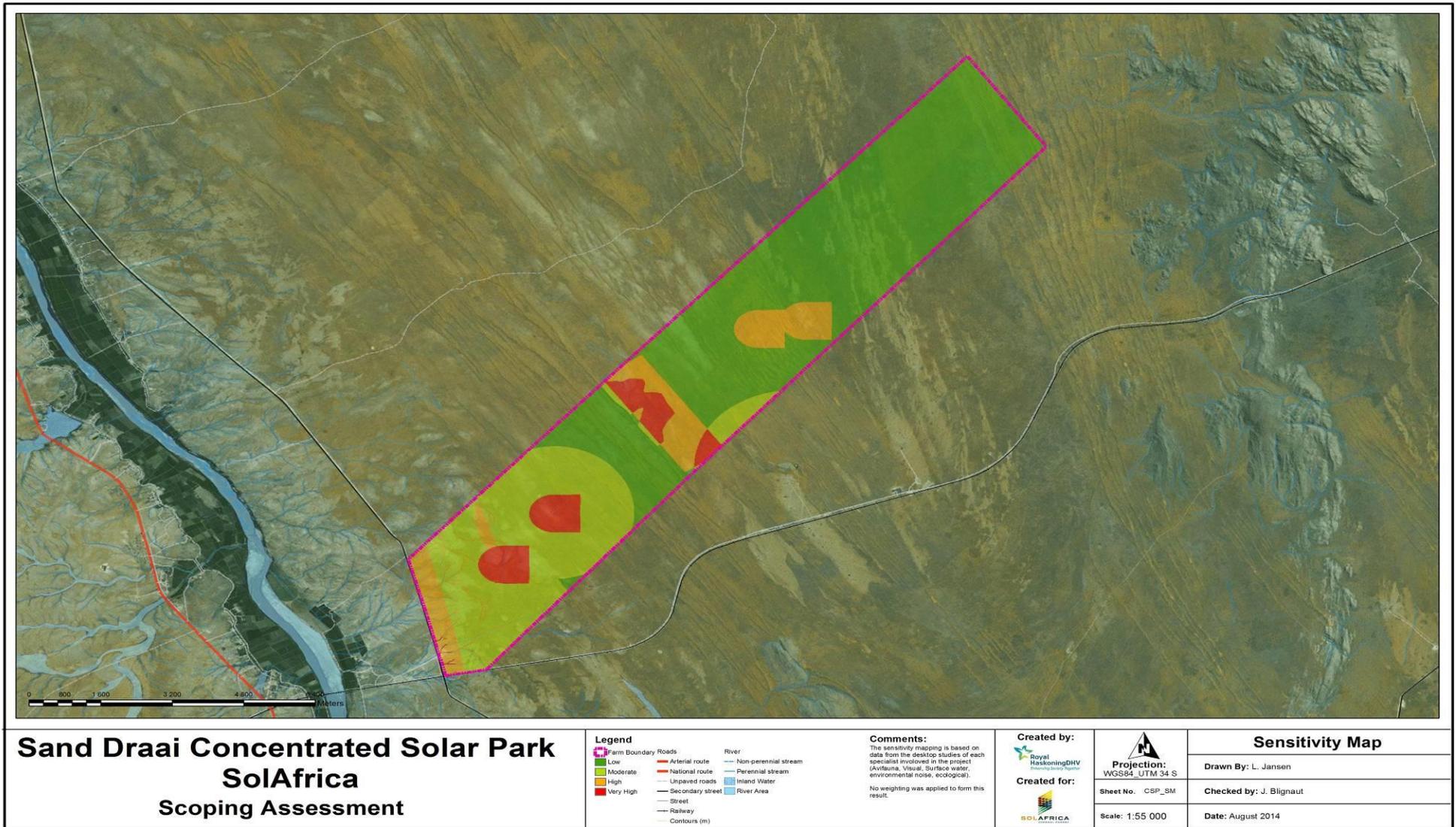


Figure 34 – Preliminary Sensitivity map

9 PLAN OF STUDY FOR THE EIA

The submission of a Plan of Study for EIA is required under Section 21(3) - Appendix 2 of the EIA Regulations (2014). The Plan of Study sets out how an EIA will be conducted.

9.1 Process Phases

The environmental studies required for the proposed project will be undertaken within the two phases, as follows:

9.1.1 Environmental Scoping Study

A desk-top issues-based Environmental Scoping Study has been undertaken for the proposed project. Existing information and input from specialists, the Authorities and Interested and Affected Parties (I&APs) will be used to identify and evaluate potential environmental impacts (both social and biophysical) associated with the proposed project. No environmental fatal flaws associated with the proposed project were identified through the Environmental Scoping Study, although a number of potentially significant environmental impacts have been identified as requiring further in-depth study. Therefore, the EIA is required to be undertaken in order to provide an assessment of these potential impacts and recommend appropriate mitigation measure, where required. The EIA will also be used as an instrument to further identify, discuss and evaluate alternatives (i.e. site, technology and layout).

9.1.2 Environmental Impact Assessment (EIA)

All potentially significant environmental impacts (social and biophysical) associated with the proposed project have been identified in the Scoping Study and will be further investigated during the EIA through various specialist studies, and their significance assessed. Mitigation measures will be proposed, where required.

The EIA will aim to adequately investigate and address all environmental issues associated with the proposed CSP plant development in order to provide the National DEA and NCDENC with sufficient information to make an informed decision regarding the proposed project.

9.2 Particulars of the Applicant

The particulars of the applicant are as follows:

Applicant:	Solafrica Energy Pty Ltd
Contact Person:	Nasi Rwigema
Telephone Number:	083 324 2097
Facsimile Number:	086 648 1006
E-mail address:	nasi@solafrica.co.za

9.3 Environmental Consultant

The particulars of the environmental assessment practitioner are as follows:

Consultant:	Royal HaskoningDHV
EAP²¹:	Johan Blignaut
Telephone Number:	(011) 798 6436
Facsimile Number:	(011) 798 6010
E-mail address:	johan.blignaut@rhdhv.com

9.4 Environmental Study Team

Royal HaskoningDHV has been appointed by Solafrica as independent environmental consultants, to undertake the Environmental Impact Assessment for the proposed project. Details of the environmental study team and their associated tasks are as follows:

Team Member	Responsibility
Johan Blignaut	<p>Johan will be responsible for the Project Management. His responsibilities will include regular liaison with the Client and the environmental authorities, and on-going review of progress of all aspects of the project. He will provide strategic input into the Scoping and EIA phases, as well as into the EMPr. In addition, he will be responsible for the review of specialist studies, and the compilation of a consolidated EIA Report and an EMPr for the Project. This will include recommendations regarding appropriate mitigation measures. He will provide support in the management of the public participation process for the project;</p> <p>He will also be responsible for the management of the Public Participation Process. He will be responsible for the day-to-day management and co-ordination of the public participation process, as well as for liaison with the Client regarding this process.</p>
Malcolm Roods	<p>Malcolm will be responsible for the review of all documentation and reports created through the entire project stages. He will also assist with the Project Management process and provide guidance/ input on the throughout the proposed project.</p>

²¹ EAP – Environmental Assessment Practitioner

Paul da Cruz	Paul will be responsible for conducting both the Surface Water and Visual Impact Assessments throughout the Scoping and EIA phases. His responsibilities include site surveys and the compilation of assessment reports illustrating his findings, identified impacts and proposed mitigation measures to be followed.
Stuart Thompson & Nicole Singh	Stuart and Nicole will be responsible for the creation of the Air Quality Assessment report. These responsibilities include site surveys and the compilation of reports indicating any impacts corresponding to the site and the proposed project and also what mitigation measures should be followed.
Siva Chetty	Siva carries the responsibility of investigating all matters relating to waste. These responsibilities include a Waste Assessment during the Scoping and EIA phases. His responsibilities also include the Waste License application for the proposed project.
Lodewyk Jansen	Lodewyk will be responsible for the assessment of <i>noise</i> impacts associated with the construction and operation of the proposed project. He will be responsible for the identification of any potential impacts during the Scoping and EIA phase. Further investigation will be conducted during the EIA phase and mitigation measures will be identified which will assist in reducing any major noise impacts.
Kementthree Moonsamy	Kementthree will be responsible for the creation of the Social Impact Assessment study and report and also the creation of the Social Management Plan (SMP). These responsibilities include site surveys and the compilation of reports indicating any impacts corresponding to the site and the proposed project and also what mitigation measures should be followed. The SIA will be based on a participative approach, involving the stakeholders as much and effectively as possible at all stages of the process. A high degree of communication will be a significant feature of the entire process.

9.5 Specialist Studies

The appointment of specialists to conduct specialist studies as part of an EIA exercise is done to fulfil the minimum requirements of Regulation 23 in the Government Gazette R982 of 4 December 2014. The contents of the specialist reports is determined in compliance with the requirements of Regulation 23(3) outlined in the same notice referred to above.

The various specialist study reports for the proposed project will be attached in the Environmental Impact Report. The following specialists were sub-contracted by Royal HaskoningDHV to assist in investigating certain aspects of the environment that might be impacted by the proposed project.

- *Clayton Cook & Prof. Leslie Brown*: Responsible for the assessment of potential impacts on *fauna* and *flora*. Professor Brown and Clayton Cook are specialists in their respected fields of ecology and has done various assessments for a number of Royal HaskoningDHV related projects;
- *Cobus Dreyer*: Responsible for the *heritage* assessment for the proposed project;
- *Chris van Rooyen* will undertake the *avifaunal* assessment for the project. He has extensive experience in undertaking studies of a similar nature and has undertaken various Assessments for Eskom related projects (generation, transmission and distribution) in the past; and
- *Mathew Ross*: Responsible for the *aquatic* assessment that will be conducted in accordance with the surface water assessment;
- *Groundwater Consulting Services (GCS)* will be responsible for the *Ground Water (Geohydrological)* Impact Assessment and associated with the project. GCS is a reputable consulting firm who have undertaken various hydrological assessments for mining, infrastructure developments and other industrial projects.

The findings of the above-mentioned specialists will assist with:

- The *preferred location of the CSP plant within the farm Sand Draai* during the EIA phase. The selection will be based on the findings of the high-level assessment of the potential environmental impacts associated with each site, undertaken during the Scoping phase; and
- Recommending measures to mitigate the impacts identified during the EIA phase for inclusion in the Environmental Management Programme.

9.5.1 Noise Impact Assessment

The Noise Impact Investigation will be conducted in accordance with procedures contained in the South African National Standard (SANS) 10328 "Methods for environmental noise impact assessments". The noise impacts will be assessed in terms of:

- SANS 10103 for "The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication";
- Noise Control Regulations of the Environment Conservation Act 73 of 1989 applicable to the Northern Cape Province;
- World Health Organisation - Guidelines for Community Noise, and
- World Bank - Environmental Guidelines.

The terms of reference for this investigation is to:

- Provide technical input regarding potential impact of noise at the identified areas so as to support the selection of preferred site location;
- Determine the land use zoning and identify all potential noise sensitive sites that could be impacted upon by activities relating to operation of the proposed solar plant facility at the preferred site location;

- Identify all noise sources relating to the activities of the facility during construction phase and operation phase that could potentially result in a noise impact at the identified noise sensitive sites;
- Determine the sound emission and nature of the sound emission from each of the identified noise sources;
- Calculate the combined sound power level due to the sound emissions of the individual noise sources;
- Calculate the expected rating level of sound at the identified noise sensitive sites from the combined sound power level emanating from identified noise sources;
- Determine the existing ambient levels of noise at identified noise sensitive sites by conducting representative sound measurements;
- Determine the acceptable rating level for noise at the identified noise sensitive sites;
- Calculate the noise impact at identified noise sensitive sites.
- Assess the noise impact at identified noise sensitive sites in terms of SANS 10103; the Noise Control Regulations; the World Health Organisation; the World Bank;
- Investigate alternative noise mitigation procedures, if required, in collaboration with the design engineers of the facility and estimate the impact of noise upon implementation of such procedures;
- Prepare and submit an environmental noise impact report of the investigation for scoping purposes containing detailed procedures and findings of the investigation with the recommendation either to accept the findings of the scoping report or to extend the investigation to a full environmental noise impact investigation;
- Conduct a full environmental noise impact investigation if decided upon after consultation with interested and affected parties, and
- Prepare and submit recommended noise mitigation procedures as part of a separate environmental noise management plan, if relevant.

9.5.2 Potential Impacts on Geohydrology and Hydrology

It is envisaged that based on the input of the various specialists (biophysical and social), the preferred alternatives will be evaluated during the EIA phase of the proposed study. During the EIA study additional site-specific groundwater data will be compiled. The data will be obtained from a hydrocensus of available data for the study area. Groundwater levels, borehole yields, and usage will be determined to assist in assessing possible impacts on the ground and surface water resources. This data will be compiled in a risk assessment to aid in developing optimal mitigation and management plans to reduce the impact of the proposed substations and powerlines on the ground and surface water regime. Potential impacts on surface hydrology will also be investigated.

The plan for the EIA study from a geohydrological and hydrological viewpoint should entail the following:

- Site visit to assess local geotechnical and hydrological conditions;
- Assessing the local climate;
- Assess if there are any fatal flaws or environmental conflicts;
- A description of the ambient geological environment in terms of rock types and strata;

- A description of the ambient geohydrological environment in terms of aquifer type and importance; and
- The identification of any significant site-specific knowledge gaps that currently limit an assessment of potential impact on the groundwater and surface hydrology environment through controlling erosion and pollutants.

9.5.3 Potential Impacts on Ecology/Biodiversity: Fauna and Flora

Environmental regulations pertaining to minimum requirements for biodiversity assessments simply require full surveys on all biodiversity data and mitigation measures to manage the impact on these living systems. In order to compile detailed knowledge of the biodiversity of the study area the following aspects should be included as part of the EIA investigation.

- **Floristic Investigation**

- Map the location and extent of all plant communities, indicating size and ecological sensitivity, areas of disturbance, surrounding land use, etc;
- A list of potential Threatened Plant Species that occur in the area;
- Conduct flora surveys during the growing season of all species that may potentially occur;
- Supply comprehensive plant species lists;
- Identify plant species that may be of conservation importance down to species level;
- Provide locality, date surveyed, GPS location, spatial resolution and distribution, including actual numbers, of plant species that may be of conservation importance;
- Provide a list of alien plant species occurring on the property, considering eradication programmes of alien vegetation; and
- Provide relocation plants for plants of conservation importance. These species may include:
 - Species endemic to the province;
 - Red Data listed plants;
 - Medicinal plants; and
 - Protected plants.

- **Faunal Investigation**

The following methodology is recommended to assess the potential occurrence of red data faunal species as well as the biodiversity elements within the study area pertaining to the relevant faunal species, assemblages and communities present in the general region:

- Invertebrates:
 - Pitfall trapping to assess various areas within the study area in terms of relative biodiversity elements such as species richness and species diversity. Specific groups such as beetles (Insecta: Coleoptera) will be used as indicator groups to standardise and simplify the data analyses;
 - A hand-held butterfly net will be used to collect butterfly species (Insecta: Lepidoptera) found in the study area. Butterflies are the best known Invertebrate group (both ecologically and taxonomically) and is useful as ecological and biodiversity indicators; and
 - Scorpions will be sampled by excavation of burrows during daytime and night-time surveys using black-lights (UV-lights).

- Amphibians:
 - Identification of species-specific calls of males (early evening) at different surface water areas; and
 - A digital audio field recorded will be used to record animal sounds during the night-time at specific areas (usually near ecological “bottle-necks” such as pans or rivers). The calls of frogs will be identified as part of this remote audio survey.

- Reptiles:
 - Preferred reptile habitat such as outcrops, rocky areas, open water and disused termite mounds will be actively searched for the presence of reptile species; and
 - Reptiles caught in the pitfall traps (as “by-catch”) will also be identified.

- Mammals:
 - Small mammal live traps will be used to assess the rodent assemblages of the study area. These traps will be baited with various bait types to include as many rodents and insectivores’ food requirements as possible;
 - Ecological tracks and signs will be used to assess the presence of large and medium-sized mammals;
 - Digital remote sensing cameras will be used to assess the presence of mammals. These cameras will be baited with bovine rumen to attract various undulates and carnivores; and
 - A digital audio field recorded will be used to record animal sounds during the night-time at specific areas (usually near ecological “bottle-necks” such as pans or rivers). The calls of nocturnal mammals will be identified as part of this remote audio survey.

In addition to these the effect of expected or likely impacts on the biological environment will be determined by compilation of an EIA phase study in a holistic manner, taking both the floristic and faunal environment into consideration.

9.5.4 Potential impacts on Avifauna

Overhead power lines and associated infrastructure such as substations are known to impact significantly on various bird species, both directly through causing mortality of birds, and indirectly through disturbance of birds and destruction of habitats. This study will identify these impacts, their location and significance, and recommend suitable mitigation measures that can be implemented to minimise these impacts. The study will also determine the order of preference of the proposed substation sites and Transmission line alternatives from an avifaunal perspective.

The Terms of Reference for the avifaunal impact assessment is as follows:

- Survey environmentally sensitive areas in order to inform the GIS sensitivity map modelling;
- Survey representative areas in order to obtain a clear understanding of the nature of sensitivity in specific sites;
- Survey the area for general avifaunal diversity (common species, Red Data faunal species);
- Assess the potential presence of Red List avifaunal species;
- Address all issues relating to habitat, including:
 - Detailed site investigations;

- Sensitivity analysis;
- Site descriptions and recommendations
- Compile an avifaunal impact evaluation, taking the following aspects into consideration:
 - The relationship of potential impacts to temporal scales;
 - The relationship of potential impacts to spatial scales;
 - The severity of potential impacts;
 - The risk or likelihood of potential impacts occurring;
 - The degree of confidence placed in the assessment of potential impacts;
- Map all relevant aspects; and
- Recommend preferred site/alignment variants based on results of the

9.6 Approach to Undertaking the Project

In order to obtain the required Record of Decision for the Environmental Scoping Study and Plan of Study for EIA from DEA for the project, the following activities will be undertaken:

9.6.1 Authority Consultation

Consultation with all relevant authorities initiated during the Scoping phase will continue throughout the duration of the project. The representatives from the relevant Departments will be requested to formally provide input into the EIA process. The authorities to be consulted include:

- Department of Environmental Affairs (DEA);
- Department of Water and Sanitation (DWS);
- Department of Agriculture;
- Department of Public Enterprises;
- Department of Trade and Industry (DTI);
- Department of Minerals and Energy (DME);
- South African Heritage Resources Agency (SAHRA);
- Relevant Northern Cape Provincial Authorities (ex. Environment & Conservation, Agriculture); and
- District and Local Authorities; Siyanda District Municipality, !Khara Hais and !Kheis Local Municipalities.

9.6.2 Environmental Impact Assessment

The Environmental Impact Assessment (EIA) will aim to achieve the following:

- To provide an overall assessment of the social and biophysical environments of the area affected by the proposed establishment of the CSP plant and associated infrastructure;
- To undertake a detailed assessment of the portion of the farm Sand Draai in terms of environmental criteria and impacts (direct, indirect and cumulative), and recommend a preferred location for the proposed plant (based on environmental sensitivity);
- To identify any cumulative impacts associated with the simultaneous development and operation of the Solafrica Bokpoort and Sand Draai CSP Plant on the identified farms; and
- To identify and recommend appropriate mitigation measures for potentially significant environmental impacts; and

- To undertake a fully inclusive Public Participation Process to ensure that I&AP issues and concerns are recorded.

9.7 Public Participation

9.7.1 On-going Consultation with all I&APs

On-going consultation with key stakeholders (e.g. local authorities, relevant government departments, local business), and other identified I&APs will ensure that I&APs are kept informed regarding the EIA findings and proposed mitigation measures. Networking with I&APs will effectively continue throughout the duration of the project until the closure of the EIA phase. Where required, key stakeholders and I&APs will be engaged on an individual basis. The database and issues trail will be continually updated throughout the process.

9.7.2 Public Involvement

A public meeting will be held to provide the general public with feedback regarding the findings of the EIA, and to provide detail regarding mitigation measures proposed. In accordance with the requirements of the EIA Regulations, the public meetings will be advertised 10 days prior to the event. I&APs registered on the project database will be notified of this public meeting by letter. In addition, key stakeholders will be personally invited to attend a separate key stakeholder workshop, as well as the public meeting, in order to encourage continued participation in the process. Focus Group meetings will also be held with key stakeholders and I&APs. Formal minutes of the public meetings, focus group meetings and key stakeholder workshop will be compiled and distributed to the attendees. These proceedings will also be included in the final EIA report.

9.7.3 Issues Trail

Issues and concerns raised during the public participation process of the EIA phase will be compiled into an Issues Trail. Proceedings of meetings and comments received will also form part of the document. This record of issues will provide a consolidated list in order to ensure that all issues and concerns raised by I&APs are considered within the EIA process.

9.8 Compilation of the Environmental Impact Assessment Report

The EIA Report will include and address the following:

- A project description (including a description of the proposed activity, plans illustrating the study area and proposed site, and detailed technical details regarding the proposed project);
- A description of the pre-construction environment;
- A description of the public participation process, including the identification of I&APs, a record of the procedures followed, and the perceptions and views of the I&APs regarding the activity;
- A description of environmental (biophysical and social) issues identified and potential impacts of the proposed project on these aspects (i.e. how the environment may be affected as a result of the proposed activity)
- Assessment of impacts identified in the Scoping Study which were determined to be significant. These impacts will be assessed in terms of the nature, extent, duration, intensity, severity and probability of the impact occurring; and

- Conclusions and recommendations regarding the presence of any environmental fatal flaws and recommendations (including a preferred site and mitigation and management measures) regarding the proposed project.

Furthermore, the EIA Report will comply with Regulation 23 – Appendix 3 of the EIA Regulations 2014 and other applicable regulations/guidelines insofar as content and issues addressed are concerned. The integration of the specialist studies into a consolidated report will allow for easy assessment of the potential environmental aspects. In order to evaluate the significance of the identified impacts, the following characteristics of each potential impact will be identified:

- **Nature:** A brief written statement of the environmental aspect being impacted upon by a particular action or activity.
- **Extent:** The area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact. For example, high at a local scale, but low at a regional scale;
- **Duration:** Indicates what the lifetime of the impact will be;
- **Intensity:** Describes whether an impact is destructive or benign;
- **Probability:** Describes the likelihood of an impact actually occurring; and
- **Cumulative:** In relation to an activity, means 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.

Table 13: Criteria to be used for the rating of impacts

CRITERIA		DESCRIPTION			
EXTENT	International (5) International scale	National (4) The whole of South Africa	Regional (3) Provincial and parts of neighbouring provinces	Local (2) Within a radius of 2 km of the construction site	Site (1) Within the construction site
	Permanent (5) Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered	Long-term (4) The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by	Medium-term (3) The impact will last for the period of the construction phase, where after it will be entirely negated	Short-term (2) The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the	Very Short-term (1) The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction

CRITERIA		DESCRIPTION			
	transient	natural processes thereafter. The only class of impact which will be non-transitory		construction phase (few months)	phase (few days)
FREQUENCY	Continuous (5) Daily to a significant percentage every day	Very Frequent (4) Few times a week to daily	Frequent (3) Few times a month	Unusual (2) Once or twice every 5 years	Very Rare (1) Once or twice a decade
INTENSITY	High (5) Natural, cultural and social functions and processes are altered to extent that they permanently cease	Medium High (4) Natural, cultural and social functions and processes are altered to extent that they temporarily cease	Medium (3) Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way	Low (2) Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected	Very Low (1) Impact does not affect the environment in such a way that natural, cultural and social functions and processes are not affected
PROBABILTY OF OCCURANCE	Definite (5) Impact will certainly occur	Very Likely (4) Most likely that the impact will occur	Likely (3) The impact may occur	Probable (2) Likelihood of the impact materialising is low	Improbable (1) Likelihood of the impact materialising is very low

- Significance is determined through a synthesis of impact characteristics. Significance is also an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Table 14: Significance rating of classified impacts

Low impact (0 -5 points)	A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
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Medium impact (6 -10 points)	Mitigation is possible with additional design and construction inputs.
Medium to High impact (11 -15 points)	The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.
High impact (16 - 20 points)	High consequences and mitigation is essential.
Extremely High	Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a “very high impact” is likely to be a fatal flaw.
Status	Denotes the perceived effect of the impact on the affected area.
Positive (+)	Beneficial impact.
Negative (-)	Deleterious or adverse impact.
Neutral (/)	Impact is neither beneficial nor adverse.

It is important to note that the status of an impact is assigned based on the status quo – i.e. should the project not proceed. Therefore not all negative impacts are equally significant.

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Solafrica has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts will be discussed and conclusions and recommendations regarding the preferred corridor.

9.9 Review of Environmental Impact Assessment Report

9.9.1 Public Review of the Draft Environmental Impact Assessment Report

The draft Environmental Impact Assessment Report will be made available at public places for public review and comment, in accordance with the EIA Regulations. A 30-day period will be allowed for this review process. An advert indicating the availability of this report and the information regarding the public meeting will be placed in the local newspaper. In addition, all I&APs registered on the project database will be notified of the public meeting and the availability of this report by letter.

9.9.2 Authority Review of the Consultation Environmental Impact Report

The Environmental Impact Report will be submitted to DEA and NCDENC for review and comment. The draft report will not be made available to the authorities as they are not obligated to review Draft reports in terms of the Regulations. All I&AP comments received during the 30-day public review period will be incorporated into a Consultation Environmental Scoping Report. This report will be submitted to the Authorities for their review and consideration.

9.10 Integrated Environmental Authorisation

On receipt of the Environmental Authorisation for the project, the I&APs registered on the project database will be informed of this Environmental Authorisation and its associated terms and conditions in writing via fast mail and email.

9.11 Work Programme

The programme for the Environmental Impact Study and the key dates relevant to the project are outlined in the table below:

Item	Activity	Timeframe
1.	Obtain written approval of ESS and POS for EIA from DEA	September 2015
2.	Specialist studies	September - October 2015
3.	Consultation with I&APs	October - November 2015
4.	Compile a draft EIA Report	September - November 2015
5.	Make a draft EIA Report available for public comment	October - November 2015
6.	Public review period	October - November 2015
7.	Finalise EIA Report	November - December 2015
8.	Submit Final EIA Report to DEA and NC DTEC	January 2016
9.	Full Authority review period	January - April 2016
10.	Integrated Environmental Authorisation	April 2016

APPENDIX A:

Newspaper Advertisement/ Notification Letter

APPENDIX B:

Briefing Document/ Comments Sheet/

Introduction Letter to I&APs

APPENDIX C:
Site Notice

APPENDIX D:
Pamphlet/Notices

APPENDIX E:
Specialist Reports

APPENDIX F:

Public Participation

Invitation Letters / Scoping Phase Presentation/
Attendance Registers/ Minutes of Meetings

APPENDIX G:
I&AP/Stakeholder Comments

APPENDIX H:
Stakeholder/ I&AP Register

APPENDIX I:

Social Issues Trail
