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DRAFT IMPACT ASSESSMENT REPORT & Environmental Management Programme

for

'KHOI-SUN DEVELOPMENT'

on

A portion of Farm 426, Skuitdrift, Northern Cape

In terms of the

National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended & Environmental Impact Regulations 2010

Prepared for Applicant: Khoi-Sun Development (Pty) Ltd. (previously Anjumode (Pty) Ltd)

By: *Cape EAPrac*

Report Reference: KHA135/29

Department Reference: 12/12/20/2600

Case Officer: Jay-Jay Mpelane

Date: 5 November 2012

APPOINTED ENVIRONMENTAL ASSESSMENT PRACTITIONER:

***Cape EAPrac* Environmental Assessment Practitioners**
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Report written & compiled by: **Dale Holder** (Nat.Diploma Nature Conservation), who has 10 years' experience as an environmental practitioner.

Report reviewed by: **Louise-Mari van Zyl** (MA Geography & Environmental Science [US]; Registered Environmental Assessment Practitioner with the Interim Certification Board for Environmental Assessment Practitioners of South Africa, EAPSA); Chairperson of the Southern Cape International Association for Impact Assessments (IAIA). Mrs van Zyl has over ten years' experience as an environmental practitioner.

PURPOSE OF THIS REPORT:

Public Review & Comment

APPLICANT:

Khoi-Sun Development (Pty) Ltd. (previously Anjumode (Pty) Ltd)

CAPE EAPRAC REFERENCE NO:

KHA135/29

DEPARTMENT REFERENCE:

12/12/20/2600

SUBMISSION DATE

05 November 2012

DRAFT ENVIRONMENTAL IMPACT REPORT

in terms of the
National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended &
Environmental Impact Regulations 2010

Khoi-Sun Development

A portion of Farm 426 Skuitdrift, Northern Cape

Submitted for:
Stakeholder Review & Comment

Report Issued by:
Cape Environmental Assessment Practitioners

Tel: 044 874 0365
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REPORT DETAILS

Title:	**DRAFT ENVIRONMENTAL IMPACT REPORT for proposed 'Khoi-Sun Development'**
Purpose of this report:	This Draft Environmental Impact Report (DEIR) forms part of a series of reports and information sources that are being provided during the Environmental Impact Assessment (EIA) for the proposed Khoi-Sun Development in the Northern Cape Province. In accordance with the EIA Regulations, the purpose of the Environmental Impact Report is to: • Provide a detailed description of the proposed project, including a description of identified potential alternatives and their comparative assessment; • Describe the local environmental and developmental context within which the project is proposed; • Provide an overview of the environmental process into the EIR phase, in particular the public participation process and specialist findings; • Present a summary of the findings and recommendations of the specialist impact assessments and studies; • Describe how the issues, concerns and potential constraints identified by stakeholders and specialists in the Scoping Phase have been assessed, the significance of issues and the extent to which the issues can be addressed by the adoption of mitigation measures. The Draft Environmental Impact Report has been made available to all stakeholders for a 40-day review & comment period, **5 November 2012** to **15 December 2012**.
Prepared for:	Khoi-Sun Development (Pty) Ltd. (previously Anjumode (Pty) Ltd.)
Published by:	*Cape Environmental Assessment Practitioners (Pty) Ltd. (Cape EAPrac)*
Authors:	Mr. Dale Holder & Mrs Siân Holder
Reviewed by:	Director: Louise-Mari v Zyl
Cape EAPrac Ref:	KHA135/29
DEA Case officer & Ref. No:	Jay-Jay Mpelane 12/12/20/2600
Date:	November 2012
To be cited as:	*Cape EAPrac,* 2012. Draft Environmental Impact Report for the proposed Khoi-Sun Development. Report Reference: KHA135/29. George.

COMPLIANCE CHECKLIST:

Regulation 543 of NEMA, Section 31(2): "*Contents of an Environmental Impact Report*".

The following is included as a "route map" for stakeholders and officials considering and reviewing this report. It contains the minimum requirements for an environmental impact report and guides the reader to the relevant pages where specific aspects are detailed:

	Requirement	**Page #**
(a)	Details of the EAP who compiled the report and the expertise of the EAP to carry out an EIA.	Second cover page
(b)	Detailed description of the proposed activity.	i & 42-68
(c)	Description of the property on which the activity is to be undertaken and the location of the activity on the property.	i-iii, 68- 78
(d)	Description of the environment that may be affected and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected.	68-78
(e)	Details of the public participation process: 1. Steps undertaken in accordance with the PoS EIR 2. List of persons, organizations and organs of state that were registered as interested & affected parties 3. Summary of comments received from, and a summary of issues raised by registered I&APs, the date of receipt of the comments and the responses of the EAP to those comments 4. Copies of any representations, objections and comments received from registered I&APs	98 Appendix F & Final Scoping Report
(f)	Description of the need & desirability of the proposed activity.	26-34
(g)	A description of identified potential alternative to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity.	49-54
(h)	An indication of the methodology used in determining the significance of potential environmental impacts.	Throughout Annexure D1
(i)	A description and comparative assessment of all alternatives identified during the environmental impact assessment process.	86-98
(j)	A summary of the findings and recommendations of any specialist report or report on a specialised process.	95
(k)	Description of all environmental issues, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures.	85 EMPr – Appendix E
(l)	An assessment of each identified potentially significant impact, including: • cumulative impacts • nature of the impact • extent and duration of the impact • probability of the impact occurring • degree to which the impact can be reversed • degree to which the impact may cause irreplaceable loss of resources; and • degree to which the impact can be mitigated.	86-95
(m)	A description of any assumptions, uncertainties and gaps in the knowledge.	99-101
(n)	A reasoned opinion as to whether the activity should be authorized, any conditions that should be made in respect of that authorisation.	101 -105
(o)	An environmental impact statement which contains:	101-105

	• a summary of the key findings; and • comparative assessment of the positive and negative implications of the proposed activity and identified alternatives.	
(p)	An Environmental management programme that complies with Regulation 33 of NEMA.	Appendix E
(q)	Copies of any specialist reports and reports on specialized processes complying with Regulation 32 of NEMA.	Appendix D & Final Scoping Report
(r)	Any specific information that may be required by the competent authority.	Table below
(s)	Any other matters required in terms of Sections 24(4)(a) and (b) of the Act.	Table below

EIA INFORMATION REQUIRED FOR SOLAR ENERGY FACILITIES:

GENERAL SITE INFORMATION	DETAILS / REPORT LOCATION
Descriptions of all affected farm portions.	Section 8 of EIR • Khoi-Sun Development on a portion of Farm 426 Skuitdrift;
21 digit Surveyor General codes of all affected farm portions	C03600000000042600000
Copies of title deeds of all affected farm portions	Copies of Farm 426 title deed to be included with FEIR.
Photos of areas that give a visual perspective of all parts of the site	In report, in Site Photo Plates (Appendix B) & Ecological Report (Annexure D1).
Photos from sensitive visual receptors (tourism routes / facilities etc.)	In report, in Site Photo Plates (Appendix B) & Ecological Report (Annexure D1).
Solar plant design specifications – Sections 5, 6 & 7 of EIR	
• Type of technology • Structure height • Surface area to be covered (incl. associated infrastructure) • Structure orientation • Laydown area dimensions (construction period & thereafter) • Generation capacity	Photovoltaic Solar (multi-crystalline cells) on single-axis tracking mechanisms Approximately 2m (not exceeding 3m) Approximately 250ha North 3ha during construction 75MW Alternating Current (AC) / >90MW Direct Current (DC)
Generation capacity of the facility as a whole & at	Approximately >90MW Direct Current (DC) to be generated in total, with 75MW Alternating Current (AC) electricity to feed into the

delivery points	Schuitdrift Eskom Substation (approximate 15MW loss (through waning module efficiency over time, transformation & transmission) accommodated.
Regional and Site Maps and GIS Information	Appendix A & B
Preferred and Alternative Layout Plans	Section 5 & Appendix C
Environmental Management Programme (EMPr)	Appendix E

ENVIRONMENTAL MANAGEMENT PROGRAMME REQUIREMENTS

The Acceptance of the Final Scoping Report & Plan of Study for the Environmental Impact Assessment, issued by the national Department of Environmental Affairs on 21 September 2012 required certain items to be included in the EMP (Appendix E) The Table below provides a quick reference to where these requirements are addressed.

EMP PROVISION	EMP Report Reference
All **recommendations and mitigation measures** to the recorded in the Final EIR.	Throughout EMPr
The **final site layout plan**.	Draft pg. 2
Measures as dictated by the **final site layout plan and micro-siting**.	Pg. 2 & 16
An **environmental sensitivity map** indicating environmental sensitive areas and features identified during the EIA process.	Section 3.3, pg. 10
A map combining the **final layout plan superimposed (overlain) on the environmental sensitivity map**.	Section 1.4, pg. 3
An **alien invasive management plan** to be implemented during construction and operation of the facility. The plan must include mitigation measures to reduce he invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.	Section 5.21, pg. 37
A **plant rescue and protection plan** which allows for the maximum transplant of conservation important species from areas to be transformed. This plan must be compiled by a vegetation specialist familiar with the site in consultation with the ECO and be implemented prior to commencement of the construction phase.	Section 5.19, pg. 35
An **open space management plan** to be implemented during the construction and operation of the facility.	Sec 5.22, pg. 37
A **re-vegetation and habitat rehabilitation plan** to be implemented during the construction and operation of the facility including timeframes for restoration which must indicate rehabilitation within the shortest possible time after completion of the construction activities to reduce the amount converted at any one time and to speed up the recovery to natural habitats.	Section 5.20, pg. 36
A **storm water management plan** to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off.	Section 5.13, pg. 29
An effective **monitoring system to detect any leakage or spillage of all hazardous substances** during their transportation, handling, use and storage.	Sections 5.17 (pg.

This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems.	33) & 5.14 (pg. 31)
An **erosion management plan** for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion.	Section 5.13, pg. 29
A **traffic management plan** for the site access roads to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimise impacts on local commuters e.g. limiting construction vehicles traveling on public roadways during the morning & late afternoon commute time and avoid using roads through densely populated built-up areas to not disturb existing retail & commercial operations.	Section 5.3 pg. 22
A **transportation plan** for the transport of PV components, main assembly cranes and other large pieces of equipment.	Section 5.3 pg. 22
Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments, and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.	Sections 5.14 (pg. 31) & 6.2 (pg. 39)

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DRAFT Environmental Impact Report – Main Report

Appendix A	:	Regional Location Map, Topographical Map & Slope Analysis
Appendix B	:	Site Photographs NPAES Map, Regional CBA Map & BGIS LUDS Evaluation
Appendix C	:	Solar Facility Layout Alternatives Conceptual Building Plan Layout Report (Aylward, 2012)
Appendix D	:	Specialist Reports
Annexure D1	:	Ecological Impact Assessment Report (Todd, 2012)
Annexure D2	:	Engineering Report (van der Merwe, 2012)
Annexure D3	:	Access Road Report (Roode, BVi Consulting, 2012)
Annexure D4	:	Planning Statement (Longland, 2012)
Appendix E	:	DRAFT Environmental Management Programme (EMPr)
Appendix F	:	Public Participation Process – post Scoping Phase
Appendix G	:	Correspondence with Competent Authority – Acceptance of Final Scoping Report & Plan of Study for EIR Acknowledgement of Receipt of Amended Application Form

The following Scoping / Baseline Reports, included in the Draft & Final Scoping Reports, have been used to inform this Draft Environmental Impact Report. Copies of these reports are available on the *Cape EAPrac* website: cape-eaprac.co.za/active under the Final Scoping Report:

Agricultural Potential Report (Beukes, 2012), Heritage Phase One Report (de Kock, 2012) Archaeological Scoping Report (Smith, 2012), Paleaontological Statement (Almond, 2012)

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EXECUTIVE SUMMARY

1 PROJECT OVERVIEW

Cape EAPrac has been appointed by **Khoi-Sun Development (Pty) Ltd.** (previously Anjumode (Pty) Ltd.), hereafter referred to as the Applicant, as independent environmental practitioner responsible for facilitating the Scoping & Environmental Impact Assessment (EIA) process required in terms of the National Environmental Management Act (NEMA, Act 107 of 1998, as amended) for the proposed development of the **Khoi-Sun Development** near Kakamas.

Khoi-Sun Development (Pty) Ltd. has sub-leased a portion Farm 426 Skuitdrift from the landowner, **Mr Frederik Johannes Nel**, for the purposes of developing the proposed solar facility.

The project involves the development of a solar-energy facility with a total generation capacity of approximately **75MW AC (Alternating Current) / >90MW DC (Direct Current) renewable electricity** to be supplied to the national Eskom grid via the existing Schuitdrift[1] Substation. The project with associated infrastructure is proposed on **approximately 250ha.**

The necessary associated infrastructure, including internal road network, overhead transmission line, on-site substation and auxiliary buildings form part of this application.

2 NEED AND DESIRABILITY

The supply of electricity in South Africa has become constrained, primarily because of insufficient generation capacity, but also due to constraints on the transmission and distribution of electricity. Considering this situation and the impact that carbon emissions from existing (and future) coal-fired power stations have on the environment (Climate Change), this **renewable energy project** will contribute to the generation of 'clean' or so-called 'green' electricity for input into the national grid to augment Eskom's power supply.

The South African Government has set a 10 year cumulative target for renewable energy 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 power (White Paper on Renewable Energy Policy, 2003). This amounts to approximately 4% (1667MW) of the total estimated electricity demand (41 539MW) by 2013. The majority of this power will be generated by Eskom. However, in order to meet the increasing power demand within the country, Eskom has set a target of 30% of all new power generation to be derived from **independent power producers** (IPPs).

Khoi-Sun Development (Pty) Ltd is one such IPP which intends to generate electricity from the proposed **Khoi-Sun Development**. This will contribute to South Africa's commitment to the Convention on Climate Change through emission-free generation of electricity and working towards an investor-friendly climate in the energy sector.

3 ENVIRONMENTAL REQUIREMENTS

[1] Variations of spelling include "Skuitdrift"(Farm), "Schuitdrift"(Substation) and "Scuitdrift"

The proposed solar energy facility project is subject to the requirements of the Environmental Impact Assessment Regulations (2010 EIA Regulations) in terms of the **National Environmental Management Act** (NEMA, Act 107 of 1998, as amended)[2]. This Act makes provision for the identification and assessment of activities that are potentially detrimental to the environment and which require authorisation from the competent authority (in this case, the national Department of Environmental Affairs, DEA) based on the findings of an EIA. An application for authorisation has been accepted by the DEA (under the Application Reference number 12/12/20/2600).

A Scoping and Environmental Impact Reporting (S&EIR) process is required in terms of NEMA, 2010. The listed activities associated with the proposed development, as stipulation under Regulations 544, 545 and 546, are as follows:

R544: Activities 1(i)&(ii), 10(i), 11(xi), 18(i) & 22(i)&(ii)
R545: Activities: 1, 8 & 15
R546: Activities: 4(a)(ii)&(gg) & 14(a)(i)

Before any of the above mentioned listed activities may be undertaken, authorisation must be obtained from the relevant authority, in this case, the **National Department of Environmental Affairs** (DEA).

4 BROAD CONTEXT

Within the regional context, the subject property is located in the Kenhardt district and jurisdiction area of the Kai!Garib Local Municipality, Siyanda District Municipality. Farm 426 Skuitdrift is located directly south of the Orange River and west of the Augrabies National Park and has a surface area of approximately 8019ha. Via road, the subject solar site is approximately 106km northeast of the town of Pofadder and 115km northwest of Kakamas respectively. Access to the solar facility site is off the N14 National road (Nous turn-off 60km east of Pofadder; 70km west of Kakamas) via a 46km long gravel track.

5 DEVELOPMENT PROPOSAL & ALTERNATIVES

The proposed Khoi-Sun Development is to consist of solar photovoltaic panels with a feed-in capacity of 75MW (megawatts) Alternating Current (AC) / >90MW Direct Current (DC), as well as associated infrastructure, which will include:

- On-site substation
- Auxiliary buildings (administration / security, workshop, storage and ablution)
- Inverters, transformers and internal electrical reticulation (underground cabling);
- Access and internal road network;
- Overhead electrical transmission line (to connect to existing Schuitdrift Substation);
- Rainwater tanks
- Perimeter fencing

[2] On 18 June 2010 the Minister of Water and Environmental Affairs promulgated new regulations in terms of Chapter 5 of the National Environmental Management Act (NEMA, Act 107 of 1998), viz, the Environmental Impact Assessment (EIA) Regulations 2010. These regulations came into effect on 02 August 2010 and replace the EIA regulations promulgated in 2006.

Various alternatives, in terms of technology of the solar arrays, as well as layout for the solar arrays and associated infrastructure on the development site, were considered and informed by the environmental constraints identified during the baseline / scoping process (refer to the Layout Report in Appendix C).

The following three initial alternatives were considered for the Khoi-Sun Development, and have been eliminated and excluded from the on-going environmental process:

- **Layout Alternative 1 - Initial Uniform Layout**
- **Layout Alternative 2 – 2.5m buffer on all washes**
- **Layout Alternative 3 – 5 m buffer on all washes**

The **NO-GO Alternative** serves as the status quo against which impacts have been identified and measured, and proposes that the Khoi-Sun Development not go ahead and that the area in proximity to the Schuitdrift Substation remain undeveloped as it is currently.

6 SPECIALIST STUDIES

The following Specialist Studies were undertaken to inform this process:

- **Agriculture Potential -** (Beukes, 2012)
- **Biophysical / Ecological / Flora & Fauna** – (Todd, 2012)
- **Heritage** – (de Kock, 2012)
- **Archaeology** – (Smith, 2012)
- **Palaeontology** – (Almond, 2012)

Of the above studies, further assessment was only required for the impacts associated with the biophysical / ecological / floral & faunal aspects of the receiving environment. The significance of these impacts is described in greater detail in **Section 11 of the main report** and the Ecological Impact Report (Todd, 2012) attached as **Annexure D1**.

7 PLANNING CONTEXT

Macroplan Town and Regional Planners (Upington) have been appointed to facilitate the necessary Planning Application process for the proposed Khoi-Sun Development. A land use change application for the rezoning from Agricultural Zone I to Special Zone was lodged at the Kai! Garib Local Municipality in August 2012, in accordance with the Northern Cape Planning and Development Act (Act 7 of 1998), to allow for the development of the proposed Khoi-Sun Development.

Parallel to the rezoning application, a long term lease application was lodged at the National Department of Agriculture, Forestry & Fisheries (DAFF) in August 2012, in accordance with the Subdivision of Agricultural Land Act (Act 70 of 1970) to allow for the development of the proposed Khoi-Sun Development. See **Section 9 of the main report** and **Annexure D4** for updated Planning Report (Longland, 2012).

8 ASSESSMENT SUMMARY

No heritage, archaeological or paleontological constraints were identified within the proposed development area (of the preferred layout). As such, further assessment in terms of these impacts was not required.

Table 1 below provides an assessment summary of the identified ecological impacts which were the only discipline which identified concerns, associated with the preferred layout, with reference to the different phases of the project (construction & operation), as well as pre- and post-mitigation.

Impact	Project Phase	Pre Mitigation	Post Mitigation
Impacts on vegetation and protected plant species	Construction	Moderate-High	Moderate
	Operation	Low	Low
Increased alien plant invasion risk	Construction	Moderate	Low
	Operation	Moderate	Low
Increased erosion risk	Construction	Moderate	Low
	Operation	Low	Low
Faunal habitat loss and disturbance	Construction	Moderate	Moderate
	Operation	Low	Low
Negative impacts on avifauna	Construction	Moderate	Low
	Operation	Moderate	Low

9 PROCESS TO DATE

This Draft Environmental Impact Report (DEIR) and the Draft Environmental Management Programme (EMPr) follows on the Final Scoping Report and Plan of Study for EIR which was accepted by the Department of Environmental Affairs (DEA) on 21 September 2012.

This DEIR and Draft EMPr, reflect the findings and recommendations of the specialist investigations, as well as comments received as part of the Scoping public participation process to date: This process has taken all the necessary steps to ensure compliance with the legislation and allowed ample opportunity for members of the public and key stakeholders to be involved and participate in the environmental process i.e. Draft and Final Scoping Reports were made available for public review. Please see **Section 13 in the main report** and **Appendix F** for evidence of this Public Participation process.

This **Draft Environmental Impact Report** (DEIR) and **Draft Environmental Management Programme** (EMPr) have been made available to registered Stakeholders and I&APs for review and comment for a period of 40 days, extending from 05 November 2012 - 15 December 2012. All comments received on this report will be included in the Final EIR and submitted to the Department for consideration and/ decision-making.

NOTE: The environmental Regulations make provision that should there are no substantive changes between the *Draft* Environmental Impact Report (DEIR) and *Final* Environmental Impact Report (FEIR), the Final EIR can be submitted to the Department (DEA) without a further public comment

period. Should this be the case the FEIR will still be made available to the public for information purposes. *Confirmation of this course of action will be sought from the DEA case officer.*

10 CONCLUSIONS & RECOMMENDATIONS

Alternative energy is considered favourable compared to conventional electricity generation methods, which include coal fired stations. International literature confirms the long-term benefit of alternative energy to far exceed fossil fuel energy and as such, it should be supported. The impacts associated with the Khoi-Sun Development, which are mainly biophysical in nature, must be considered within this context.

The preferred / mitigated layout is responsive to the integrated results and recommendations of the assessment of potential impacts made by the various specialists, the project team and participating stakeholders. The manner in which the proposed Khoi-Sun Development development is planned, answers to the challenges of need and desirability.

The majority of mitigation measures recommended in the assessment of the impacts have been **accommodated in the 75MW AC** (>90MW DC) **preferred / mitigated solar layout (Alternative 4)** and those proposed for the detailed design phase, construction and operation of the Khoi-Sun Development, have been included in the Environmental Management Programme (EMPr) for the development.

The initial alternatives were refined in an iterative manner during the process to ensure that the constraints and concerns raised by the specialists and I&APs have been incorporated into the design of the preferred / mitigated layout, thereby ensuring that the negative impacts associated with the proposal are minimized and the positive benefits enhanced. The proposed development, in its mitigated form, and subject to the implementation of the various mitigation measures and the EMPr and associated plans, can be recommended for environmental authorisation.

Registered I&APs, key stakeholders, relevant state departments, organs of state and members of the public are required to consider the contents of this DEIR and submit responding comments in writing, to bring to the attention of the competent authority, any remaining issues which that party believes have not been adequately addressed and may therefore be of significance to the consideration of the application.

This DEIR is available for a review and comment period of 40-days, extending from **05 November 2012 to 15 December 2012**. Comments and submissions received in response to this report will be responded to and addressed in the Final EIR.

Written submissions must be addressed to:

***Cape EAPrac* (Pty) Ltd**
Attention: **Mr Dale Holder**
PO Box 2070, George, 6530
Tel: 044 874 0365 Fax: 044 874 0432
Email: dale@cape-eaprac.co.za

DRAFT ENVIRONMENTAL IMPACT REPORT
Main Report

1 INTRODUCTION

Cape EAPrac has been appointed by **Khoi-Sun Development (Pty) Ltd.** (previously Anjumode (Pty) Ltd.), hereafter referred to as the Applicant, as independent environmental practitioner, to facilitate the Scoping & Environmental Impact Reporting (S&EIR) process required in terms of the National Environmental Management Act (NEMA, Act 107 of 1998, as amended) for the proposed development of the **'Khoi-Sun Development'** near Kakamas in the Northern Cape.

Khoi-Sun Solar Development (Pty) Ltd. has sub-leased a portion of Farm 426 Skuitdrift from the landowner, Mr Frederik Johannes Nel, for the purposes of developing the proposed solar facility.

The total generation capacity of the solar facility will not exceed **75MW AC** (Alternating Current) / >90MW DC (Direct Current) for input into the national Eskom grid, at the Schuitdrift Substation.

The total project infrastructure covers an area of approximately **250ha.** The necessary associated infrastructure, including access roads, overhead electric lines, substation and control building(s) form part of this application.

The purpose of this ***Draft*** **Environmental Impact Report** is to describe the environment to be affected, the proposed project, the process followed to date (focussing on the outcome of the scoping public participation process and specialist studies), to present the findings and recommendations presented in the specialist impact assessment studies, and to assess the potential impacts of the project on the environment as well as to provide a description of how the development concept has been adjusted to consider the above.

1.1 WHY RENEWABLE ENERGY? WHY NORTHERN CAPE?

South Africa has for several years been experiencing considerable constraints in the availability and stability of electrical supple. Load shedding procedures have been applied since December 2005 due to multi-technical failures, as well as capacity and transmission constraints.

Eskom generates about 95% of South Africa's electricity supply, and has undertaken to increase capacity to meet growing demands. At the moment, the country's power stations are 90% coal-fired, and two huge new facilities are being built to add to this capacity. However, Eskom's plans to increase its national capacity by 40 000 megawatts in the period to 2025 have had to be scaled down due to the global economic recession (Northern Cape Business website).

International best-practice requires a 15% electricity reserve margin to deal with routine maintenance requirements and unexpected shutdowns in electricity supply systems. South Africa has historically enjoyed a large reserve margin (25% in 2002, 20% in 2004 and 16% in 2006), but that has declined over the recent past to 8% - 10%, as a result of robust economic growth and the associated demand for electricity. The spare power available to provide supply at any time of the day is known as the reserve capacity and the spare plant available when the highest demand of the year is recorded is known as the reserve margin (National Response to South Africa's Electricity Shortage, 2008). This has resulted in limited opportunities for maintenance and necessitated that power stations are run harder. This results in station equipment becoming highly stressed and an increase in unplanned outages and generator trips. The expected demand growth will rapidly erode this margin, as well as Eskom's ability to recover after it's already stressed systems shutdown.

This necessitates the additional generation of at least 3 000MW in the shortest possible time, to allow the reserve necessary to bring Eskom's system back into balance (*ibid*). This need can either be addressed from the *supply* or the *demand* side. Where the demand side interventions include short, medium and long term aspects of a national Power Conservation Programme to incentivise the public to use less electricity (as mentioned above), one of the supply side options (besides Eskom building new plants and returning old plants to service) is to allow **Independent Power Producers** (IPPs) to contribute electricity to the national grid (National Response Document, 2008). **Khoi-Sun Development (Pty) Ltd.** is one such body, which intends generating electricity from a renewable energy resource, namely solar (in the form of photovoltaic generation).

In March 2011, the Cabinet approved South Africa's Integrated Resource Plan 2010, in terms of which energy from renewable sources will be expected to make up a substantial 42% of all new electricity generation in the country over the next 20 years. The government's New Growth Path for the economy also envisages up to 300 000 jobs being created in the "green" economy by 2020 (South Africa info website).

The Northern Cape is suggested by many to be the ideal location for various forms of alternative energy. This has resulted in a number of feasibility studies being conducted, not least of which an investigation by the Industrial Development Corporation in 2010 (R33-million spent) into potential for photo-voltaic, thermal, solar and wind power (Northern Cape Business website).

The area of the Northern Cape that borders on the Gariep (Orange) River and Namibia boasts the highest solar radiation intensity anywhere in southern Africa. Solar energy is therefore likely to be the most viable alternative energy source for the Northern Cape, although wind-power potential is generally good along the coast (State of the Environment, S.A.)

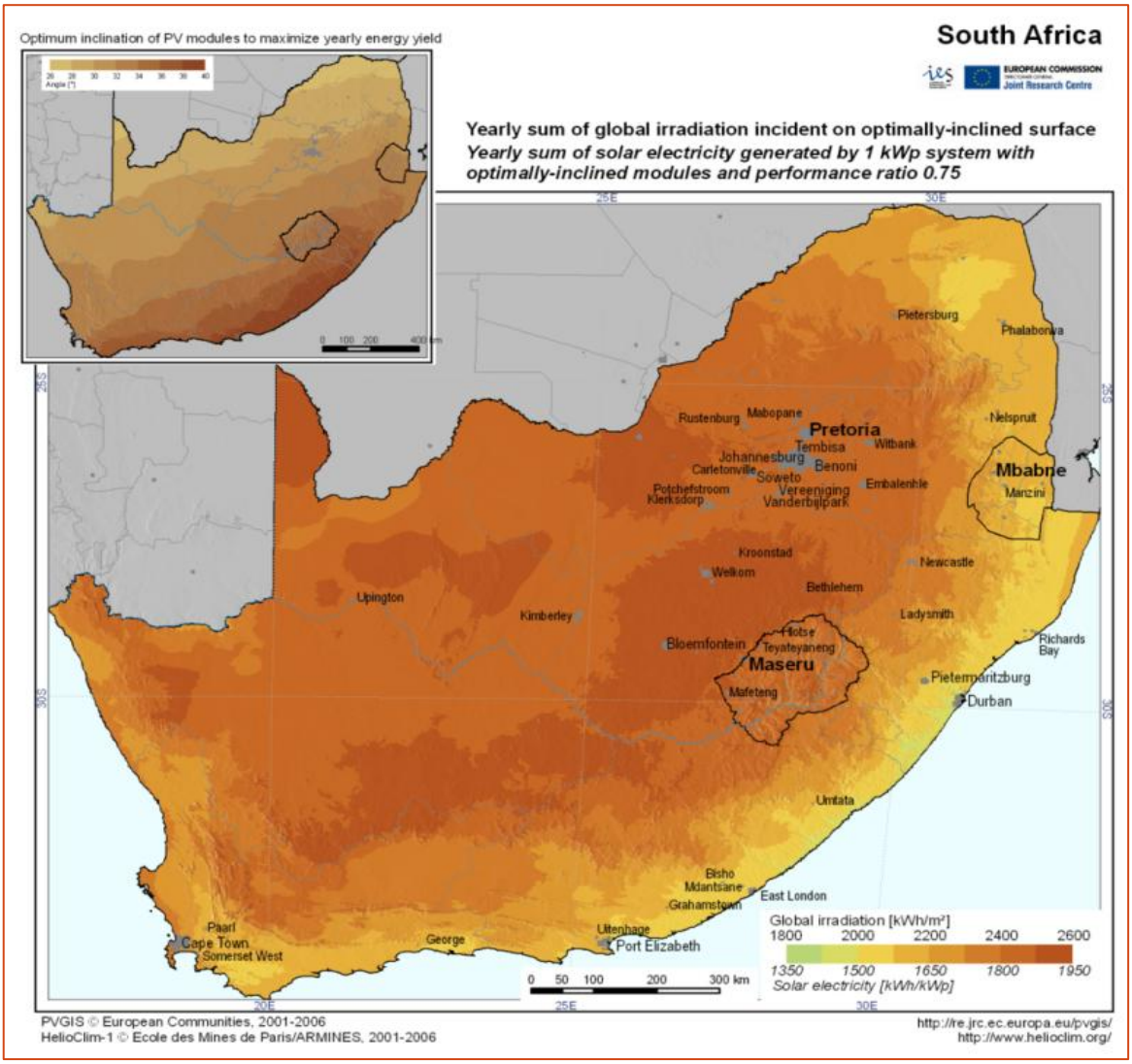


Figure 1: Solar radiation map for South Africa (Source: Solek Engineering Report, 2012).

The Northern Cape area is considered to have extremely favourable solar radiation levels over the majority of the year, making it ideal for the production of solar-power via Photovoltaic (fixed and tracking panels) and Concentrated (solar thermal) Solar systems. Several solar irradiation maps have been produced for South Africa, all of which indicate that the Northern Cape area **high solar irradiation**.

A solar-investment conference, held in November 2010 at Upington Northern Cape, was attended by 400 delegates from all over the world. Dipuo Peters, the national Minister of Energy, outlined the competitive advantages of the Northern Cape, over and above its extremely high irradiation levels, amongst others:

- relative closeness to the national power grid compared to other areas with comparable sunshine;
- water from the Orange River;

- access to two airports; and
- good major roads and a flat landscape (Northern Cape Business website – solar power).

The Northern Cape is not too dusty, the land is flat and sparsely populated, and there are little to no geological or climate risks, meaning that the sun can be used year-round (BuaNews online). An advantage that the Northern Cape has over the Sahara Desert is the relatively wind-free environment that prevails in the province. A Clinton Climate Initiative (CCI) pre-feasibility study has found that South Africa has one of the best solar resources on the planet (Northern Cape Business website – solar power).

To take advantage of this potential for the Northern Cape to become a national renewable-energy hub, the groundwork is being done on a mega-project that has the capacity to fundamentally change the structure of South Africa's power sector: to build a massive solar park that will generate an eighth of the country's electricity needs – 5 000MW – in the Northern Cape near Upington. Sixteen square kilometres of land (thousands of hectares) have been identified and Eskom is looking for private partners. The park, which will cost more than R150-billion, will generate 1 000MW in its first phase. A full feasibility study will now be conducted with the support of the Central Energy Fund and the Development Bank of Southern Africa (Northern Cape Business website – solar power). Significant job creation, lucrative private-sector investments, local industry development and a cleaner, more secure power supply are among the benefits of a large-scale park such as this (BuaNews online).

Indeed this potential for solar energy generation plants has resulted in the emergence of smaller solar energy projects throughout the Northern Cape. The Energy Minister, Dipuo Peters announced in February 2012 that 16 of the initial 28 preferred projects identified by the Department of Energy (DoE) under the renewable energy independent power producer (IPP) programme were located in the sun-drenched province (Creamer, Feb. 2012). Mining companies in the Northern Cape are looking to concentrating solar power (CSP) to provide power for their operations.

Engineering company Group Five announced in 2011 that they were investigating the construction of a 150MW plant near Kathu. The Industrial Development Corporation (IDC) is supporting a number of projects in the province. These include a 100MW plant conceived by Abengoa Solar, a Spanish company with a global presence, and a Solafrica scheme to spend more than R3-billion on a Concentrated Solar Plant at Groblershoop (Northern Cape Business website – solar power).

Not comparable in size with these larger projects, the Khoi-Sun Development (Pty) Ltd. is one such smaller IPP solar project which intends to generate 75MW AC / >90MW DC of electricity from solar-energy via single-axis tracking photovoltaic technology, for inclusion into the National grid.

The Khoi-Sun (Pty) Ltd development site is considered ideal, primarily due to:

- The flat topography of the proposed development site (see Slope Analysis in Appendix A) and it's the availability for use for an alternative energy generation facility; and
- The grid connection potential based in proximity to existing transmission & substation infrastructure.

2 LEGISLATIVE AND POLICY FRAMEWORK

The legislation that is relevant to this study is briefly outlined below. These environmental requirements are not intended to be definitive or exhaustive, but serve to highlight key environmental legislation and responsibilities only.

2.1 THE CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA

The Constitution of the Republic of South Africa (Act 108 of 1996) states that everyone has a right to a non-threatening environment and that reasonable measure are applied to protect the environment. This includes preventing pollution and promoting conservation and environmentally sustainable development, while promoting justifiable social and economic development.

2.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA)(ACT 107 OF 1998)

The current assessment is being undertaken in terms of the **National Environmental Management Act** (NEMA, Act 107 of 1998)[3] . This Act makes provision for the identification and assessment of activities that are potentially detrimental to the environment and which require authorisation from the competent authority (in this case, the national Department of Environmental Affairs, DEA) based on the findings of an Environmental Assessment.

The proposed scheme entails a number of listed activities, which require a **Scoping & Environmental Impact Reporting (S&EIR) process**, which must be conducted by an independent environmental assessment practitioner (EAP). Figure 2 depicts a summary of the S&EIR process.

[3] On 18 June 2010 the Minister of Water and Environmental Affairs promulgated new regulations in terms of Chapter 5 of the National Environmental Management Act (NEMA, Act 107 of 1998), viz, the Environmental Impact Assessment (EIA) Regulations 2010. These regulations came into effect on 02 August 2010 and replace the EIA regulations promulgated in 2006.

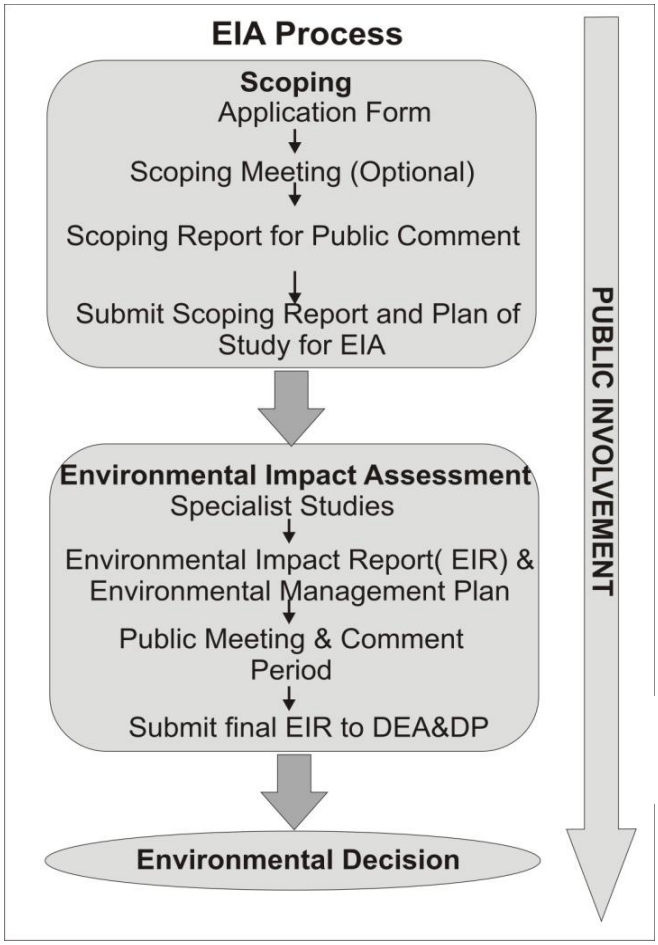


Figure 2: Summary of Scoping & EIR Process

The listed activities associated with the proposed development, as stipulation under 2010 Regulations 544, 545 & 546 are as follows:

Table 2: NEMA 2010 listed activities for the Khoi-Sun Development

R544	Listed Activity	Activity Description
activity 1 sub-listing (i) &(ii)	The construction of facilities or infrastructure for the **generation of electricity** where the output is more than 10 megawatt and the total extent of the facility covers an area in excess of 1 hectare.	Construction of Khoi-Sun Development with a maximum capacity of **75MW (AC) / >90MW (DC).** The total area to be affected by the development will be **approximately 250ha**
activity 10 sub-listing (i)	The construction of facilities or infrastructure for the **transmission and distribution or electricity (i)** outside urban areas or industrial complexes with a capacity of more than 33kV, but less than 275kV.	**New overhead power line** linking the proposed on-site substation/operation building to the existing Schuitdrift Substation.
activity 11 sub-listing	The construction of **(xi)** infrastructure or structures covering 50m² or more, where such construction occurs **within a watercourse or within 32m of a watercourse**, measured from the edge of the	The possible construction of roads/tracks & PV arrays across the on-site washes / drainage systems. Low-level-river-crossing (LLRC).

(xi)	watercourse, excluding where such construction will occur behind the development line.	
activity 18 sub-listing (i)	The **infilling or depositing of any material** of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, pebbles or rock of more than 5cubic metres from **(i) a watercourse.**	The possible construction of roads/tracks & PV arrays across he on-site washes / drainage systems. Low-level-river-crossing (LLRC).
activity 22 sub-listing (i) & (ii)	The **construction of a road**, **outside urban areas**, **(i)** with a reserve wider than 13.5m or, **(ii)** where no reserve exists where the road is wider than 8m.	Construction of **access and internal roads <8m wide** for the solar facility for construction and operation phases outside the urban edge of Kai! Garib municipal area. Although the on site maintenance roads are less than 8m wide, widening of some of the corners of the existing access road may be required in order to allow for access by heavy vehicles.
R545	**Listed Activity**	**Activity Description**
activity 1	The construction of facilities or infrastructure for the **generation of electricity** where the electricity output is **20MW or more**.	Khoi-Sun Development will have a maximum capacity of **75MW (AC) / >90MW (DC)**.
activity 8	The construction of facilities or infrastructure for the **transmission and distribution of electricity** with a capacity of 275 kilovolts or more, outside an urban area or industrial complex.	**New overhead power line** linking the proposed on-site substation/operation building to the existing Schuitdrift Substation.
activity 15	**Physical alteration of undeveloped, vacant or derelict land** to **(ii)** residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is **20ha or more**.	Development of the Khoi-Sun Development of approximately **250ha** on vacant land, outside of the Kai! Garib urban edge.
R546	**Listed Activity**	**Activity Description**
activity 4 sub-listing (a).ii (gg)	The **construction of a road wider than 4m** with a reserve less than 13.5m. All areas outside urban areas.	Construction of **access and internal roads <4 metres wide** for solar facility, outside the Kai! Garib urban edge.
activity 14 sub-listing (a) i	The **clearance of an area of 5ha or more of vegetation** where 75% or more of the vegetative cover constitutes indigenous vegetation. All areas outside urban areas.	**Vegetation clearing** for the Solar Panels and associated infrastructure: access roads, cable trenches and on-site substation & axillary buildings etc. **outside of the Kai! Garib urban edge**. The Khoi Sun Solar Development will be constructed over an area approximately 250ha on private land. Intact and sensitive vegetation has been avoided by solar facility as far as possible.

Before any of the above mentioned listed activities can be undertaken, authorisation must be obtained from the relevant competent authority, in this case the National Department of Environmental Affairs (DEA). Should the Department approve the proposed activity, the Environmental Authorisation does not exclude the need for obtaining relevant approvals from other Authorities who have a legal mandate to provide such.

2.3 NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT (NEMBA)(ACT 10 OF 2004)

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The Draft National List of Threatened Ecosystems (Notice 1477 of 2009, Government Gazette No 32689, 6 November 2009) has been gazetted for public comment.

The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the NSBA 2004. In terms of the EIA regulations, a basic assessment report is required for the transformation or removal of indigenous vegetation in a critically endangered or endangered ecosystem regardless of the extent of transformation that will occur.

However, all of the vegetation types within and surrounding the study site are classified as Least Threatened.

NEMBA also deals with endangered, threatened and otherwise controlled species. The Act provides for listing of species as threatened or protected, under one of the following categories:

- **Critically Endangered**: any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- **Endangered**: any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- **Vulnerable**: any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- **Protected species**: any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Certain activities, known as Restricted Activities, are regulated by a set of permit regulations published under the Act. These activities may not proceed without environmental authorization. Those relevant to the Khoi Sun Solar development are included in section 2.2 above.

According to the national vegetation map (Mucina & Rutherford 2006), the site lies within the **Blouputs Karroid Thornveld** vegetation type (Figure 3). Blouputs Karroid Thornveld occurs as

a belt of irregular flat areas from the vicinity of Augrabies Falls in the east to Kotie se Laagte and Samoep se Laagte in the west. The vegetation type is listed as **Least Threatened** and less than 1% has been transformed. It is well conserved (27%) within Augrabies Falls National Park. At 607 km2 it is however the smallest mapped vegetation unit within the Nama Karoo Biome. Other vegetation types which occur in the vicinity of the site include Lower Gariep Broken Veld, Bushmanland Arid Grassland and along the banks of the Orange River, Lower Gariep Alluvial Vegetation. Lower Gariep Broken Veld and Bushmanland Arid Grassland are also classified as Least Threatened and have been little impacted by transformation. Lower Gariep Alluvial Vegetation is however classified as Endangered on account of the high degree of transformation it has experienced. This vegetation is however restricted to the banks of the Orange River and would not be affected by the development.

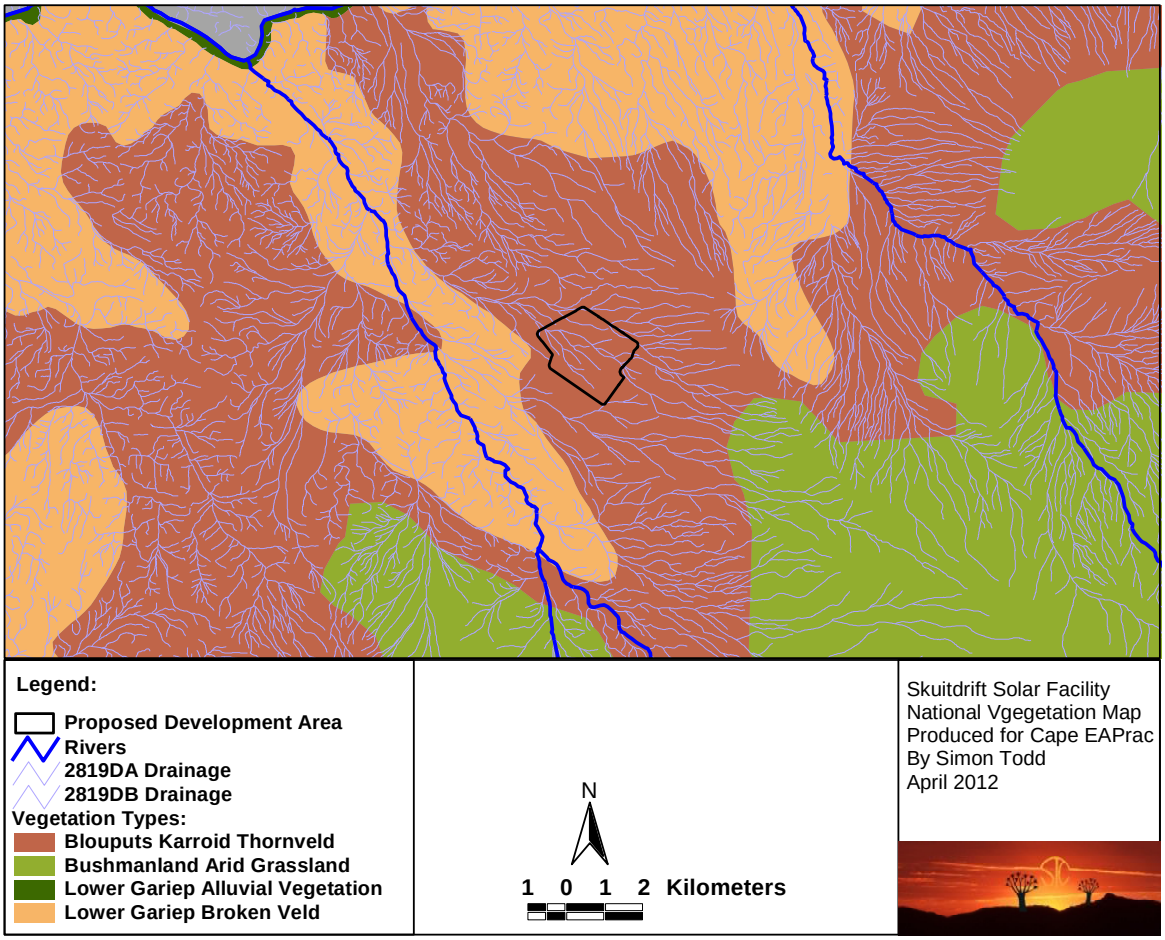


Figure 3: The broad-scale vegetation in and around the proposed Skuitdrift Solar Facility. The vegetation map is an extract of the national vegetation map as produced by Mucina & Rutherford (2006), and also includes rivers delineated by the National Freshwater Ecosystem Priority Areas assessment (Nel et al. 2011) as well as small-scale drainage (Todd, 2012).

2.4 NATIONAL PROTECTED AREA EXPANSION STRATEGY (NPAES) FOR S.A. 2008 (2010)

Considering that South Africa's protected area network currently falls far short of sustaining biodiversity and ecological processes, the NPEAS aims to achieve cost-effective protected area expansion for ecological sustainability and increased resilience to Climate Change. Protected areas, recognised by the National Environmental Management: Protected Areas Act (Act 57 of 2003), are considered formal protected areas in the NPAES. The NPAES sets targets for expansion of these protected areas, provides maps of the most important protected area expansion, and makes recommendations on mechanisms for protected area expansion.

The NPAES identifies 42 focus areas for land-based protected area expansion in South Africa. These are large intact and unfragmented areas suitable for the creation or expansion of large protected areas.

The Khoi-Sun Solar Development site is located in proximity to one such formally protected areas namely the Augrabies National Park, located approximately 20km to the east (see Location Plan in **Appendix A** and NPAES maps in **Appendix B**).

Focus Area number **15: Kamiesberg Bushmanland Augrabies**, represents the largest remaining natural area for expansion of the protected area network and forms part of the planned Lower Orange River Trans-frontier Conservation Area (TFCA – extending from Augrabies Falls to the mouth, along the S.A./Namibian border). It provides an opportunity to protect 22 Desert and Succulent Karoo vegetation types, mostly completely unprotected, several river types that are still intact but not protected, and important ecological gradients and centres of endemism.

The **Kamiesberg Bushmanland Augrabies focus area** considers two areas in proximity to Farm 426 Skuitdrift: one as possible expansion areas for the Augrabies National Park (predominantly to the NE and SW of the existing Park) and one delineating the sub-catchment around the river system located approximately 10km to the west of the target property (see NPAES map attached in Appendix B).

This suggests that the solar development property and site itself is unlikely to be highly significant from a biodiversity maintenance perspective, but the broader area is potentially important for the maintenance of biodiversity and broad-scale ecosystem function (patterns and processes). The development is relatively small in extent when considered in light of the overwhelmingly intact nature of the surrounding landscape.

Furthermore, the proximity of the development to the existing ESKOM substation and power lines would decrease the cumulative impact of the development on the connectivity of the landscape (Todd, 2012).

2.5 MUNICIPAL BIODIVERSITY SUMMARY PROJECT (SANBI BGIS)

No fine-scale conservation planning has been conducted for the Skuitdrift area of the Northern Cape. According to the information provided by the South African National Biodiversity Institute (SANBI) through their Biodiversity GIS (BGIS) system, the environment in the Kai! Garib Local Municipality is mostly untransformed (96% natural areas remaining). The Augrabies National Park covers 45 828ha, which amounts to 6.3% of the municipal area. Two biomes occur within the municipality, which support seven (7) vegetation types, none of which are classified as critically endangered, while one (Lower Gariep Alluvial vegetation) is considered to be Endangered. This vegetation is however restricted to the banks of the Orange River and would not be affected by the Khoi-Sun Solar Development. The Orange River forms the only water management area in the Municipality and has an ecosystem status of Endangered.

2.6 NATIONAL FORESTS ACT (NFA)(NO. 84 OF 1998):

The National Forests Act provides for the protection of forests as well as specific tree species, quoting directly from the Act: “no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated”.

Several protected tree species were observed by the biodiversity specialist on the site including *Hoodia gordonii*, *Acacia erioloba* and *Aloe dichotoma*.

According to the SANBI SIBIS database, only one endangered species *Caesalpinia bracteata* is known from the area, and is classified as Vulnerable. This species has a highly restricted distribution and is known from a total population of about 1000 adult plants (Threatened Species Programme, Red List of South African Plants (2011), but as it occurs on rocky outcrops along the Orange River, it would not occur within the proposed development area and was not observed by the specialist.

The abundance of ***Hoodia gordonii*** was **quite high** within certain areas, while a **limited** number of ***Aloe dichotoma*** and ***Acacia erioloba*** trees occur within the proposed development area.

The affected Hoodia and Aloe plants should be translocated outside the development area before construction. A permit would be required for any activities involving the protected species. Permit application forms for provincially protected species are obtainable from DENC, while nationally protected species are regulated by DAFF. Both Departments are registered Stakeholders on this project and will be requested to submit further comment in this regard.

2.7 NATIONAL VELD & FOREST FIRE ACT (NVFFA) (ACT 101 OF 1998)

The purpose of the National Veld and Forest Fire Act is to **prevent and combat veld, forest and mountain fires** throughout the Republic of South Africa and to provide institutions, methods and practices for achieving this purpose. Institutions include the formation bodies such as **Fire Protection Associations** (FPA's) and Working on Fire. The Act provides the guidelines and constitution for the implementation of these institutions, as well as their functions and requirements.

Every owner on whose land a veldfire may start or bum or from whose land it may spread must prepare and **maintain a firebreak on his or her side of the boundary between his or her land and any adjoining land.** The procedure in this regard and the role of adjoining owners and the fire protection association are dealt with within this Act. An owner on whose land is subject to a risk of veldfire or whose land or part of it coincides with the border of the Republic, must prepare and maintain a firebreak on his or her land as close as possible to the border.

The proposed solar site is arid and given the sparse, succulent nature of the vegetation, it is highly unlikely that fires are a normal occurrence in the area, and thus fires at the site are not considered to be a significant risk. However, under exceptional circumstances, such as following years of very high rainfall, sufficient biomass may build up to carry fires, especially in the fenced-off areas. Therefore, **management of plant biomass within the site** should be part of the management of the facility.

Given the risk that this would pose to the development, it would be in the operators' interests to manage plant cover at an acceptable level through grazing or alternative management practice (brush-cutting). Grazing by livestock is the simplest and most ecologically sound way to manage plant biomass and is recommended the preferred method to manage plant biomass at the site (Todd, 2012).

2.8 CONSERVATION OF AGRICULTURAL RESOURCES ACT – CARA (ACT 43 OF 1983):

CARA provides for the regulation of control over the utilisation of the natural agricultural resources in order to promote the maintenance of ecological health of land, combating and preventing erosion and weakening or destruction of water resources, protecting vegetation and combating weeds and invader plant species i.e. conservation of soil, water & vegetation.

The hydrological features, which occur within the Khoi-Sun Development development area, include **washes and a larger drainage line** (running from the north-west to south-east of the study site)**.**

The drainage lines are dominated by grasses and scattered shrubs but do not support unique vegetation any different to surrounding areas. The construction of the solar facility will require limited disturbance of vegetation or soil (rammed / driven piers) and thus minimal impact on these washes. The larger collecting drainage line has been avoided by the preferred layout.

The Conservation of Agricultural Resources Act defines different categories of alien plants:

- Category 1 - prohibited and must be controlled;
- Category 2 – must be grown within a demarcated area under permit; and
- Category 3 - ornamental plants that may no longer be planted, but existing plants may remain provided that all reasonable steps are taken to prevent the spreading thereof, except within the floodlines of water courses and wetlands.

The Khoi-Sun Development development site is **relatively free of alien plant species**, which can be ascribed firstly to the aridity of the site, as well as the low rainfall in the period preceding the site visit.

Alien plants may however become an issue if the site is highly disturbed during construction or if water runoff is not properly managed. Mitigation measures have been recommended to avoid the risk of increased alien invasion during construction and operation phases of the solar facility (see EMPr in Appendix E for details of the Alien Invasive Management Plan).

2.9 NORTHERN CAPE NATURE CONSERVATION ACT, NO. 9 OF 2009:

The Northern Cape Nature Conservation Act provides inter alia for the sustainable utilisation of wild animals, aquatic biota and plants as well as permitting and trade regulations regarding wild fauna and flora within the province. In terms of this act the following section may be relevant with regards to any security fencing the development may require.

Manipulation of boundary fences:

> **19.** No Person may: (a) erect, alter remove or partly remove or cause to be erected, altered removed or partly removed, any fence, whether on a common boundary or on such person's own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape therefrom;

The perimeter fencing of the Khoi-Sun Solar Development site will be constructed in a manner which allows for the passage of small and medium sized mammals: i.e. steel palisade fencing (20 cm gaps min), alternatively the lowest strand or bottom of the fence will be elevated to 15 cm above the ground at least at strategic places to allow for fauna to pass under the fence. The most appropriate method will be confirmed during the final design phase in collaboration with the biodiversity specialist. No electrified strands will be placed within 20 cm of the ground – to allow free movement of tortoises and reptiles in particular. During operation, all gates will be kept closed to ensure that no larger fauna enter and become trapped within the fenced-off area.

The Act also lists protected fauna and flora under 3 schedules ranging from Endangered (Schedule 1), protected (schedule 2) to common (schedule 3).

The majority of mammals, reptiles and amphibians are listed under **Schedule 2**, except for listed species which are under Schedule 1. A permit is required for any activities which involve species listed under schedule 1 or 2.

2.10 NATURE AND ENVIRONMENTAL CONSERVATION ORDINANCE (19 OF 1974)

This legislation was developed to protect both animal and plant species within the various provinces of the country which warrant protection. These may be species which are under threat or which are already considered to be endangered. The provincial environmental authorities are responsible for implementing the provisions of this legislation, which includes the issuing of permits etc. In the Northern Cape, the Department of Environment and Nature Conservation fulfils this mandate.

2.11 NATIONAL HERITAGE RESOURCES ACT (NHRA) (ACT 25 OF 1999)

The protection and management of South Africa's heritage resources are controlled by the National Heritage Resources Act (Act No. 25 of 1999). **South African National Heritage Resources Agency (SAHRA)** is the enforcing authority in the Northern Cape, and is registered as a Stakeholder for this environmental process.

In terms of **Section 38** of the National Heritage Resources Act, SAHRA will comment on the detailed Heritage Impact Assessment (HIA) where certain categories of development are proposed. Section 38(8) also makes provision for the assessment of heritage impacts as part of an EIA process.

The National Heritage Resources Act requires relevant authorities to be notified regarding this proposed development, as the following activities are relevant:

- *the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;*
- *any development or other activity which will change the character of a site exceeding 5 000 m² in extent;*
- *the re-zoning of a site exceeding 10 000m^2 in extent.*

Furthermore, in terms of Section 34(1), no person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit issued by the SAHRA, or the responsible resources authority. **No buildings older than 60 years and heritage significance were identified within the solar development site.**

Nor may anyone destroy, damage, alter, exhume or remove from its original position, or otherwise disturb, any grave or burial ground older than 60 years, which is situated outside a formal cemetery administered by a local authority, without a permit issued by the SAHRA, or a provincial heritage authority, in terms of Section 36 (3). **The grave sites found directly north**

of the solar development site are not considered to be of cultural significance and furthermore will not be affected by the proposed development

In terms of Section 35 (4), no person may destroy, damage, excavate, alter or remove from its original position, or collect, any archaeological material or object, without a permit issued by the SAHRA, or the responsible resources authority. **No archaeological occurrences identified to occur with the solar development site (occurrences found outside the site is to be avoided by all activities).**

The on-going environmental process has been informed by inputs from heritage, archaeological and paleontological specialists. Sites that are considered to be sensitive have been identified and mapped with appropriate buffers on the constraints map. The layout for the Solar Facility itself has been informed by these constraints and **avoids select features**.

The Integrated Heritage Impact Assessment (including the above studies) have been submitted to SAHRA for further input, comment and decision-making.

The Final Comment / Decision of no objection had been received from SAHRA based on the Phase One Heritage Impact Report submitted as part of the Scoping Report.

Recommendations made by SAHRA in this Decision, have been included in the Environmental Management Programme (EMP) for implementation.

2.12 NATIONAL WATER ACT (NWA) (NO 36 OF 1998)

Section 21c & i of the National Water Act (NWA) requires the Applicant to apply for authorisation from the Department of Water Affairs for an activity in, or in proximity to any watercourse. This may be required for the crossing of the drainage line and washes by the internal road network of the solar facility. The **preferred method** of crossing these water courses will be via a Low Level River Crossing (**LLRC**).

Water required for the construction and operation of the Solar Facility is to be sourced from the on-site boreholes, from Southern Farms and from a rainwater collection (off the on-site substation and axillary building roofs) and storage system.

According to Solek (2012), the water volume required during the construction of the facility would be no more than $24m^3$ per day while the water volume required during the operation of the solar facility would be no more than $18m^3$ per day.

In the past such a small amount of water would have been allocated under Small Industrial Use by means of a General Authorisation. However, since the development area falls within the D81E and D82C quaternary area, a formal water license must be applied for. After various discussions with the Department of Water Affairs (DWA), it was confirmed that the **Water Use Licence Application** (WULA) would only be undertaken by the DWA once the Department of

Environmental Affairs (DEA) have issued the relevant **Environmental Authorisation** (EA) and the proposed project has been approved and selected as a **preferred bidder** by the Department of Energy (DOE).

The Environmental Impact Assessment application can therefore be submitted without a water license; as long as there is confirmation that sufficient water sources are available.

Considering this process, a preliminary investigation was done to make sure there is sufficient water available. The preliminary investigation showed that the two water-source alternatives, namely the onsite boreholes and water from Southern Farms (from Orange River), both have **sufficient capacity** to supply in the water demands of the proposed development. Statistics on the boreholes is shown below.

In their comment on the **Draft Scoping Report** and Engineering Report, **dated 28 June 2012**, the DWA recommended the following:

- A full geo-hydrological study be done, to ensure that the groundwater use will not affect any surrounding groundwater users. This study will be submitted with the water use license application;
- That the existing farm boreholes be fitted with flow meters to measure the volumes of water abstracted (and keep record of such);
- That the water level of the boreholes be monitored on a monthly basis (and records kept);
- That a 24-hour pump test be done on each borehole to determine the amount of water each borehole can deliver (these pump test results must be submitted to the DWA with the WULA); and
- Should the option to use water from Southern Farm be taken, and the proposed pipeline or road alteration / upgrade cross any dry watercourses/drainage lines/ washes, the Water Use Licence Application (WULA) should be supplemented to apply in terms of Section 21(c)&(i) (DW781 Supplementary Form). This application will also be required for the crossings washes/ drainage line by the internal roads network.
- In addition, water used for dust suppression on gravel roads must be of a quality compliant with the General Special Effluent Standards (31/03/2009): Temperature: max.25^{0}C, pH: between 5.5 & 7.5 and conductivity: not be increased more than 15% above the intake water & not exceed 250 milli-Siemens per metre (determined at 25^{0}C). The water used for dust suppression is likely to be borehole water / water from Southern Farms, and not treated effluent. However the water quality standards mentioned will be taken note of.

These recommendations from the Department of Water Affairs have been included in the **Environmental Management Programme**, attached in **appendix E**

As stated in the DWA comments, these requirements will only be applicable once the project has been appointed as a preferred bidder and the application for a water license can be submitted. Regarding water-use, DEA can therefore issue the EA on the conditions that the abovementioned requirements from the DWA will be adhered to.

A copy of the comment from DWA is included in appendix E of the Final Scoping Report. A copy of the water declaration is included in Appendix D (Annexure D2)

2.13 ASTRONOMY GEOGRAPHIC ADVANTAGE ACT, 2007 (ACT NO. 21 OF 2007)

The purpose of the Act is to preserve the geographic advantage areas that attract investment in astronomy. The entire Northern Cape excluding the Sol Plaatjie municipality has been declared an astronomy advantage area.

Comment was received from Dr Adrian Tiplady from South Africa SKA. It is confirmed that the proposed Khoi Sun Solar Project will not negatively impact the SKA project. Certain recommendation's are made and have been included in the Draft EMP.

2.14 SUSTAINABILITY IMPERATIVE

The norm implicit to our environmental law is the notion of sustainable development ("SD"). SD and sustainable use and exploitation of natural resources are at the core of the protection of the environment. SD is generally accepted to mean development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. The evolving elements of the concept of SD *inter alia* include the right to develop; the pursuit of equity in the use and allocation of natural resources (the principle of intra-generational equity) and the need to preserve natural resources for the benefit of present and future generations. Economic development, social development and the protection of the environment are considered the pillars of SD (the triple bottom line).

"*Man-land relationships require a holistic perspective, an ability to appreciate the many aspects that make up the real problems. Sustainable planning has to confront the physical, social, environmental and economic challenges and conflicting aspirations of local communities. The imperative of sustainable planning translates into notions of striking a balance between the many competing interests in the ecological, economic and social fields in a planned manner. The 'triple bottom line' objectives of sustainable planning and development should be understood in terms of economic efficiency (employment and economic growth), social equity (human needs) and ecological integrity (ecological capital).*"

As was pointed out by the Constitutional Court, SD does not require the cessation of socio-economic development but seeks to regulate the manner in which it takes place. The idea that developmental and environmental protection must be reconciled is central to the concept of SD - it implies the accommodation, reconciliation and (in some instances) integration between

economic development, social development and environmental protection. It is regarded as providing a "conceptual bridge" between the right to social and economic development, and the need to protect the environment.

Our Constitutional Court has pointed out that the requirement that environmental authorities must place people and their needs at the forefront of their concern so that environmental management can serve their developmental, cultural and social interests, can be achieved if a development is sustainable. "*The very idea of sustainability implies continuity. It reflects the concern for social and developmental equity between generations, a concern that must logically be extended to equity within each generation. This concern is reflected in the principles of inter-generational and intra-generational equity which are embodied in both section 24 of the Constitution and the principles of environmental management contained in NEMA.*"

In terms of NEMA sustainable development requires the integration of the relevant factors, the purpose of which is *to ensure that development serves present and future generations.*[4]

It is believed that the proposed 75MW (AC) / >90MW (DC). Khoi-Sun Solar Development supports the notion of sustainable development by presenting a reasonable and feasible alternative to the existing vacant land use type, which has limited agricultural potential due the lack of supporting water and infrastructure.

Furthermore the proposed alternative energy project (reliant on a natural renewable resource – solar energy) is in line with the national and global goal of **reducing reliance on fossil fuels**, thereby providing long-term benefits to future generations in a sustainable manner.

2.15 RELEVANT REGULATIONS & GUIDELINES

Amongst others the following environmental Regulations and Guidelines were considered as background to this application:

- Brownlie S (2005). *Guideline for involving biodiversity specialists in EIA processes*. Department Environmental Affairs & Development Planning.
- DWA (2001). *Generic public participation guideline*. Department of Water Affairs and Forestry.
- DEA (2010). *Public Participation*, Integrated Environmental Management Guideline Series 7, Department of Environmental Affairs, Pretoria.
- DEAT (2002). Integrated Environmental Management Information Series 3: *Stakeholder Engagement*. Department of Environmental Affairs and Tourism, Pretoria.
- DEAT (2004). *Criteria for determining alternatives in EIAs*, Integrated Environmental Management, Information Series 11, Department of Environmental Affairs & Tourism, Pretoria.

[4] See definition of "sustainable development" in section 1 of NEMA.

- DEAT (2004). *Environmental management Plans*, Integrated Environmental management, Information Series 12, Department Environmental Affairs & Tourism
- DEAT (2005). *Assessment of Impacts and Alternatives*, Integrated Environmental Management Guideline Series, Department of Environmental Affairs & Tourism, Pretoria.
- DEAT (2005). Guideline 4: *Public Participation*, in terms of the EIA Regulations 2005, Integrated Environmental Management Guideline Series, Department of Environmental Affairs and Tourism, Pretoria.
- DEADP (2003). Waste Minimisation *Guideline for Environmental Impact Assessment reviews.* NEMA EIA Regulations Guideline & Information Series, Department Environmental Affairs & Development Planning.
- DEADP (2005). *Guideline for the review of specialist input in the EIA process*. NEMA EIA Regulations Guideline & Information Document Series, Department of Environmental Affairs & Development Planning.
- DEADP (2005). *Guideline for involving biodiversity specialists in the EIA process*. NEMA EIA Regulations Guideline & Information Document Series, Department of Environmental Affairs & Development Planning.
- DEADP (2005). *Guideline for environmental management plans*. NEMA EIA Regulations Guideline & Information Document Series, Department of Environmental Affairs & Development Planning.
- DEADP (2005). *Provincial urban edge guideline*. Department Environmental Affairs & Development Planning.
- DEAT (2006). *EIA Regulations* in terms of the National Environmental Management Act (Act No 107 of 1998) (Government Notice No R 385, R 386 and R 387 in Government Gazette No 28753 of 21 April 2006).
- DEADP (2006). *Guideline on the Interpretation of the Listed Activities.* NEMA EIA Regulations Guidelines & Information Document Series, Department of Environmental Affairs & Development Planning.
- DEADP (2007 & 2009). *Guide on Alternatives,* NEMA EIA Regulations Guidelines & Information Document Series, Department of Environmental Affairs & Development Planning.
- DEADP (2007 & 2009). *Guideline on Appeals,* NEMA EIA Regulations Guidelines & Information Document Series, Department of Environmental Affairs & Development Planning.
- DEADP (2007 & 2009). *Guideline on Exemption Applications.* NEMA EIA Regulations Guidelines & Information Document Series, Department of Environmental Affairs & Development Planning.
- DEADP (2010 & Oct 2011). *Guideline on Generic Terms of Reference for EAPs and Project Schedules,* NEMA EIA Regulations Guideline and Information Document Series, Department Environmental Affairs & Development Planning.
- DEADP (2010 & Oct.2011). *Guideline on Need & Desirability,* NEMA EIA Regulations Guideline and Information Document Series, Department Environmental Affairs & Development Planning.

- DEADP (2010 & Oct 2011). *Guideline on Alternatives*, NEMA EIA Regulations Guideline and Information Document Series, Department Environmental Affairs & Development Planning.
- DEADP (2010 & Oct 2011). *Guideline on Transitional Arrangements,* NEMA EIA Regulations Guideline and Information Document Series, Department Environmental Affairs & Development Planning.
- DEADP (2010 & Oct 2011). *Guideline on Exemption Applications*. NEMA EIA Regulations Guideline and Information Document Series, Department Environmental Affairs & Development Planning.
- DEADP (2010 & Oct 2011). *Guideline on Appeals*. NEMA EIA Regulations Guideline and Information Document Series, Department Environmental Affairs & Development Planning.
- DEADP (2010 & Oct 2011). *Guideline on Public Participation*. NEMA EIA Regulations Guideline and Information Document Series, Department Environmental Affairs & Development Planning.
- Keatimilwe K & Ashton PJ (2005). *Guideline for the review of specialist input in EIA processes.* Department Environmental Affairs & Development Planning.
- Lochner P (2005). *Guideline for Environmental Management Plans*. Department Environmental Affairs & Development Planning.
- Munster F (2005). *Guideline for determining the scope of specialist involvement in EIA processes.* Department Environmental Affairs & Development Planning.
- Oberholzer B (2005). *Guideline for involving visual & aesthetic specialists*. Department Environmental Affairs & Development Planning.
- Winter S & Beaumann N (2005). *Guideline for involving heritage specialists in EIA processes.* Department Environmental Affairs & Development Planning.

3 NEED & DESIRABILITY OF THE ACTIVITY

The supply of electricity in South Africa has become constrained, primarily because of insufficient generation capacity, but also due to constraints on the transmission and distribution of electricity. Considering this situation and the impact that carbon emissions from existing (and future) coal-fired power stations have on the environment (Climate Change), this **renewable energy project** will contribute to the generation of 'clean' or so-called 'green' electricity for input into the national grid to augment Eskom's power supply.

The South African Government has set a 10 year cumulative target for renewable energy 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 power (White Paper on Renewable Energy Policy, 2003). This amounts to approximately 4% (1667MW) of the total estimated electricity demand (41 539MW) by 2013. The majority of this power will be generated by Eskom. However, in order to meet the increasing power demand within the country, Eskom has set a target of 30% of all new power generation to be derived from **independent power producers** (IPPs).

Khoi-Sun Solar Development (Pty) Ltd is one such IPP which intends to generate electricity from the proposed **Khoi-Sun Solar Development**. This will contribute to South Africa's commitment to the Convention on Climate Change through emission-free generation of electricity and working towards an investor-friendly climate in the energy sector.

In keeping with the requirements of an integrated Environmental Impact process, the DEA&DP *Guidelines on Need and Desirability (2010 & 2011)* were referenced to provide the following estimation of the activity in relation to the broader societal needs. The concept of need and desirability can be explained in terms of its two components, where ***need* refers to *time*** and ***desirability* refers to *place***. Questions pertaining to these components are answered in Sections 3.2 and 3.3 below.

Section 3.4 considers the **overall need for alternative**, so-called 'green energy' in light of the known environmental burdens associated with the impact of coal power generation through which most of our country's electricity is currently being generated. Associated aspects such as air pollution, water use and carbon tax are discussed in order to further explain the need and desirability for 'green energy' projects in general.

3.1 FEASIBILITY CONSIDERATION

The commercial feasibility for the proposed 75MW (AC) / >90MW (DC) Khoi-Sun Development to be built on private land near Kakamas, has been informed by its contextual location, and economic, social and environmental impacts and influence. The project has gathered sufficient information and conducted studies of the site and the region to make qualified and reliable assumptions on the project's various impacts.

3.1.1 Solar Resource & Energy Production

The arid climate experienced in the Northern Cape lends itself to the availability of high levels of solar energy. Considering the steady nature of the solar radiation at the Khoi-Sun site, the resource is sufficient to guarantee a positive return on investment.

3.1.2 Solar Farm & Grid Connection

Among the outstanding characteristics of the Khoi-Sun Development site is its exceptionally flat nature and accessible location, facilitating the delivery of bulky PV Panel infrastructure, and the construction and assembly process.

The proximity of the existing Schuitdrift Substation also allows for connection via a short transmission line. As the site is not used for extensive agricultural purposes, the solar facility will not interfere with the agricultural productivity of the area and the large remainder of the Farm 426 will still be available for agricultural activities.

3.1.3 Social impact

The Northern Cape region is economically challenged due to its arid climate, challenging agricultural conditions, lack of water and limited natural resources (away from the Orange River).

The Northern Cape is well-known for the large number of copper and zinc mines in the area, but since the early 1990's, many of these mines have closed down, leaving a devastating trail of unemployment behind. The local economy, mainly supported by limited agriculture, simply isn't enough to accommodate the high level of unemployment.

The population for the Kai! Garib Municipality was estimated at **27 955 people** with Kakamas, the second largest centre with an estimated 7303 residents (Kai! Garib SDF, October 2012)

Power generation is one of the rare growth opportunities for the Northern Cape due to the high solar irradiation levels and its strategic position relative to the National Transmission Network. According to the Kai! Garib SDF (October 2012) the Gross Domestic Product (GDP) in the municipality for Electricity has increased from R7.51mill in 1995 to R20.46,mill in 2010.

This setup creates growth opportunities for the area and the establishment of a **renewable energy project is considered essential to the economic development of the region**.

3.1.4 Employment & Skills Transfer

The benefits of renewable energy facilities to local regions are not confined to the initial investment in the project. They also provide a reliable and on-going income for landowners and municipality, creating direct employment opportunities for locals, as well as flow-on employment for local businesses through provision of products and services to the project and its employees.

The Khoi-Sun Development will have a significant impact on local employment. During the estimated 18 month construction phase, the project will **employ approximately 40-50 people** of various qualifications. The majority will be provided by the local labour market. During operations, the solar facility is expected to have **6-10 permanent employees** ranging from security staff to administration and artisans.

Due the fact that there is no skilled labour in the field of renewable energy as yet, the employment structure will consist of local and overseas capacity. To guarantee successful operations over the lifetime of the investment, the Khoi-Sun Development will use the skills of outside labour to **cross-train local specialists**. This cross training and skills development will take place especially in the area of technical maintenance and administration.

The economic impact of the proposed Khoi-Sun Development reflects expenditures related to the construction and operation. These activities will increase economic activity within the region and province.

3.2 NEED (TIME)

Is the land use considered within the timeframe intended by the existing approved Spatial Development Framework (SDF)? (I.e. is the proposed development in line with the projects and programmes identified as priorities within the credible IDP?

Yes, the Kai! Garieb SDF (October 2012) specifically makes provision for specific spatial planning categories for renewable energy structures and includes:

Any wind turbine or solar voltaic apparatus, or grouping thereof, which captures and converts wind or solar radiation into energy for commercial gain irrespective of whether it feeds onto an electricity grid or not. It includes any appurtenant structure or any test facility which may lead to the generation of energy on a commercial basis.

Should the development occur here at this point in time?

Yes, the proposed Khoi-Sun Development is to be located outside the Kakamas urban edge, within a low output farming area. Considering that the proposed Khoi Sun Development is situated in an area with very few economic drivers, the solar facility would provide a welcomed diversification to the local economy and perhaps serve as a catalyst for further expansion in the stream of sustainable renewable energy development. A smaller 10MW solar facility (The Scuitdrift solar Project) has been authorised on the same property and directly adjacent to this proposal. This project thus considers the centralisation of infrastructure for electricity development in close proximity the required grid connection points.

Does the community / area need the activity and the associated land use concerned?

The community has not indicated any objection to the proposed project throughout the course of the environmental process to date.

The proposed renewable energy development will allow for a diversification of employment, skills and contribute to the potential development of small business associated with its construction, operation and maintenance (and that of other renewable energy projects proposed in the area around the Scuitdrift Substation).

From the location near Kakamas, the proposed solar farm will contribute electricity to the constrained Northern Cape and national electrical network, contributing to a provincial and national need. The Khoi Sun solar project has been designed to in such a way as to avoid or minimize potential negative impacts of the local environment while enhancing potential positive impacts, locally and regionally.

Are the necessary services with adequate capacity currently available?

Some existing services are in place, however some new services will be required.

The proposed Khoi Sun Development is directly adjacent to the existing Scuitdrift Sub Station and thus has easy access the National Grid.

The Khoi-Sun Development requires the installation of a 132kV overhead transmission line of approximately 200m to connect to the existing Schuitdrift substation (feed into the national grid system),

The water required for the construction and operation of the solar facility will be sourced from existing water resources (boreholes – supplemented by stored rainwater). An alternative to source water from Southern Farms is available for consideration should the borehole pump tests indicate insufficient capacity (this will be considered as part of a Water Use License Application and will only take place if the Khoi Sun Project is selected as a preferred bidder).

Construction waste will be disposed of at the existing Kakamas landfill site.

Is this development provided for in the infrastructure planning of the municipality?

Not Applicable. The infrastructure planning around the bulk distribution of electricity is controlled by ESKOM and not the local municipality.

There is currently an excess capacity of 75MW available at the Scuitdrift Eskom substation when connecting to the 132kV busbar or 10MW when connecting to the 33kV busbar without any alterations of the substation's existing infrastructure necessary.

Scuitdrift sub station is supplied from Paulputs substation, which is equipped with a 125MVA 220/132kV transformer. Currently 110MW has been allocated to the Independent Power Producer Procurement Programme (IPPPP) phase 1 preferred bidders. Depending on the allocation of preferred bidders in IPPPP phase 2, Paulputs might require strengthening to accommodate additional generation which might require a second transformer being installed. The necessity for any of these upgrades can only be determined after allocation of the preferred bidders from the phase 2 bidding process.

Is this project part of a national programme to address an issue of national concern or importance?

Yes. In order to meet the increasing power demand within South Africa, Eskom has set a target of 30% of all new power generation to be derived from independent power producers (IPPs). Khoi-Sun Development (Pty) Ltd. is one such IPP which intends to generate not exceeding 75MW (megawatts) of Alternating Current (AC) / >90MW of Direct Current (DC) electricity from

the proposed Khoi-Sun Development, for input into the national grid (Schuitdrift Eskom substation connection).

3.3 DESIRABILITY (PLACE)

Is the development the best practicable environmental option for this land / site?

The target property is far outside the Kakamas Urban Edge and as such may not be considered for an alternative land use such as urban development. The property has a poor agricultural potential due to excessive overgrazing in the past coupled with the arid climate. These factors have rendered the property vacant with only limited land use options. Since Photovoltaic solar facilities have a limited footprint, the physical impact on receiving environment would be low, while the remaining undeveloped areas may rehabilitate to their natural state in time and remain protected as such.

Would the approval of this application compromise the integrity of the existing approved and credible municipal IDP and SDF?

No. The Kai! Garieb SDF (October 2012) identifies the N14 Corridor between Upington and Kakamas as the centre of solar development in the area.

Would the approval of this application compromise the integrity of the existing approved environmental management priorities for the area?

Unlikely. According to the national vegetation map (Mucina & Rutherford 2006), the site lies within the **Blouputs Karroid Thornveld** vegetation type. Blouputs Karroid Thornveld occurs as a belt of irregular flat areas from the vicinity of Augrabies Falls in the east to Kotie se Laagte and Samoep se Laagte in the west. The vegetation type is listed as **Least Threatened** and **less than 1% has been transformed**. **It is well conserved (27%) within Augrabies Falls National Park**. At 607 km^2 it is however the smallest mapped vegetation unit within the Nama Karoo Biome.

Other vegetation types which occur in the vicinity of the site include **Lower Gariep Broken Veld**, **Bushmanland Arid Grassland** and along the banks of the Orange River, Lower Gariep Alluvial Vegetation. Lower Gariep Broken Veld and Bushmanland Arid Grassland are also classified as **Least Threatened** and have been little impacted by transformation.

Lower Gariep Alluvial Vegetation is however classified as **Endangered** on account of the high degree of transformation it has experienced. This vegetation is however restricted to the banks of the Orange River and **would not be affected by the development**.

Do location factors favour this land use at this place?

Yes. The Northern Cape region has been identified as being one of the most viable for Solar energy generation due to the following factors:

- Excellent solar radiation (compared to other regions).
- Close to existing main transport routes and access points.
- Close to connection points to the local and national electrical grid.
- Outside Critical Biodiversity areas.

The ecological sensitive areas on and surrounding the solar site have informed the optimal location and layout for the proposed solar project, with minimal impact to the receiving environment, subject to implementation of mitigation measures.

How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas?

The alternatives considered for the solar development have been iteratively designed and informed by various investigations and assessments that considered both the natural and cultural landscapes. The natural and cultural sensitive areas have been identified and where possible, avoided to prevent negative impacts on such areas.

How will the development impact on people's health and wellbeing?

The site is located far outside of the Kakamas urban edge and as a result is unlikely to impact negatively on the community's health and wellbeing. More specifically, due to the remote nature of the site, visual impact is deemed to be negligible.

Civil Aviation Authority has confirmed that they have no objection (as the proposed solar facility will not impact on any aviation routes).

Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?

Unlikely. The next best land use alternative to the solar facility is limited agriculture (the status-quo). However, the proposed solar development site does not have any significant agricultural value, is in a degraded state due to overgrazing and has not been utilized for any extensive agricultural purposes for many years.

The site is too small to generate noteworthy financial benefit from agricultural activities. The development of the proposed solar facility would constitute the loss of less than 250ha of the overall approximate 9 800ha property area (less than 2.5%), which will not have a significant impact on the agricultural potential of the farm.

The economic benefits and opportunities that the proposed solar development holds for the landowner and the local economy of Kai! Garieb municipal area cannot be recovered from the current or potential agricultural activities.

The opportunity costs in terms of the water-use requirements of the solar facility are within acceptable bounds if one considers the confirmed borehole water availability and minimal demand on the resources.

Will the proposed land use result in unacceptable cumulative impacts?

There are already a number of on-going applications in the region. The potential for further, future solar developments near the site cannot be discounted and in fact a smaller 10Mw project has also been authorised on the same property.

The cumulative impacts of this facility along with others (authorised and future planned) in the area may result in benefits for the economy and growth of the area, while the contribution to cumulative habitat loss in the area associated with this and potential future solar development can be managed through proper planning (strategic location, avoidance of sensitive habitats etc), and therefore would be relatively small in relation to the land resources available, with low impacts restricted to the local area.

3.4 IMPACTS OF COAL-POWER (ALTERNATIVE TO RENEWABLE ENERGY)

South Africa, estimated to have produced **244 million tons of coal in 2006**, is ranked as the world's sixth largest hard coal producer, behind China, the USA, India, Australia and Russia. Eskom, the national power utility, is in the process of returning to service three coal-fired power stations (Camden, Grootvlei and Komati) with a combined capacity of 3,800 megawatts (MW). It has also begun construction of the new 4,800 MW Medupi power station, whose first unit was due to begin generation in 2012, while the Kusile power station (5,400 MW), is scheduled to start generating power in 2013. The combined consumption of these five power plants could raise Eskom's coal use by over **50 million tons**, assuming they use the average amount of coal burned by existing power stations in 2007.

South Africa's **emissions** from coal are **significant**, as the country's energy supply is heavily dependent on coal. In 2005, it was estimated that coal-fired power stations accounted for approximately **93%** of South Africa's electricity. If current building plans are go ahead, the growth in coal use – especially by Eskom and Sasol – is expected to continue or even accelerate over the next few years.

The True Cost of Coal - Besides its huge **impact on the climate** (Climate Change), everything related to the mining, combustion and waste disposal of coal, and each activity in between, has a devastating impact on people's health, on local communities and on the environment. One of these impacts is **Acid Mine Drainage** (AMD), water draining from the mines filled with sulphate salts, heavy metals and carcinogenic substances (like benzene and toluene). There are

hundreds of unused, abandoned coal mines in the Northern Cape and around South Africa. This AMD damages wildlife and spreads illness and disease. According to the Department of Water Affairs and Forestry, coupled with failing sewage works, **AMD also poses the biggest threat to the quality of South Africa's limited water resources**.

Furthermore, coal-fired power generation is a **very water intensive industry**. In a region that is already water stressed, and likely to become more so according to the latest climate models, future water conflicts between power generation, agriculture and people could become very common in the future.

The potential negative impacts are associated with this alternative energy project are minimal and incomparable to the impact magnitude associated with as coal production.

3.4.1 Water use

Eskom is a large consumer of freshwater in South Africa, accounting for approximately **1.5%** of the country's **total water consumption** annually. Eskom power stations run constantly, supplying in excess of 95% of South Africa's electrical energy and more than half of the electricity used on the African continent. Without water, this output would not be possible.

Eskom uses raw water, which is put through extensive purification and treatment before entering the production processes. The salinity of the raw water dictates the volume of effluents that are produced during the treatment process. During 2005 (April 2005 to March 2006) Eskom used approximately **292 million cubic metres of water** for electricity generation, mainly at its coal-fired power stations.

The water catchment areas in which many of Eskom's power stations were built are relatively water scarce, necessitating the need for **inter-basin transfers** (and their associated Impacts). Over the years, various water supply schemes have been constructed to supply the necessary water to the power stations. These schemes consist of dams, pipelines, pumping stations and reservoirs and are inter-linked and operated as a system (Reduction in water consumption, Eskom).

Photovoltaic (solar) energy facilities require **minimal water** during **construction** and **maintenance** (cleaning of panels), and **no water to generate electricity**. Considering that South Africa, and particularly the Northern Cape, is known as a water scarce region, the option of photovoltaic energy generation is favourable one.

The Khoi-Sun Development will use little water in comparison to other methods of electricity generation.

3.4.2 Carbon tax – an additional burden

Eskom's unstable financial position, attributed to its declining reserve position, increased power usage, inadequate coal supply infrastructure and the delay in finalising its funding model, could be exacerbated by a carbon tax, should its dependence on coal persist. This environmental tax on emissions of carbon dioxide is designed to penalise polluters, and could financially burden Eskom, South Africa's single biggest polluter (NERSA electricity policy pricing briefing, Sept. 2009).

Eskom emitted about **221-million tons** of **carbon dioxide** in the 2009 financial year, through its coal-fired power stations. "However, coal reserves adjacent to certain plants are running out, which has caused an increase in the amount of coal now being transported over long distances to each plant. The costs associated with this, including road maintenance, have risen astronomically over the past two years," he said. In response, Eskom advocates that the global financial crisis had frustrated its plans to invest in expensive technologies that emit less carbon (NERSA electricity policy pricing briefing, Sept. 2009).

Alternative energy projects all over the world are being used to off-set carbon emissions through a system of carbon credits in an attempt to promote 'green' energy as a more sustainable resource. As the potential and viability of renewable energy is realised in South Africa, the burden of carbon tax may diminish.

The Khoi-Sun Development project is one such project aimed at contributing 'green energy' into the Northern Cape's electricity network.

In addition to the need to consider the 'need and desirability' of the project, it must also be measured in terms of relevant policy and planning requirements as well. The following section provides a broad overview of the policies that may be applicable and that must be reflected on when considering this application.

4 RENEWABLE ENERGY POLICY & GUIDELINES

The decision to expand South Africa's electricity generation capacity is based on **national policy** and informed by on-going strategic planning undertaken by the national Department of Minerals & Energy (DME), the National Energy Regulator of South Africa (NERSA) and Eskom Holdings Ltd. (as the primary electricity supplier in South Africa). "The entry of multiple players into the generation market will be encouraged (NERSA to set tariffs, basis full avoided cost)" (White Paper on Energy Policy (1998).

The following policies and guidelines are considered relevant to the generation of energy from renewable resources in a sustainable manner.

4.1 UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCC)

South Africa signed the UNFCC in 1994, indicating that it intended to follow the procedures to become bound by the Convention (by ratifying the Convention). The Convention is called a framework convention because it is seen as a starting point of addressing the problem of climate change. This means that the Convention is not specific, but reflects a broad consensus in establishing institutions and procedures for further defining and approaching climate change. The Convention is therefore an evolutionary document, which will be expanded upon by protocols such as the Kyoto Protocol, which was adopted in 1997. Protocols are usually separate legal instruments that are not strictly subject to the Convention. The protocols will therefore have their own Parties and ratification processes.

4.2 THE KYOTO PROTOCOL

Climate change, as a result of human activities, is one of the most serious global environmental problems facing the world today. The international community agreed to address this problem in a global manner by drafting the United Nations Framework Convention on Climate Change and the subsequent Kyoto Protocol.

The Kyoto Protocol was adopted at a Conference of the Parties to the UNFCCC in Kyoto, Japan in December 1997. The conference resulted in a consensus decision to adopt a protocol under which industrialised countries will reduce their combined greenhouses gas emissions. This legally binding commitment promised to produce an historical reversal of the upward trend in emissions that started in these countries some 150 years ago. In developing the Kyoto Protocol, the Parties to the UNFCC took into consideration the need to promote sustainable development by implementing policies and measures to, among others, enhance energy efficiency, protect and enhance sinks and reservoirs of greenhouse gases, promote sustainable forms of agriculture, increase the usage of new and renewable forms of energy and of advanced and innovative environmentally sound technologies.

By ratifying the Convention (in 1997) South Africa is obliged to perform certain emission reducing activities, which have indirect consequences for sectors such as trade, economic development, agriculture, mining, energy, transport and the environment generally. As a signatory to the Convention and Protocol South Africa needs a co-ordinated and holistic national strategy.

4.3 INTERNATIONAL FINANCE CORPORATION (IFC) ENVIRONMENTAL, HEALTH & SAFETY (EHS) GUIDELINES (WORLD BANK, 2007)

The IFC Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). Of particular interest for this project are the EHS Guidelines for Electric Power Transmission and Distribution. These industry sector guidelines are designed to be used together with the General EHS Guidelines, which provide guidance on EHS issues potentially

applicable to all industry sectors. These sets of Guidelines will be considered by the Project Developers.

4.3.1 EHS Guidelines for Electric Power Transmission & Distribution

The electricity generated by the proposed Khoi-Sun Development is to be transmitted via a new overhead line (approximately 200m) to the existing Schuitdrift Substation (directly adjacent the solar site). The EHS guidelines for electrical transmission and distribution highlight the environmental issues applicable to the construction of power transmission and distribution projects and include the following:

- Terrestrial habitat alteration: Construction of, and maintenance of, Right-of-Way; Fires & Avian and Bat Collisions and Electrocutions;
- Aquatic habitat alteration;
- Electric and magnetic fields; and
- Hazardous materials: Insulating Oils and Fuels; Wood Preservatives & Pesticides.

4.4 WHITE PAPER ON ENERGY POLICY OF THE REPUBLIC OF SOUTH AFRICA (DME, 1998).

This is the Government's overarching policy with regards to energy generation, transmission and distribution.

4.4.1 The White Paper on Renewable Energy (DME, 2003)

This Paper supplements the above Energy Policy, which recognises the significance of renewable energy potential. The Constitution (Act No. 108 of 1996) requires that Government establish a national energy policy to ensure that national energy resources are adequately tapped and delivered to cater for the needs of the nation; further, the production and distribution of energy should be sustainable and lead to an improvement in the standard of living of citizens. This Paper sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. It also informs the public and the international community of the Government's vision, and how the Government intends to achieve these objectives; and informs Government agencies and organs of their roles in achieving the objectives.

4.4.2 National Climate Change Response Green Paper 2010

This document describes South Africa's climate change response objective as – making a fair contribution to the global effort to achieve the stabilisation of greenhouse gas concentrations in the atmosphere; and effectively adapt to and manage unavoidable and potential damaging climate change impacts through interventions that build and sustain S.A's social, economic and environmental resilience and emergency response capacity. It further outlines the achievement strategies and specifically, the proposed implementation plan of various policy approaches and

actions for key climate change impacted and/or affected sectors, as well as the roles and responsibilities associated with these. The key sectors described, include water, agriculture, human health, energy, industry (commerce & manufacturing, mining & mineral resources, tourism), transport and disaster risk management; as well as natural resource sectors (terrestrial biodiversity, marine biodiversity, commercial forestry fisheries) and human society, livelihoods and services sectors (human settlements, infrastructure and the build environment).

4.4.3 Integrated Resource Plan (IRP) for Electricity 2010

The objective of the IRP is to develop a sustainable electricity investment strategy for generation capacity and transmission infrastructure for South Africa over the next twenty-five years. The investment strategy includes implications arising from demand-side management (DSM) and pricing, and including capacity provided by all generators (Eskom and independent power producers). The IRP is intended to:

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

The primary objective of the Integrated Resource Plan (IRP 2010) is to determine the long-term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing and cost. However, the IRP 2010 also serves as input to other planning functions, *inter alia* economic development, funding, environmental and social policy formulation. The accuracy of the IRP is improved by regular reviews and updates as and when things change or new information becomes available. For this reason, all long-term plans should be considered as indicative rather than "cast in concrete" plans.

4.4.4 NERSA – Rules on selection criteria for renewable energy projects under the REFIT Programme.

In terms of regulation 7 of GN R. 721 GG No. 32378 of 5 August 2009 (Electricity Regulation Act No.4 of 2006: Electricity Regulations on New Generation Capacity), the National Energy Regulator of South Africa ("NERSA") is required to issue rules relating to the selection of renewable energy or co-generation Independent Power producers (IPPs) that qualify for licences under the REFIT Programme, based on the following considerations:

(a) compliance with the integrated resource plan and the preferred technologies;

(b) acceptance by the IPP of a standardized power purchase agreement;

(c) preference for a plant location that contributes to grid stabilisation and mitigates against transmission losses;

(d) preference for a plant technology and location that contributes to local economic development;
(e) compliance with legislation in respect of the advancement of historically disadvantaged individuals;
(f) preference for projects with viable network integration requirements;
(g) preference for projects with advanced environmental approvals;
(h) preference for projects demonstrating the ability to raise finance;
(i) preference for small distributed generators over centralized generators; and
(j) preference for generators that can be commissioned in the shortest time.

In line with the established Regulations the System Operator will initiate a solicitation process for renewable energy projects eligible for the REFIT programme based on the selection criteria outlined in the document. The proposals that score the highest score will enter into power purchase agreement (PPA) with the buyer, provided that the project obtains a generation licence by NERSA. One of the key criteria for qualifying renewable energy technologies under REFIT is compliance with the Integrated Resource Plan that is approved by the Minister of Energy.

4.4.5 IPP Procurement Programme (August 2011)

The South African government formally launched the long-awaited process to procure new renewable energy generation capacity, having published an advertisement for a request for qualifications and proposals end July 2011. The Department of Energy (DoE) invited potential developers to submit proposals for the financing, operation and maintenance of renewable energy facilities. This Request for Qualification and Proposals (RFP) was released on the 3rd August 2011 and constituted the formal invitation to IPP Bidders to submit their detailed Bid Responses for the supply of Energy to the Buyer, generated from new Renewable Energy power generation Facilities, following the Determination. That is to say that successful bidders would enter into a PPA implementation agreement with the DoE, as mentioned above.

According to the Electricity Regulation Act, the Minister of Energy determined that 3725 megawatts (MW) of energy is required to be generated from Renewable Energy sources. The Independent Power Producer (IPP) Procurement Programme was designed to procure the 3725MW and to contribute towards socio-economic and environmentally sustainable growth, job creation and to stimulate the renewable energy industry in South Africa (Fact Sheet for Media Briefing, 31 August 2011).

Khoi-Sun Development (Pty) Ltd. is one such IPP which will be required to bid on tariff and the identified socio-economic development objectives of the DoE. Selection criteria for Bidders include technical feasibility and grid connectivity, as well as environmental acceptability, black economic empowerment, community development and local economic and manufacturing propositions. Projects able to comply with these selection criteria will be assessed on the proposed sale price of the power producer. In other words, the renewable energy feed-in tariffs

(Refit) promulgated by NERSA in 2009 will not be deployed, but will be used as a "ceiling" price for any Bid (Creamer, 2011).

The Applicant intends to submit a Bid Response for the Khoi-Sun Development project in the 3rd bidding window (7 May 2013) within the IPP Procurement Programme. This environmental process has, and will continue to strive to comply with the necessary environmental and land use consents required as part of the qualification criteria for this bidding process. These are summarised in the table below:

Table 3: IPP Procurement Programme Environmental & Landuse Requirements for Khoi-Sun Development

Environmental Consent	*Compliance*
Notification to SAHRA & the Northern Cape Heritage Resource Authority (NCHRA) Ito: National Heritage Resource Act (25 of 1999).	**Done.** Registration of & notifications to SAHRA & NCHRA as part of the environmental process. Undertaking of a Heritage Impact Assessment. SAHRA **approved** the proposed solar project in their letter dated 11 July 2012.
Heritage Approval Ito: NHRA	***Received.*** Record of Decision from SAHRA is included in appendix F of this document.
Environmental Authorization Ito: NEMA (Act 107 of 1998, as amended)	***Pending.*** Environmental process on-going: in Environmental Impact Assessment Phase. • Application to DEA accepted • Draft Scoping Report reviewed by public and relevant stakeholders • Final Scoping Report accepted by DEA on 25 September 2012. • Draft Environmental Impact Report is made available for public review & comment 05 November 2012 to 15 December 2012. • Final Environmental Impact Report to be submitted to DEA in January 2013.
Consent of Minister of Agriculture to register long lease Ito: Subdivision of Agricultural Land (Act 70 of 1970)	***Pending*** Mashudu Marubini and Thoko Buthelezi of the National Department of Agriculture and N.J. Toerien, Cynthia Fortune and Leon October of the Provincial Department of Agriculture are registered as key stakeholders in the environmental process and have been provided with an Agriculture Potential study and all necessary reports of the proposed solar farm. Mr. Toerien has indicated **no objection** to the development provided the provisions of CARA are met (project will require NO alteration to or draining of wetlands, marshes or water sponges on agricultural land). • The relevant Application to Register a Long-term Lease on Agricultural Land has been submitted to the Department of

	Agriculture in August 2012.
Re-zoning from Agricultural Land to Special Zone Ito: Northern Cape Planning Development Act (Act 7 of 1998).	***Pending.*** The relevant Application Re-zoning of Agricultural Land to Special Zone for the purposes of a renewable energy development has been submitted to the local Authority (Kai! Garieb Municipality) and the Department of Agriculture.
Biodiversity Consents Ito: NEM:BA (10 of 2004) NVFFA (101 of 1998) NFA (84 of 1998) NPAES (2010) Northern Cape Nature Conservation Act (NCNCA, 9 of 2009) Nature Environment & Conservation Ordinance (19 of 1974)	***Considered in terms of the on-going NEMA Application:*** The Northern Cape Department of Environmental Affairs & Nature Conservation, the Department of Agriculture, Forestry & Fisheries and South African National Parks (Augrabies National Park & head office) have been registered as key stakeholders in the environmental process. The preferred technological and layout alternative accommodates and/or mitigates ecological sensitivities on site covered by these Acts and the concerns raised by these bodies, and the EMPr provides further guidance to minimise potential impacts.
Aviation Consents Ito: Civil Aviation Act	***RECEIVED – no objection*** Chris Isherwood of the South African Civil Aviation Authority (SACAA) was registered as key stakeholder in the environmental process, and has confirmed that CAA has **no objection** to the proposed solar facility.
Water Use Authorisation from Department of Water Affairs Ito: National Water Act (Act 36 of 1998)	***Pending.*** The required Water Use Licence Applications for the use of the on-site and adjacent farm boreholes will be submitted to the Department of Water Affairs (DWA) should Environmental Authorisation be granted. Recommendations provided by DWA have been included in this EIR and EMPr for implementation.
Local Authority Consents Ito: Municipal Bylaws National Building Standards Act	***Pending.*** The Municipal Manager and relevant Ward Councillors for the Kai! Garieb Municipality have been registered as Interested & Affected Parties in the environmental process. No comment received to date. Detailed **Building Plans** for the on-site substation and auxiliary buildings will be submitted to the Kai! Garib Municipality should Environmental Authorisation to granted.
Water Use Authorisation Ito: Water Services Act (108 of 1997)	***Pending.*** To be concluded only if the Khoi Sun project is considered as a preferred bidder as part of the IPPPP process.

5 ACTIVITY

The following is provided as background to better understand the design of a typical Photovoltaic solar panel structure as it is described and referred to throughout the remainder of this report.

A solar *'array'* consists of a number of *'panels / modules'* that in turn is made up of hundreds of small individual *'cells'*. Individual arrays (20m to 200m in length) are then grouped into rows, arranged in series, which make up the bulk of what one sees as a solar facility. Arrays are mounted on aluminium frames that are rammed into the soil to keep them in an upright and stable position.

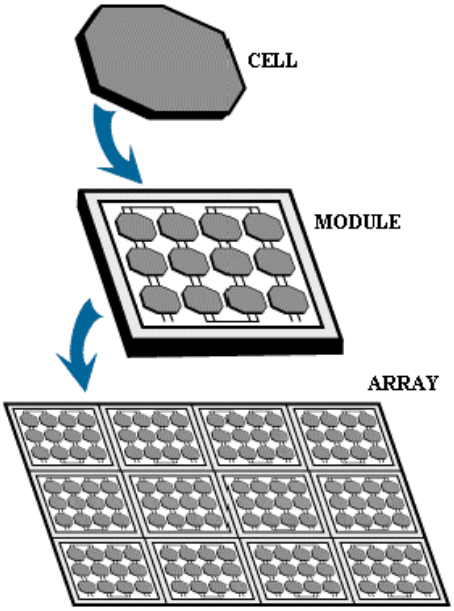


Figure 4: Diagrammatic representation of a typical PV structure panel.

5.1 DESIGN PROCESS

Since the submission of this Application to DEA, there have been several technological and layout changes made to the proposed Khoi-Sun Development. As part of the scoping phase, potential sensitive areas were identified through reference to the biodiversity spatial planning from the area (regional), as well as by the various specialist baseline studies and through the initial stakeholder engagement (site-specific constraints).

These 'constraints' have informed the incremental adjustment and revision of the solar development proposal, layout details and the associated infrastructure (roads, overhead power lines, sub-stations, grid connections etc.), to ensure that it avoids areas of high environmental sensitivity as far as possible.

The final changes and/or modifications to the proposed development will be further informed and adjusted by inputs and feedback gathered from the project team and the public throughout the remainder of the process.

5.2 ACTIVITY DESCRIPTION

The Applicant intends to develop a **solar energy facility** with a feed-in capacity not exceeding **75MW** (Megawatt) Alternating Current (AC) / >90MW Direct Current (DC). The proposed Khoi-Sun Development is to be located on farm 426 Skuitdrift, Northern Cape, and will consist of the following:

The Khoi-Sun Development is to consist of **multi-crystalline / thick-film modules** as part of a **Photovoltaic System (PV)**, mounted onto **single-axis tracker arrays**, which use an east-west **tracking system** to follow the sun's movement throughout the day.

The **tracker arrays are to be approximately 2m (not exceeding 3m) in height and arranged in a series of rows, spaced approximately 5m apart** to avoid shading each other, while minimizing the footprint of the facility. The tracker array rows will be between 50 and 200m in length and be **oriented at a tilt, facing approximately North**, to maximize annual solar energy yield.

The total solar facility, including tracker spacing and associated infrastructure, will occupy a **footprint of approximately 250 hectares.**

Associated infrastructure, with an approximate footprint of 13ha, will typically include the following:

- approximately **75 x inverter stations** (built within transport containers of approximately 25m²);
- an **on-site substation** (approximately 20m x 20m)(including a feed-in transformer to allow the generated power to be connected to Eskom's electricity grid);
- an overhead **transmission power line** to distribute the generated electricity from the on-site substation to the existing Schuitdrift Eskom substation (approximately 200m to the south-east);
- **auxiliary buildings**, including:
  - administration / office & security (gate house),
  - control room & workshop,
  - visitor centre,
  - ablution / change room and
  - warehouse / storeroom.
- a **laydown area** of approximately 3ha;
- an **internal electrical reticulation network** (underground cabling);
- an **access road** and **internal road / track network**;
- 10 x 10kLt **rainwater tanks;** and
- electrified **parameter fencing** around the solar facility.

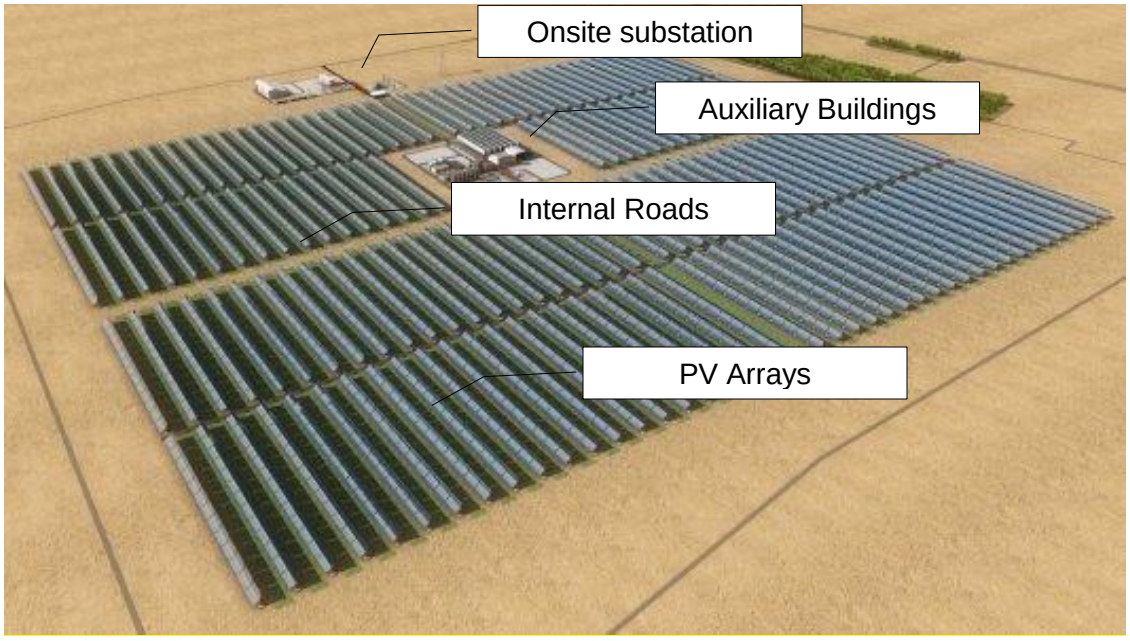


Figure 5: A typical layout of the components of a Solar PV facility (Source: Solek Engineering Report, 2012).

The 75MW (AC) / >90MW (DC) Khoi-Sun Development will occupy approximately 250ha of land – the estimated portion of land each component will typically occupy summarised in table below:

Table 4: Component / area summary of Khoi-Sun Development

Component	Estimate extent of the 75MW plant	Percentage of selected area (less than 250ha)	Percentage of whole farm (±9800ha)
PV Arrays	230 ha (2 km^2)	90%	less than 2.5%
Internal Roads	12 ha (0.12 km^2)	6%	less than 0.2%
Auxiliary Building Area	1 ha (0.01 km^2)	0.5%	less than 0.02%

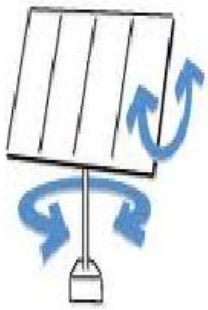
5.3 TECHNOLOGICAL ALTERNATIVES

Photovoltaic (PV) solar power technology has been identified as the preferred technology to generate electricity in this project. Several alternate options in terms of this specific solar technology have been considered. These alternatives can be grouped in terms of fixed/tracking, mounting and film alternatives.

5.3.1 Fixed & Tracking Alternatives

Fixed-tilt / stationary solar technology was initially considered for this Solar Development where the Solar PV modules would be fixed to the ground in a specific north facing angle and consist of no moving parts. Although this type of technology is less expensive than tracker technology, it has been excluded as it has a much lower energy yield, due to the limited exposure to sun radiation.

D*ouble axis tracking systems* were also investigated for this project, due to the high yield and efficient operation of the technology. Systems incorporating this technology are very effective due to the sun being tracked in more than one axis. This allows maximum radiation over the entire solar module.



Figures 6 & 7: Double axis PV tracking systems (Solek Layout Report, 2012)

As can be seen from the above figures, **a much larger ground area / footprint** is required, due to the individual units and the elevated angle combined with the rotational axis, casting very long shadows. The wind loading on this type of structure plays is significant, requiring foundations with steel reinforcing and a significant amount of concrete.

In addition, complexity of the control system required to operate a two-axis PV system like this is **not adequately suited to isolated areas**, where spare parts and technicians are few and far between (more spares must be stored to keep the plant in a running condition, which increases capital layout costs and storage area required). As such this tracking technology (Double axis tracking systems) was **eliminated and not assessed further.**

Single axis tracking systems yield maximum available power for a certain period of every day throughout the year, as opposed to stationary / fixed systems which only yield the maximum available power for a certain period of time in a single season.

Considering the above, a **single-axis tracking system has been selected as the preferred tracking technology**, as it requires comparatively less capital costs, less land coverage and is suitable to isolated areas such as the proposed site for the Khoi Sun Solar Development.

The **preferred technology** type for the Khoi-Sun Development is known as horizontal tracker technology. This single-axis technology is designed to follow the path of the sun across the sky, allowing the modules to be **exposed to typically 25% more radiation than fixed PV systems**. The preferred design is extremely robust and contains only a few moving parts, while still having more or less the same footprint and infrastructure requirements than that of fixed-tilt designs.

Figures 8 & 9: Single / horizontal axis PV tracking systems (Source: Solek Engineering Report, 2012).

The horizontal tracker requires approximately 1.8 – 2.3 hectares per megawatt and is based on a simple design, allowing this well proven off-the-shelve **technology to be readily available**. The **maximum height of the trackers is typically less than 2m (not exceeding 3m)**.

5.3.2 Founding / Mounting Options

Concrete Cast Foundations. The most common foundation used for anchoring single axis tracking or fixed solar frames is concrete cast foundations. This type of foundation requires a foundation trench, shuttered aboveground, to be filled with concrete and reinforcing steel. Once the concrete has cured, the solar frame could either be welded or bolted to protruding reinforcing steel (or could have been left to cure within the concrete).


Figure 10 & 11: Examples single axis & fixed solar cast foundations.

This technology is much more suitable to European conditions and not for the extremely hard surfaces of the proposed site, unless the concrete is cast onto the surface using shutters. This process poses the risk of concrete spillages which could have long term negative effects.

With reference to the abovementioned option of the surface cast foundations (using removable shutters), another similar alternative considered for the mounting of the solar frames is **pre-cast concrete footing.** The pre-cast concrete feet could be manufactured off site, reducing the risk of concrete spillages and the need for exorbitant amounts of water during the construction phase of the project. Drawbacks associated with pre-cast footing include the large physical footprint required to keep the structures stable, in addition to the possible need for them to be bolted or grouted to the ground surface for stability.

In terms of the context, the greatest drawback applicable to the proposed site is the negative influence on surface water flow within the washes / drainage lines (obstruction and diversion) and associated risk of erosion, which cast and pre-cast foundations, may pose.

Considering the above, is has been recommended that the Khoi-Sun Development be installed by means of **driven/rammed piers**, **earth-screws or rock anchors**, as these will have a similarly reduced impact on the environment. **Driven piers have been selected as the preferred method of installation**, however where earth-screws or rock anchors would be more suitable, the driven pole would be replaced by either method. The figures below show the equipment required for the ramming process.

This type of technology will result in the least environmental disturbance since its footprint will be limited and result in minimum obstruction. Selecting this infrastructure will allow fauna and flora to continue underneath the panels.

Figures 12 & 13: Ramming equipment for solar mounting structures (Source: Solek Layout Report, 2012).

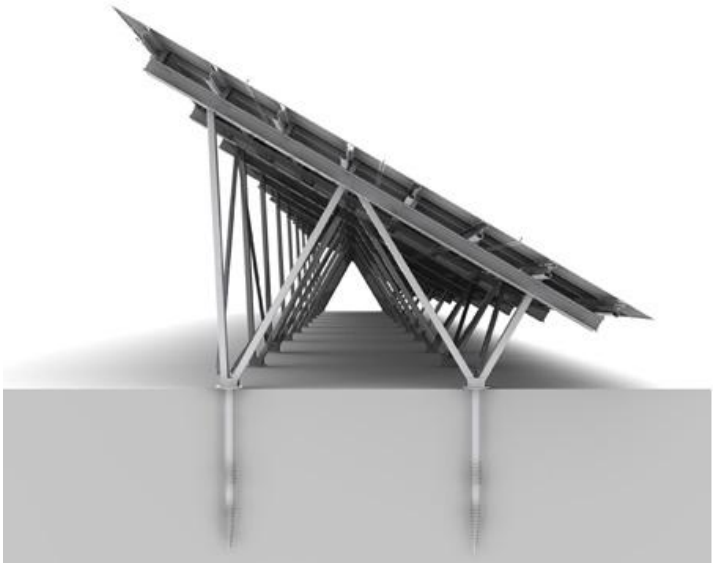


Figure 14: Typical rammed or screwed method with fixed frame (Source: Solek Layout Report, 2012).

This installation technology eliminates the need for the use of cement or polymeric products, and as a result of the very small mounting footprint, has minimal disturbance of the ground cover, substrate or natural water flow (which could have significant long term effects on the ecology of the surrounding area).

5.3.3 Film Options

There are a multitude of different Photovoltaic (PV) film technologies available today. The best options, according to research conducted, are currently either thin-film (amorphous silicon or cadmium telluride) or multi-crystalline cells, depending on the space available and irradiance conditions, with the electricity yield and application being the deciding factor.

Thin-film technology is expensive and is not suited to the conditions of the Northern Cape Province, due to its inferior performance at high temperatures. With ambient temperatures regularly exceeding 40 °C in the area, the **proposed multi-crystalline or thick-film technology** easily outperforms the thin-film alternative, to such an extent that any financial benefit can be disregarded.

Each solar PV module consists of approximately 60 crystalline silicon cells, forming a single module / panel. Each module is capable of generating typically 230W of DC electrical power.

The solar PV modules/panels are assembled in long rows on Solar PV arrays, with are themselves arranged in a series of rows. The **rows approximately 5m apart**. The exact number of modules in each Solar PV array, as well as the number of array rows, is subject to the final facility design.

5.4 SOLAR LAYOUT ALTERNATIVES

During the planning phase of the project numerous layouts and technologies were taken into consideration before the preferred proposal was decided upon. Three of the major points which lead to the preferred proposal are:

- Minimal disturbance to water washes and highly sensitive areas
- Minimum distance to the substation
- Area of around 250 ha to ensure the project would be economically viable

The factor having the single biggest influence on point number one is the mounting technology. The preferred technology (i.e. rammed piers, earth screws and rock anchors) allow arrays to be constructed over the wash lines and high sensitivity areas while having a minimal effect on the vegetation mitigating the chances of erosion.

A number of layouts were considered in detail during the environmental process. The constraints identified by the participating specialists (biophysical, heritage, archaeology and peleontology) were used to inform the preferred layout.

5.4.1 LAYOUT ALTERNATIVE 1 – Initial Uniform Layout

This conceptual layout was initially designed to make use of a large portion of the 450ha study area identified for the Khoi-Sun Development.

This conceptual design entailed a series of 3 large groups of solar arrays of 120, 88 and 28ha.

The shape and size of this layout represented the most practical and cost-effective option, in terms of the typical PV solar technology.

This initial uniform layout did not consider any of the environmental sensitive areas later identified by the participating specialists. This layout will result in unacceptable impacts on the biophysical environment and as such has thus been **excluded / discarded from the on-going environmental process and not assessed further**.

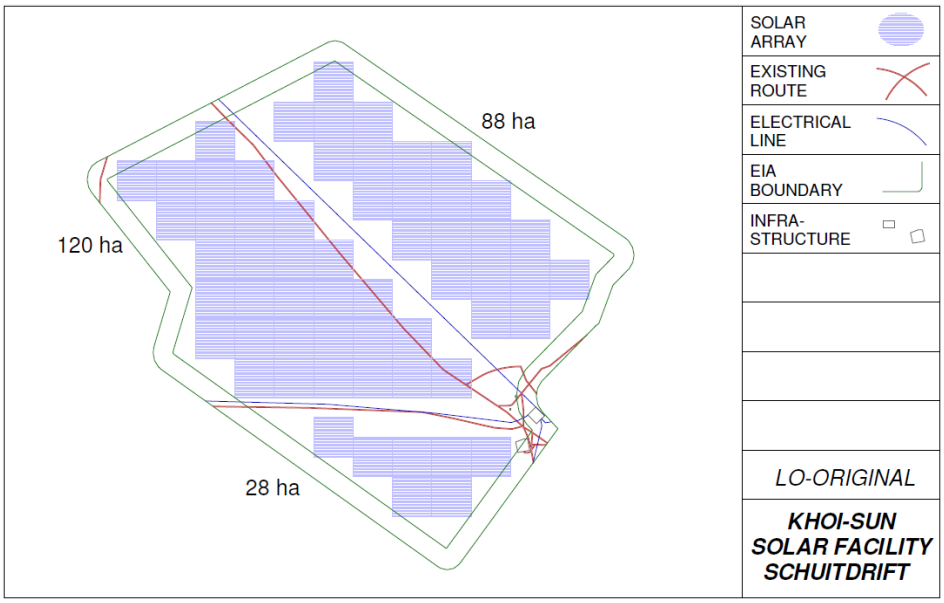


Figure 15: Layout Alternative 1 - Initial Uniform Layout This layout was eliminated due to unacceptable impacts on the biophysical environment.

5.4.2 LAYOUT ALTERNATIVE 2 – Scattered layout with a 2.5m buffer on all washes.

This alternative proposes a 2.5m buffer on all washes. The resulting layout is extremely fragmented and is not viable from an engineering point of view.

Furthermore, this layout will not result in a decreased biophysical impact, as the washes are not static (in other words they change with every rainfall event). These washes also do not contain associated vegetation and their avoidance will not result in a lesser impact on the vegetative component on site.

The biophysical specialist confirmed that the use of rammed pier, earth screws or rock anchors as the preferred founding technology would cause significant environmental impact on the biophysical environment.

This alternative is not technically feasible and as such is **excluded / discarded from the on-going environmental process and not assessed further.**

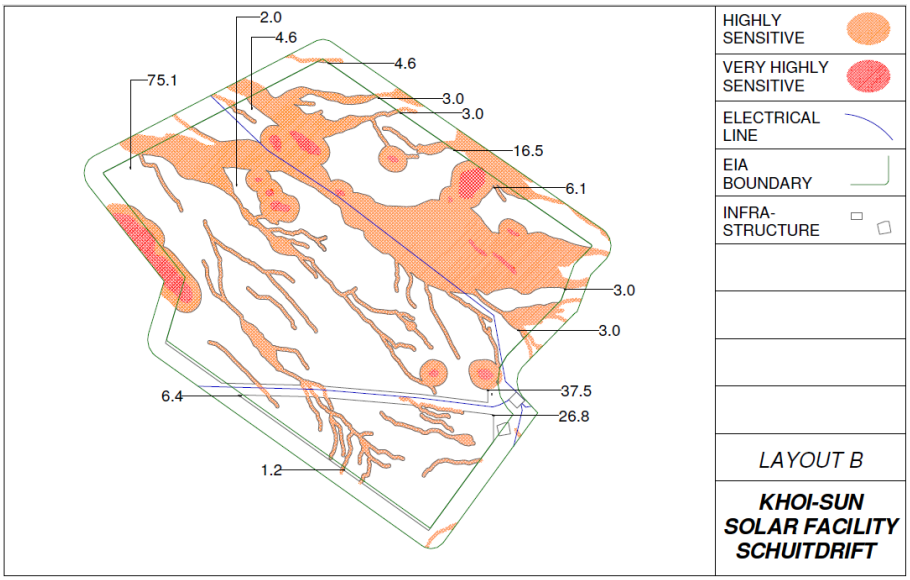


Figure 16: Layout Alternative 2 - Scattered layout with a 2.5m buffer on all washes. This layout was eliminated as it is not deemed to be technically feasible. It would also not result in less of an environmental impact than the preferred alternative.

5.4.3 LAYOUT ALTERNATIVE 3 – Scattered Layout with a 5m buffer on all washes

This alternative proposes a 5m buffer on all washes. As with alternative 2, the resulting layout is extremely fragmented and is not viable from an engineering point of view.

Furthermore, this layout will not result in a decreased biophysical impact, as the washes are not static (in other words they change with every rainfall event). These washes also do not contain associated vegetation and their avoidance will not result in a lesser impact on the vegetative component on site.

The biophysical specialist confirmed that the use of rammed pier, earth screws or rock anchors as the preferred founding technology would cause significant environmental impact on the biophysical environment.

This alternative is not technically feasible and as such is **excluded / discarded from the on-going environmental process and not assessed further.**

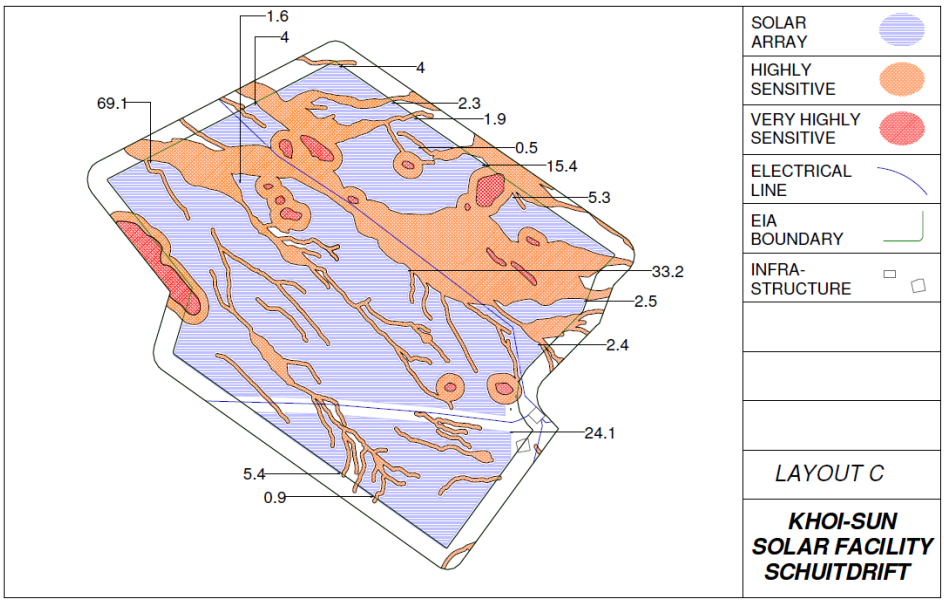


Figure 17: Layout Alternative 3 - Scattered layout with a 5m buffer on all washes. This layout was eliminated as it is not deemed to be technically feasible. It would also not result in less of an environmental impact than the preferred alternative.

5.4.4 LAYOUT ALTERNATIVE 4 – Preferred / mitigated layout

The preferred / mitigated layout was designed to have the lowest possible environmental impact while still keeping the project economically viable and practically implementable.

This layout is fragmented into 9 series of arrays and associated supporting infrastructure totalling approximately 250ha. The layout has been designed to avoid the sensitive koppies and the main east-west drainage line. It also makes use of the existing road / track network as far as possible in order to minimise the construction of new roads.

Unlike Alternative 1 this layout has **taken the identified sensitive areas and site constraints into account**, and can thus be considered the **mitigated alternative.**

Unlike alternatives 2 & 3, it is **less fragmented** and is considered to be **technically feasible** and **practically implementable**.

The method of founding / mounting the solar arrays has been changed from the concrete cast-foundation to consider **driven or screwed piers as the preferred mounting technology**. This minimalistic method of installation will allow the solar arrays to be installed over / across the minor washes, which is considered acceptable from an ecological perspective (provided all mitigation recommendations are implemented).

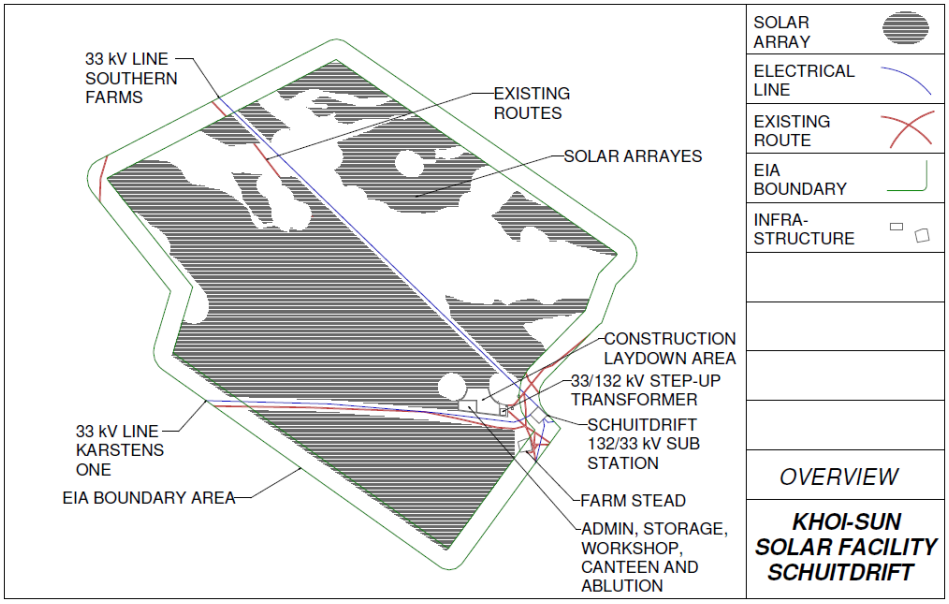


Figure 18: Layout Alternative 4 - Preferred / Mitigated Layout

It is proposed that as far as practically possible, the ramming piers / poles will be driven into the ground away from washes. Some of the ground cover in the plain areas in-between the washes (of medium to medium-high sensitivity) may have to be partially cleared of vegetation to allow for proper installation i.e. access by ramming equipment etc. Although the site is very flat, some minor excavation may be necessary where surface irregularity exists. These excavations will however avoid the washes and will be kept to an absolute minimum.

The vegetation cover under the proposed solar arrays will be left intact to avoid the risk of erosion. Large brushes, high enough to cast shadows, will be kept trimmed, or removed (these are however minimal).

The preferred / mitigated layout will require the removal of the following protected / important plants:

- 9 x *Acacia erioloba*
- *5 x Hoodia gordonii*
- 3 x *Aloe dichotoma*

The Aloe dichotoma, and Hoodia gordonii can be **transplanted** with much success. Acacia erioloba however cannot be successfully transplanted and will have to be removed. A permit for these actions will be sought from the Northern Cape Conservation Authority. This permit can only be considered by the authority if this project receives environmental authorisation.

The exclusion of casted cement foundation blocks and limited mounting footprint will allow natural runoff flow within the washes. Recommendations for runoff management, as well as anti-erosion measures for construction, operation and decommissioning phases of the development, have been provided for and described in the Environmental Management

Programme (attached as Appendix E). These recommendations attempt to ensure that the washes are kept clear of any obstructions / impediments / diversions and that anti-erosion measures be implemented. Education and training of personnel would be component of the abovementioned measures.

The preferred / mitigated layout aims at having the lowest possible environmental impact, while still keeping the project economically viable. **The potential impacts (negative and positive) associated with this layout have been assessed** and reasonable avoidance, mitigation and management measures for the further design of the Khoi-Sun Development have been provided

It must be noted that the final positioning / micro-siting of the PV panel arrays and rows in the preferred layout will only be done upon selection of a supplier post decision-making.

This should be noted and addressed as such in the Department's decision in that the final detailed design and micro-siting of this preferred layout must be done in conjunction with the ecological specialist.

The proposed layout should therefore be described and considered in *approximation* to avoid unnecessary amendment applications in the event that micro-siting differs slightly (based on input from the ecological specialist) from the preferred layout plan presented in this EIR.

It is recommended however that a maximum facility footprint of 250ha and a maximum solar array height of 3m above ground level be dictated to avoid unexpected changes to assessment ratings/significance of impacts.

5.5 NO-GO ALTERNATIVE

The **Status Quo Alternative** proposes that the Khoi-Sun Development not go ahead and that the area in within the study site and within proximity to the Schuitdrift Substation remain undeveloped as it is currently.

The land on which the proposed solar project is proposed is currently vacant. The current land-use is agricultural - limited cattle grazing activities, however due to a combination of poor soil quality, water scarcity and distance from the major agricultural markets, it has no potential for irrigated crop cultivation. The area in question is also considered too small to generate noteworthy financial benefit from agricultural activities due to its low carrying capacity.

The solar-power generation potential of the study site, particularly in proximity to the Schuitdrift Substation, is significant and will persist should the no-go option be taken. The 'No-go/Status Quo' alternative will limit the potential associated with the land and the area as a whole for ensuring energy security locally, as well as the meeting of renewable energy targets on a provincial and national scale. Should the 'do-nothing' alternative be considered, the positive impacts associated with the solar facility (increased revenue for the farmer, local employment opportunities and generation of electricity from a renewable resource) will not be realised.

The **no-go alternative is thus not considered a favourable option in light of the benefits associated with the proposed solar facility development, however it has been used as a baseline from which to determine the level and significance of potential impacts in this Impact Assessment phase of the on-going environmental process.**

It should be noted that the type of land use associated with a renewable energy facility (PV Solar) has a limited life span (i.e. 30 years), where after a similar, or different land use can be investigated. Unlike normal township development (i.e. residential, commercial, industrial etc.), the *potential* for future agricultural practices (post decommissioning and/or rehabilitation of the PV Solar facility) is therefore not eliminated or diminished, *albeit* used for a different purpose (PV Solar) in the interim.

6 INFRASTRUCTURE OVERVIEW

The following section provides an overview various types of solar infrastructure as well as the infrastructure proposed for the Khoi Sun Sloar Development.

6.1 PHOTOVOLTAIC VS CONCENTRATED SOLAR

Solar power is the conversion of light energy into electricity, either directly, using *Photovoltaics (PV)* or indirectly, using *Concentrated Solar Power (CSP).* **Concentrated solar power** systems use lenses or mirrors and tracking systems to focus a large area of sunlight (solar thermal energy) into a concentrated beam. Electrical power is produced when the concentrated light is converted to heat, which drives a heat engine (usually a steam engine) connected to an electrical power generator (wikipedia – solar power, 2011).

Figure 19: Concentrated solar facility in Spain (Source: renewable-energy-info)

Figure 20: Concentrated solar facility, Powe (Source: solarthermalmagazine.com)

Photovoltaic panels convert solar radiation (sunlight) into electric current using semiconductors that exhibit a photoelectric effect. PV gets its name from the process of converting light (photons) to electricity (voltage), which is called the photovoltaic or ***PV effect***. As of 2010, solar photovoltaic generate electricity in more than 100 countries and, while yet

comprising a tiny fraction of the 15TW total global power-generating capacity from all sources, is the fastest growing power-generation technology in the world. Between 2004 and 2009, grid-connected PV capacity increased at an annual average rate of 60 percent, with installations being ground-mounted (and sometimes integrated with farming and grazing) or on rooftops (wikipedia – photovoltaics, 2011).

Six years ago CSP and PV technologies were relatively comparable, but in 2011 solar PV may well have become the cheaper option due to storage-capacity related costs (Farrell, 2011). The major reason for the cost difference between CSP and PV is summed up in one word: *water*. CSP uses considerable amounts of water for steam production and cooling purposes and is invariably located in some of the driest places on Earth. Besides using little water, Photovoltaics may have another advantage over solar thermal technology, in that CSP requires arranging a field of mirrors around the "power tower". The placement of the mirrors is critical, and in some cases requires bulldozing a large area, which can destroy animal habitats. CSP has also been known to result in the death of birds flying into the concentrated sun rays and being burned to death or injured. PV facilities are far less destructive, as they do not require substantial earthworks and can be arranged in a variety of ways/options and they do not reflect concentrated solar rays.

Due to the water scarce nature of the study site, **CPV is not considered an option.**

6.2 KHOI SUN SOLAR DEVELOPMENT: PHOTOVOLTAIC INFRASTRUCTURE

The following details were drawn from the Engineering Report (van der Merwe, 2012, attached in Appendix D, Annexure D2), the Layout Report (Aylward, 2012 attached in Appendix C) and discussions with the Solek project team.

The Khoi-Sun Development is to consist of **multi-crystalline / thick-film modules** as part of a **Photovoltaic System (PV)**, mounted onto **single-axis tracker arrays**, which use an east-west **tracking system** to follow the sun's movement throughout the day.

The **tracker arrays are to be approximately 2m (not exceeding 3m) in height and arranged in a series of rows, spaced approximately 5m apart** to avoid shading each other, while minimizing the footprint of the facility. The tracker array rows will be between 50 and 200m in length and be **oriented at a tilt, facing approximately North**, to maximize annual solar energy yield. The total solar facility, including tracker spacing and typical associated infrastructure, will occupy a **footprint of approximately 250ha.**

Photovoltaic (PV) panels convert the energy delivered by the sun to Direct Current (DC) electric energy. The panel array rows are connected to inverters by means of a network of underground cables. These grid-tied inverters invert the DC power to Alternating Current (AC) power which can be added to the national electricity network (grid). The power generated is then stepped-up to the required voltage and frequency of the national grid, by using transformers. The electricity is then distributed from the on-site substation / transformers via an overhead

transmission/distribution power line to the nearest Eskom Substation. From the Eskom substation, the electricity is fed into the national Eskom grid.

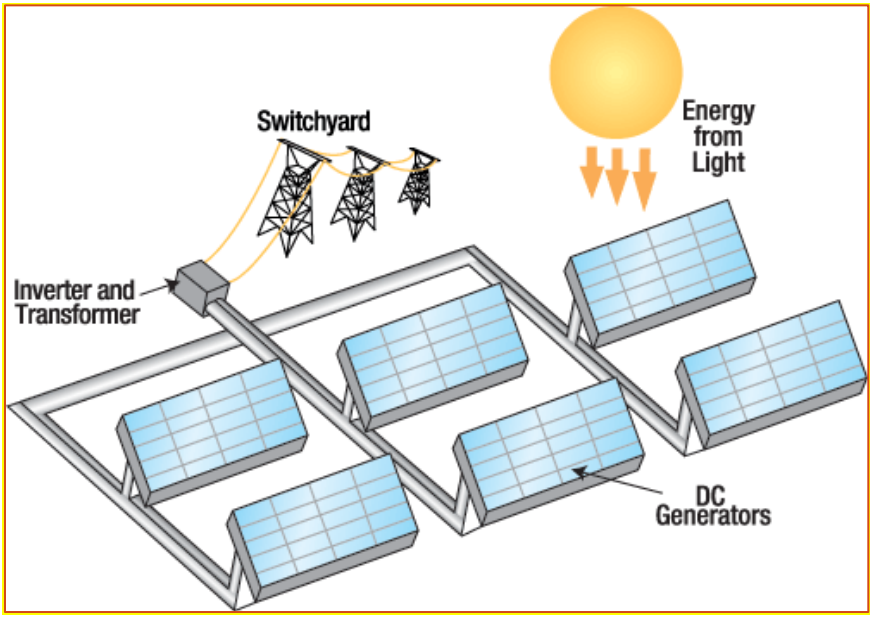


Figure 21: Typical Solar PV Plant diagram (Source: Engineering Report, 2012)

The infrastructure of the facility includes the ground-mounted panels, cables, a laydown area, access roads, auxiliary roads, an on-site substation, auxiliary buildings (admin/security, workshop & storage etc.), an overhead distribution line and parameter fencing.

6.2.1 Generation Capacity (DC) vs Feed-in Capacity (AC)

The Khoi-Sun Development has been designed to provide 75MW (AC) / >90MW (DC) electricity, at 66kV (kiloVolts), to the Schuitdrift Eskom Substation (and so the national grid). In order to provide for / accommodate the loss in generation capacity over time, intrinsic to photovoltaic panels as they loose efficiency over their 30-year lifespan; as well as the net loss associated with the electrical inversion, transformation and transmission (distribution line) processes (2-4%), the generation capacity (the DC electricity generated) of the solar facility will need to be a minimum of 90MW.

The inverters (converting DC to AC) are programmed / derated to ensure that regardless of the amount of DC electricity generated, only 75MW (AC) electricity will be inverted for feed-into the Schuitdrift Substation i.e. the inverters govern the feed-in capacity of 75MW (AC) (pers. comm. with Ernie Aylward on 10 October 2012 via telephone).

6.2.2 Electrical Infrastructure

Approximately **75 inverting stations** will convert the DC power produced by the solar panels into a form that it could be fed into the step-up on-site substation (AC power). These inverting

stations will be connected to the array row series via underground cabling and would be placed along the service roads for quick and easy access. These inverter stations would typically be built into transportable containers measuring 10 x 2.5m, having an approximate footprint of 25 square metres each. The **underground electrical cables** will then be aligned alongside / within these internal roads and pathways between the arrays to connect to the on-site substation.

The interconnecting cables will be trenched where practically possible, but in areas of high sensitivity (e.g. across the minor drainage lines / washes), cables will be fixed onto the panel mounting structures to avoid excessive excavation works and clearing of vegetation.



Figures 22, 23 & 24: Photos of typical underground cable trenches (Source: Solek Engineering Report, 2012).

The **step-up on-site substation** and its associated infrastructure (transformers etc.) will have a footprint of approximately 0.09 ha (30m x 30m). Note that the 0.09 ha is included in the entire auxiliary building footprint of <1ha. The electricity generated by the solar panels (and converted by the inverters) is stepped up to the required voltage (66Kv) and frequency of the national grid by transformers. The proposed building plans showing the proposed layout of the auxiliary building is included in Appendix C.


Figures 25 & 26: Typical examples of on-site step-up substations (Source: Solek Engineering Report, 2012)

Electricity from the on-site substation will be transmitted

via a **132kV overhead power line** to the existing Eskom Schuitdrift Substation which is located approximately 200m south-east of the proposed solar site. There are two viable alternatives proposed for the alignment of this overhead power line:

Transmission Line

The proposed transmission line is limited and will consist of a 132kV overhead line from the facility to the Schuitdrift sub-station. This transmission line will be approximately 200m long.

Potential impacts on vegetation are directly associated with the positioning of the pylon structures, as these are the only areas to be disturbed during construction. The short length of the proposed line will require that a maximum of 4 pylons be constructed. These pylons will not be constructed in areas identified as high or very high sensitivity.

The type and height of the **powerline pylons** determines the foundation size and stabilisation material required (compacted sand or sand/concrete combination). As the type of pylons to be used for the proposed new transmission line have not yet been confirmed by Eskom and the electrical engineers (whether they will be self-supporting, lattice or single pole structures), the exact number and position of the pylons required is still unknown, and will likely only be confirmed during the final design phase for the Solar Farm. It is thus recommended that once these pylon details are confirmed, the surveyed positions of the pylons should be ground-truthed by the appointed ECO and ecological/biophysical specialist to determine the occurrence of conservation-worthy plants and identify possible no-go areas.

The proposed transmission line has been assessed by the ecological/biophysical specialist (Todd, 2012), who has recommended that the entire new powerline be **configured in a bird-friendly manner** and **marked with bird flight diverters** (flappers) along its entire length, in addition to **the insulation of all powerline infrastructure to avoid bird electrocutions**.

During operation, maintenance of the transmission infrastructure will retain these bird-friendly design features. Any bird electrocution and collision events that occur will be recorded, including the species affected and the date. If repeated collisions occur within the same area, then input regarding further mitigation and avoidance measures will be sought.

6.2.3 Auxiliary Buildings

The infrastructure for the auxiliary buildings should occupy approximately 1ha, and include (see Building Plan in Appendix C):

- A Gate-house (5m x 5m)
- Step-up Transformer / On-site Substation (30m x 30m)
- A Workshop / Control building (12m x 25m)
- A Storeroom / Warehouse (24m x 36m)
- A Visitor Centre & Ablution facility (20m x 12m)
- Septic Tank System (8m x 8m)

- An Administrative / Office building (20m x 12m)
- 10x 10kL water tanks

The final detailed design and exact co-ordinated position of these buildings will be confirmed during the final detailed design / micro-siting phase, should the facility be approved and awarded a tender as an IPP. The component list above is typical to such projects and may deviate due to engineering requirements, new technologies and regulatory changes from the government's tender process, but will be contained in the 1ha building footprint.

6.2.4 Solar Array CONSTRUCTION

The majority of the proposed solar site is flat and covered with sparse, low vegetation. Therefore accessibility to development areas should be possible with minimal vegetation clearing. The majority of the vegetation clearing and earthworks required for the solar facility will be associated with the construction of the on-site substation, auxiliary buildings, access roads and laydown area. Where stripping of topsoil is required, the soil will be temporarily stockpiled for use during rehabilitation activities post construction (in line with EMPr requirements).

The vegetation along the <4m wide access road and internal road network will need to be cleared to allow access by construction and assembly vehicles, while the vegetation between the array rows will be trimmed where necessary (not removed), to form vegetated tracks (to minimise disturbance and erosion). Road areas where soft soils occur may need to be covered with a gravel layer to avoid vehicles becoming stuck. Further details pertaining to the required road infrastructure is provided under Section 7.2 below.

The area to be disturbed for the installation of the solar panel array support / mounting structures will be minimal (in comparison to the surface area to be covered). The physical footprint of the PV arrays on the ground is formed by a **network of vertical piers / poles** (typically 100mm in diameter) on which the PV panels are mounted (see examples below).

Figure 27 & 28 Examples of foundation structures – driven / rammed piers/poles.

These piers are rammed / drilled into the ground, which allows for easy removal, should the facility be de-commissioned after 30-years. The use of concrete for stabilisation is to be avoided as far as possible.

A **laydown area of approximately 3ha** will be required during the construction period as a general placement/storage space for equipment and material before it is installed / assembled into position. The laydown area will be located approximately adjacent to the workshop and office areas to avoid excessive traffic during this period while conveying equipment and materials. See appendix C for proposed plans of laydown areas.

The proposed development site is extremely flat (see slope analysis in Appendix A) and thus it is **unlikely that cut-and-fill excavations will be necessary**. Any cut-and-fill activities required for the access road will be kept to a minimum.

6.2.5 Security Fencing

During construction it may be necessary to fence in the Contractor's Site Camp (to avoid theft of construction equipment and materials) and the PV Laydown Area/s (to avoid theft of the solar panels and typical associated infrastructure). Additional security measures during construction will include cctv camera surveillance and one/two security guards. The temporary fencing will be restricted to these areas and be removed at the end of the construction phase. The completed solar facility will be fenced with a permanent parameter electrified fence in order to prevent theft of infrastructure during operation. Recommendations made by the ecologist applicable to the erection of this permanent fence are as follows:

Only the facility itself should be fenced-off by the proposed parameter fencing, which should be constructed in a manner to **allow for the passage of small and medium sized mammals**, at least at strategic places, such as along drainage lines or other areas of dense vegetation. **No electrified strands may be within 20cm of the ground** (tortoises retreat into their shells when electrocuted and eventually succumb from repeated shocks). Any security lighting associated with the fencing should be kind to a minimum and be of the low-UV emitting kind that attracts fewer insects (Todd, 2012).

7 SERVICES

7.1 WATER REQUIREMENTS

It is estimated that **approximately 11 200kl of water in total should be required during the eighteen (18) month construction phase**, while **approximately 10 - 18kl of water per day should be required for the cleaning of solar panels and for other operational phase requirements**. No water will be used for cooling purposes as the electricity transformers will make use of dry cooling. This also reduces the threat of environmental risks associated with alternative oil cooled transformers.

Weather conditions, traffic and general dustiness of the site play a role in the exact volume of ground water required to wash the Solar PV panels during the operation phase. At present, it is assumed that the panels will need to be washed twice a month.

To further reduce the use of water at the solar facility, the use of **alternative panel cleaning methods** is being investigated. The most feasible technology under consideration uses compressed air to blow off any debris from the panel's surface. At this stage, the technology is being tested and needs refinement before it would be commercially viable. In addition, water conservation methods have been recommended in the EMPr for implementation.

Water sources identified are on site boreholes and rainwater collection from auxiliary structures. An alternative will be to obtain water from the Southern Farms. As confirmed with the Department of Water Affairs – an application for use of these water sources will be submitted to the Department if the project receives environmental authorisation and is selected as a preferred bidder.

7.1.1 Boreholes:

The preferred water sources are the existing nearby boreholes on the proposed farm. Three bore-holes are situated near the proposed site, and are seen as water options for the facility. The small volumes of water required for washing of the Solar PV panels and for general operational purposes (maximum of 18kl per day or 500kl per month) can be sourced from this borehole. According to the initial drilling test records, the boreholes are all strong enough and the water it supplies is drinking water quality. The boreholes at the proposed site can currently supply over 130kl per day compared to the 18kl required. The borehole statistics are included in the engineering report attached in Appendix D, Annexure D2).

7.1.2 Southern Farms (alternative supply)

Another option is to get water from Southern Farms, which is situated 7km directly north of the proposed site. Southern Farms acquires water from the Orange River. Negotiations regarding this agreement are being done with the Southern Farms Management. In principle Southern Farms does not have any objections supplying the water, as long as the requirements from the DWA are adhered to. A formal letter confirming the consent has been received. In the instance of the onsite bore-holes not being approved as a liable water source, a pipeline would then be aligned from the proposed site to the Southern Farms facilities, along an existing road (this pipeline will not cross any water courses and will be far below the thresholds defined in NEMA). The screening of this road has been included in the specialists' studies. If this option is taken, the water use license application will become an integrated water use license application where Section 21 C and I will also be included as required by the DWA.

7.1.3 Rainwater

As an additional measure, PVC rainwater tanks could also be placed alongside the onsite buildings to collect the rainwater runoff from the roof. These PVC tanks will then form part of the

water storing tanks. If necessary, measures can also be put in place to capture the rainwater runoff from the PV panels.

7.1.4 Water buffer

Water storing infrastructure is to be provided as part of the auxiliary building footprint area. A week's storing capacity are planned to be provided for. This will add up to 10 x 10 kl water tanks.

7.1.5 Water-use permission / licencing

The quantity of water required usually qualifies for a general authorisation, but the specific quaternary area in which the development site is situated does not allow for general authorisation. Thus, a formal water use license would have to be applied for. However, after various discussions with the DWA, it was confirmed that a full assessment of the water use license application will only be undertaken by the DWA, if DEA authorises the and the proposed project has been appointed as a preferred bidder by the Department of Energy (DOE).

The EIA application can therefore be submitted without a water licence, as long as there is confirmation that there are sufficient water available. Feedback from the DWA on the Draft Engineering Report and Draft Scoping Report provides guidance on the requirements for the Water Use Licence and associated water use monitoring. The recommendations made by the DWA will be taken into account. A water declaration letter explaining the process followed has been attached.

7.2 ROAD INFRASTRUCTURE

7.2.1 Transportation of Solar Equipment

All solar plant components and equipment are to be transported to the solar development site by road via container trucks. Construction is likely to extend over a period of approximately 18 months, during which time the majority of the solar PV panels and construction components will be transported by utilising standard **2 x 40ft container trucks**.

Less than 30 containers are required per installed MW, which typically includes all solar PV components and additional construction equipment. **Over the period of 18 months, approximately 2250 containers will therefore be transported to the proposed site**, which amounts to approximately two 2x40ft container trucks per day. Normal construction traffic will also need to be taken into account. The usual civil engineering construction equipment will need to be transported to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.), as well as components required for the establishment of the onsite substation power line. Some of this power station equipment may be defined as abnormal loads in terms of the Road Traffic Act (Act No.29 of 1989). Input and approval will be sought from the relevant road authorities for this purpose.

7.2.2 Access Road / Routes & Required Upgrades

Transport to the site will be along appropriate national, provincial and local roads. The access roads to the site will be from Pofadder or Kakamas, along the N14. This is a tarred national road and no alterations should be necessary to handle construction traffic and traffic involved in the operation phase. The access road to the Scuitdrift facility from the N14 has been confirmed as two divisional roads, the R359 and DR3256 which falls under the Siyanda District Municipality. After a very extensive process it has been clarified that this should not pose any constraints to the projects. According to SANRAL (the South African National Road Agency Limited) these roads fall under Department of Transport, Northern Cape, and no private farm owners consent is necessary.

In some instances, the smaller farm roads may require some alterations (e.g. widening of corners etc.), due to the dimensional requirements of the loads to be transported during the construction phase (i.e. transformers of the onsite substation). Permission from the local authorities can be obtained in this regard if required.

7.2.3 Internal Road Network & Vegetated Tracks

The **internal road network** of the solar facility will be gravelled roads (less than 4m width), necessary for assembly & installation during construction and access throughout the facility during operation. Un-surfaced tracks, in-between the solar array rows, will to be used for maintenance activities and cleaning of solar modules during operation. Vegetation along these tracks will be routinely trimmed to allow easy access and avoid shading of panels.

Figures 29 & 30: Typical internal road and track examples (Source: Solek Engineering Report, May 2012).

7.3 STORMWATER MANAGEMENT

This section in drawn from the Engineering Report (van der Merwe, 2012 in Annexure D2):

Due to the extremely low annual rainfall in the Kakamas area the risk of water erosion is low. The ground condition is such that any surface water is very quickly absorbed into the soil which avoids water build up on the surface and quickly reducing any water flow which might cause water erosion.

Rainwater run-off from the roof surfaces of the auxiliary buildings and on-site substation will be **captured by guttering and stored in rainwater tanks** to serve as a supplementary water supply during operation. Any rainfall on the solar panels would be welcomed due to its cleaning effect. The solar panel surfaces will be installed at a relatively large incline with gaps between panels, which would avoid water build up on the panels, while reducing the energy of falling droplets. The tracking system will also ensure that droplets leaving the solar panel surfaces do not drop onto the same ground surfaces all this time.

The solar array rows have been designed to cross over / traverse a number of seasonal washes / minor drainage lines. To avoid erosion in these washes, vegetation will be maintained under the panel arrays (trimmed) to avoid erosion and recognised storm water management practices will be followed to promote the natural flow of water within its natural borders. It is in the interest of the solar operator to keep these washes free of obstruction / impediments and erosion to avoid any damage to the equipment. The solar panels would be installed on frames, on poles / piers, which will allow for natural water flow beneath the solar array structures.

Access roads and internal roads would also be designed and built using recognised erosion and storm water management systems. During the construction phase of the solar PV facility temporary solutions, typical culvert and water dissipation structures (packed rock beds), would be implemented to avoid erosion.

During operation, the preferred structure for the internal road crossings of the drainage lines would be Low-level River Crossings (LLRC). LLRC structures are designed to provide a base flow when when water flow is low, while under high flow conditions, water flows over the roadway, without causing damage.

Two types of LLRC can be used, depending of the particular situation. A “Causeway” contains openings underneath the surface, which allows passing water through, where a “Drift” does not. Both methods will include rock filled baskets, loosely packed rock or perforated bags filled with stone, to minimise water speed and erosion potential.

7.4 WASTE MANAGEMENT

7.4.1 Solid Waste

During the construction phase, an estimated <**5m^3 non-hazardous solid construction waste will be produced per month**, for the expected 18 month construction period. All construction waste will be safely stored in containers and be removed from site on an ad hoc basis by the appointed construction contractor, as and when deemed necessary. The construction waste will

be **disposed of at an appropriately licenced Municipal landfill site** (The closest identified municipal site is situated in Kakamas).

No solid wastes will be generated during the operational phase.

7.4.2 Sewerage Effluent

Portable **chemical ablution facilities** will be made available for the use by construction staff for the duration of the construction and decommissioning periods. Details pertaining to the positioning of these facilities, as well as how they should be secured, the number required, cleaning, servicing and removal, have been included in the attached Environmental Management Programme (EMPr).

Sewage from the on-site ablution facility, to be used during operation by operation / maintenance staff and site visitors, is to be treated onsite by means of a **septic tank system**.

7.4.3 Hazardous Waste

Lubricants used to grease bearing of panel tracking systems should be conservatively used to avoid leakage or spills. Any leaks or spills that occur during maintenance operations must be cleaned up immediately and the contaminated soil / material disposed on at a registered disposal site for hazardous materials. Used oil and grease must be removed from site to an approved used oil recycling company.

7.5 OPERATION & MAINTENANCE PHASE

The aim is for the solar facility to be fully operational (i.e. generating 75MW AC) by 2015. The facility will be operational during daylight hours, except during maintenance, poor weather conditions or breakdowns. Regular maintenance will typically include periodic cleaning, greasing of bearings and inspection. The panels are planes to be cleaned with water or compressed air. Any waste products are to be disposed of in accordance with relevant waste management legislation.

An estimated total of **six full-time staff members** will be required during the operation phase of the project, which will include technicians, maintenance and security personnel. Approximately **three unskilled labourers will be required for maintenance purposes and two security personnel will be deployed on a shift basis**. **One skilled staff member will be needed to manage and oversee the operations**. From time to time additional contract staff may be required for ad hoc vegetation trimming or special panel cleaning.

7.6 PROJECT RE-CONDITIONING / DECOMMISSIONING

PV panels are guaranteed to produce at least 80% of their rated power for 30 years. In practice, PV panels will perform satisfactorily well beyond this timeframe. At the end of the 20-30 year lifespan, two scenarios exist for the PV panels:

1) The old, redundant panels can be disposed of (at a registered disposal facilities designated for this purpose); or
2) The panels can be recycled, by either using their components to fix or make new panels, or be donated for use elsewhere e.g. for the electrification of local schools and clinics.

It is unlikely that the Khoi-Sun Development will be completely decommissioned after 30 years, especially considering the long-term lease for the renewable energy facility on the property. Instead, the photovoltaic facility will continually be reconditioned as the PV panels are **recycled and replaced with more advanced technology as it becomes available**. Should replacement not be deemed necessary, then the facility would be completely decommissioned i.e. all infrastructure will be disassembled and removed from site. Site decommissioning activities will ensure integrity of access to the site and well as rehabilitation of the site as necessary.

The components would be disassembled, reused and recycled wherever possible, or disposed of in accordance with regulatory requirements. Functional components will be donated to and installed at local schools and clinics to benefit the local community.

8 SITE DESCRIPTION AND ATTRIBUTES

The following sections provide a description of the environmental and built context of Farm 426 with particular focus of the proposed Khoi-Sun Development site.

8.1 LOCATION & BUILT ENVIRONMENT

Farm 426 Skuitdrift[5] is located in the **Kenhardt district** and jurisdiction area of the **Kai! Garib Local Municipality** within the **Siyanda District Municipality.** The cadastral unit has a surface area of approximately **8 019ha**. The property is directly south of the Orange River and west of the Augrabies National Park. The subject site which is **not** being used by the land owner for **farming** (**comprising approximately 400ha**) is located on the southern portion of this farm (see Location Plan as **Appendix A**). Via road, the subject site is approximately 106km northeast of the town of Pofadder and 115km northwest of Kakamas respectively. Access to the site is off the N14 National road (Nous turn-off 60km east of Pofadder; 70km west of Kakamas) via a 46km long gravel track.

The proposed development site is located within a flat, arid landscape bound by a series of low granite hills to the northeast. Soils were found to be sandy, covered with sparse vegetation - grass interspersed with low-growing shrubs.

Figure 31: Existing Schuitdrift Substation

Figure 32: Existing 132kV power line, north of solar site.

A **small building complex**, including a much-altered **farmstead**, **outbuildings** older than 60 years, a **modern labourer's cottage** and **agricultural building** (most likely older than 60 years) are located outside proposed development site boundary). The farmstead consists of a pitch-roofed core with modest mono-pitch extensions to side and rear and interesting gabled extension to other side. Outbuildings to the rear of the farmstead as well as an agricultural outbuilding (with stonewalled kraal to side) just east of the farmstead are both considered older than 60 years. A small mono-pitched labourer's just northeast of the farmstead is not older than 60 years (de Kock, 2012).

[5] Variations of spelling include "Skuitdrift"(Farm), "Schuitdrift"(Substation) and "Scuitdrift"

8.2 GEOLOGY & TOPOGRAPHY

The following description of the geological context of the site was drawn from the Paleontological Statement (Almond, 2012). See Appendix D, Annexure D5 in the final scoping report.

The proposed solar plant study area (28° 36' 26'S, 19° 45' 55"' E) is situated some 12 km south of the Orange River on arid, gravelly to sandy terrain at c. 630-670 m amsl, sloping gently towards the Orange River.

Rocky ridges project through the superficial alluvial fan deposits along the western border.

The geology of the study area northeast of Pofadder is shown on the 1: 250 000 geology map 2818 Pofadder (Council for Geoscience, Pretoria). A comprehensive sheet explanation for this map has been published by Moen and Toogood (2007). The proposed solar plant and associated infrastructure are underlain by ancient Precambrian basement rocks – the Schuitdrift Gneiss (Nsc) – that belong to the Namaqua-Natal Province of Mid Proterozoic (Mokolian) age (Cornell et al. 2006, Moen 2007). These basement rocks are approximately two to one billion years old and entirely unfossiliferous (Almond & Pether 2008).

The Precambrian basement rocks within the study area are mantled with a spectrum of other coarse to fine-grained superficial deposits such as rocky soils, downwasted gravels, colluvium (slope deposits), sheet wash, and alluvium of intermittently flowing streams. These deposits are generally young (Quaternary to Recent) and largely unfossiliferous. It is considered unlikely that significant deposits of Late Tertiary Orange River alluvial gravels are present within this area, and none are mapped here on the 1: 250 000 Pofadder geology sheet

8.3 VEGETATION

Mr. Simon Todd, of Simon Todd Consulting, conducted an Ecological Impact Assessment of the proposed Khoi Sun Project development site (see **Appenindix D, Annexure D1** for full report), from which the following is drawn.

According to the national vegetation map (Mucina & Rutherford 2006), the Scuitdrift Solar Project development site lies within the **Blouputs Karroid Thornveld** vegetation type, which occurs as a belt of irregular flat areas from the vicinity of Augrabies Falls in the east to Kotie se Laagte and Samoep se Laagte in the west. The vegetation type is listed as **Least Threatened and less than 1% has been transformed**. It is **well conserved (27%) within Augrabies Falls National Park**.

Other vegetation types which occur in the vicinity of the site include: Lower Gariep Broken Veld, Bushmanland Arid Grassland and along the banks of the Orange River, Lower Gariep Alluvial

Vegetation. Lower Gariep Broken Veld and Bushmanland Arid Grassland are also classified as Least Threatened and have been little impacted by transformation.

Lower Gariep Alluvial Vegetation is however classified as Endangered on account of the high degree of transformation it has experienced. This vegetation is however restricted to the banks of the Orange River and would not be affected by the development.

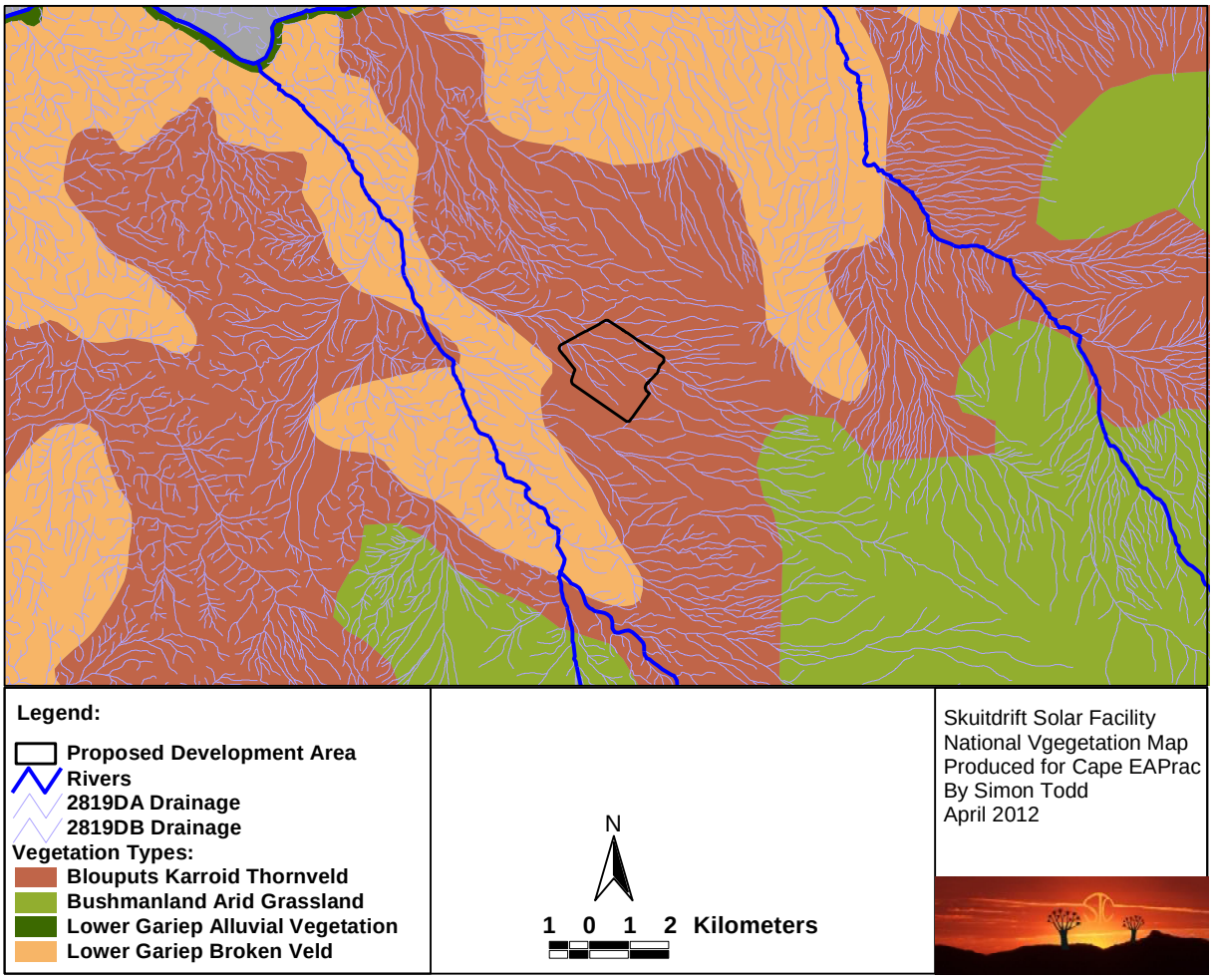


Figure 33: The broad-scale vegetation in and around the proposed Khoi-Sun Solar Development. The vegetation map is an extract of the national vegetation map as produced by Mucina & Rutherford (2006), and also includes rivers and wetlands delineated by the National Freshwater Ecosystem Priority Areas assessment (Nel et al. 2011).

The ecological specialist confirmed that there are **several** different **plant communities** that occur at the site each associated with a different soil type or physical condition. The following major plant communities where identified by the ecological specialist.

8.3.1 Drainage Lines and Washes

The site is dissected by a large number of **drainage** features. The **smaller** drainage lines are **not significant** from an ecological perspective because they do not receive or retain sufficient water to develop characteristic or unique plant communities.

The **larger** drainage lines are however **significant** as they contain large trees not found elsewhere on the site, as well as shrub and grass species which are restricted to the drainage lines. Although development could proceed with little ecological impact near the smaller drainage lines, the collective **larger drainage lines** should be considered **highly sensitive** and development should not occur within these areas.

The smaller drainage lines are characterized by the presence of **large shrubs** and **low trees** such as *Acacia mellifera*, *Boscia foetida*, *Phaeoptilum spinosum*, *Monechma spartioides* and *Rhigozum trichotomum*. The larger drainage lines are characterised by a **bed** and **floodplain** of deep coarse sand, and are dominated by species such as *Acacia erioloba*, *Sisyndite spartea*, *Stipagrostis namaquensis*, *S.brevifolia* and *Leucophrys mesocoma*.

Figure 34. View towards the Orange River along the large drainage line which runs through the site. (Todd, 2012).

This drainage line is classified as sensitive by the ecologist and as such has been excluded from any development (Layout Alternative 4 – Preferred / Mitigated Alternative)

8.3.2 Rocky Outcrops

The ecologist identified a number of relatively **small rocky outcrops** within the study area, which varied from low outcrops, no more than a meter in height, to much larger outcrops 15-20 m in height above the surrounding plain. The rocky outcrops have a **distinctive vegetation** composition and are also **significant** from a **faunal** perspective. Species which are common or characteristic of the outcrops include small trees and shrubs such as *Aloe dichotoma*,

Commiphora gracilifrondosa, *Hibiscus engleri*, grasses such as *Tricholaena capensis* subsp *arenaria* and *Enneapogon scaber*, and forbs such as *Chascanum garipense*, *Rogeria longiflora*, *Trichodesma africanum* and *Hermannia minutiflora*.

The position of the rocky outcrops where mapped and used to inform the preferred layout (Layout Alternative 4). The avoidance of these sensitive features was a principal factor in the layout design.

Figure 35. One of the larger rocky outcrops at the site identified by the ecological specialist. Most of the green shrubs are *Commiphora gracilifrondosa* and the grass tussocks are *Tricholaena capensis (Todd, 2012)*

This drainage line is classified as sensitive by the ecologist and as such has been excluded from any development (Layout Alternative 4 – Preferred / Mitigated Alternative)

8.3.3 Sandy Plains

Large parts of the north and western sections of the site consist of **open grassland** with scattered trees on deeper Kalahari and granitic soils. These areas are dominated by grasses such as *Stipagrostis ciliata*, *S.uniplumis*, *S.anomala* and in wet years, *Schmidtia kalahariensis*. Common trees include *Acacia erioloba*, *Boscia foetida* and *Parkinsonia africana*. Shrubs are often associated with drainage areas and typical species include *Phaeoptilum spinosum*, *Lycium pumilum*, *Monechma spartioides*, *Kissenia capensis* and *Zygophyllum rigidum*. Forbs include *Cucumis africanus*, *Coccinia rehmannii* and *Pergularia daemia*. The **protected succulent** *Hoodia gordonii* was also observed within this habitat.

Figure 36. Sandy Plains community type, near the western boundary of the site. The grasses are various *Stipagrostis* species, while the trees are largely *Acacia mellifera* and *Phaeoptilum spinosum*. (Todd,2012)

8.3.4 Rocky Plains

A **large proportion** of the site, particularly the **central area**, consists of **rocky** ground or exposed bedrock. These areas contain less grass than the sandy plains and a high proportion of woody species. Common species in this habitat include trees such as *Acacia mellifera* and *Boscia foetida*, low shrubs such as *Microloma incanum*, *Hibiscus elliottiae*, *Hermannia spinescens*, *Petalidium lucens*, *Asparagus denudatus*, *Commiphora namaensis*, *Salsola rabieana* and *Hermannia stricta*. The dominant grass in these areas is *Enneapogon scaber*. The **protected** species ***Aloe dichotoma*** and ***Hoodia gordonii*** occur within this habitat.

Figure 37. The Rocky Plains community type. Looking towards the homestead from the southeastern boundary of the site. The central parts of the site are largely shallow soils and exposed bedrock. The majority of woody species are *Acacia mellifera*, with some *Boscia foetida* (Todd, 2012)

8.3.5 Threatened Plant Species

According to the **SANBI SIBIS** database, only **one endangered species** *Caesalpinia bracteata* is known from the area, and is classified as **Vulnerable**. This species has a highly restricted distribution and is known from a total population of about 1000 adult plants (Threatened Species Programme, Red List of South African Plants (2011), but as it occurs on rocky outcrops along the Orange River, it would not occur within the proposed development area and was not observed. The abundance of *Hoodia gordonii* was quite high within certain areas, while a limited number of *Aloe dichotoma* and *Acacia erioloba* trees occur within the proposed development area. Approximately 9x *Acacia erioloba*, 3x *Aloe dichotoma* and 3x Hoodia gordonii occur within the proposed development.

8.3.6 Site Sensitivity Analysis

The ecological sensitivity map for the site is depicted below (Figure 38). According to Todd (2012), the dominant feature in terms of the sensitivity map is the large drainage line which traverses the site in a roughly east to west direction. Typically of drainage lines in sandy, arid environments, it forms a braided channel with a number of anastomosing channels. This is a dynamic and ecologically sensitive area and the development should not impact this area. Outside of the large drainage lines the rocky outcrops are also sensitive features that should be avoided. The sensitivity map includes buffer areas around these features and it is therefore not necessary to implement additional buffers in terms of the placement of infrastructure at the site. There are however a number of protected plant species within the proposed development area, and although it would be preferable to avoid these, those species such as *Aloe dichotoma* which are suitable for search and rescue and cannot be avoided should be translocated outside of the development footprint.

This area also contains a number of small drainage lines or washes and the development would also have to accommodate these in some manner. If it is possible to build over the channels without interfering with them, then this would be an acceptable solution. The site is generally quite flat and so the erosion risk associated with the development would be quite low. The large amount of panels that would used in the development, which would amount to approximately 65 ha of surface area, would generate a lot of runoff during large rainfall events and measures to regulate this runoff would be required. Overall, the site is however not highly sensitive and the final layout provided by the developer in response to the sensitivity map takes account of the major sensitive features of the site, and while it would certainly generate some local impact, there are not likely to be any impacts generated of broader significance.

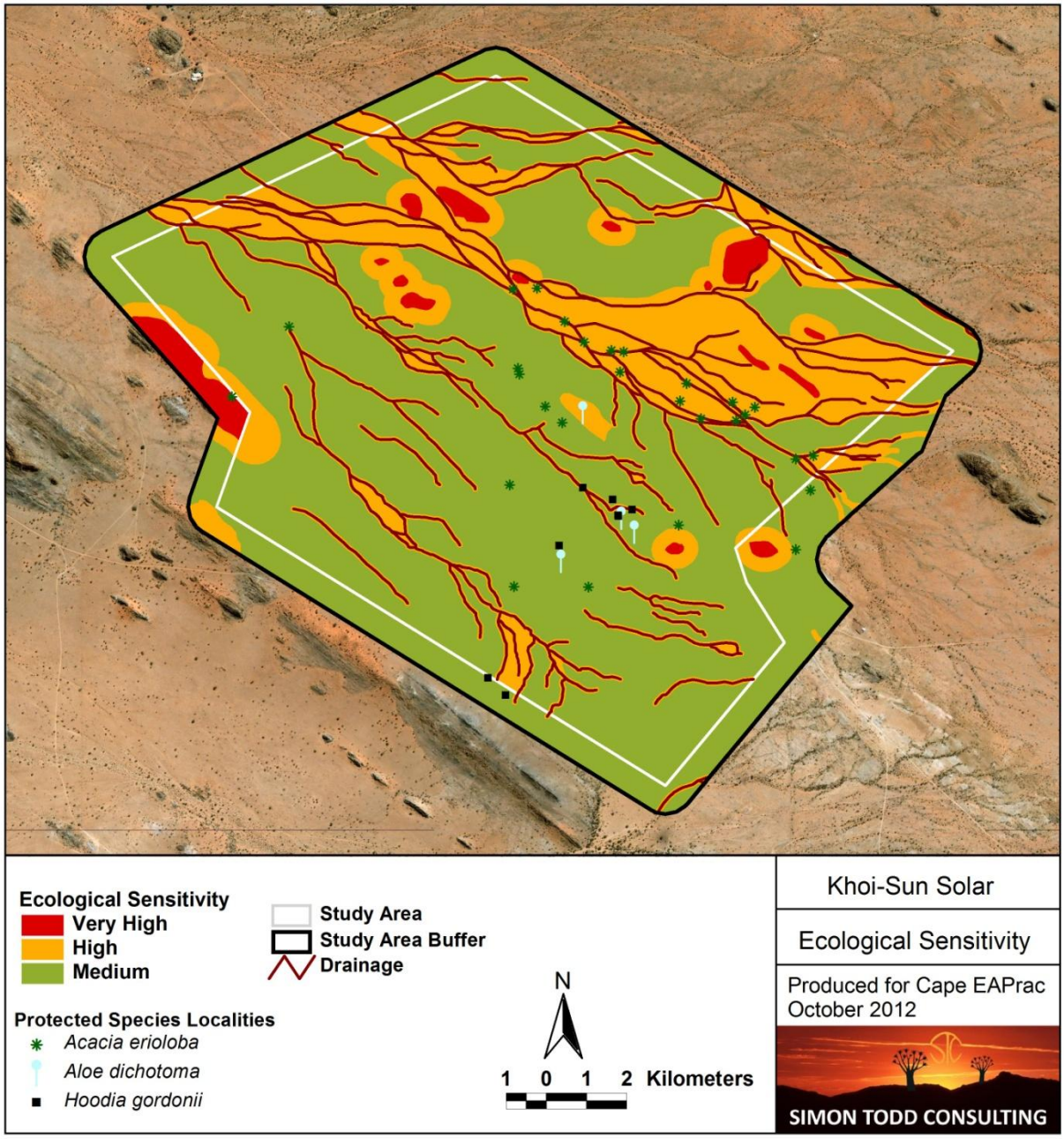


Figure 38: Showing the Ecological Sensitivity of the Study site as well as the location of the protected species.

8.4 FAUNA

8.4.1 Mammals

According to Todd, 2012, the site falls within the distribution range of 46 terrestrial mammals, indicating the mammalian diversity at the site is potentially quite high. Listed species which may occur in the area include the Brown Hyaena *Hyaena brunnea* (Near Threatened), Black-footed

cat *Felis nigripes* (Vulnerable) and Leopard *Panthera pardus* (Near Threatened). Given the agricultural activity that takes place in the area, the abundance of Leopard and Brown Hyaena in the area is likely to be low. The habitat is suitable for the Black-footed Cat which favours a mix of open and more densely vegetated areas. However this species is widely distributed across the arid and semi-arid areas of South Africa, and the development would not amount to a significant amount of habitat loss for this species.

In terms of important mammalian habitats in the vicinity of the development, the rocky outcrops and drainage lines can be singled out as being the most significant. Compared to the adjacent plains the rocky habitats are likely to harbor far greater species richness, particularly of small mammals. Species associated with such rocky outcrops include Rock Hyrax *Procavia capensis*, Klipspringer *Oreotragus oreotragus*, Pygmy Rock Mouse *Petromyscus collinus*, Namaqua Rock Mouse *Aethomys namaquensis* and Western Rock Elephant Shrew *Elephantulus rupestris*.

The greater overall plant cover and higher frequency of large tree species such as *Acacia erioloba* within the drainage lines is also likely to be of significance for species such as Duiker *Sylvicapra grimmia*, Acacia Tree Rat *Thallomys paedulcus* and Black-tailed Tree Rat *Thallomys nigricauda*.

The open plains such as those which occur within the proposed development area are likely to be dominated by species associated with open sandy ground such as various gerbils such as Hairy-footed Gerbil *Gerbillurus paeba* and Highveld Gerbil *Gerbilliscus brantsii*. Other mammals observed at the site include South African Ground Squirrel *Xerus inauris*, Cape Hare *Lepus capensis* and Cape Porcupine *Hystrix africaeaustralis*.

The medium to larger sized mammals which occur at the site all have home ranges which are likely to exceed the extent of the study site. The erection of fencing which prevents the movement of such animals is therefore a concern regarding the development of the site and specific mitigation measures to reduce these impacts have been recommended.

8.4.2 Reptiles

The site lies in or near the distribution range of at least 45 reptile species (see Appendix D, for a copy of the species list), indicating that the reptile diversity at the site is likely to be quite high. Given the variety of habitats available at the site which range from sandy plains and dunes, to rocky plains and outcrops to drainage lines, a large proportion of these reptiles are likely to occur at the site. Based on distribution maps and habitat requirements, the composition of the reptile fauna is likely to comprise **1 tortoise**, **17 snakes**, **18 lizards** and skinks, **one chameleon** and **8 geckos**.

No listed reptile species are known from the area. Broadley's Flat Lizard (*Platysaurus broadleyi)* is however a narrow endemic which is associated with rocky, arid savannah along the Orange River between Augrabies and Pella and may occur in the area. This conspicuous

species was not observed at the site and it is likely that if it occurs in the area, it is likely to occur in closer proximity to the Orange River. Species observed at the site include the Western Rock Skink (*Mabuya sulcata sulcata)* which was common on the rocky outcrops, the Namaqua Sand Lizard (*Pedioplanis namaquensis)* which was abundant on the plains as well as an individual of the Black Spitting

Cobra (*Naja nigricollis woodi)* As with small mammals, the rocky areas are likely to contain the greatest reptile diversity and the majority of Skinks, Girdled Lizards and Geckos which occur at the site are likely to be associated with rocky areas. The plains are likely to contain fast moving species such as Sand Lizards and nocturnal species such as Barking Geckos.

Apart from a relatively small direct loss of habitat, the shading of the soil by the solar panels is likely to affect reptile composition, as the shading is likely to alter soil temperatures which will have implications for the activity patterns of cold-blooded animals. Most reptiles are also sensitive to the amount of plant cover which is also likely to be affected by the arrays. The presence of the arrays and electrical infrastructure would however create additional habitat for species which utilise such structures such as tubercled geckos (*Chondrodactylus spp*) and agamas (*Agama spp*). Depending on the management of the vegetation beneath the panels, reptile abundance in the development area could increase as a result of increased habitat diversity as well as a protective effect of the panels on reptiles from avian predators.

8.4.3 Amphibians

According to Todd, 2012, the site lies within the distribution range of six amphibian species. However, given the paucity of surface water at the site, only those species able to persist away from perennial water are likely to occur at the site. The proposed development area is not likely to be an important area for amphibians within the context of the site as there is little suitable cover or habitat present within this area. Given the overall lack of specialized natural amphibian habitats present at the site, amphibians are not likely to be highly sensitive to the development. The greatest risk associated with the development in terms of amphibians is pollution spills which may occur during the construction phase and which could affect amphibians in downstream areas.

8.4.4 Avifauna

According to the SABAP 1 and 2 data sets, 130 bird species are known from the broad area surrounding the Skuitdrift site. The area has however been poorly sampled and the list is probably not comprehensive, particularly with regards to birds that may occur as a result of the proximity of the Orange River. Of the recorded species only Ludwig's Bustard *Neotis ludwigii* (Vulnerable) and Sclater's Lark *Spizocorys sclateri* (Near Threatened) are listed species. Both species are nomadic and would potentially use the site at times, but would also be able to avoid the area when developed. Sclater's Lark would be affected by a very small amount of habitat loss, while Ludwig's Bustard would be potentially more severely impacted due to the possibility of collisions with new transmission lines.

However, the planned transmission line for the development is approximately 200 m and occurs in very close proximity to the existing substation as well as a large amount of existing transmission infrastructure. The area is therefore likely to already be avoided to some extent and the **impact is likely to very low.**

Other bird species that were observed to be common at the site include Sociable Weaver (*Philetairus socius)*, Dusky Sunbird (*Cinnyris fuscus*), Capped Wheatear (*Oenanthe pileata*) and Verreaux's Eagle (*Aquila verreauxii*).

Verreaux's Eagle is potentially impacted by habitat loss as it may avoid the vicinity of the development and is also vulnerable to electrocution with transmission lines. However, the extent of the development is very small in relation to the home range of this species and the **impact on this species is likely to be negligible**.

Other bird species vulnerable to electrocution which probably occur in the area include the Martial Eagle (*Polemaetus bellicosus*) which listed as Vulnerable, and both the Spotted and Cape Eagle-Owl.

The construction of new powerlines at the site would pose an additional risk. In terms of general impacts on avifauna, these are likely to be relatively **low** as the area does not fall within any of Birdlife South Africa's Important Bird Areas, indicating that the area is not within the range of any range-restricted or globally threatened species.

9 PLANNING CONTEXT

Mr Bennie Scheepers of Macroplan Town and Regional Planners (Upington) compiled a Planning Statement (see Appendix D, Annexure D7 for full statement), from which the following was drawn:
Macroplan Town & Regional Planners are to handle the following components regarding the project:

A land use change application for the rezoning of 425ha,from Agricultural Zone I to Special Zone, will be lodged at the Kai!Garib Local Municipality, in accordance with the Northern Cape Planning and Development Act (Act 7 of 1998).

Where applicable, the consent of SANRAL, Civil Aviation Authority (CAA) and the bondholder will be obtained as part of the rezoning application *(Comment from SANRAL and Civil Aviation Authority has already been received on the Draft Scoping Report).*

If there are restrictive Title Deed conditions burdening the proposed development, an application for the removal thereof will be lodged at the Government of the Northern Cape Province, Department: Corporate Governance and Traditional Affairs, in accordance with the Removal of Title Deed Restriction Act (Act 84 of 1967).

Parallel to the rezoning application, a long term lease application will be lodged at the National Department of Agriculture, in accordance with the Subdivision of Agricultural Land Act (Act 70 of 1970).

Relevant planning documents, on all spheres of Government, will be evaluated before any land use change application is launched. These documents include, but are not limited to the following: NSDP (National Spatial Development Perspective); PGDS NC (Provincial Growth and Development Strategy), Northern Cape Province; IDP (Integrated Development Plan); SDF (Spatial Development Framework).

10 AGRICULTURAL POTENTIAL STATEMENT

Mr. Hendri Beukes, of **Solek Renewable Energy Engineers**, compiled an **Agricultural Potential report** of the proposed Scuitdrift Solar Project development site, based on of his knowledge and experience of farming in the Northern Cape (see **Appendix D, Annexure D2** for full report), from which the following is drawn:

10.1.1 Agricultural Potential Context

The proposed development site consists mainly of **dune sand** and **rocky outcrops** and is not fit for the extensive cultivation of crops and grains. The **soil** is shallow, generally **less than**

450mm, on weathering rock. The soil is mainly **calcareous**, typical of arid climates, and contains **less than 15% clay**. Calcareous soils develop in regions of low rainfall and usually **only** become **productive under irrigation**. The soil surface is covered with rocks and stones, and rocky outcrops are plentiful. The geology of the area would make the cultivation of crops very difficult.

The Kakamas area is a summer rainfall district and classified as a semi-desert area with arid conditions. Average annual precipitation amounts to approximately 100 mm, considered to be highly variable and extremely low. **Day temperature**s are known to become extremely high and range on average between **21°C** and **36°C**. In winter months, it can become very cold, with **frost** occurring regularly. These climatic conditions are not favourable for intensive agriculture, due to the low rainfall and the extreme temperatures that characterises the region.

The farm is situated within the **Nama Karoo biome**, with the dominant vegetation type on the proposed solar development site being **Blouputs Karroid Thornveld**. The dominant plant species found within the proposed site are annual grasses. Annual grass types such as *Schmidtia kalahariensis* and *Stipagrostis uniplumis* are commonly found in areas with low rainfall and are known to be an indicator of veld deterioration. The **grazing value** of these plant types is **relatively poor**.

According to the Department of Agriculture, the prescribed carrying capacity of the farm is **60ha per** unit of **cattle** or **15ha** per **sheep**. The proposed site of approximately **250ha (total footprint of arrays and infrastructure)** can house a maximum of **4 heads of cattle** or **16 sheep**. The **economic value** of the site is thus **insignificant** in terms of its grazing capacity.

10.1.2 Existing Land Use & Infrastructure

The remainder of the farm not under consideration for the solar project is currently utilised for **stock farming**. The farm (+/- 8 019ha) is under indigenous vegetation used as **natural grazing** for some **800 ewes** and **80 heads** of cattle. Although the area is very dry, there is no need to provide extra feed to the livestock as the **carrying capacity** is **not exceeded** and since there is ample vegetation along the riverbanks.

The built **infrastructure** on the farm includes **a homestead**, **a windpump**, **cement reservoirs**, **dams**, an **Eskom Substation** and **two transmission lines**. There is a small **network** of **roads** on the farm, but the majority of the farm is inaccessible without the use of four wheel drive vehicles or motorcycles.

The farm is not divided into camps and the border fences are well maintained. There are cattle handling facilities on the farm, but not on the proposed solar development site. The access roads to the farm are in superb condition, both from the N14 to the south and Augrabies to the east. This facilitates comfortable transportation of livestock and other agricultural necessities and supplies to and from the farm. However, the farm is very far from the primary markets, which complicates the economical export of agricultural products from the farm.

There are **two primary water sources** on the farm, namely **rainwater** and **groundwater**. **Groundwater** is readily available from **three boreholes** (and windpumps) and of **high quality**, perfect for human and animal consumption. The water is currently accumulated in two small reservoirs and is mainly used to supply the livestock of drinking water.

The farm is surrounded by other livestock farms and Southern Farms, a farm that cultivates vineyards under irrigation, along the north-eastern border of the farm (the Orange River) (Solek 2012).

10.1.3 Potential Land Use Options

The combination of poor soil quality, water scarcity and distance from the major market hinders the possibility of the commercial production of grain, vegetables and horticultural products. Irrigation on this arid area is excluded due to low availability of water and shallow soils. It is possible to consider game farming in the area, especially Springbok and Gemsbok, but the capital expenditure would be extremely high. The **proposed solar development site does not have any significant agricultural value and has not been utilized for any extensive agricultural purposes for many years**. The site is too small to generate noteworthy financial benefit from agricultural activities. The development of the proposed solar facility would constitute the loss of 45ha of the overall approximate 8 019ha area, which will **not have a significant impact on the agricultural potential of the farm**. The **economic benefits that the proposed solar development holds cannot be recovered from the current or potential agricultural activities** (Solek, 2012).

11 ECOLOGICAL IMPACT ASSESSMENT

The Ecological (Flora & Fauna) Scoping Study compiled by Mr. Simon Todd, of Simon Todd Consulting, identified potential impacts associated with the proposed Khoi-Sun Development on the biophysical environment, which was used to inform the preferred solar facility proposal. As this ecological baseline study was the only specialist study which identified significant impacts within the proposed development area, it was expanded to report the assessment on these impacts in the form of an Fauna & Flora Impact Assessment Report (Todd, 2012) (see **Appendix D, Annexure D1** for full report), from which the following is drawn.

Please refer to Section 1 of the Fauna & Flora Impact Assessment Report and the Section 13 of the Final Scoping Report (on the *Cape EAPrac* website) for detail of the methodology for impact assessment and the project specific Terms of Reference for the EIR Phase.

11.1 ALTERNATIVES CONSIDERED IN THE ASSESSMENT

A single site is being considered and alternative sites were excluded on various grounds such as environmental unsuitability or economic considerations, during the scoping phase of the

development. The no-go alternative remains as a potential outcome if the development does not proceed. Under this scenario it is likely that the site will remain under its current landuse of extensive livestock farming. Due to the aridity of the area and the lack of alternative landuses, the economic potential of the site under this scenario will remain low in comparison with the potential economic benefits associated with the development of the solar energy facility at the site. The status quo option is inherent in the assessment as it forms the baseline from which the significance of the potential impacts associated with the development of the site as a PV facility is determined. The final preferred layout as provided by the developer in response to the sensitivity map as provided in this report, is depicted below. This final layout is that which is assessed in this report.

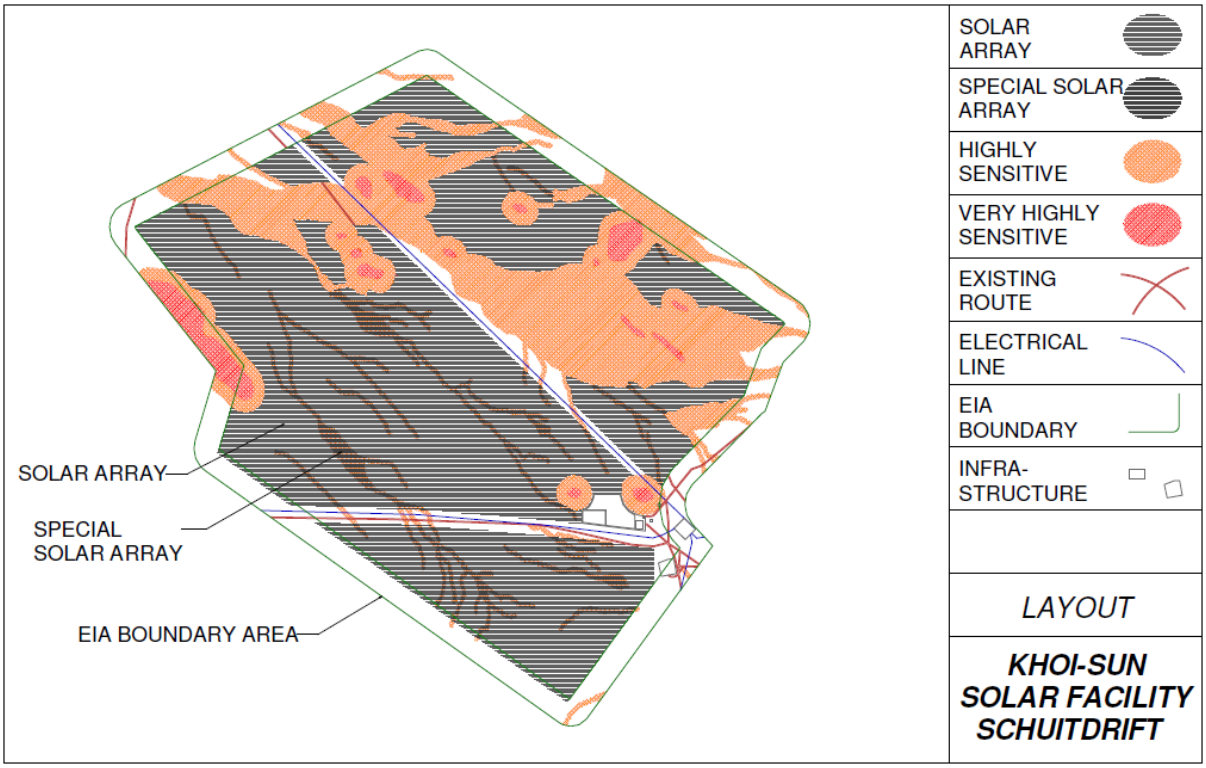


Figure 39. The preferred layout in response to the sensitivity map provided in this report.

11.2 ASSESSMENT & SIGNIFICANCE CRITERIA

The assessment criteria used in the assessment are described below and are drawn from the EIA Regulations, published by the Department of Environmental Affairs and Tourism (April 1998) in terms of the Environmental Conservation Act No. 73 of 1989 as well as Brownlie (2005).

For each of the identified impacts the following are described:

Nature of the impact. A description of positive or negative effect of the project on the affected environment, or *vice versa*. The description includes who or what would be affected, and how.

Extent of the impact. This includes assessing the spatial scale of the impact, i.e. is it local (within the boundaries of the study site), regional, national or international.

Duration of the impact. The lifespan of the impact is assessed, i.e. is it short term (0 - 5 years) Medium term (6 - 15 years) long term (where the impact will cease after the operational life of the proposed project) or permanent (the impact will persist beyond the operational life of the proposed project). Certain impacts can also be *discontinuous or intermittent* (where the impact may only occur during specific climatic conditions or during a particular season of the year).

Intensity or magnitude of the impact. The intensity or severity of the impact would be indicated as either Low (where the impact affects the environment in such a way that functioning and processes are not affected), Medium (i.e. where the affected environment is altered but functioning and processes continue albeit in a modified way) or High (i.e. where functioning and processes are altered to the extent that they will temporarily or permanently cease).

Probability of occurrence. The likelihood of the impact actually occurring would be indicated as either Improbable (the possibility of the impact materialising is very low as a result of design or historic experience), Probable (there is a distinct possibility that the impact will occur), Highly probable (it is most likely that the impact will occur), or Definite (the impact will occur regardless of the implementation of any prevention measures).

Significance of the impact. Based on a synthesis of the information contained in the criteria above, the potential impact would then be described according to following significance criteria:

No significance: the impacts do not influence the proposed development and/or environment in any way.

Low significance: the impacts will have a minor influence on the proposed development and/or environment. These impacts require some attention to modification of the project design where possible, or alternative mitigation.

Moderate significance: the impacts will have a moderate influence on the proposed development and/or environment. The impact can be ameliorated by a modification in the project design or implementation of effective mitigation measures.

High significance: the impacts will have a major influence on the proposed development and/or environment and will result in the “no-go” option on the development or portions of the development regardless of any mitigation measures that could be implemented. This level of significance must be well motivated.

Confidence The level of confidence in predicting the impact can be described as low, where there is little confidence in the prediction, due to inherent uncertainty about the likely response of the receiving ecosystem, or inadequate information; medium, where there is a moderate level of confidence in the prediction; or high, where the impact can be predicted with a high level of confidence.

Cumulative Impact

Consideration is given to the extent of any accumulative impact that may occur due to the proposed development. Such impacts are evaluated with an assessment of similar developments already in the environment. Such impacts will be either positive or negative, and will be graded as being of negligible, low, medium or high impact.

Mitigation

The objective of mitigation is to firstly avoid and minimise impacts where possible and where these cannot be completely avoided, to compensate for the negative impacts of the development on vegetation and animal habitats and to maximise re-vegetation and rehabilitation of disturbed areas. For each impact identified, appropriate mitigation measures to reduce or otherwise avoid the potential impacts are suggested. All impacts are assessed without mitigation and with the mitigation measures as suggested appropriately implemented.

11.3 IDENTIFICATION & NATURE OF IMPACTS

The primary impacts on the terrestrial environment likely to be associated with the development of solar PV facility at the site are as follows:

11.3.1 Impacts on vegetation and protected plant species

Some loss of vegetation is an inevitable consequence of the development.

In addition there are a number protected species within the development footprint including *Acacia erioloba*, *Aloe dichotoma*, *Hoodia gordonii* and *Boscia foetida*. The loss of some individuals of these species is likely to be unavoidable and only the succulent species can be translocated.

Increased risk of alien plant invasion

The disturbance created during construction will leave the site vulnerable to alien plant invasion. Drainage lines and other areas which receive run-off are likely to be most vulnerable to invasion.

11.3.2 Increased erosion risk

Increased erosion risk would result from soil disturbance and the loss of plant cover within cleared and disturbed areas. The runoff created from the panels and other hardened surfaces at the site would also increase the erosion risk associated with the development and specific measures to control runoff flow should be implemented to reduce this risk.

11.3.3 Direct Faunal impacts

Increased levels of noise, pollution, disturbance and human presence will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some mammals and reptiles such as tortoises would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. Some habitat loss for fauna is likely to occur, but would not be of high significance given the scale of the development relative to the intact nature of the surrounding landscape.

11.3.4 Impacts on avifauna

Negative impacts on avifauna would result from habitat loss as well as from the risk of electrocution and collisions with transmission lines, which is a particular problem for many larger birds such as eagles, flamingos, cranes and bustards.

Although this is potentially a significant impact, the development is close to the existing substation and the limited length of any new power lines required for the development would be very short and not likely to contribute significantly to avifaunal impact, especially after suitable mitigation measures have been applied.

11.4 ASSESSMENT OF IMPACTS

The five major impacts identified above are assessed below, before and after mitigation as well as during the construction and operational phases of the project. This assessment is relevant to Layout Alternative 4 – Preferred / Mitigated alternative. Layout Alternative 1 was eliminated due to unacceptable impacts and Layout Alternative 2 & 3 were eliminated as they were not technically feasible.

Impact 1. Impacts on vegetation and protected plant species would occur due to construction activities.							
Extent	**Intensity**	**Duration**	**Probability**	**Confidence**	***Significance & Status*** **Without Mitigation**	**Mitigation**	***Significance & Status*** **With Mitigation**
Construction Phase							
Local	High	Long term	Definite	High	Moderate-High (-tve)	Vegetation clearing to be kept to a minimum. If possible the ground grass layer should be left intact and only the larger woody plants cleared. All areas to be cleared should be clearly demarcated. Sensitive areas as demarcated on the sensitivity map should be avoided, and where such areas cannot be avoided specific mitigation measures to reduce their impact would need to be implemented. Only those individuals of protected plant species directly within the development footprint should be cleared. A search and rescue operation for protected species which could survive translocation such as *Hoodia* and *Aloe*, should be conducted prior to construction. Sensitive areas with appropriate buffers at the site such as the washes should be demarcated at the site by an ecologist as part of the preconstruction activities for the site.	Moderate-Low (-tve)
Operational Phase							
Local	Low	Long term	Definite	High	Low (-tve)	Any vegetation clearing that needs to take place as part of maintenance activities, should be done in an environmentally friendly manner, including avoiding the use of herbicides and using manual clearing methods wherever possible.	Low (-tve)

Impact 2. *Increased alien plant invasion risk, resulting from construction-phase disturbance as well as operational phase maintenance activities*							
Extent	**Intensity**	**Duration**	**Probability**	**Confidence**	***Significance & Status*** **Without Mitigation**	**Mitigation**	***Significance & Status*** **With Mitigation**
Construction Phase							
Local	Medium	Long term	High	High	Moderate (-tve)	Soil disturbance and vegetation clearing should be kept to minimum. Cleared areas that are not going to be used should be revegetated with locally-collected seed of indigenous species. Regular monitoring to ensure that alien plants are not increasing as a result of the disturbance that has taken place.	Low (-tve)
Operational Phase							
Local	Medium	Long term	Moderate	High	Moderate (-tve)	All alien plants present at the site should be controlled annually using the best practice methods for the species present. Bare soil should be kept to a minimum, and at least some grass or low shrub cover should be encouraged under the panels.	Low (-tve)

Impact 3. Increased erosion risk as a result of soil disturbance and loss of vegetation cover.							
Extent	**Intensity**	**Duration**	**Probability**	**Confidence**	***Significance & Status*** **Without Mitigation**	**Mitigation**	***Significance & Status*** **With Mitigation**
Construction Phase							
Local	Medium	Long term	Moderate	High	Moderate (-tve)	Wherever possible, roads and tracks should be constructed so as to run along the contour. All roads and tracks running down the slope must have water diversion structures present. Any extensive cleared areas that are no longer or not required for construction activities should be re-seeded with locally-sourced seed of suitable species. Bare areas can also be packed with brush removed from other parts of the site, encourage natural vegetation regeneration and limit erosion. All construction vehicles should remain on properly demarcated roads. No construction vehicles should be allowed to drive over the vegetation except where no cleared roads are available. In such cases a single track should be used and multiple paths should not be formed	Low (-tve)
Operational Phase							
Local	Low	Long term	Low	High	Low (-tve)	Regular monitoring for erosion to ensure that no erosion problems are occurring at the site as a result of the roads and other infrastructure. All erosion problems observed should be rectified as soon as possible. All maintenance vehicles to remain on the demarcated roads.	Low (-tve)

Impact 4 Faunal habitat destruction, alteration and physical disturbance.							
Extent	**Intensity**	**Duration**	**Probability**	**Confidence**	***Significance & Status*** **Without Mitigation**	**Mitigation**	***Significance & Status*** **With Mitigation**
Construction Phase							
Local	High	Short term	High	High	Moderate (-tve)	Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person. The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. The rocky outcrops are particularly sensitive in this regard and construction personnel should not be allowed off of the construction site and onto these areas. All staff and contractors should undergo an environmental induction course by the ECO. Fires should only be allowed within fire-safe demarcated areas. No fuelwood collection should be allowed on-site. No dogs should be allowed on site. All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. Should the site need to be fenced, the fencing should be constructed in manner which allows for the passage of small and medium sized mammals. Steel palisade fencing (20 cm gaps min) is a good option in this regard as it allows most medium-sized mammals to pass between the bars, but remains an effective obstacle for humans. Alternatively the lowest strand or bottom of the fence should be elevated to 15 cm above the ground at least at strategic places to allow for fauna to pass	Moderate (-tve)

						under the fence. If electrified strands are to be use, there should be no strands within 20 cm of the ground because tortoises retreat into their shells when electrocuted and eventually succumb from repeated shocks.	
Operational Phase							
Local	Low	Long term	High	High	Low (-tve)	No unauthorized persons should be allowed onto the site. Staff present during the operational phase should receive environmental education so as to ensure that that no hunting, killing or harvesting of plants and animals occurs.	Low (-tve)

Impact 5 Negative impacts on avifauna as a result of habitat loss, electrocution and collisions with transmission lines							
Extent	**Intensity**	**Duration**	**Probability**	**Confidence**	***Significance & Status*** **Without Mitigation**	**Mitigation**	***Significance & Status*** **With Mitigation**
Construction Phase							
Local	Low	Short term	High	High	Moderate (-tve)	The length of any new power lines that need to be installed should be kept to a minimum. Ensure that all new lines are marked with bird flight diverters along their entire length. If the new lines were to run parallel to existing unmarked lines this would potentially create a net benefit as this could reduce the collision risk posed by the older line. All new power line infrastructure should be bird-friendly in configuration and adequately insulated (Lehman et al. 2007). These activities should be supervised by someone with experience in this field.	Low (-tve)

Operational Phase							
Local	Low	Long term	High	High	Moderate (-tve)	Ensure that any maintenance on the transmission infrastructure of the site retains the bird-friendly design features. Any electrocution and collision events that occur should be recorded, including the species affected and the date. If repeated collisions occur within the same area, then further mitigation and avoidance measures may need to be implemented.	Low (-tve)

11.5 ECOLOGICAL IMPACT SUMMARY

A summary assessment of the above impacts is provided below with reference to the different phases of the project (construction & operation) as well as pre- and post-mitigation. The majority of impacts can reduced to a low level through avoiding the sensitive receptors and implementing relatively simple mitigation. There are no highly sensitive ecosystems present within the proposed development area. The washes are more sensitive than the surrounding plains as a result of their associated erosion risk. Cover of the ground layer is generally not significantly higher within the washes and is in fact often lower. As a result these small **washes are not highly significant** from an ecological and biodiversity perspective, but should not be impacted as they regulate water movement across the site.

The proposed development area is floristically homogenous and is not locally significant from a faunal perspective as this habitat is widely available in the area. Faunal disturbance during the construction phase is inevitable and cannot be fully mitigated. The impact is however restricted to the construction phase and fauna are likely to return to the area during the operational phase of the project. Given the relatively flat nature of the site and the coarse sandy nature of the substrate, erosion risk is likely to be low and provided that vegetation clearing is kept to a minimum, few measures to combat erosion will need to be implemented. Very few alien species were observed at the site which can be ascribed to the arid nature of the area combined with nutrient-poor soils. As a result, the risk of alien plant invasion should be relatively low. Alien plants are however likely to become an issue if the site is highly disturbed during construction or if water runoff is not properly managed.

Table 5. Summary assessment of the pre- and post-mitigation impacts associated with the construction and operation phases of the project

Impact	Project Phase	Pre Mitigation	Post Mitigation
Impacts on vegetation and protected plant species	Construction	Moderate-High	Moderate
	Operation	Low	Low
Increased alien plant invasion risk	Construction	Moderate	Low
	Operation	Moderate	Low
Increased erosion risk	Construction	Moderate	Low
	Operation	Low	Low
Faunal habitat loss and disturbance	Construction	Moderate	Moderate
	Operation	Low	Low
Negative impacts on avifauna	Construction	Moderate	Low
	Operation	Moderate	Low

11.6 CUMULATIVE IMPACTS

Cumulative impacts arise from the combined presence of several similar developments within an area which affect ecological processes operating at broader scales or which each have a small impact which becomes significant when combined. At this point, other known development in the vicinity of the Skuitdrift site is a proposed 10 MW solar facility which is adjacent to the substation, but to the northeast of the current site, as well as two other proposed 20 MW facilities on the adjacent property to the east of the current development. However, at this point, these are all proposed facilities and actual developments already present include the ESKOM substation on the site as well as some intensive agriculture northwest of the site.

This suggests that the current levels of development in the area are low and the contribution of the current development to cumulative impacts, while potentially significant at a local level would be low at the landscape and regional level and the potential for the development to contribute towards the disruption of broad-scale ecological processes remains low.

11.7 MITIGATION

As a general mitigation strategy, an Environmental Control Officer (ECO) should be present for the site preparation and initial clearing activities to ensure the correct demarcation of no-go areas, facilitate environmental induction with construction staff and supervise any flora relocation and faunal rescue activities that may need to take place during the site clearing. Thereafter weekly site compliance inspections would probably be sufficient. However, in the absence of the ECO there should be a designated environmental officer present to deal with any environmental issues that may arise such as fuel or oil spills.

The following other mitigation measures were recommended by the Botanical Specialist and have been included in the EMP:

11.7.1 Construction Phase

- Vegetation clearing to be kept to a minimum. If possible the ground grass layer should be left intact and only the larger woody plants cleared.
- All areas to be cleared should be clearly demarcated.
- Sensitive areas as demarcated on the sensitivity map should be avoided, and where such areas cannot be avoided specific mitigation measures to reduce their impact would need to be implemented.
- Only those individuals of protected plant species directly within the development footprint should be cleared.
- A search and rescue operation for protected species which could survive translocation such as Hoodia and Aloe, should be conducted prior to construction.
- Sensitive areas with appropriate buffers at the site such as the washes should be demarcated at the site by an ecologist as part of the preconstruction activities for the site.
- Soil disturbance and vegetation clearing should be kept to minimum.
- Cleared areas that are not going to be used should be revegetated with locally-collected seed of indigenous species.
- Regular monitoring to ensure that alien plants are not increasing as a result of the disturbance that has taken place.
- Wherever possible, roads and tracks should be constructed so as to run along the contour.
- All roads and tracks running down the slope must have water diversion structures present.
- Any extensive cleared areas that are no longer or not required for construction activities should be re-seeded with locally-sourced seed of suitable species. Bare areas can also be

packed with brush removed from other parts of the site, encourage natural vegetation regeneration and limit erosion.

- All construction vehicles should remain on properly demarcated roads. No construction vehicles should be allowed to drive over the vegetation except where no cleared roads are available. In such cases a single track should be used and multiple paths should not be formed
- Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
- The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. The rocky outcrops are particularly sensitive in this regard and construction personnel should not be allowed off of the construction site and onto these areas.
- All staff and contractors should undergo an environmental induction course by the ECO.
- Fires should only be allowed within fire-safe demarcated areas.
- No fuelwood collection should be allowed on-site.
- No dogs should be allowed on site.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- Should the site need to be fenced, the fencing should be constructed in manner which allows for the passage of small and medium sized mammals. Steel palisade fencing (20 cm gaps min) is a good option in this regard as it allows most medium-sized mammals to pass between the bars, but remains an effective obstacle for humans. Alternatively the lowest strand or bottom of the fence should be elevated to 15 cm above the ground at least at strategic places to allow for fauna to pass under the fence.
- If electrified strands are to be use, there should be no strands within 20 cm of the ground because tortoises retreat into their shells when electrocuted and eventually succumb from repeated shocks.
- The length of any new power lines that need to be installed should be kept to a minimum.
- Ensure that all new lines are marked with bird flight diverters along their entire length. If the new lines were to run parallel to existing unmarked lines this would potentially create a net benefit as this could reduce the collision risk posed by the older line.
- All new power line infrastructure should be bird-friendly in configuration and adequately insulated (Lehman et al. 2007). These activities should be supervised by someone with experience in this field.

11.7.2 Operational Phase

- Any vegetation clearing that needs to take place as part of maintenance activities, should be done in an environmentally friendly manner, including avoiding the use of herbicides and using manual clearing methods wherever possible.
- All alien plants present at the site should be controlled annually using the best practice methods for the species present.
- Bare soil should be kept to a minimum, and at least some grass or low shrub cover should be encouraged under the panels.
- Regular monitoring for erosion to ensure that no erosion problems are occurring at the site as a result of the roads and other infrastructure. All erosion problems observed should be rectified as soon as possible.
- All maintenance vehicles to remain on the demarcated roads.
- No unauthorized persons should be allowed onto the site.
- Staff present during the operational phase should receive environmental education so as to ensure that that no hunting, killing or harvesting of plants and animals occurs.

- Ensure that any maintenance on the transmission infrastructure of the site retains the bird-friendly design features.
- Any electrocution and collision events that occur should be recorded, including the species affected and the date. If repeated collisions occur within the same area, then further mitigation and avoidance measures may need to be implemented

12 HERITAGE BASELINE STUDIES

An Integrated Heritage baseline study was compiled for the proposed Khoi Sun Solar Development project site and includes inputs from the following specialist reports sanctioned as part of the HIA:

- Archaeological Impact Assessment (Pre-colonial, Historical) – Prof. Andrew Smith
- Historical background report – SE de Kock
- Recommendation for Mitigation from further paleontological studies and mitigation (Desktop) – Natura Viva (Dr. John Almond)

This Integrated HIA has been submitted to the SAHRA, as the competent heritage authority, for consideration. SAHRA has accepted the report and confirmed that no further studies or assessment are required (see appendix F).

Certain mitigation measures were recommended in this integrated heritage study and are summarised below.

- Although there are no inhibitors to the installation on the proposed footprint from an archaeological perspective (no significant impact), **instructions should be given to the engineers to avoid these quartz scatter areas during the period of construction** (koppies are just outside the solar facility footprint), so as to prevent any destruction of the sites. The dense scatters of white quartz stand out, so they are easily recognisable, even to the non-specialist.
- In the event that vegetation clearing and earthmoving activities expose archaeological or **paleontological materials**, such activities must stop and SAHRA (the heritage authority) must be notified immediately.
- If **archaeological materials** are exposed through earthmoving activities, then they must be dealt with in accordance with the National Heritage Resources Act (No. 25 of 1999) and at the expense of the developer(s) and/or property owner(s).
- Unmarked human burials may occur anywhere in the landscape and are often exposed during earthmoving activities. Human remains are protected by law and, if older than 60 years, are dealt with by the State Archaeologist at the South African Heritage Resources Agency.

These mitigation measures have been included in the EMPR.

13 PROCESS TO DATE

As part of the public participation process the following steps were taken to ensure compliance with the legislation and to allow ample opportunity for members of the public and key stakeholders to be involved and participate in the environmental process. Please see the Final Scoping Report on the *Cape EAPrac* website for evidence of the public participation process undertaken during the Scoping phase of the environmental process. **Appendix F** of this Draft EIR provides a summary of comments received and responses provided during the process, as well as evidence of the public

participation post-Final Scoping Report. The Public Participation Process has been undertaken according to the requirements of the new NEMA EIA regulations. The following requirements i.t.o the environmental process have been undertaken and complied with in terms of Regulation 56:

Table 12: Summary of Public Participation Process to date.

CHRONOLOGY OF EVENTS	
DATE	**ACTION**
4 Nov'11	**Notification** was sent to the Landowner of Farm 426 informing him of the development proposal and the environmental process to be followed.
1 Dec'11	**Notifications** were sent to neighbouring landowners informing them of the development proposal and the environmental process, and inviting them to register as Interested & Affected Parties (I&APs).
8 Dec. 2011	The **Siyanda District Municipality and the Kai! Garieb Local Municipality** (which have jurisdiction over the area), as well as other **organs of state** (including SANParks, Northern Cape Nature Conservation; Department of Agriculture, Forestry & Fisheries; Department of Minerals and Energy; Department of Water Affairs; SAHRA; Eskom; Civil Aviation Authority etc.), were notified and registered as key stakeholders.
25 Nov. 2011	**Advertisements** were placed in a regional newspapers (*Namaqua Weekly & Die Plattelander*), calling for stakeholders to register as I&APs.
30 Jan. 2012	**Notice Boards** (English & Afrikaans) were placed at the local municipal offices in Pofadder and at the Aggeneys Postal Agency.
Jan.2012	A **Stakeholder Register** was opened and the details of all registered stakeholders entered for future correspondence.
25 May 2012	Registered I&APs were sent notifications informing that of the availability of the Draft Scoping Report (DSR) for a review and comment period of 40-days. Registered State Departments, Organs of State & Stakeholders were sent notifications and CD copies of the DSR for a review and comment period of 40-days
25 May 2012	Hard copies of the Draft Scoping Report (DSR) were placed at the Khai-Ma Municipality offices (Pofadder) and the Kai! Garib Municipality in Kakamas, for public review (comment period from Monday 28 May 2012 to Friday 6 July 2012). The DSR has also been made available on the *Cape EAPrac* website: www.cape-eaprac.co.za/active from 28 May 2012.
4 July 2012	Registered State Departments, Organs of State & Stakeholders were sent urgent reminders to provide comment of the Draft Scoping Report before the end of the comment period.
16 July 2012	Registered I&APs and State Departments, Organs of State & Stakeholders were sent notifications informing they of the availability of the Final Scoping Report for information purposes on the *Cape EAPrac* website: www.cape-eaprac.co.za/active from 16 July 2012.

Comments received in response to the Draft and Final Scoping Reports have been included in this Draft Environmental Impact Report, made available to I&APs and Stakeholders for a 40-day review and comment period, extending from **05 November 2012 to 15 December 2012**.

NOTE: The environmental Regulations make provision that if there are no substantive changes between the *Draft* Environmental Impact Report (DEIR) and *Final* Environmental Impact Report (FEIR), the Final EIR can be submitted to the Department (DEA) without a further public comment period of 21-days (subject to approval by the delegated Authority).

11 ASSUMPTIONS & LIMITATIONS

This section provides a brief overview of *specific assumptions and limitations* having an impact on this environmental application process:

- It is assumed that the information on which this report is based (specialist studies and project information, as well as existing information) is **correct, factual, credible and truthful.**

- The proposed development is **in line** with the statutory planning vision for the area (namely the local Spatial Development Plan), and thus it is assumed that issues such as the cumulative impact of development in terms of character of the area and its resources, have been taken into account during the strategic planning for the area.
- It is assumed that all the relevant **mitigation measures** and agreements specified in this report will be implemented in order to ensure minimal negative impacts and maximum environmental benefits.
- It is assumed that due consideration will be given to the **discrepancies in the digital mapping** (PV panel array layouts against possible constraints), caused by differing software programs, and that it is understood that the ultimate/final positioning of solar arrays, and associated infrastructure will only be confirmed on-site during the final detailed design phase post-environmental decision.
- It is assumed that Stakeholders and Interested and Affected Parties notified during this public participation process will submit all relevant **comments timeously**, so that these can be considered and addressed during this impact assessment phase.

The following specialists have listed the following specific assumptions & limitations in their reports:

ECOLOGICAL / BIOPHYSICAL:

- Narrow temporal window of sampling - ideally, a site should be visited several times during different seasons to ensure that the full complement of plant and animal species present are captured. However, this is rarely possible due to time and cost constraints and therefore, the representivity of the species sampled at the time of the site visit should be critically evaluated. There had been some rainfall in the period preceding the site visit, and the vegetation within the drainage lines and run-on areas was green and growing with many species in flower. However, the rainfall had not been sufficient to stimulate large amounts of annuals, forbs or geophytes and as a result the plant species list obtained for the site can be considered to be representative of the trees, shrubs and grasses only. In order to overcome this potential limitation, the list of species observed during the site visit was supplemented with a **list of those protected or endangered species which are known to occur** in the area. The lists of amphibians, reptiles and mammals for the site are based on those observed at the site as well as those likely to occur in the area based on their distribution and habitat preferences. The species lists compiled for the site are therefore likely to include a much wider array of species than which actually occur at the site and represents a sufficiently conservative and cautious approach which takes account of the study limitations.

PLANNING:

- Due to the fact that **no applicable zoning** currently exists for alternative / renewable energy facilities or their ancillary facilities in the Northern Cape Province, it was necessary to apply for rezoning from Agriculture 1 to Special zone, as well as for a long-term lease on Agricultural land for the purposes of the renewable energy facility.

HERITAGE / ARCHAEOLOGY / PALEONTOLOGY:

- The Heritage Phase One Report is limited to the assessment of the potential impact of the proposed Khoisun 75MW (AC) Photovoltaic Solar Power Station on **heritage resources found on / within the proximity of the development site**.
- There is a limitation in terms of understanding the **cumulative impacts** of the project when taken in conjunction with other similar future development projects in the surrounding area;
- While every precaution was taken to accurately represent the location and extent of heritage resources with GIS software through the **integrated heritage resource mapping**, this should be considered **for illustrative purposes only**.

- Further archaeological and palaeontological artefacts/sites may only be identified once earth works have commenced, and thus it is **not possible** to identify such areas upfront. However should monitoring be implemented during earthworks, exposed heritage resources will be identified and the relevant authorities will be notified.

This impact assessment process was undertaken with full knowledge of the above assumptions and cognisance was taken of the limitations as specified.

12 OPINION & SUMMARY STATEMENT

The decision to grant or refuse authorisation in terms of Section 24 of NEMA must be made in the light of the provisions of NEMA. Section 24 provides that, in order to give effect to the general objectives of integrated environmental management laid down in NEMA, the potential impact on the environment of listed activities must be considered, investigated, assessed and reported on to the competent authority charged by the Act with deciding applications for environmental authorisation. An environmental impact assessment report (an "EIA Report") concerning the impact of the proposed activity and alternative activity options on the environment, has been compiled and submitted as prescribed and authorisation may only be issued after consideration of such report.

The Regulations *inter alia* require that an EIA report must contain all information that is necessary for the competent authority to consider the application and to reach a decision concerning the application, and must include an assessment of each identified potentially significant impact, including cumulative impacts of the proposed development on the environment, socio-economic conditions and cultural heritage. The *objective of this exercise* is both to identify and predict the actual and potential impact on socio-economic conditions, and consider ways of minimising negative impacts while maximising benefit. We submit that the environmental process undertaken thus far complies with these requirements and that the assessment has considered potential impacts and responded thereto by either complete avoidance where possible, or appropriate mitigation.

Irrespective of having investigated and addressed the known impacts, NEMA requires "*a risk-averse and cautious*" approach to be applied by the decision-makers. This process entails taking into account the limitation on present knowledge about the consequences of an environmental decision (i.e. cumulative impacts associated with other photovoltaic applications).

The preferred / mitigated development proposal presented in this report is responsive to the integrated results of the assessment of potential impacts made by the various specialists on the project team. The majority of recommendations have been accommodated in the Khoi-Sun Development layout and mitigation measures proposed for the construction, operation and decommissioning have been included in the Environmental Management Programme (EMPr) for implementation.

The relevant alternatives considered were refined in an iterative manner during the process to ensure that the constraints / concerns raised and recommendations provided by the specialists, the public, state departments and the competent authority have been incorporated into the design, thereby ensuring that the negative impacts associated with the proposal were avoided as a priority, and reduced via mitigation measures were necessary. This precautionary approach has allowed impacts to be avoided and/or minimised, while the positive benefits enhanced.

Based on comparative evaluation of the various alternatives, including the No-Go option, it is evident that the status quo (vacant land with limited agricultural potential) is not necessarily the best environmental option (subject to the implementation of recommended development mitigation measures).

The preferred development alternative (Alternative 4) for the Khoi-Sun Development consists of the following:

A **photovoltaic (PV) solar facility** with a generation capacity of 75MW (AC) / >90MW (DC). The solar technology will include **multi-crystalline PV modules** on a series of array rows approximately 2m (not exceeding 3m) in height and approximately 5m apart, **oriented at a tilt, facing approximately North**, mounted on **single axis tracking systems**, attached to **rammed/driven piers/poles**, arranged within the Western Layout covering a **footprint of approximately 250ha**. Associated infrastructure, with an approximate footprint of 19ha, will typically include the following:

- approximately **75 x inverter stations** (built within transport containers of approximately 25m²);
- an **on-site substation** (approximately 30m x 30m)(including a feed-in transformer to allow the generated power to be connected to Eskom's electricity grid);
- an overhead **transmission power line** to distribute the generated electricity from the on-site substation to the existing Schuitdrift Eskom substation (approximately 200m)
- **auxiliary buildings**, including:
  - administration / office & security (gate house),
  - control room & workshop,
  - visitor centre,
  - ablution / change room and
  - warehouse / storeroom.
- a **laydown area** of approximately 3ha;
- an **internal electrical reticulation network** (underground cabling);
- an **internal road / track network**
- 10 x 10kLt **rainwater tanks;** and
- electrified **parameter fencing** around the solar facility.

The abovementioned preferred / mitigated proposal is considered a reasonable and feasible alternative that requires only limited mitigation to enable it to be sustainable, and is thus considered to be the best practicable environmental option with the least level of impact.

This DEIR therefore concludes that the proposed Khoi-Sun Development development has been considered via a balanced approach, mindful of cumulative impacts and need and desirability requirements, and that no fatal flaws have been identified that warrant refusal of the proposed development. As such, it can be considered for environmental authorisation subject to implementation of the EMPr and specific specialist mitigation measures as specified in this report.
This DEIR is available for a review and comment period of 40-days, extending from 05 November 2012 to 15 December 2012. Comments and submissions received in response to this report will be responded to and addressed in the Final EIR.

Written submissions must be addressed to:

***Cape EAPrac* (Pty) Ltd**
Attention: **Mr Dale Holder**
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ABBREVIATIONS

AC	Alternating Current	**Km**	Kilometre
Alt.	Alternative	**kV**	Kilo Volt
BGIS	Biodiversity Geographic Information System	**LLRC**	Low Level River Crossing
ºC	Degree Centigrade	**Lt**	Litre
CARA	Conservation of Agricultural Resources Act (43 of 1983)	**LUDS**	Land Use Decision Support
CBA	Critical Biodiversity Area	**LUPO**	Land Use Planning Ordinance
Cctv	Closed Circuit Television (camera)	**M**	Metre
DAFF	Department of Agriculture, Forestry & Fisheries	**m²**	Metres squared
DC	Direct Current	**m³**	Metres cubed
DEA	Department of Environmental Affairs (national)	**MW**	Mega Watt
DEA&DP	Department of Environmental Affairs & Development Planning (Western Cape)	**NCHRA**	Northern Cape Heritage Resources Authority
DEANC	Department of Environmental Affairs & Nature Conservation (Northern Cape)	**NCNCA**	Northern Cape Nature Conservation Act (9 of 2009)
DEIR	Draft Environmental Impact Report	**NEMA**	National Environmental Management Act (107 of 1998, as amended in 2006)
DME	Department of Minerals and Energy	**NEMBA**	National Environmental Management: Biodiversity Act (10 of 2004)
DoE	Department of Energy	**NERSA**	National Energy Regulator of South Africa
DSR	Draft Scoping Report	**NFA**	National Forest Act (84 of 1998)
DWA	Department of Water Affairs	**NHRA**	National Heritage Resources Act (25 of 1999)
EA	Environmental Authorisation	**No.**	Number
EAP	Environmental Impact Practitioner	**NSBA**	National Spatial Biodiversity Assessment
ECO	Environmental Control Officer	**NVFFA**	National Veld and Forest Fire Act (101 of 1998)
EIA	Environmental Impact Assessment	**NWA**	National Water Act (36 of 1998)
EIR	Environmental Impact Report	**pH**	Potential of Hydrogen
EMPr	Environmental Management Programme	**PIA**	Paleontological Impact Assessment
FPA	Fire Protection Association	**PM**	Post Meridiem; “Afternoon”
GPS	Global Positioning System	**PV**	Photovoltaic
GWh	Giga Watt hour	**PVC**	Polyvinyl Chloride (piping)
Ha	Hectare	**SACAA**	South African Civil Aviation Authority
HIA	Heritage Impact Assessment	**SAHRA**	South African National Heritage Resources Agency
I&APs	Interested and Affected Parties	**SANBI**	South Africa National Biodiversity Institute
IDP	Integrated Development Plan	**SANS**	South Africa National Standards
IPP	Independent Power Producer	**SDF**	Spatial Development Framework
ISO	International Organisation for Standardisation (ISO 9001)	**S&EIR**	Scoping & Environmental Impact Reporting
Kl / Klt	Kilo Litre	**WULA**	Water Use Licence Application

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