Van Zyl Environmental Consultants cc

2009/073037/23

Environmental Impact Assessment Process

Draft Basic Assessment Report

&

Environmental Management Programme

21/2011

Proposed Kwartelspan PV Power Station I
and

Associated Infrastructure

Pixley ka Seme District Municipality

Northern Cape Province

27 August 2012

NEAS REF No: DEA/EIA/0001020/2012

DEA REF No: 14/12/16/3/3/1/484

Applicant:

suntrace

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

	(For official use only)
File Reference Number:	
Application Number:	
Date Received:	

Basic assessment report in terms of the Environmental Impact Assessment Regulations, 2010, promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended.

Kindly note that:

1. This **basic assessment report** is a standard report that may be required by a competent authority in terms of the EIA Regulations, 2010 and is meant to streamline applications. Please make sure that it is the report used by the particular competent authority for the activity that is being applied for.

2. The report must be typed within the spaces provided in the form. The size of the spaces provided is not necessarily indicative of the amount of information to be provided. The report is in the form of a table that can extend itself as each space is filled with typing.

3. Where applicable **tick** the boxes that are applicable in the report.

4. An incomplete report may be returned to the applicant for revision.

5. The use of "not applicable" in the report must be done with circumspection because if it is used in respect of material information that is required by the competent authority for assessing the application, it may result in the rejection of the application as provided for in the regulations.

6. This report must be handed in at offices of the relevant competent authority as determined by each authority.

7. No faxed or e-mailed reports will be accepted.

8. The report must be compiled by an independent environmental assessment practitioner.

9. Unless protected by law, all information in the report will become public information on receipt by the competent authority. Any interested and affected party should be provided with the information contained in this report on request, during any stage of the application process.

10. A competent authority may require that for specified types of activities in defined situations only parts of this report need to be completed.

11. Should a specialist report or report on a specialised process be submitted at any stage for any part of this application, the terms of reference for such report must also be submitted.

PROJECT DETAILS

FILE NAME:	**KWARTELSPAN PV I**
FILE NUMBER:	**21/2011**
DEA REFERENCE:	**14/12/16/3/3/1/484**
NEAS REFERENCE:	**DEA/EIA/0001020/2012**
REPORT:	**DRAFT BASIC ENVIRONMENTAL IMPACT ASSESSMENT REPORT & ENVIRONMENTAL MANAGEMENT PROGRAMME**
FOR:	**PROPOSED CONSTRUCTION AND OPERATION OF A PHOTOVOLTAIC POWER STATION OF UP TO 15 MWp**
LOCATION**:**	**REMAINING EXTENT OF FARM KWARTELSPAN NO. 25** (PV PLANT)**, REMAINING EXTENT OF PORTION 1, FARM KWARTELSPAN NO. 25** (EVACUATION LINE)**, NORTHERN CAPE**
DATED:	**AUGUST 2012**
WRITTEN BY:	**VAN ZYL ENVIRONMENTAL CONSULTANTS CC**
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Sub-Consultants:	**Ekotrust CC (Ecological Study)** **Beryl Wilson (Avifauna & Chiroptera Study)** **Nilssen Archaeological Resources Management (Heritage Impact Assessment)** **Axis Landscape Architecture (Visual Study)** **Christo Lubbe (Agricultural Study)** **TerraGIS (GIS)**
APPOINTED BY:	**SUNTRACE AFRICA (PTY) LTD**
Contact Person**:**	**Mr. A. Chaudhry**
Mobile:	**073 145 1949**
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Physical Address:	**P.O.Box 1559, Gallo Manor 2052, Johannesburg, 2052**

Should this report be used as a reference, it should be cited as follows:
Van Zyl Environmental Consultants, 2012. **Draft Basic Environmental Impact Assessment Report for the Construction and Operation of the Kwartelspan Photovoltaic Power Station I, Northern Cape.** Upington

GENERAL SITE INFORMATION

FARM PORTIONS:	**SURVEYOR GENERAL CODE:**
Remaining Extent of the Farm Kwartelspan nr 25 Portion 1 (Remaining Extent) of the Farm Kwartelspan nr 25 Registration Division, Hopetown (Appendix G4)	C03300000000002500000 (PV Power Plant) C03300000000002500001 (Evacuation Line)

SOLAR PLANT DESIGN SPECIFICATIONS:

TYPE OF TECHNOLOGY:	Photovoltaic Power Generation
STRUCTURE HEIGHT:	~ 7 meters
TOTAL EIA STUDY AREA:	~ 19.9 ha
LAYDOWN AREA: CONSTRUCTION:	~ 2.4 ha
LAYDOWN AREA: OPERATIONS:	~ 2.4 ha
STRUCTURE ORIENTATION:	North
GENERATION CAPACITY:	up to ~ 15 MWp
TOTAL GENERATION CAPACITY AT DELIVERY POINT:	up to ~ 15 MW (MVA)

PUBLIC PARTICIPATION PROCESS

INVITATION TO COMMENT ON THE DRAFT BASIC ENVIRONMENTAL IMPACT ASSESSMENT REPORT

The draft basic environmental impact assessment report is available for review at the Douglas Public Library, which was identified as readily accessible to I&APs. It can also be requested from the EAP below.

The availability of the report will be communicated to all registered I&APs. They will be allowed a review period of 40 days from **30 August 2012 until 10 October 2012.**

Please submit your written comments, including a declaration of any business, financial, personal or other interest you may have in the approval or rejection of this application, via facsimile, or post to:

FOR ATTENTION: **I.B. van Zyl**

Mobile: **072 222 6194**
Telephone: **054 338 0722**
Facsimile: **086 624 0306**
Email: **ibvanzyl@telkomsa.net**
Address: **P.O. Box 567**
UPINGTON
8800

Always cite the reference number in order to ensure that your comments are allocated correctly.

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GLOSSARY OF TERMS

Alternatives:	different options with regard to site or location, type of activity, design or layout, technology, and operational aspects of the activity that could be considered in order to meet the general purpose and requirements of the activity
Aquifer:	a geological formation of porous rock, such as sandstone, that has the ability to store water and may yield water to wells and springs
Cumulative Impact	an impact that is not necessarily significant in itself, but which may become significant when considered in addition to the existing and potential impacts of other similar or diverse activities in the area
Direct Impact	a generally obvious and quantifiable impact, usually associated with the construction, operation or maintenance of an activity, which is caused directly by the activity and generally occurs at the time and place of the activity
'Do-Nothing' Alternative	the option of not undertaking the proposed activity or any of its alternatives, which provides the baseline against which the impacts of other alternatives should be compared
Endangered Species	taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating, including taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction
Endemic	having a distribution restricted to a particular area or region
Environment	all external conditions and factors, living and non-living (chemicals and energy), that affect an organism or other specified system during its lifetime (Miller, 2005: G6)
Environmental Impact Assessment (EIA)	a study of the environmental consequences of a proposed course of action, usually conducted in order to provide information for the consideration of an application for environmental authorisation as defined in NEMA
Environmental Impact	an environmental change caused by a human activity
Environmental Management	addressing environmental concerns in all stages of development, in order to ensure that the development is sustainable and does not exceed the carrying capacity of the environment.
Environmental Management Programme	an operational plan that organises and coordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation
Homogeneous	of the same nature; uniform
Hydrology	the science encompassing the behaviour of atmospheric, surface and ground water
Indigenous	having occurred naturally in the area in question before 1800
Indirect Impact	an impact that occurs at a different time or place to the activity that causes it
Interested and Affected Party (I&AP)	a person, group or organisation interested in or affected by a proposed activity, and any organ of state that may have jurisdiction over any aspect of the activity
Laydown area	An area that has been cleared for the temporary storage of equipment and supplies. Laydown areas are usually covered with rock and/or gravel to ensure accessibility and safe manoeuvrability for transport and off-loading of vehicles
Parameter	a set of measurable factors such as temperature, pressure and pH that define a system and determine its behaviour
Photovoltaic Cell	a cell that converts solar energy into electrical energy
Photovoltaic Effect	the effect attained when the electrons within a photovoltaic cell are excited by solar radiation
Photovoltaic Module	a packaged unit consisting of interconnected photovoltaic cells
Public Participation Process	a process of involving the public in order to identify needs, address concerns, choose options, plan and monitor in terms of a proposed project, programme or development

Red Data Species	a species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or the South African Red Data List
Scoping	a procedure for determining the extent of and approach to an EIA, used to focus the EIA to ensure that only the significant issues and reasonable alternatives are examined
Scoping Report	a report describing the issues identified
Significant Impact	an impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment
Sky glow	illumination of the night sky when light reflects off particles in the atmosphere such as moisture, dust, or smog
Topography	graphic representation of the surface features of a place or region on a map, indicating their relative positions and elevations

ABBREVIATIONS

BEE	Black Economic Empowerment
BID	Background Information Document
CLO	Community Liaison Officer
CO_2	Carbon dioxide
CSP	Concentrating Solar Power
DENC	Department of Environment and Nature Conservation
DEA	Department of Environmental Affairs
DM	District Municipality
DNI	Direct Normal Irradiation
DoE	Department of Energy
DR&PW	Provincial Department of Roads and Public Works, Northern Cape
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMC	Electromagnetic Conformance
EMF	Environmental Management Framework
EMP	Environmental Management Programme
EPWP	Expanded Public Works Programme
ESS	Environmental Scoping Study
F	Fluorides
FIT	Feed-in Tariff
GDP	Gross Domestic Product
GG	Government Gazette
GHG	Greenhouse Gas
GIS	Geographical Information Systems
GN	Government Notice
GPS	Global Positioning System
GWh	Gigawatt Hour

I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IPP	Independent Power Producer
kV	Kilovolt
LED	Local Economic Development
MAR	Mean Annual Rainfall
MW	Megawatt
NEMA	National Environmental Management Act
NERSA	National Energy Regulator of South Africa
NO_3 as N	Nitrates
POL	Petrochemicals, Oils and Lubricants
PV	Photovoltaic
REFIT	Renewable Energy Feed-In Tariff
RFQ	Request for Qualification
RFP	Request for Proposal
RoD	Record of Decision
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
TDS	Total Dissolved Solids
ToR	Terms of Reference
UV	Ultraviolet
VAC	Visual Absorption Capacity
WMA	Water Management Area

1. SUMMARY AND OVERVIEW OF THE PROPOSED PROJECT

Suntrace Africa (Pty) Ltd proposes the construction of a commercial photovoltaic (PV) power station of fixed or tracking systems and associated infrastructure with a generation capacity of 15MWp at the farm Kwartelspan near the Greefspan Substation situated between Douglas and Prieska in the Northern Cape. The Eskom Greefspan Substation is located on the farm De Rust, of Portion 1 (Remaining Extent) of the farm Kwartelspan No. 25 approximately 60 km south of Douglas on the R357.

The development will have a footprint of less than 20 ha and associated infrastructure will include:

- Lighting protection systems, including masts
- Any equipment and upgrades or expansions required to the substation
- Internal service roads and where required an access road
- Small administrative, control and security buildings
- Ablution facilities
- Workshops, storerooms and laydown areas
- Perimeter fencing and security systems
- Area lighting (movement activated)
- small parking area

DEA and the National Energy Regulator of South Africa (NERSA) have already authorised the construction and operation of a 10MW PV power station consisting of one axis tracker systems and associated infrastructure on an area of approximately 44 ha to the south of the substation (Figure 1) to AE-AMD Renewable Energy.

The study identified and evaluated potential environmental impacts associated with all aspects of the project for detailed study, including specialist studies. It contains a detailed description of the nature and extent of a PV power station. Not any environmental fatal flaws were identified.

Due to the technical and economical requirements of a PV power station, close proximity to a substation is preferred and therefore only one possible site has been identified for the development. Suntrace Africa selected this site as it conformed to the criteria for the development of a PV power station.

Environmental, technical and economic feasibility must be taken into account and therefore factors such as meteorology, land availability and land use capability, costs and grid connection capacity have been considered by the proponent. The purpose of this study would therefore be to investigate the environmental feasibility of using the proposed site for the development in question, with consideration for alternatives with regard to other factors such as technology and design.

The application for authorisation has been submitted in accordance with the EIA Regulations published in Government Notices R 543 to 546 GG No. 33306, dated 18 June 2010, in terms of Chapter 5 of the National Environmental Management Act, Act No 107 of 1998 and was accepted by the competent authority.

1.1 Background to the Study

The energy demand in South Africa increases each year due to economic and population growth, as well as social development and upliftment. While fossil fuels have long been the preferred energy source, it has become apparent that more sustainable resources must be utilised in order to avoid an energy crisis. The worldwide awareness of environmental degradation and subsequent climate change also forces the energy industry to find alternative sources of energy that would have a less detrimental effect on the environment.

South Africa has an abundance of renewable, and therefore sustainable, energy resources at its disposal. Renewable energy is acquired from cyclical, non-depletable natural resources, such as sunlight, wind, biomass, water, waves, tides, ocean current, and heat radiated by the earth (geothermal energy) (DME, 2003). These resources can be harnessed to produce heat, electricity, gaseous and liquid fuels, or combinations of these types of energy.

The high level of solar radiation experienced in South Africa, and especially in the Northern Cape, renders it suitable for energy generation through solar technology.

This project would make a contribution to improving the sustainability of development in South Africa.

The cost of greenhouse gas emissions from power generation can be easily decreased using PV power generation. Moreover, the carbon footprint of PV systems is decreasing every year. Currently, the external costs to society incurred from burning fossil fuels are not included in electricity prices. (Greenpeace, 2011)

The proposed development would provide clean energy from an unlimited and sustainable resource, which would cause minimal environmental impact and reduce fossil fuel dependence. It would produce minimal waste and avoid CO_2 emissions, and therefore reduce further global warming.

The proposed development could possibly qualify for registration as a Clean Development Mechanism (CDM) project. The developer would then be able to sell carbon credits from the project. The project would lead to reductions in GHGs due to the

reduction in electricity that would need to be produced from coal-fired plants. Should the project be registered with the Executive Board of the CDM, these reductions in GHGs could be registered as Certified Emission Reductions (CERs), the official name for carbon credits. It could then be sold to buyers who could use the credits for compliance purposes in developed countries.

1.1.1 The Renewable Energy Independent Power Producer Procurement Programme

The government has abandoned the Renewable Energy Feed-In Tariff (REFIT) in favour of a selection process that would involve both price and non-price elements. South Africa presently has in place a target of 10 000 GWh of Renewable Energy. The Minister has determined that 3 725 megawatts (MW), to be generated from Renewable Energy sources, is required to ensure the continued uninterrupted supply of electricity. This 3 725 MW is broadly in accordance with the capacity allocated to Renewable Energy generation in IRP 2010-2030.

The Renewable Energy Independent Power Producer Procurement Programme (IPP Procurement Programme) has been designed so as to contribute towards the target of 3 725 megawatts and towards socio-economic and environmentally sustainable growth, and to start and stimulate the renewable industry in South Africa.

The following technologies shall be considered as qualifying technologies for selection under this IPP Procurement Programme:

- Onshore wind
- Concentrating solar thermal
- Solar photovoltaic
- Biomass solid
- Biogas
- Landfill gas
- Small hydro

The Department of Energy (DoE) has allocated capacity across various renewable technologies, with 1 850 MW set aside for onshore wind, 200 MW for concentrating solar thermal, a further 1 450 MW for solar photovoltaic solutions, 12.5 MW for both biomass and biogas, 25 MW for landfill gas capacity, 75 MW for small hydro, and a further 100 MW for small-scale IPP projects of less than 5 MW.

In terms of this IPP Procurement Programme, the bidders are required to bid on tariff and the identified socio-economic development objectives of the Department. The tariff will be payable by the buyer pursuant to the power purchase agreement (PPA) to be entered into between the buyer and the project company of a preferred bidder.

Each facility procured in terms of this IPP Procurement Programme will be required to achieve commercial operation by not later than the dates set out in the request for proposal (RFP).

Based upon the principles of this IPP Procurement Programme, the Department intends to introduce a separate 'Small Projects IPP Procurement Programme' for electricity generation projects of less than 5MW.

Projects will only be considered if they can feasibly enter commercial operation by June 2014. However, concentrating solar thermal projects will qualify if they are able to show that commercial operations can be achieved by June 2015. Besides meeting these timelines, projects would also need to pass land-security, environmental, grid-connectivity, primary-energy availability, technical-feasibility, generation-forecasting, legal, black economic-empowerment, economic-development, as well as regulatory thresholds.

Wind developers would need to provide 12 months of wind data from the proposed site, as well as an independently verified generation forecast, and show that the proposed contractors have participated in at least two previous projects. The projects would also only qualify if they were larger than 1 MW and smaller than 140 MW in size and include turbines that are IEC 64-100-certified. Similar criteria have been set for the solar projects but greater emphasis is given to water use and availability.

Besides the pricing, financial, legal and technical criteria, the IPPs would also need to show how their projects could stimulate job creation, local content and local manufacturing, rural development and community involvement, education and development of local communities. Government is particularly keen on the localisation aspects as the New Growth Path and the Industrial Policy Action Plan have placed green industries at the centre of South Africa's plans to grow employment and to stimulate manufacturing investments and activities.

1.2 Legal Requirements

Environmental Impact Assessments, when conducted with the purpose of obtaining Environmental Authorisation for a development activity, are regulated by legislation. South African Environmental Law is grounded in the Constitution of South Africa (Act No. 108 of 1996). The Bill of Rights states that everyone has a right to a non-threatening environment and requires that reasonable measures are applied to protect the environment. This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development.

The National Environmental Management Act (NEMA, Act 107 of 1998) expands on and specifies these principles. The act states that the principles of Integrated Environmental Management (IEM) should be adhered to in order to ensure sustainable development. Accountability to the various parties that may be interested in and/or affected by the proposed development forms an integral part of the IEM procedure. This procedure requires public participation, starting during the application phase, when the application for authorisation is submitted to the competent authority and continued through towards the environmental impact

assessment decision making phases. The purpose of the IEM procedure is to ensure that the environmental consequences of a development proposal are understood and adequately considered and that negative aspects are resolved or mitigated and positive aspects enhanced.

Government Notices R 543 to 546 Government Gazette No. 33306, dated 18 June 2010, in terms of Chapter 5 of the National Environmental Management Act, Act No 107 of 1998 (as amended), contain the EIA Regulations, as well as a schedule of activities that may have substantial detrimental effects on the environment and therefore require authorisation from the competent environmental authority. The listed activities that will be associated with the proposed project include the following:

Notice No	Activity	Description	Project Description:
R544, 18 June 2010	1 (i)	The construction of facilities or infrastructure for the generation of electricity where: the electricity output is more than 10 megawatts but less than 20 megawatts	The proposed PV power station would generate electricity of up to 15 MWp.
R544, 18 June 2010	10 (i)	The construction of facilities or infrastructure for the transmission and distribution of electricity - outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts	Should there not be capacity to feed into the Greefspan substation, it would be an option to tie into the network on the sub transmission level, which is from 22kV to 132kV.
R544, 18 June 2010	11 (xi)	The construction of infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	It is a **slight** possibility that some of the PV structures or associated infrastructure with a combined size of 50 square metres or more might need to be erected nearer than 32 metres from drainage channels.
R544, 18 June 2010	18 (i)	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from: a watercourse;	A possibility exists that material of more than 5 cubic metres might be infilled, deposited, removed or moved from a watercourse.
R544, 18 June 2010	22 (ii)	The construction of a road, outside urban areas, where no reserve exists where the road is wider than 8 metres.	An access road of approximately 6.5 km long and 10 metres wide could be constructed if required.
R544, 18 June 2010	23 (ii)	The transformation of undeveloped, vacant or derelict land to – (ii) residential, retail, **commercial**, recreational, **industrial** or institutional use, outside an urban area and where the total area to be transformed is bigger than 1 hectare but less than 20 hectares	The construction and operation of the proposed 15 MWp PV power station could be classified as a commercial and/or industrial activity and would require an area of less than 20 hectares of undeveloped land.
R544, 18 June 2010	47 (ii)	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- where no reserve exists, where the existing road is wider than 8 metres – excluding widening or lengthening occurring inside urban areas.	It is a possibility that access roads might need to be lengthened by more than 1 km or widened by more than 6 metres to provide for access of trucks to offload construction equipment.
R546, 18 June 2011	14 (a) i	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, Northern Cape All areas outside urban areas.	The activity will be situated in an area in the Northern Cape where indigenous vegetation constitutes more than 75% of the total vegetation, and more than 5 hectares will be cleared for the construction phase of the proposed PV power station.

An application for environmental authorisation through the execution of a basic EIA process has been motivated by the applicant and accepted by the DEA who is the competent authority with regard to environmental authorisation for electricity-related developments and developments of national importance.

The Northern Cape Department of Environment and Nature Conservation (DENC) is involved as a commenting authority.

In addition to its function as a decision-making aid in terms of environmental authorisation, an EIA is an effective planning and decision-making tool for the project developer as it allows for the identification and management of potential environmental impacts, as well as the identification of other applicable legislation that must be considered and adhered to.

1.2.1 Other Applicable Legislation and Policies

In terms of the **National Heritage Resources Act, Act No. 25 of 1999**, any person who intends to undertake "*any development or other activity which will change the character of a site – exceeding 5 000 m² in extent*" and "*the construction of a …linear development or barrier exceeding 300 m in length*" must at the very earliest stages of initiating the development notify the responsible heritage resources authority, *viz.* the Northern Cape Provincial Heritage Resources Agency (NCPHRA) and/or the South African Heritage Resources Agency (SAHRA), as well as the Northern Cape Department of Sports, Arts and Culture. These authorities have been notified about the EIA process. (Appendix G2)

A Phase 1 Archaeological Impact Assessment and exemption from a Palaeontological Assessment are attached in Appendices D3 and D4. Find SAHRA's comment attached in Appendix G2f.

Section 5 of the **Conservation of Agricultural Resources Act, Act No. 43 of 1983**, prohibits the spreading of weeds and Section 6 and Regulation 15 and 15 E of GN R 1048 address the implementation of control measures for alien and invasive plant species. This aspect has been addressed in the Environmental Management Programme (Appendix F). This act also makes provision for the conservation of agricultural land.

Subdivision of Agricultural Land Act, Act 70 of 1970 control the subdivision and, in connection therewith, the use of agricultural land. It also controls long term leases over portions of agricultural land. The applicant needs to apply for consent from Dept. Agriculture for these leases.

National Forests Act, Act No. 84 of 1998 and Regulations, Section 7: No person may cut, disturb, damage or destroy any indigenous, living tree in a natural forest, except in terms of a licence issued under Section 7(4) or Section 23; or an exemption from the provisions of this subsection published by the Minister in the Gazette. Sections 12-16 deal with protected trees, with the Minister having the power to declare a particular tree, a group of trees, a particular woodland, or trees belonging to a certain species, to be a protected tree, group of trees, woodland or species. In terms of Section 15, no person may cut, disturb, damage, destroy or remove any protected tree; or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister.

National Veld and Forest Fire Act No.101 of 1998 regulate Fire Protection Associations and the building of fire breaks. The competent authority is the Department of Agriculture, Fisheries and Forestry.

Section 17 of the **Fencing Act, Act No. 31 of 1963,** states that any person erecting a boundary fence may clean any bush along the line of the fence up to 1.5 metres on each side thereof and remove any tree standing in the immediate line of the fence. However, this provision must be read in conjunction with the environmental legal provisions relevant to protection of flora.

Sections 9-11 of the **National Environmental Management: Air Quality act, Act No. 39 of 2004,** regulates national, provincial and local ambient air quality standards. Activities are addressed in Section 21. Section 22 addresses atmospheric emissions licenses.

The **National Environmental Management: Biodiversity Act, Act No. 10 of 2004** provides for the MEC/Minister to list ecosystems that are threatened and in need of protection (Section 52) and to identify any process or activity in such a listed ecosystem as a threatening process (Section 53). A list of threatened and protected species has been published in terms of Section 56 (1) GG 29657 GN R 151 and GN R 152, Threatened or Protected Species Regulations.

The act also deals with restricted activities involving alien species; restricted activities involving certain alien species totally prohibited; and duty of care relating to listed invasive species.

The **National Environmental Management Waste Act, Act No. 59 of 2008** reforms the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development.

In terms of the definitions contained in Section 1 of the **National Water Act, Act No. 36 of 1998**, a "water resource" includes a watercourse, surface water, estuary, or aquifer. "Aquifer" means a geological formation which has structures or textures that hold water or permit appreciable water movement through them. "Watercourse" means a river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake or dam into which, or from which, water flows; and any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

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

The Minister of Water and Environmental Affairs is allowed to regulate activities which have a detrimental impact on water resources by declaring them to be controlled activities. No person may undertake a controlled activity unless such person is authorised to do so by or under this Act.

Duty of Care to prevent and remedy the effects of pollution to water resources is addressed in Section 19. Section 20 addresses the procedures to be followed, as well as control of emergency incidents which may impact on a water resource.

Recognised water uses are addressed in terms of Section 21 and the requirements for registration of water uses are stipulated in Section 26 and Section 34.

The Siyancuma LM, a water services provider, has been consulted by the developer for possible water supply during the construction and operational phases and an application for water is in process. Water would be needed for activities such as concrete batching, dust control, potable use etc.

Should groundwater be considered at any stage, a water use authorisation should be obtained from the Department of Water Affairs (DWA). An application for this license should be submitted well in advance (6-12 months before commencement of the construction phase).

The quaternary drainage region F40A is excluded from General Authorisations (GA) for taking of water from a [ground] water resource [as extended under Notice 837 in the Government Gazette of 23 September 2010]. Note that energy developments are not part of small industrial users and as such cannot be entitled to the water use allowance set aside for small industrial users as determined by the GA.

Section 25 of the **Environment Conservation Act, Act No. 73 of 1989,** as well as the National Noise Control Regulations GN R 154 dated 10 January 1992, regarding noise, vibration and shock, is applicable.

Section 8 of the **Atmospheric Pollution Prevention Act, Act No. 45 of 1965**, regulating controlled areas, as well as Section 27, with regard to dust control, is still applicable.

Section 28 of the **National Environmental Management Act, Act No. 107 of 1998** requires duty of care where reasonable measures are taken to prevent pollution or degradation from occurring, continuing or recurring, or, where this is not possible, to minimise and rectify pollution or degradation of the environment. Section 29 addresses the protection of workers refusing to do environmentally hazardous work. Section 30 addresses procedures to be followed in the event of an emergency incident which may impact on the environment. Access to environmental information and protection of whistle blowers are addressed in Section 31.

Should the developer wish to obtain gravel for the concrete required for the bases of the PV installations rather than outsourcing the supply of concrete, the **Minerals and Petroleum Resources Development Act, Act No. 28 of 2002** may become directly applicable. If the concrete supply is outsourced, this act would be indirectly applicable through the ISO 9001 and ISO 14001 and the cradle-to-grave principles, by which the developer has an obligation to ascertain that the contractor supplying the concrete complies with the relevant legislation by only sourcing gravel from permitted areas.

The **Occupational Health and Safety Act, Act No. 85 of 1993** GN. R. 2281 of 1987 – 10-16: Environmental Regulations for Workplaces are applicable.

The **Northern Cape Nature Conservation Act, Act No. 9 of 2009** addresses protected species in the Northern Cape and the permit application processes related thereto.

The **South African Civil Aviation Regulation Act, Act 13 of 2009** controls markings of structures that may influence aviation through the Civil Aviation Technical Standard, SA-CATS-AH 139.01.33 Obstacle Limitations and Markings outside Aerodrome or Heliports.

It states that any structure exceeding 45 m above ground level, or structures where the top of the structure exceeds 150 m above the MEAN ground level, like on top of a hill, the mean ground level considered to be the lowest point in a 3 km radius around such structure. Structures lower than 45 m, which are considered as a danger or a potential danger to aviation, shall be marked as such when specified. Overhead wires, cables, etc., crossing a river, valley or major roads shall be marked and in addition, their supporting towers marked and lighted if an aeronautical study indicates that it could constitute a hazard to aircraft.

The highest structures that would be constructed at the proposed development would be the lightning conductors, which would have a height of 25 m.

The **White Paper on Renewable Energy (2003**) with national targets for renewable energy generation is applicable.

1.3 Terms of Reference

Van Zyl Environmental Consultants has been appointed by the applicant, Suntrace Africa (Pty) Ltd, as the independent Environmental Assessment Practitioner (EAP) to manage the Environmental Assessment Process including the Public Participation Process as stipulated in Government Notice R 543 to 546 Government Gazette No. 33306, dated 18 June 2010, in terms of Chapter 5 of the National Environmental Management Act, Act No 107 of 1998 (as amended) for the proposed project. Neither Van Zyl Environmental Consultants nor any of its specialist sub-consultants on this project are subsidiaries of or are affiliated to Suntrace Africa (Pty) Ltd. Van Zyl Environmental Consultants does not have any interest in secondary developments that may arise from the authorisation of the proposed project.

1.4 Details of the Environmental Assessment Practitioner and Expertise to Conduct the EIA

Van Zyl Environmental Consultants is an environmental consulting firm providing environmental management services, including environmental impact assessments and planning to evaluate risk and ensure compliance of proposed developments, as well as the implementation of environmental management tools.

Van Zyl Environmental Consultants has experience in environmental impact assessments, environmental risk assessments and environmental management and has been involved in environmental studies for a variety of projects throughout the Northern Cape. Irmé van Zyl has 12 years' environmental consulting experience. She holds a National Diploma in Nature Conservation, a Further Diploma in Environmental Education and a Masters Degree in Environmental Management. (Appendix G6)

2. APPROACH TO THE ENVIRONMENTAL STUDY

An investigation with regard to the environmental impacts associated with the proposed development is being conducted in compliance with the Environmental Impact Assessment Regulations published in Government Notices R 543 to R 546, promulgated on 2 August 2010 in terms of the National Environmental Management Act (Act No. 107 of 1998) (as amended).

The Environmental Impact Assessment Process is being conducted by identifying the scope and conducting an Environmental Impact Assessment (EIA), including an Environmental Management Programme (EMP).

2.1 Methodology of the Environmental Impact Assessment

The study describes the preliminary decision-making processes with regard to the project, including the investigation of development alternatives and the selection of preferred alternatives. The specific activities expected to form part of the proposed development are also described.

The study provides a description of the receiving environment and investigates how this environment may be directly, indirectly and cumulatively affected by the proposed development. Potentially significant impacts (both social and biophysical) that may result from the construction, operation and maintenance phases of the proposed development are identified.

An Impact Matrix (Appendix G5) is used to determine any positive and/or negative impacts, whether direct, indirect or cumulative, that the proposed activities and development in this area may pose to the environment and people in the vicinity. Proposed mitigation through design and/or operational changes, as well as the significance of the impact thereafter is being investigated.

The nature of the activity, extent, duration, intensity, and probability of the direct, indirect and cumulative identified impacts are assessed. These parameters are used to establish the significance of the impact of an activity that will take place or is already taking place. The parameters are then compared to the level of significance in the Significance Rating Scale.

The EIA phase provides an overall social, economic and biophysical assessment of the environment surrounding the proposed development, as well as a detailed assessment of the site for development, in terms of environmental criteria. It also provides a discussion of alternatives to the proposal, which would meet the stated need for the activity, and ways to reduce the impact of the project by imposing mitigating measures. Significant impacts identified are rated and appropriate mitigation measures for potentially high environmental impacts are recommended in the EMP.

The objective of the EIA is to provide environmental authorities with sufficient relevant and objective environmental information to make an informed decision regarding the proposed project.

The Public Participation Process will be continued in order to ensure that I&AP issues and concerns are documented and addressed during the EIA process. This process also enables I&APs and stakeholders to review the basic assessment report and to verify that the issues they have raised to date have been captured and adequately considered. The first phase of the participatory and transparent Public Participation Process has been conducted (Appendix G2).

The basic assessment report phase is based on the Application for Environmental Authorisation filed with the National Department of Environmental Affairs (DEA) for the proposed development. It was accepted. The Northern Cape DENC is acting as a commenting authority.

2.2 Specialist Studies

Specialist studies were conducted on a larger study area of approximately 220 ha. It comprised of:

- a biodiversity/ecology impact study by Ekotrust CC (Appendix D1);
- Avifaunal and bat desktop specialist report by Ms Beryl Wilson (Appendix D2); and
- an archaeological impact study by Nilssen Archaeological Resources Management (Appendix D3); and
- a palaeontological exemption (Appendix D4);
- Visual Impact Assessment by Mr Gerhard Griesel (AXIS Landscape Architecture) (Appendix D5);
- Agricultural Impact Assessment including a soil potential survey by Mr Christo Lubbe (Appendix D6).

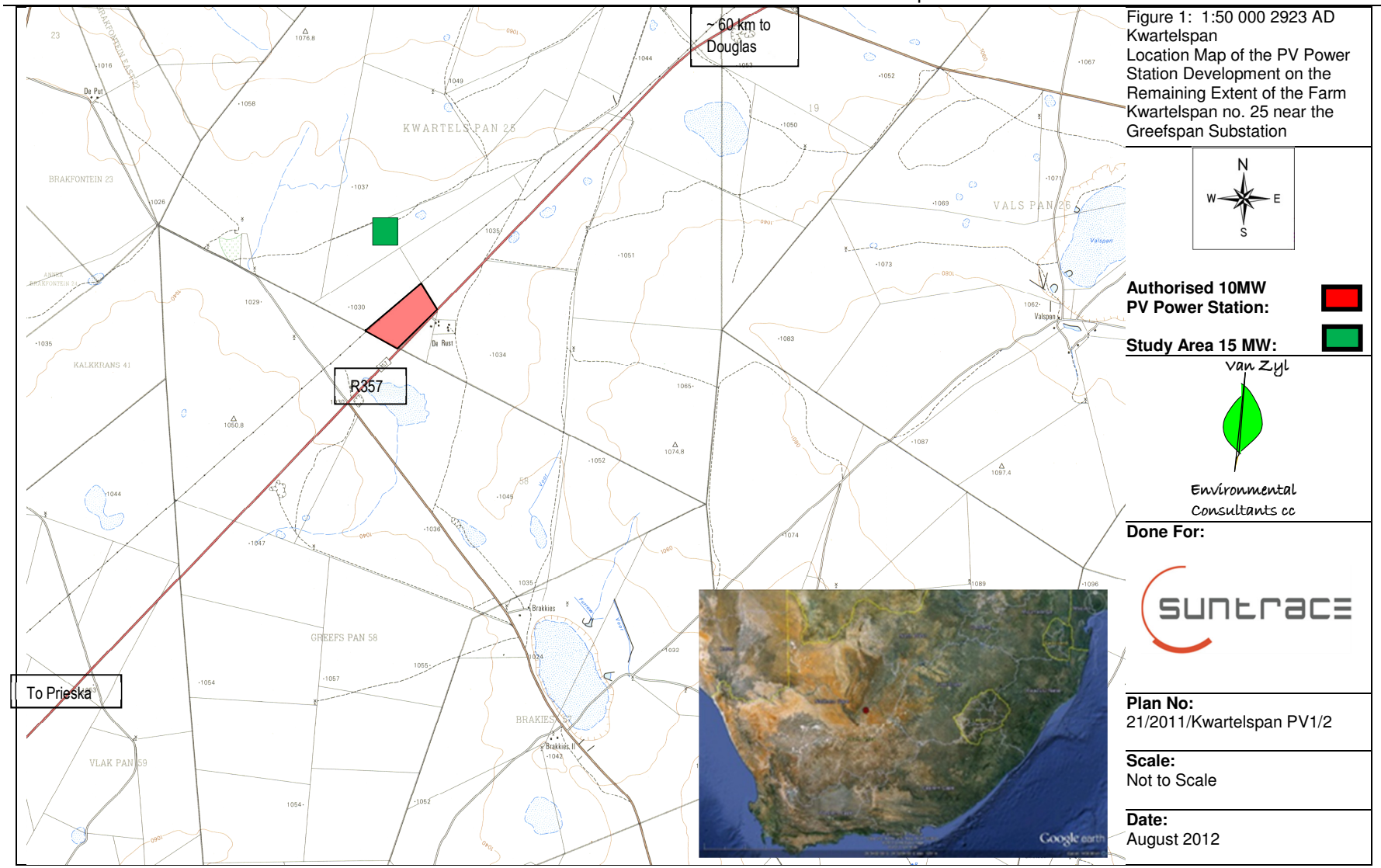


Figure 1: Location Map of the Study Area - South Africa 1:50 000 Topographic Map - 2923 AD Kwartelspan (Chief Director Surveys and Mapping, 1988)

SECTION A: ACTIVITY INFORMATION

Has a specialist been consulted to assist with the completion of this section?	~~YES~~	**NO**

If YES, please complete the form entitled "Details of specialist and declaration of interest" for appointment of a specialist for each specialist thus appointed:
Any specialist reports must be contained in **Appendix D**.

1. ACTIVITY DESCRIPTION

Describe the activity, which is being applied for, in detail[1]:

1.1 The Site

The PV power plant will be located on the Remaining Extent of the Farm Kwartelspan No. 25. Eskom Greefspan Substation is located on the farm De Rust, Remaining Extent of Portion 1 of the Farm Kwartelspan No. 25 in the Northern Cape. The evacuation line will be situated on the farm De Rust. The farms are situated approximately 60 km from Douglas on the R357. The site where the PV power station is proposed to be developed lies less than 650 meters to the north of the Greefspan Substation and northwest of the R357. (Figure 1)

The proposed site for development is situated in a remote area, mostly used for stock farming, within the boundaries of the Pixley ka Seme District Municipality and Siyancuma Local Municipality in the Northern Cape. Alluvial mining is expanding in the areas near the Orange River. The identified site is accessible from a dirt road off the R357 with Douglas to the north and Prieska to the south. The wider study area is approximately 220ha with the core site applied for less than 20ha.

1.2 Photovoltaic Technology and Generation of Electricity

Photovoltaic (PV) technology is widely used for supplying electricity to single households, but can also be used to generate higher volumes of electricity for distribution by an electricity supplier like Eskom. It is also used to supply electricity for military uses, as well as for isolated units like boats, motor vehicles, chargers, lampposts, telecommunication towers and billboards. It is also becoming very popular for powering borehole pumps.

Solar photovoltaic energy power plants use the light from the sun to generate electricity through a process known as the Photovoltaic Effect. This is achieved through the use of a PV cell that is made of silicone, which acts as a semiconductor. The cell absorbs solar irradiation, which energises the electrons inside the cells and produces electricity. PV cells are linked and placed behind a protective glass sheet to form a PV module. As a single cell produces a small amount of electricity, the proposed activity would require numerous cells arranged in arrays that would be fixed to a support structure. Inverters convert the direct current from the solar cells into alternating current, which can be fed into the electricity grid. The main components of a solar PV plant are:

- PV modules (crystalline modules, thin film modules)
- Inverter, transformer, switch gear
- Mounting system (fixed system, tracking system)

Insolation is a term for incident solar radiation from sunrays, usually measured in kWh/m^2/day or kWh/m^2/year. The radiation reaching the earth's surface can be represented in a number of different ways. Global Horizontal Irradiance (GHI) is the total amount of shortwave radiation received from above by a surface horizontal to the ground. This value is of particular interest to photovoltaic installations and includes both Direct Normal Irradiance (DNI) and Diffuse Horizontal Irradiance (DIF).

DNI is solar radiation that comes in a straight line from the direction of the sun at its current position in the sky. DIF is solar radiation that does not arrive on a direct path from the sun, but has been scattered by molecules and particles in the atmosphere (such as vapour and dust) and comes equally from all directions.

On a clear day, most of the solar radiation received by a horizontal surface will be DNI, while on a cloudy day most will be DIF. It is measured as a unit of W/m^2. DNI and DIF can be measured as a unit of kWh/m^2/day or kWh/m^2/year, the same with insolation for measuring energy. Sites that receive high levels of DNI and DIF of typically more than 1 800 kWh/m^2/year of solar irradiation, is suitable for the construction of PV power stations.

[1] Please note that this description should not be a verbatim repetition of the listed activity as contained in the relevant Government Notice, but should be a brief description of activities to be undertaken as per the project description.

1.3 Project Description

The development of a 15 MWp PV power plant at the farm Kwartelspan, Douglas, Northern Cape. The electricity generated would be transferred via a medium voltage transmission line (e.g. 22 kV) to the Eskom electricity grid. (Suntrace, 2012)

1.4 Construction Phase Activities

Construction phase activities would include inter alia the following activities (Suntrace, 2012):

- site clearing and site preparation
- preparation and construction of access roads and preliminary service roads at site
- preparation of construction lay down and assembly area
- delivery of material and equipment (modules, inverter, mounting system, etc.)
- construction of fencing
- construction of cable trenches
- construction of foundations
- installation of mounting system
- installation of PV modules
- installation of electrical reticulation
- construction and installation of inverter containers
- construction of buildings
- installation of lightning protection equipment
- installation of security system
- commissioning of PV plant
- start of operation of PV plant

1.4.1 Surveys

Before construction can commence, a number of surveys might be required including, but not limited to, a geotechnical survey, a site survey to confirm the micro footprint, a survey of the Greefspan Substation where the evacuation line would tie into, a survey of the evacuation power line corridor/servitude, surveying of identified GPS points of PV support structures, and the road servitudes and the internal access roads.

In order to obtain an objective idea of the situation at location, the following surveys are usually carried out (Suntrace, 2012):

- Inclined pull tests in the effective load direction
- Horizontal pressure tests
- Creation of soil profiles
- Chemical analysis in a laboratory

1.4.2 Construction of Access Roads to the Site and Internal Roads

The R357 provincial road provides access to the area, with Douglas to the north and Prieska to the south.

Several options have been identified to gain **access to the site** that has been identified for the development (Appendix A2) from the R 357. All specialists involved in this project agreed that the Option 3 for an access road was the best option. Access Road Option 1 was not selected due to the fact that it cut through several camps that would have made it difficult to continue farming activities within the affected camps on the farm (Lubbe, 2012). The archaeologist identified artefacts along Access Road Option 1 and the farm road that should be conserved. Option 2 did not contain any artefacts. (Nilssen, 2012) The ecologist identified several protected plants and trees along all the proposed access roads and has proposed the slightly deviated route (Option 3) from Option 2 that passed through the pan that was identified as a no-go zone. (Van Rooyen, 2012) Access Route Option 3 would follow the fence between the farm Kwartelspan and De Rust east towards a disused gravel road that can be re-commissioned and a connection made to the R357 at the nearest point. The applicant undertook to either deviate the road around protected plant communities identified in the path of Access Road Option 3 or obtain permits for the transplanting or removal of these should it not present a detrimental impact to the particular plant communities. The EMP (Appendix F) address this aspect in Section 2A point 1.5 that stipulates that the surveys and delineation must be done in collaboration with a suitably qualified ecologist who must ensure that any environmentally sensitive aspects identified during the EIA investigation are taken into consideration and that access roads be planned properly.

The design of the access roads will follow the standards and requirements set by the Department of Roads and Public Works. The following requirements have been assumed by the applicant regarding access road dimensioning (Suntrace Africa, 2012):

- minimum road width: 6 m for the main road and 4 m for the auxiliary road
- radius of the inner roadside to facilitate proper movement of traffic required for the erection of the PV power station:
  - 9 m for the main road
  - 4 m for the auxiliary road
- design of main road would be for heavy construction vehicles and trucks

- surface: tar, paving and/or gravel

Internal or service roads would be needed within the site for the construction as well as the operation and maintenance phases. The construction of these tracks would comprise gravel for filling and higher quality surfacing on top. Should this be needed, the gravel is to be sourced from a permitted borrow pit. The strength and durability of the in situ rock strata at the proposed site are currently unknown and are to be assessed via a geotechnical study to be conducted by the project proponent if necessary. The results of this study would indicate whether the vegetation and ground surface could be stripped, and the exposed formation levelled, compacted and used as an access track surface.

The layout of these internal roads has been planned due to the fact that not any high environmental sensitive issues have been identified by the specialist studies already conducted on the study area (Appendix C1).

1.4.3 Site Preparation and Construction of Laydown Areas

The lay down area is an area on site which has been cleared for the temporary storage of equipment and supplies. Laydown areas are covered with rock and/or gravel to ensure accessibility and safe manoeuvrability for transport and off-loading of vehicles. The assembly area is an area in which the mounting system, inverter containers, etc. is preassembled to enable a safe and quick construction period. (Suntrace, 2012) See the assembly and laydown areas on the plans in Appendix C.

Activities would include the removal of vegetation and levelling of the laydown and storage areas for the construction equipment as well as the footprint of each project component. The topsoil would be stripped and stockpiled, backfilled and/or spread on the site. Areas where construction would take place would be levelled. A construction camp and offices, as well as an area for the storage and use of petrochemicals, oils and lubricants (POL), and a storage area for construction equipment and infrastructure, machinery and vehicles would be established. The construction camp and offices would be fenced with 1,8m fencing. Temporary ablution facilities for workers on site would be implemented and a waste storage area would be implemented with bins for recyclable and non-recyclable materials to be removed weekly.

The ecology study (Appendix D1) has identified some protected plants on the western border of the core study area. Permits for the transplanting or removal of these should be obtained prior to the construction phase. This aspect has been addressed in the Pre-Construction Phase section of the EMP (Appendix F).

1.4.4 Transportation of Equipment, Infrastructure and Materials to Site

Equipment and materials required for the construction of the proposed power station would be transported to the study area from various parts of the country by means of national and provincial roads as well as the proposed internal access road.

Civil construction equipment would need to be brought to the site. These could include, among other types of equipment, excavators, trucks, graders, compaction equipment, and cement trucks as well as equipment needed to establish the evacuation power lines and tie into the substation.

Worst-case scenario calculation would result in peak traffic volume during construction of concrete foundations with approximately 10 vehicles and 40 to 50 concrete trucks per day. During installation of PV modules, electrical reticulation, etc. the traffic is about 20 to 30 vehicles per day. (Suntrace, 2012)

1.4.5 Ancillary Infrastructure

Lighting protection systems, any equipment and upgrades or expansions required to the substation, small administrative, control and security building, ablution facilities, storeroom, kitchen, perimeter fencing and security systems, area lighting (movement activated), and a small parking area would be constructed and implemented.

A **workshop** is not planned at site, as only general and emergency maintenance will be done at site in cooperation with local contractors. (Suntrace, 2012)

A **lightning protection system** will be installed to protect the whole power plant from any damages coursed by lightning. The current design implies lightning protection masts with a height of approximately 25 m. The system will be installed from a specialist company in order to comply with South African regulations. (Suntrace, 2012)

A **security fence** will surround the whole power plant with CCTV equipment at selected points to monitor the site. Furthermore, passive intrusion detection systems will be linked to security lights. Fence details are subject to contractual agreement with EPC contractor. It is assumed that fences are wire mesh, galvanized plastic-coated with approximately 2.40 m high above the plant formation level. The fence posts are steel profiles hot dip galvanized standing on single concrete footings. Where required the fence is topped by an inclined barbed wire climbing protection. (Suntrace, 2012)

The service for the buildings are provided as follows (Suntrace, 2012):

- electricity supply will be sourced from the ESKOM substation
- potable water supply from rainwater, borehole water (already existing) or water supply from local town (Douglas)
- office room is equipped with air-conditioning
- portable toilets (e.g. Enviro Loo) maintained by a local company on a regular basis

Vegetation would be required to be cleared and soil would need to be levelled. Excavation and laying of foundations of buildings and other structures would be required.

The temporary water usage during construction phase is mainly for construction of concrete foundations and service water. A **concrete batching plant** could possibly be erected on site or pre-mixed concrete obtained from an external supplier. The distance to the site from Douglas and Prieska would however be a limiting factor. Concrete would be required for the bases of the support structures as well as for anchoring and foundations of the entire ancillary infrastructure such as pylons, fencing, poles, buildings etc.

The total amount of water is mainly determined by the total amount of concrete. The total amount of concrete depends on the selected technology. The geotechnical survey during preconstruction phase will finally determine the preferred foundation type, either pile driven profiles or concrete foundations. In case concrete foundations are required about 10 000 m3 of concrete have to be mixed. The volume of water required to mix the concrete, general construction processes, dust control and potable use is about 10 000 m3. (Suntrace, 2012)

Potable **water** would be supplied via trucks or small trailers where personnel are working.

The Siyancuma LM, a water services provider, is being consulted by the developer for possible water supply during the construction and operational phases and an application for water is in process.

Should groundwater be considered at any stage, a water use authorisation should be obtained from the Department of Water Affairs (DWA). An application for this license should be submitted well in advance (6-12 months before commencement of the construction phase).

The quaternary drainage region F40A is excluded from General Authorisations (GA) for taking of water from a [ground] water resource [as extended under Notice 837 in the Government Gazette of 23 September 2010]. Note that energy developments are not part of small industrial users and as such cannot be entitled to the water use allowance set aside for small industrial users as determined by the GA.

The EPC contractor is responsible to make available and operate/maintain chemical **toilets** during construction.

The contractor is also responsible for the frequent (weekly or more frequent) removal of **general waste** according to South African law and regulations. **Hazardous waste** would be stored at a secure area at site until collection from a certified company. (Suntrace, 2012)

During the construction phase the EPC contractor would be responsible for the power supply. Generators would most likely be used for power supply. Alternatively, since the site is generally developed adjacent to the electrical substation, it might be arranged to temporarily source construction power directly from the substations depending on Eskom requirements and response (Suntrace, 2012).

Only general and emergency maintenance of infrastructure, vehicles and machinery would be done on site. Vehicles and machinery would be moved to the nearest workshop to be repaired.

1.4.6 Construction of Evacuation Line

Vegetation would be cleared and areas levelled where pylons would be located for the line of less than 1 km. The holes for pylons would be dug and pylons concreted into place. Electrical reticulation would be done on the pylons and connections at the transmission centre and substation.

1.4.7 Footing Execution, Positioning and Assembly of Support Structures, and Ancillary Infrastructure

Vegetation and topsoil (15-20cm) would be removed and topsoil stockpiled. Concrete, screw or the driving pile method would be used. After transporting the main parts of the structures to the field the structures would be assembled. Internal electrical reticulation would be approximately 500mm below ground. Vegetation would be removed and trenches dug for the reticulation. Concentration boxes with inspection covers, transformation centres and a distribution centre would be installed.

1.5 Decommissioning of Construction Areas after Completion of Construction Work

All the clean and solid construction waste would be used in backfill or onsite landscaping where possible. This is a use/reuse matter and is usually the most cost-effective as well. Construction waste that is not appropriate for backfill or for landscaping would be disposed of at the closest municipal waste site.

Construction rubble and other waste would be removed to nearest general waste site. The construction camp, infrastructure, equipment, machinery and vehicles that would not be used during the operation and maintenance phase would be removed. Compacted areas would be ripped where necessary. Topsoil would be replaced in areas where the operational phase would not continue and rehabilitated where practical and reasonable.

1.6 Operational & Maintenance Phase Activities

The photovoltaic modules will generate electricity during daytime. The electricity will be converted from DC to AC by inverters, transformed to a middle voltage transmission line (e.g. 22 kV) and transferred to the ESKOM electricity grid. The PV plant Kwartelspan PV 1 intends to sell the electricity as IPP under the South African Renewable Energy IPP program. (Suntrace, 2012)

Full-time security personnel would remain on the site and maintenance and control room staff would be required. The entire PV power station would be operational except under circumstances of mechanical breakdown, unfavourable weather conditions or maintenance activities.

Electrical and mechanical maintenance of the PV structures and all ancillary infrastructure will take place as and when necessary.

The PV modules would have to be cleaned regularly. This could either be done by using a vehicle based compressor to wash the modules down with water or by mechanically cleaning the modules with squeegees. The latter option is labour intensive and would create general unskilled jobs. The PV plant requires water for the cleaning of the PV modules as well as potable water for the operational and security personnel. The yearly water consumption for module cleaning is 10 m3 per MW and wash cycle, in total 600 m3 per year. Furthermore, the water consumption of portable water is estimated with 600 l per day, in total 219 m3 per year. The total water consumption is estimated with 820 m3 per year for the operation of a 15 MW PV plant. (Suntrace, 2012)

Due to daily activities of general labourers and contractors doing maintenance at the site, as well as security guards changing shifts, personnel would be transported to and from the site regularly.

Sewage storage and removal would be applicable in this phase. During operation a waterborne sewage or Enviro Loo would be considered. A local contractor will be mandated to handle maintenance and handle sewage. A waterborne sewage system or dry “Enviro-Loo’s” would be constructed. (Suntrace, 2012)

The waste generated by the daily activities of labour at site and during maintenance work would be handled the same as household waste with suitable storage, recycling wherever possible and disposal by local contractor or municipality where possible. (Suntrace, 2012)

1.7 Decommissioning Phase Activities

After 20 years of operation and the end of the Power Purchase Agreement concluded with ESKOM Holdings SOC Limited two options are possible (Suntrace, 2012):

- the PV plant could be decommissioned, or
- a new PPA is negotiated and the plant will continue with operation.

1.7.1 New PPA and repowering of PV plant

In case the Kwartelspan PV 1 project negotiates a new PPA contract with ESKOM or other potential electricity consumers after the initial 20 year contract with ESKOM the plant could be upgraded with new components such as PV modules, inverters, etc. depending on the conditions and maintenance effort and costs. (Suntrace, 2012)

1.7.2 Decommissioning of PV plant

In case the plant would be decommissioned the site would be returned to a state similar to its original state and conditions. The PV plant components would be recycled and the area would be cleaned from all equipment and material, e.g. foundations, cables, etc. Furthermore, the soil will be inspected for any industrial waste or other remaining contamination. Such parts will be decontaminated and cleaned according to international and South African standards. Compacted areas would be contoured and ripped. If plant growth should not establish, active seeding and planting of vegetation would be conducted. (Suntrace, 2012)

2. FEASIBLE AND REASONABLE ALTERNATIVES

"alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to—

(a) the property on which or location where it is proposed to undertake the activity;
(b) the type of activity to be undertaken;
(c) the design or layout of the activity;
(d) the technology to be used in the activity;
(e) the operational aspects of the activity; and
(f) the option of not implementing the activity.

Describe alternatives that are considered in this application. Alternatives should include a consideration of all possible means by which the purpose and need of the proposed activity could be accomplished in the specific instance taking account of the interest of the applicant in the activity. The no-go alternative must in all cases be included in the assessment phase as the baseline against which the impacts of the other alternatives are assessed. The determination of whether site or activity (including different processes etc.) or both is appropriate needs to be informed by the specific circumstances of the activity and its environment. After receipt of this report the competent authority may also request the applicant to assess additional alternatives that could possibly accomplish the purpose and need of the proposed activity if it is clear that realistic alternatives have not been considered to a reasonable extent.

2.1 Planning and Design Phase Alternatives

2.1.1 Site Location

The object of the site selection process was to locate sites that matched as many of the ideal criteria for the development of a PV power station as possible. These selection criteria were applied by Suntrace Africa before commissioning the EIA and filtered out alternative sites that were not suitable for the development of a PV power station that is environmentally and economically sustainable.

The ideal site for a PV power station would be:

- in a high solar irradiation area allowing for the maximisation of the solar energy received;
- on flat to gently sloped terrain allowing for the optimisation of the layouts and minimum interference with respect to shadows etc., between the individual structures; and
- adjacent to an existing substation on the grid, avoiding the need for extensive transmission infrastructure.

It would **not** be:

- on high potential agricultural land that avoids conflict with competing activities and the national priority of food security; or
- in an environmentally sensitive area.

The ideal site would have:

- a northern orientation or no obstructions to the north, allowing for efficiency;
- suitable ground conditions for the sake of stability of the structures and reduction of construction costs;
- existing capacity at the substation and local grid to receive the generated electricity, meaning that the electricity generated by the plant can be used locally from the time of commissioning, thus avoiding infrastructure costs as well as transmission losses and costs; and
- potential for expansion, which depends on a reasonable demand growth at the substation as well as sufficient space for the expansion of the PV plant.

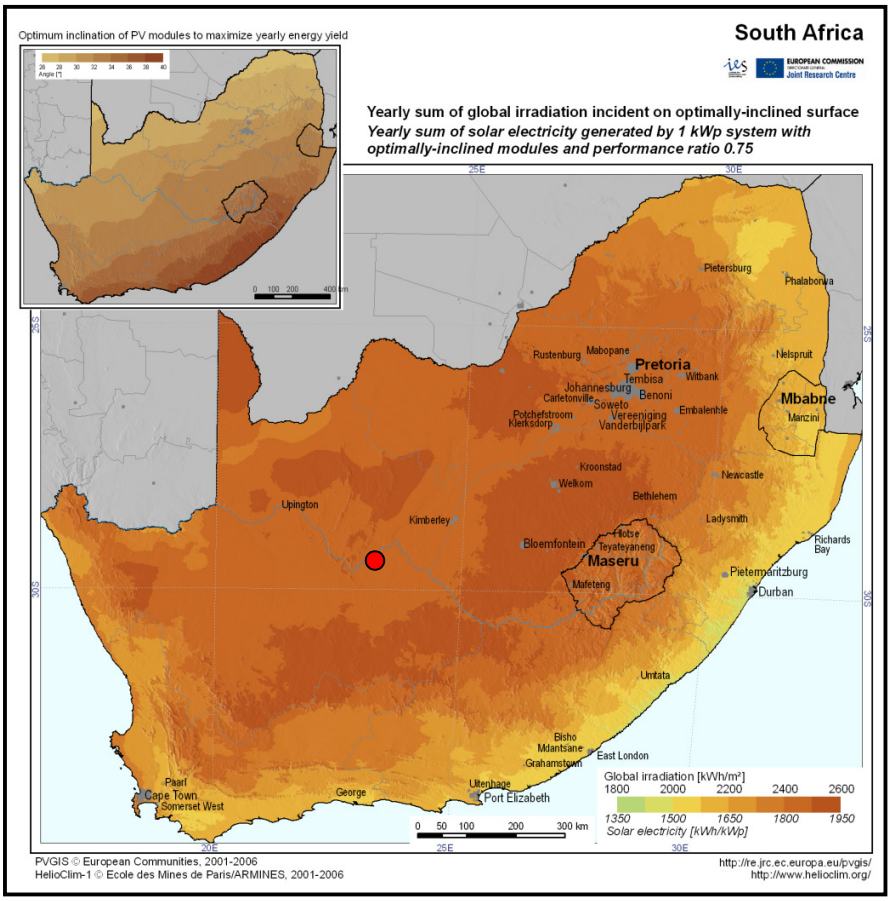
Due to the technical and economical requirements of a PV power station, close proximity to a substation is essential and therefore only one possible site has been identified for the development. The purpose of this study was therefore to investigate the environmental feasibility of using the proposed site for the development in question, with consideration for alternatives regarding other factors such as technology and design.

Based on the aforementioned aspects, Suntrace Africa considers the study area to be a highly suitable and preferred site for the development of the Kwartelspan PV power station 1. No other site alternatives are proposed for this project as a solar energy facility is strongly dependent on these aspects.

Solar Electricity Potential

The economic viability of a PV power station is directly dependent on the annual solar irradiation values. The Northern Cape receives the highest average daily irradiation in South Africa. The Eskom Greefspan Substation is therefore situated in an ideal location for receiving additional electricity generated by means of solar technology. (Figure 2)

The preliminary results for Global Horizontal Irradiance (GHI) conditions found at the site in South Africa are suitable for setting up a commercial PV plant. The best estimate (P50) for DNI is found to be 247 W/m2 (2164 kWh/m2/a = 5.93 kWh/m2/d). Uncertainty of the derived long-term average is estimated to be 7% related to a 1-sigma value. Thus, the GHI could be as low as 2 012 kWh/m2/a, but also as high as 2 316 kWh/m2/a. Year to year variability can be characterized by a standard deviation of approximately 3%. (Suntrace Africa, 2012)



Study Area:

Figure 2: Solar Electricity Potential in South Africa (Huld, 2005)

Availability of Land

A large, open, flat area is required for the development of a PV power station and this is available on the farm Kwartelspan. The generation of 15 MW, which is envisaged in the long term, requires less than 20ha. The level gradient of the study area, which is a preferred characteristic for the installation of a PV power station, has been a contributing factor to its selection.

Site Access

The site can be accessed via a gravel road off the R357 provincial road (Figure 1).

Availability and Accessibility of Infrastructure (Connection to the Eskom Substation)

The Eskom Greefspan Substation was identified because of the capacity of the grid to accept electricity being fed in at this point. The output of the PV power station would not exceed the electricity needs in the vicinity of the substation (Appendix A1), but would be increased when the capacity of the substation is upgraded and an increased electricity need is identified in the area.

Integration into the Grid

Integration of the new power station into the existing distribution network (grid) would be possible and the environmental impacts associated with such integration would be low as the length of the evacuation lines to the Greefspan substation would be less than 1 km (Appendix C). The cumulative effect of the evacuation line would therefore be very low.

Infrastructure and technical competence can easily be imported from Kimberley (170 km) or Bloemfontein (300 km).

Environmental Acceptability

The study area falls within a vegetation type categorised as 'least threatened' (Appendix A4d, D1b).

Study Area Selection

The area required for the development of the PV plant is determined by a number of factors. Given that these sites are mostly flat, with a northern orientation, the key factors are the production capacity of the plant and the technology used. The density of development is highest for fixed panel systems and lowest is two axis trackers are used.

2.1.2 Infrastructure, Technology & Process

Compared to conventional coal-fired power stations, wind and solar energy facilities produce insignificant amounts of greenhouse gases throughout their lifecycle. The operational phase of a solar power station does not produce carbon dioxide, sulphur dioxide, mercury, particulates, or any other type of air pollution, as fossil fuel power generation technologies do.

Power Plant Technology

Wind Energy

Advantages:

- No water requirements during operation
- Cost of electricity cheaper than solar energy
- Possibility of combination of agriculture and energy production on wind farm area
- Possibility of increasing power output
- No CO_2 emissions
- Construction time is relatively low
- Proven technology installed in numerous different areas worldwide

Disadvantages:

- Topography is important as it affects wind resource
- Higher dependence on wind resource than solar energy on solar irradiation
- Higher operational and maintenance costs
- Deep foundation for wind turbines
- Much higher visual impact (average height of wind turbines is 125 m)
- Need to be connected to transmission network

Two main types of solar technology are used for solar electricity generation, namely concentrating solar power (CSP) and photovoltaic (PV) technology, more commonly known as solar panels.

Concentrating Solar Power (CSP) Technologies

Concentrating solar power (CSP) technologies use mirrors to concentrate (focus) the sun's light energy and convert it into heat in order to generate steam, which is used to drive a turbine that generates electrical power.

All CSP technological approaches require large areas for solar radiation collection when used to produce electricity at commercial scale.

CSP technology utilizes four alternative technological approaches: trough systems, power tower systems, linear Fresnel and dish/engine systems.

Advantages

- Storage possible for 6-8 h and more with molten salt
- Higher power generation can be achieved
- Can produce electricity at night
- Steam turbine production
- Low air pollution or greenhouse gas emissions
- Low noise

Disadvantages

- Construction to be executed by skilled technicians
- Huge consumption of water during both construction and operation
- Minimum construction time of 2 years
- Need personnel with good technical expertise to operate and maintain
- Chemicals used as heat transfer fluid are harmful to the environment
- Minimum feasible size of 30 MW
- Must be connected to transmission network
- Area must be absolutely flat
- High visual impact due to size of the solar field
- New substation required
- High maintenance
- Land disturbance/land use impacts
- Risk of explosion
- Possible interference with aircraft operations

Photovoltaic Technologies

Solar energy power plants use energy from the sun to generate electricity through a process known as the Photovoltaic Effect. This is achieved through the use of a PV cell that is made of silicone, which acts as a semiconductor. The cell absorbs solar irradiation, which

energises the electrons inside the cells and produces electricity. PV cells are linked and placed behind a protective glass sheet to form a PV module. As a single cell produces a small amount of electricity, the proposed activity would require numerous cells arranged in arrays that would be fixed to a support structure. Point 1.2 discusses the PV technology and that electricity can be generated from both DNI and DIF.

Insolation is a term for incident solar radiation from sunrays. It is the amount of solar radiation energy received on a given surface during a given time, usually measured in kWh/m^2/day or kWh/m^2/year. Vapour or dust particles in the air can scatter the sunrays before reaching the earth's surface (diffuse irradiation).

Advantages:

- Low operational and maintenance cost
- No water requirements during operation
- Variability in size (from 10 kW to 100 MW) and installation possible on rooftops
- Can be connected to distribution network
- Simple and fast construction (20 MW can be built in 6 months)
- Topography is not important (can be built on gentle slopes as well as flat areas)
- Does not need advanced technical skills to operate and maintain
- Low visual impact
- No CO_2 emissions
- Established technology installed in numerous areas worldwide
- No noise
- Does not interfere with aircraft operations
- Feasible from as small as 0.5 MW
- Boosts local and regional economy by creating employment and business opportunities
- Requires the shortest delivery time and can be commissioned within a year
- Safe technology and no hazardous materials
- Combination of energy production and agriculture possible if sun trackers are used

PV technology is safe. If a disaster should occur at or in the area of a PV power plant there would be no negative effects emanating from the plant itself and it would not affect the quality of life of local inhabitants.

Disadvantages:

- Cost of technology
- No production at night time
- No storage
- Suitable only in sunny areas
- Land disturbance/land use impacts

Preferred Alternative

PV technology has been chosen by the developer due to the following reasons:

- The substation can only accept a limited amount of electricity to be fed in, which would be upgraded in the future.
- The identified site has enough flat space of low agricultural value.
- The irradiation of the area is high.
- The PV power station would be situated directly adjacent to the substation, limiting the evacuation line to less than 1 km.
- PV power station technology is easier and faster to implement than other power plants.
- The delivery and commissioning period is short.

Photovoltaic power plants have a wide range of technologies that can be considered for incorporation into the plant. Suntrace Africa has investigated a number of different technologies and equipment suppliers for these PV plants. These include the PV module manufacturer, the capacity of the modules, the support structure type, the manufacturer and the inverter type (Suntrace, 2012). These alternatives are discussed in more detail below.

Various combinations of fixed, single and two axis trackers, together with different PV modules, were modelled using software packages to arrive at the most efficient and cost-effective package.

Structures

Structures are required to support the PV modules. These modules can be mounted in a variety of ways. They can be fixed at a given azimuth and elevation or can be in motion to better follow the ecliptic path of the sun. A tracker is a device supporting the PV array that moves the modules in a prescribed way to minimize the angle of incidence of beam radiation on the module surfaces. To achieve the maximum output, the PV array can be tracking on one-axis, two-axis (azimuth tracking) or dual- axis Azimuth. (Suntrace, 2012)

Fixed system

The PV-mounting system is usually a modular unit-assembly system with universally applicable components (aluminium / high-grade steel). The mounting system is designed according to the special needs and requirements of the site and region. The design of the rack is for instance based on the module type, as modules without frame require a different retainer than modules with frame. (Suntrace, 2012)

Schletter FS system

The FS system has been optimized in order to allow for a fast and economic realization of large photovoltaic plants with any desired kind of photovoltaic module. Pile-driven steel profiles with optimized geometry are the foundation and guarantee long-term durability, optimum anchoring in the soil, minimum soil sealing and good accessibility for later maintenance operations on the installation site. The module bearing construction is made up of aluminum and is pre-fabricated to 100 %, it can be delivered to the installation site just in time in any desired quantity. (Suntrace, 2012)

The design is based on the following assumption (Suntrace, 2012):

- Tilt 25°
- Shading angle 37.2° (20 June 2008, 10:37 a.m. UTC)

Thin film design with First Solar FS 275 modules and mounting system from Schletter with 4 modules horizontal. The rough estimation resulted in a total of 147 860 modules on less than 20 ha area. The crystalline design with Trina Solar modules TSM-230PC05 and mounting system from Schletter with 3 modules vertical. The rough estimation resulted in a total of 65 217 modules on less than 20 ha area. (Suntrace, 2012)

The materials commonly used in support and PV structures are:

- galvanized steel;
- stainless steel; and
- anodized aluminium.

Foundations

For fixed structures, small concrete footings are most commonly cast in the ground. The following foundation options may also be considered:

- mass concrete block foundation;
- screw foundation;
- concrete pile foundation; and
- vibratory driven steel pile foundation.

The geological survey forms the basis of the structural analysis for the foundations. In order to get the best picture of the situation on location, the following surveys are usually carried out (Suntrace, 2012):

- Inclined pull tests in the effective load direction
- Horizontal pressure tests
- Creation of soil profiles
- Chemical analysis in a laboratory

The choice of the right foundation profile shape is decisive for a safe and at the same time economic soil anchoring foundation of the plant.

Mechanical background of inclined pulling

The basic idea of horizontal pull tests is the fact that the wind does not act in an isolated manner in vertical or horizontal direction, but almost perpendicular to the module surface. Thus, a surface pressure is created from the transmission of the bending moment in the form of a pair of forces. In case of inclinations of more than 15°, the frictional resistance between the pile and the surrounding ground is usually higher than the jacket friction, which leads to a higher pull-out resistance. (Suntrace, 2012)

Pile driving techniques

Generally, the foundation procedure determines the maximum mounting speed – especially with difficult soil conditions. Hot-dip galvanized pile-driven profiles in different size categories are used for the foundation. The specially developed kind of pile driving grants an optimum anchoring in the soil and maximum bending stiffness at the same time. Thus, the anchoring forces can also be transmitted up to the upper connection point, so that the plant will have optimum structural safety against wind and snow loads. The anchoring of the pile driven profiles in the soil is carried out using special terrain-friendly hydraulic pile drivers. This pile-driving technique is especially suitable for large scale plants. Depending on the terrain, a pile-driving performance of 250 piles/day can be achieved. Pile driving on difficult terrain (stones, etc.) is also possible. In case of rocky subsoil, the machine can be additionally equipped with a drilling unit. Mounting on slopes is also possible. (Suntrace, 2012)

Concrete foundations

Concrete foundation solution: the solar mounting system is connected to the precast concrete foundation through use of special components. The advantages of this solution are easy installation and the ability to withstand high wind velocity and excessive snow load. (Suntrace, 2012)

PV Modules

The most visible part of the PV power station will be the PV modules, or solar panels, and their associated structures. There are various types of PV modules defined according to the materials used (Figure 3):

- Monocrystalline silicon
- Polycrystalline silicon
- Thin-film
- High-concentration

Figure 3: Example of PV Modules

PV crystalline technology

There are two cell technologies that are prevalent in today's market. They are referred to as polycrystalline and mono-crystalline silicon. Some manufacturers will use one or the other technologies in the manufacture of their product. Some will use both. Solar cells that are created from mono-crystalline or (single crystal) technology are cut from a silicon boule that is grown from a single crystal, in other words a crystal that has grown in only one plane or (one direction). Single crystalline are more expensive to manufacture and typically have a slightly higher efficiency than do conventional polycrystalline cells resulting in smaller individual cells and thus typically a slightly smaller module.

Solar cells that are created from polycrystalline or (multi-crystalline) technology are cut from a silicon boule that is grown from multifaceted crystalline material, or a crystal that grows in multiple directions. Conventional multi-crystalline solar cells typically have a slightly lower efficiency resulting in larger individual cells and thus typically a slightly larger module. All of this has changed with the advent of the new silicon nitride multi-crystalline cells which are rated as high or even higher efficiency than similarly sized mono-crystalline cells. (Suntrace, 2012)

PV thin film technology

Size and flexibility are the first and most obvious advantages of thin film technology. The light absorbent layers of a thin film PV cell are only one micron thick, compared to 200 to 350 microns for silicon cells. Material usage is reduced in the production of thin film cells compared to silicon wafer technologies. Furthermore, thin film modules are less influenced in power reduction at increased ambient temperatures. On the other hand, the total land requirement of thin film modules is significant higher than of crystalline modules. Consequently, thin film technology is typically used at big ground mounted PV plants and crystalline technology is used at limited areas as roof installations.

A thin-film solar cell is a solar cell that is made by depositing one or more thin layers (thin film) of photovoltaic material on a substrate. Many different photovoltaic materials are deposited with various deposition methods on a variety of substrates.

Thin-film solar cells are usually categorized according to the photovoltaic material used:

- Amorphous silicon (a-Si) and other thin-film silicon (TF-Si)
- Cadmium Telluride (CdTe)
- Copper indium gallium selenide (CIS or CIGS)
- Dye-sensitized solar cell (DSC) and other organic solar cells

Due to various reasons this technical concept will focus on CdTe technology as applied by the company First Solar. As a pure example and without having done the final supplier election, attention is drawn to the fact that that First Solar modules are widely used in PV ground mounted solar parks. In general, solar cells become less efficient at converting solar energy into electricity as their cell temperatures increase. First Solar cells, however, the efficiency of CdTe, the semiconductor used, is less susceptible to cell temperature variations than traditional semiconductors. First Solar currently offer series 2 PV modules and series 3 PV modules. As series 3 modules are new on the market and performance experience are still little-known the technical concept will focus on FS 275 modules.

First Solar FS Series 2 PV Modules are IEC 61646 and IEC 61730 certified for use in systems up to 1000 VDC, UL Listed (600 VDC), and meet the requirements of Safety Class II. (Suntrace, 2012)

Inverters

In large-size plants, the PV field is generally divided into more parts (subfields), each of them served by an inverter to which different strings in parallel are connected. In comparison with plants with one inverter for each string, there are a smaller number of inverters with a consequent reduction of the investment and maintenance costs. However it remains the advantage of reduction of the problems of shading, different exposition of the strings and also of those due to the use of modules different from one another, provided that subfield strings with equal modules and with equal exposition are connected to the same inverter.

Besides, the failure of an inverter does not involve the loss of production of the whole plant (as in the case single-inverter), but of the relevant subfield only. It is advisable that each string can be disconnected separately, so that the necessary operation and maintenance verifications can be carried out without putting out of service the whole PV generator.

With this configuration the diagnosis of the plant is assigned to a supervision system which checks the production of the different strings.

Inverters convert the direct current electricity generated by solar panels into grid-compatible alternating current. They are the heart of every solar power system. The global market leader is currently SMA. Suntrace has still not elected the final manufacturer, but to show the actual normal parameters it will concentrate on SMA products.

Two powerful Sunny Central HE inverters are components of a medium-voltage station (MV), which feeds directly into a shared medium-voltage transformer. In this way, for example, two Sunny Central 630HE inverters are combined into a Sunny Central 1250 MV station. The inverter station is further equipped with ground fault monitoring, circuit breaker AC side (SI load disconnection switch) and DC side (switch disconnector with motor), and monitored overvoltage protectors AC/DC. (Figure 4) (Suntrace, 2012)

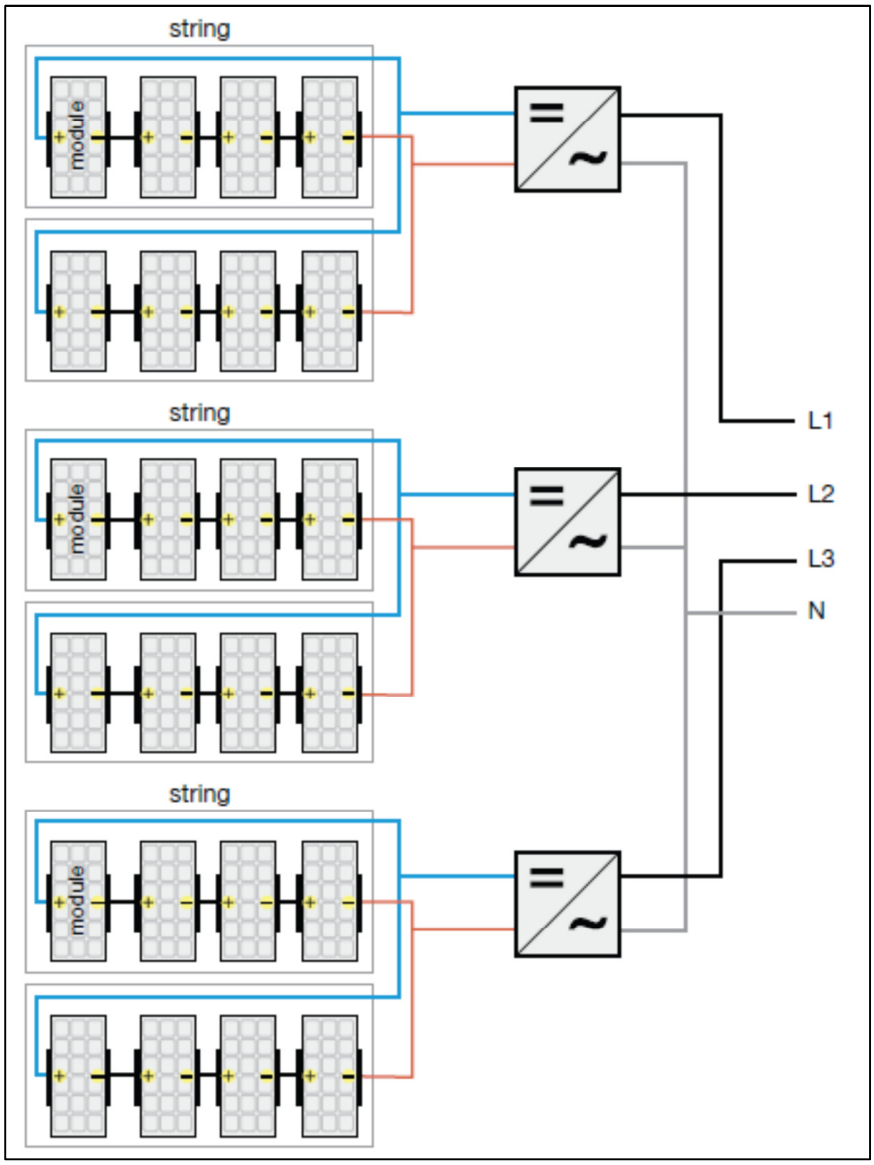


Figure 4: Schematic diagram of a multi-inverter PV plant

Combiner Boxes

Modules are commonly connected into an electrical string to produce the desired voltage and amperage. The resulting wires from each string are routed to the combiner box. In this box all the strings are combined into one electrical output that is then fed to the inverter.

The combiner boxes are outdoor switchgear boxes or cabinets where the electrical wires from the PV module group are collected. The combiner boxes are designed for outdoor conditions and are mounted on a concrete base.

Some of the international manufacturers that provide these devices are (Figure 5):

- ABB
- Schneider Electric
- Ormazabal
- Omron
- PowerTech

Figure 5: Switchgear Boxes

No choice has been made yet.

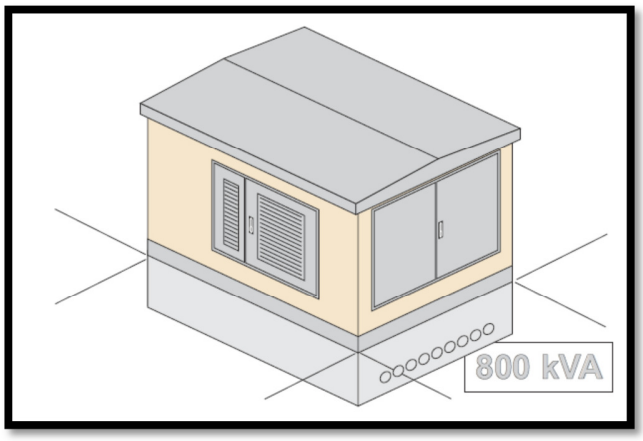
Inverter and Transformation Container

The transformation centre would be a prefabricated concrete structure built to house the inverter, transformer, switch gear and the associated protection devices.

Some companies that provide transformation centres, prefabricated structures and auxiliary protection devices are:

- ABB
- Schneider Electric
- Ormazabal
- Omron
- PowerTech

Figures 6-7 show typical examples of different prefabricated structures that could be used for housing the transformers. The type and dimensions of the structure depend on the transformer and protection equipment to be used.



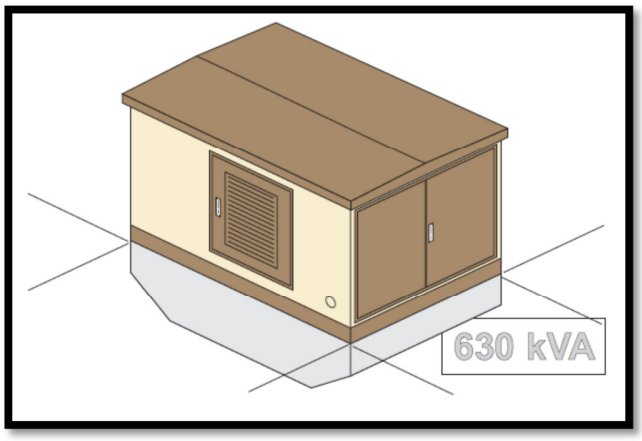


Figure 6 and 7: Prefabricated Transformer Centre

2.1.3 Layout Alternatives

The choice of the PV module and structure is the chief determinant in the layout of the PV plant. Fixed, single and two axis trackers have different spatial requirements.

The initial layout drawing of the Kwartelspan PV 1 project is shown in Appendix C. As road access has not been finalized the drawing includes two options for assembly area and lay down area.

2.1.4 Electrical Reticulation & Grid Connection

The electrical reticulation between combiner boxes and inverter station would be installed underground. The electrical cables from the PV models to the combiner boxes will run behind the modules and fixed at the mounting system. The following figure shows the block diagram for a schematic overview about the electrical reticulation of PV panels, combiner boxes, inverters, transformers and switch gear. The grid access will be at ESKOM grid either at Greefspan substation or connection point at transmission line. The first option is to access the line in the Greefspan substation. The substation is 800 m away from the nearest point of the Kwartelspan farm. The second option is to access the 22 kV line passing the Kwartelspan PV 1 project site at the South-West corner. The following two points have been submitted to ESKOM (grid application part 1):

Option A:

Electrical connection point (where known):

Latitude	S	2	9	°	2	3	‘	1	2	.	6
Longitude	E	2	3	°	1	8	‘	4	5	.	4

Option B:

Electrical connection point (where known):

Latitude	S	2	9	°	2	3	‘	0	1	.	6
Longitude	E	2	3	°	1	8	‘	0	5	.	9

2.1.5 Cable Trenches

The dimensions of the tranches for the electrical reticulation are assumed with a maximum width of 0.6 m and a maximum depth of 1.10 m. Trenches are usually excavated by means of a TLB or specialist trenching machines. The bedding material is sand or similar material. If the material in the trench is not suitable for bedding, material would be sourced from local commercial sources. The trenches would then be backfilled using material excavated from the trench. Trenches crossing the internal or perimeter service roads within the power plant would be properly protected in order to prevent degradation due to vehicular traffic. (Suntrace, 2012)

2.1.6 Ancillary Facilities

Access Roads and Internal or Service Roads

The different alternatives studied have been sufficiently addressed within point 1.4.2 of this study and is not repeated in this section so as to prevent duplication. Access Road Option 3 (a variant of option 2) has been identified as the preferred option taking into account the findings of the specialist studies and location of the study area.

The width of the access road would allow the circulation of two trucks in opposite directions at the same time during construction and operation phase.

The site would be sufficiently cleared to allow access for excavation equipment as well as for rough-terrain vehicles that would deliver the site-assembled PV structures or trackers to their positions. Vegetative ground cover reduces dust, which has an influence on the efficiency of the PV panels. Rehabilitation and regrowth of the ground cover is thus important to the PV plant and it would be sensible to minimise disruption of the existing vegetative ground cover. During the operational phase access around the site is required for security and routine inspection. Access for cleaning operations or maintenance is very infrequent, thus the internal service roads need only be tracks. Service and perimeter road reserve widths would be 4 m. (Appendix C)

Buildings and Parking Area

The buildings and facilities needed to service a PV plant are a control room, a small office, ablution facilities, a kitchen area, and a store. Space has been allocated in the PV plant laydown areas (two options identified depending on the access road option chosen) for the buildings and parking area. Should the Access Road Option 3, indicated on Appendix A2 and A3, be decided upon, the eastern laydown area indicated on the plans in Appendix C would probably be used.

Services for the buildings have been addressed in point 1.4.5.

Security System and Fencing

Refer to point 1.4.5. Due to the high material value and risk of theft associated with PV panels and electrical cabling it is imperative that the perimeter fences and security systems be installed and commissioned as soon as practical. It is proposed to start by fencing off a delivery, storage and processing area within the site and then to erect the perimeter fence and install additional security systems. This would allow the initial construction start-up activities to begin earlier.

Lightning Protection System

Refer to point 1.4.5.

2.1.7 Timing

Suntrace Africa would want to have all the planning and permitting completed by the end of January 2013 to be able to bid in April 2013 in the Renewable Energy Independent Power Producer Procurement Programme.

The following processes also influence the timeframe of the proposed project:

- the EIA Phases and outcomes from these phases, which are to inform the planning, construction, operation and maintenance phases of the project;
- consideration of the Equator Principles within the EIA phase as stipulated by financial institutions;
- land availability agreements and addendums;
- a land use change application if necessary;
- building plan approvals;
- a road access application to the Department of Roads and Public Works (DR&PW);
- design and costing phase;
- funding application and compliance;
- application to Eskom to tie into the substation;
- application to NERSA for a generation license;
- preliminary and detail planning for electrical and civil engineering;
- manufacturing of support structures – feasibility, establishment and manufacturing process;
- PV module procurement;
- sources of gravel and sand for concrete mixing plant in the Douglas area; and
- authorisations for water use during the construction and operational phases.

2.1.8 Resources

The following types of resources are to be obtained:

- financial resources to drive the process;
- high quality, financially viable resources/suppliers for the infrastructure such as the support structures and PV modules; and
- resources such as gravel, sand and water for the concrete bases.

2.1.9 Technical Competence

Technical competence is needed from the planning to the operational and maintenance phases of the project. In some cases it might be viable to import competent technicians in the short term especially during the construction phase. The project could, especially during the operational phase, add future socio-economic value to the area as it could be regarded as an opportunity to further train and educate engineers, technicians etc. to implement new technology. Local or regional construction companies could be involved in the construction and manufacturing processes.

2.1.10 Demand

Electricity forms an integral part of development and progress and, as communities in South Africa is uplifted, their energy demands are growing. A decrease in electricity demand is therefore not foreseen in any part of the country and could therefore not be considered as an alternative in this study.

2.1.11 Activity/Land Use

The applicable Remaining Extent and Portion 1 (Remaining Extent) of the Farm Kwartelspan no. 25, Hopetown District are zoned for agricultural use. The development would be legally bound to the EMP (Appendix F) which would be enforced by an independent ECO, in consultation with the different government departments such as the DAFF, DEA and DENC.

One of the issues associated with fixed panels is the treatment of the ground underneath the structures as this area is permanently in the shadow and hence the vegetation growth is affected. In order to prevent soil erosion and dust Suntrace Africa need to either introduce or promote suitable ground cover or put down gravel.

A rezoning application has been lodged for this proposed development and the applicant is consulting with a specialist in this regard. This is a parallel process to the EIA.

2.1.12 Scheduling Alternative

Should the EIA be authorised, it is envisaged that the applicant would bid in the April 2013 IPP Procurement Programme. Should it be the case this proposed development is envisaged to take place in 2014 and 2015 to be operational by 2016. The EIA therefore needs to be completed by January 2013.

2.1.13 'Do Nothing' Alternative

The 'do nothing' alternative is the option of not undertaking the development of a PV power station at Eskom Greefspan Substation. Should this alternative be selected, it would have local and broader impacts.

The identified site, at a local level, would not be impacted on from an environmental perspective and would continue to be utilised for agricultural activities on marginal agricultural land. Deciding not to proceed with the development would have a negative impact on the socio-economic development of the area. The job creation and poverty alleviation that would have occurred due to the development, would not take place.

The diamond mine located on the Saxendrift property and operated by Rockwell Diamonds obtains its electricity from the Greefspan

Substation. Rockwell Diamonds has indicated that it applied for the remaining capacity available at Greefspan Substation (Norton, 2012). In future this mine would possibly not be able to develop further and expand due to the lack of electricity capacity at the Greefspan Substation and surrounding network.

In 2006 South Africa sourced approximately 90% of its energy from fossil fuels (coal, oil, gas). Coal, which is the main contributor to the country's carbon dioxide emissions, is the major primary energy supplier with a contribution of 65.9% to the total primary energy supply in 2006. (Subramoney et. al., 2009) Carbon dioxide is the main greenhouse gas connected with climate change. Hydro and renewable energy supply has seen little change since 2004; hydro supply had an increase of about 0.1% since 2004 while renewable supply declined by 0.4% (Subramoney et. al., 2009).

In order to develop sustainably whilst preparing for growing energy demands, South Africa's future energy supply must therefore be diversified with regard to power generation sources. This is also important in the light of the country's commitment under the Copenhagen Accord to reduce its carbon dioxide emissions by 34% below the "business as usual" level by 2020.

The generation of electricity from renewable energy resources offers many potential socio-economic and environmental benefits for South Africa. It can ensure increased energy security, which is highlighted by the current ongoing electricity crisis in South Africa, as well as resource saving, as conventional coal-fired plants are major consumers of coal (diminishing fast) and water (South Africa is a water scarce country) during the cooling process.

The development of small-scale, evenly distributed renewable energy supply schemes, such as the one proposed at Eskom Greefspan Substation, is strategically important for the diversification of domestic energy supplies and for avoiding possible energy imports in the future.

Without the implementation of this development, renewable options for future power supply would be compromised and fossil fuel-based energy would possibly be used to supply for the growing demand. This could have significant negative environmental and social impacts.

The 'do nothing' alternative is not a preferred alternative in this application.

2.2 Construction Phase Activities

Preconstruction phase activities would include surveys such as a geotechnical survey, as well as a land survey to confirm the micro footprint of the infrastructure and associated infrastructure as discussed in detail in point 1.4.1 of this study.

The construction phase includes all the varied activities and operations needed to develop a fully operational PV power plant. (Appendix A and C)

The laydown area is the area where different materials such as PV modules, support structure components, motors, gears, electrical devices, tubes for wires, transformers, switchgears and prefabricated structures would be received. The assembly area would be equipped for the safe and quick assembly of the support structures and PV modules. All the necessary materials would be laid out in the assembly area in order to streamline the assembly process. When the support structure is pre-assembled, a rough-terrain vehicle would transport it to its final position to be mounted on its foundation and connected to the electrical reticulation.

Should gravel, stone and sand be needed, borrow pits could be registered or gravel could be sourced from commercial sources surrounding Douglas or Prieska and transported by truck to the sites.

Spoil would include material excavated from the trenches or pile holes that is considered unsuitable to be used as backfilling. Excess spoil could be used as covering material on general waste sites as local authorities normally experience lack of proper covering material at waste sites. Should the quantities be insignificant, it could be spread on site. Should the quality be of a good standard, it could be used for road surfacing. The archaeological and palaeontological studies indicated that the study area is underlain by calcrete that is a very good material for road building purposes.

The water usage and concrete batching options has been addressed within point 1.4.5 and duplication would be caused should it be repeated here.

The bulk of the water is required for concrete in the construction phase. The concrete requirements and therefore also the water requirements would be determined by the PV technology selected as discussed in point 2.1.2. The water application process is a parallel process to the EIA.

The contractor would be responsible for providing and maintaining chemical toilets on site during the construction period, as well as for the removal of sewage to the municipal sewage works.

During the construction phase generators would most likely be used for power supply because of the expanse of the construction site. Alternatively, since development would be adjacent to the electrical substation, it might be arranged to temporarily source construction power directly from the substation.

The contractor would be responsible for the weekly or more frequent removal of general waste to the municipal waste site. Waste generated on the site should be disposed of in closed bins, which would be located within an enclosed area in the site camp, from where it would be removed to the municipal waste site.

Hazardous waste would be disposed of in impervious, closed bins and kept in a secure area at the site camp until safely removed by a suitably certified company. Proof of safe disposal must be kept on file.

2.2.1 Construction Phase Job Creation

It is proposed to contract an EPC company that is responsible for a turnkey PV plant and thus, the final decision regarding personnel depends on the EPC. Usually the EPC engages local subcontractors, while the subcontractors would possibly employ unskilled labour to a certain extent. It is assumed that about 100 to 150 jobs will be created for a construction period of four to six months. There could be approximately 100 local employment opportunities involved in this project. Depending on the construction schedule it might happen that double of workforce is required to shorten the construction period.

2.3 Decommissioning of Construction Areas after Completion of Construction Work

All the clean and solid construction waste would be used in backfill or onsite landscaping where possible. Remaining construction waste would be used for infilling towards the rehabilitation of the nearest possible abandoned old quarry pit, provided that the owner of the quarry and/or the land approves of such infilling. This is a use/reuse matter and is usually the most cost-effective as well. Construction waste that is not appropriate for backfill or for landscaping would be disposed of at the closest municipal waste site where it can be used as cover material for waste.

The construction camp, infrastructure, equipment, machinery and vehicles that would not be used during the operation and maintenance phase would be removed. Compacted areas would be ripped where necessary. Topsoil would be replaced in areas that would not be utilised during the operational phase and would be rehabilitated where practical and reasonable.

2.4 Operational & Maintenance Phase Activities

The photovoltaic modules will generate electricity during daytime. The electricity will be converted from DC to AC by inverters, transformed to a middle voltage transmission line (e.g. 22 kV) and transferred to the ESKOM electricity grid. (Figure 8) The PV plant Kwartelspan PV 1 intends to sell the electricity as IPP under the South African Renewable Energy IPP program.

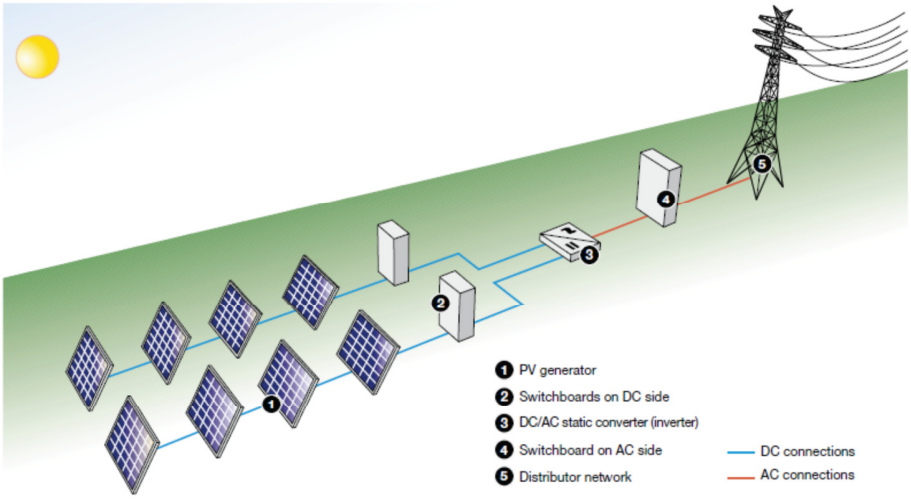


Figure 8: Energy flow in a PV power station with fixed modules (Suntrace, 2012)

The operational phase includes all operations that are necessary to maintain the PV power plant in a fully operational mode, producing as much electricity as possible. The traffic generated by the PV plant during the operational phase would be negligible and would be of the order of four or five vehicles per day. Full-time security personnel would remain on the site and maintenance and control room staff would be required. Electrical and mechanical maintenance of the PV structures and ancillary infrastructure would take place as and when necessary.

The **auxiliary power consumption** of the power plant during operation is mainly determined by the consumption of the inverter containers and to a small extent by the service facilities, such as the service building, security, etc. The auxiliary power consumption of one inverter container of SMA Sunny Central 1250 MV is 3 000 W per container at nominal conditions. The resulting total auxiliary power consumption for all inverters are 36 kW. In addition, the power consumption for service facilities, such as office, kitchen, and security at peak times is estimated with 14 kW. In total, a peak auxiliary power consumption of 50 kW is assumed. The power for the auxiliary power consumption will be supplied by Eskom.

2.4.1 Water Usage

A PV plant does not require much water for operation. The only water requirements are for the domestic needs of the security and operational personnel and for the cleaning of the PV modules (Figure 9). The yearly water consumption for module cleaning is 10 m3 per MW and wash cycle, in total 600 m3 per year. Furthermore, the water consumption of potable water is estimated with 600 l per day, in total 219 m3 per year. The total water consumption is estimated with 820 m3 per year for the operation of a 15 MW PV plant.

Figure 9: Cleaning PV panels

2.4.2 General Waste

The waste caused by the daily activities of labour at site and during maintenance work will be handled the same as household waste with suitable storage, recycling wherever possible and disposal by local contractor or municipality.

2.4.3 Sewage

A waterborne sewage system or dry Enviro Loos would be considered for use during the operational phase. Grey and sewage water would be contained in closed-cell tanks of a size sufficient to contain a month's effluent. When the tank is full, the contractor/operator or, preferably, the local municipality, would remove sewage to the sewage works at Douglas.

The Enviro Loo (Figures 10-11) is a waterless, onsite, closed-circuit, dry sanitation toilet system. No sewage treatment is required. It is odourless, does not attract flies, has minimum monthly operating costs; and allows for indoor installation, which requires the addition of a low wattage electrical fan. It does not require chemicals or electricity, but only radiant heat and wind to evaporate and dehydrate waste matter, turning it into a safe, stabilised and odourless dry material. It is built from tough, linear, low density, UV-treated polyethylene. It is supplied with a ceramic bowl and has no internal moving parts. As it is a sealed system, waste cannot leak out and, conversely, storm water cannot penetrate and flood the container. It can be assembled and installed within hours.

The maintenance schedule depends largely on the volume of usage and climatic conditions. While high usage units may need to be serviced and waste removed more often, lower usage units may need attention less frequently. Safety clothing must be worn when conducting maintenance work.

The Enviro Loo system should be serviced through the rear external inspection cover. It is to be ensured that the liquid level is below the drying plate and that the system is in an aerobic state of operation i.e. liquid and solid wastes are separated by the drying plate. The solid waste should be raked from under the pan section towards the open rear-end section of the drying plate. Debris such as bottles, cans, plastics etc. should be removed from the unit and safely disposed of at the general waste disposal site with the rest of the general solid waste. The dried waste can be deposited in a bucket or bag and safely disposed of at the local authority sewage works with the dried sludge from the sewage works.

The remaining waste should be lightly covered with normal garden compost. Approximately three handfuls of new compost should be added to the front section of the unit via the ceramic toilet bowl. Ensure free operation of the wind turbine on top of the external vent pipe and free air flow to side inlet pipes.

Daily cleaning procedures includes the cleaning of the ceramic toilet bowl using a damp toilet brush with only organic cleaners. Chemical detergents should not be used. The toilet seat can be cleaned with detergents ensuring that no excess enters the ceramic toilet bowl. The toilet lid should always be left in the closed position after cleaning the toilet bowl.

The waterborne sewage system/flushing system require water. Should this system be implemented an extra amount of 200 ℓ of water would be required per day for four security guards on site. Sewage would need to be removed regularly by truck to the sewage facility at Douglas. The running and maintenance costs of the truck for removal of sewage would be much higher for the conventional flushing system than for the Enviro Loo system. The conventional system would also release CO_2 into the atmosphere and thereby increase the carbon footprint of the proposed activity. The conventional flushing system is well-known and robust, but still needs maintenance and cleaning. The Enviro Loo system must be used more carefully. This should not be a problem because of the limited number of people who would be on site during the operational phase. Mere good hygienic practice should be promoted and maintained. The use of this system poses a very low risk of impacting on the environment through groundwater and surface water pollution and requires less environmental resources than the waterborne system.

Figures 10 and 11: Enviro Loo System

2.4.4 Operational Phase Job Creation

The following staff of the O&M contractor has been considered:

- 1 plant operator (not at site)
- 1 security manager (at site)
- 4 security guards (at site)

The following staff will be provided by the O&M contractor on demand, e.g. during maintenance:

- 1 technical manager
- 1 financial manager
- 1 operational manager
- 1 Administration/Accountant
- 4 electrical technicians
- 4 mechanical technicians

It is intended that staff would be taken on during the manufacturing and construction process and thereafter, following skills transfer and further training, be deployed in the O&M operations should it be possible..

2.5 Decommissioning Phase Activities

The decommissioning of a PV power station has been discussed in sufficient detail in point 1.7 to also assess alternatives regarding decommission or repowering.

Paragraphs 3 – 13 below should be completed for each alternative.

3. ACTIVITY POSITION

Indicate the position of the activity using the latitude and longitude of the centre point of the site for each alternative site. The co-ordinates should be in degrees and decimal minutes. The minutes should have at least three decimals to ensure adequate accuracy. The projection that must be used in all cases is the WGS84 spheroid in a national or local projection.
List alternative sites, if applicable.

Alternative: **Latitude (S):** **Longitude (E):**

Alternative S1[2] (preferred or only site alternative)	29°	22.270‘	23°	18.503‘
~~Alternative S2 (if any)~~	°	‘	°	‘
~~Alternative S3 (if any)~~	°	‘	°	‘

In the case of linear activities:

Alternative: **Latitude (S):** **Longitude (E):**

Alternative S1 (preferred or only route alternative)

• Starting point of the activity	°	‘	°	‘
• Middle/Additional point of the activity	°	‘	°	‘
• End point of the activity	°	‘	°	‘

[2] “Alternative S..” refer to site alternatives.

Alternative S2 (if any)

• Starting point of the activity	o	‘	o	‘
• Middle/Additional point of the activity	o	‘	o	‘
• End point of the activity	o	‘	o	‘

Alternative S3 (if any)

• Starting point of the activity	o	‘	o	‘
• Middle/Additional point of the activity	o	‘	o	‘
• End point of the activity	o	‘	o	‘

For route alternatives that are longer than 500m, please provide an addendum with co-ordinates taken every 250 meters along the route for each alternative alignment. **Note: Find the Alternative S1 to S3 for the access roads attached in Addendum 1**

4. PHYSICAL SIZE OF THE ACTIVITY

Indicate the physical size of the preferred activity/technology as well as alternative activities/technologies (footprints):

Alternative:	**Size of the activity:**
Alternative A1[3] (preferred activity alternative)	199 990m^2
Alternative A2 (if any)	m^2
Alternative A3 (if any)	m^2

or, for linear activities:

Alternative:	**Length of the activity:**
Alternative A1 (preferred activity alternative)	m
Alternative A2 (if any)	m
Alternative A3 (if any)	m

Indicate the size of the alternative sites or servitudes (within which the above footprints will occur):

Alternative:	**Size of the site/servitude:**
Alternative A1 (preferred activity alternative)	199 990m^2
Alternative A2 (if any)	m^2
Alternative A3 (if any)	m^2

5. SITE ACCESS

Does ready access to the site exist?	~~YES~~	**NO**
If NO, what is the distance over which a new access road will be built	~6 500 m	

Describe the type of access road planned:

[3] “Alternative A..” refer to activity, process, technology or other alternatives.

The design of the access roads will follow the standards and requirements set by the Department of Roads and Public Works. The following requirements have been assumed by the applicant regarding access road dimensioning (Suntrace Africa, 2012):

- minimum road width: 6 m for the main road and 4 m for the auxiliary road
- radius of the inner roadside to facilitate proper movement of traffic required for the erection of the PV power station:
  - 9 m for the main road
  - 4 m for the auxiliary road
- Design of main road would be for heavy construction vehicles and trucks
- surface: tar, paving and/or gravel

Internal or service roads would be needed within the site for the construction as well as the operation and maintenance phases. The construction of these tracks would comprise gravel for filling and higher quality surfacing on top. Should this be needed, the gravel is to be sourced from a permitted borrow pit. The strength and durability of the in situ rock strata at the proposed site are currently unknown and are to be assessed via a geotechnical study to be conducted by the project proponent if necessary. The results of this study would indicate whether the vegetation and ground surface could be stripped, and the exposed formation levelled, compacted and used as an access track surface.

The layout of these internal roads has been planned due to the fact that not any high environmental sensitive issues have been identified by the specialist studies already conducted on the study area (Appendix C1).

Include the position of the access road on the site plan and required map, as well as an indication of the road in relation to the site.

6. SITE OR ROUTE PLAN

A detailed site or route plan(s) must be prepared for each alternative site or alternative activity. It must be attached as **Appendix A** to this document.

The site or route plans must indicate the following:

6.1 the scale of the plan which must be at least a scale of 1:500;
6.2 the property boundaries and numbers of all the properties within 50 metres of the site;
6.3 the current land use as well as the land use zoning of each of the properties adjoining the site or sites;
6.4 the exact position of each element of the application as well as any other structures on the site;
6.5 the position of services, including electricity supply cables (indicate above or underground), water supply pipelines, boreholes, street lights, sewage pipelines, storm water infrastructure and telecommunication infrastructure;
6.6 all trees and shrubs taller than 1.8 metres;
6.7 walls and fencing including details of the height and construction material;
6.8 servitudes indicating the purpose of the servitude;
6.9 sensitive environmental elements within 100 metres of the site or sites including (but not limited thereto):
- rivers;
- the 1:100 year flood line (where available or where it is required by DWA);
- ridges;
- cultural and historical features;
- areas with indigenous vegetation (even if it is degraded or invested with alien species);

6.10 for gentle slopes the 1 metre contour intervals must be indicated on the plan and whenever the slope of the site exceeds 1:10, the 500mm contours must be indicated on the plan; and
6.11 the positions from where photographs of the site were taken.

7. SITE PHOTOGRAPHS

Colour photographs from the centre of the site must be taken in at least the eight major compass directions with a description of each photograph. Photographs must be attached under **Appendix B** to this form**.** It must be supplemented with additional photographs of relevant features on the site, if applicable.

8. FACILITY ILLUSTRATION

A detailed illustration of the activity must be provided at a scale of 1:200 as **Appendix C** for activities that include structures. The illustrations must be to scale and must represent a realistic image of the planned activity. The illustration must give a representative view of the activity.

9. ACTIVITY MOTIVATION

9(a) Socio-economic value of the activity

What is the expected capital value of the activity on completion?	~R 295 million	
What is the expected yearly income that will be generated by or as a result of the activity?	~R 32 million (in 2011 terms of RFP regulations)	
Will the activity contribute to service infrastructure?	**YES**	~~NO~~
Is the activity a public amenity?	~~YES~~	**NO**
How many new employment opportunities will be created in the development phase of the activity?	~100-150	
What is the expected value of the employment opportunities during the development phase?	~R 4.5-6.8 million	
What percentage of this will accrue to previously disadvantaged individuals?	~ 67%	
How many permanent new employment opportunities will be created during the operational phase of the activity?	~ 18	
What is the expected current value of the employment opportunities during the first 10 years?	~ R 11 million	
What percentage of this will accrue to previously disadvantaged individuals?	~ >50%	

9(b) Need and desirability of the activity

Motivate and explain the need and desirability of the activity (including demand for the activity):

NEED:			
1.	Was the relevant provincial planning department involved in the application? **Note: The communication to this department is a parallel process to the EIA.**	**YES**	~~NO~~
2.	Does the proposed land use fall within the relevant provincial planning framework?	**YES**	~~NO~~
3.	If the answer to questions 1 and / or 2 was NO, please provide further motivation / explanation:		

DESIRABILITY:			
1.	Does the proposed land use / development fit the surrounding area?	**YES**	~~NO~~
2.	Does the proposed land use / development conform to the relevant structure plans, SDF and planning visions for the area?	**YES**	~~NO~~
3.	Will the benefits of the proposed land use / development outweigh the negative impacts of it?	**YES**	~~NO~~
4.	If the answer to any of the questions 1-3 was NO, please provide further motivation / explanation:		
5.	Will the proposed land use / development impact on the sense of place?	**YES**	~~NO~~
6.	Will the proposed land use / development set a precedent?	~~YES~~	**NO**
7.	Will any person's rights be affected by the proposed land use / development?	~~YES~~	**NO**
8.	Will the proposed land use / development compromise the "urban edge"?	~~YES~~	**NO**
9.	If the answer to any of the question 5-8 was YES, please provide further motivation / explanation.		
	A visual impact assessment was conducted by AXIS Landscape Architects. (Appendix D5) This assessment indicated that the most significant impacts would occur during the construction phase of the project, when grassland areas would be cleared to make way for construction areas, roads and stockpiles. The change in surface cover from the shrub-land character to exposed soil would diminish the shrub-land character of the area and cause a very severe impact. The impacts would abate as the project reaches completion and the disturbed areas are rehabilitated. The visual receptors that would mostly be affected are the residents within a 5 km distance from the site. The visual impact would occur during the construction of the development when unsightly views of the construction activity would be visible. The residents would experience a high level of visual exposure due to their proximity to the development, and the exposed soil, construction equipment and material stockpiles would cause severe visual intrusion. Mitigation is proposed to lower the significance of the impacts to acceptable standards. Mitigation addresses predictable impacts that should be addressed in the design phase as well as potential impacts during the construction and operational phases of the development.		

BENEFITS:			
1.	Will the land use / development have any benefits for society in general?	**YES**	~~NO~~
2.	Explain:		

Cost Benefit Analysis of PV Power Stations

PV technology exploits the most abundant source of free power from the Sun and has the potential to meet almost all of mankind's energy needs. Unlike other sources of energy, PV has a negligible environmental footprint, can be deployed almost anywhere and utilises existing technologies and manufacturing processes, making it cheap and efficient to implement. (Greenpeace, 2011)

There are no substantial limits to the massive deployment of PV power generation. Material and industrial capability are plentiful and the industry has demonstrated an ability to increase production very quickly to meet growing demands. (Greenpeace, 2011)

Sustainable development can be described as a "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The concept of sustainability is based on three pillars: social, environmental and economic sustainability. (Greenpeace, 2011)

Economic Factors

The implementation of the proposed PV power station would:

- stimulate the regional economy;
- promote the local economy development;
- create new job opportunities;
- avoid electricity price fluctuation;
- contribute to network integration;
- network expansion compatible;
- reduce the fossil fuel dependence of the area;
- be part of a high-standardized sector;
- contribute to the import and later possibly export know-how to other countries;
- benefit from proven safety and reliability;
- be easy and has very low maintenance requirements; and
- promote food security.

Support Schemes Benefits

Apart from being a clean and reliable source of electricity, PV generates a number of economic benefits for the entire society. Feed-in Tariffs generate more benefits than what they cost initially to electricity consumers.

The Feed-in Tariffs received by PV plant owners are a benefit to them (Greenpeace, 2011), the land owners, the immediate community and region in general. The overall costs for the Feed-in Tariffs are usually rolled over to final electricity consumers and included in their electricity bills (Greenpeace, 2011) in the long term. In turn they receive all the benefits of a reliable clean energy.

Improving Grid Efficiency

PV power stations can be placed at the centre of an energy generation network or used in a decentralised way (Greenpeace, 2011). These small PV power stations would spread throughout the distribution network in the Northern Cape Region, connecting directly into the grid.

Reduction of Grid Losses

These PV power stations can be considered as a distributed and decentralised source of energy. Producing electricity near the place where it is consumed implies a reduction in the distribution and transmission losses (costs) which are linked to the distance between the point of generation and the point of use. (Greenpeace, 2011)

Energy Security

Once installed, these PV power stations will produce electricity for at least 20 years at a fixed and known cost. Conventional power plants must deal with fluctuating prices for fossil fuels such as oil, gas or coal on the international markets. The certainty of being

independent from such fluctuations can be valued depending on the assumptions of the oil, gas and coal prices evolution. (Greenpeace, 2011)

Operating Reserve

PV requires additional operating reserves to ensure the full reliability of PV electricity systems. This cost is due to the variable nature of PV electricity production and is well-known. (Greenpeace, 2011)

Lost Margins for Utilities

Every kWh of PV that would be produced by a PV plant owner or an Independent Power Producer (IPP) instead of a traditional utility will cause that the margins of the utilities will shrink. However, this offers also opportunities for utilities as they will have to adapt their business models transforming into new generation utilities that can take up important tasks in the future electricity grids as aggregators, facilitators and network service providers. (Greenpeace, 2011)

Industry Development

The PV power station would require industrial capacity: raw material providers; module manufacturers; machinery and equipment providers; installers; and other services linked to the electricity system. This generates added value for the community; not only in terms of jobs, but also in terms of industrial development, and business generation. (Greenpeace, 2011)

Moreover, PV power stations would contribute to the structural change needed to build an efficient and distributed energy system. It also contributes to the enhancement of competition in the currently rather concentrated power generation market. (Greenpeace, 2011)

Food Security

Electricity shortages or blackouts have previously caused serious problems and damage to the intensive agriculture farming sector in the Douglas area, putting into jeopardy the very important food security of the region. Alternative sustainable energy production within this area would contribute to ensuring higher reliability in energy supply to the immediate area.

Environmental Factors

- Clean energy;
- Unlimited resource;
- Free-cost resource;
- Minimal environment impact;
- Other land uses can be performed;
- Produces no radioactive or other hazardous waste;
- Avoids CO2 emissions and reduces the Global Warming;
- Simple technology;
- Low Water Consumption;
- Quiet operation; and
- Visually less obtrusive than CSP and wind power generation.

The damage that is being done to the climate by the use of fossil fuels (i.e. oil, coal and gas) for energy and transport is likely to destroy the livelihoods of millions of people, especially in the developing world. It would also disrupt ecosystems and significantly speed up the extinction of species over the coming decades. (Greenpeace, 2011)

Reduction of Greenhouse Gas Emissions and Climate Change Mitigation

The cost of greenhouse gas emissions from power generation can be easily decreased using PV power generation. Moreover, the carbon footprint of PV systems is decreasing every year. Currently, the external costs to society incurred from burning fossil fuels are not included in electricity prices. (Greenpeace, 2011)

The proposed development would provide clean energy from an unlimited and sustainable resource, which would cause minimal environmental impact and reduce fossil fuel dependence. It would produce minimal waste and avoid CO_2 emissions, and therefore reduce further global warming.

Environmental Footprint of PV Power Generation

The energy it takes to make a solar power system is usually recouped by the energy costs saved over one to three years. Some new generation technologies can even recover the cost of the energy used to produce them within six months, depending on their location. PV systems have a typical life of at least 25 years, ensuring that each panel generates many times more energy than it costs to produce. (Greenpeace, 2011)

Energy Payback Time (EPBT)

The production of PV modules requires energy. The energy payback time (EPBT) indicates the number of years a PV power station has to operate to compensate for the energy it took to produce, install, dismantle and recycle. (Greenpeace, 2011)

The EPBT depends on:

- the level of irradiation (in sunny areas like the Northern Cape the EPBT is shorter than in areas with relatively low solar irradiance);
- the type of system (integrated or not, orientation, inclination; and
- the technology (because of different manufacturing processes and different sensitivities to solar irradiation). (Greenpeace, 2011)

New techniques have been developed to reduce energy consumption. This leads to further decreases in the EPBT of PV systems, improving their sustainability. (Greenpeace, 2011)

The main drivers for further reduction of the EPBT are:

- Reduce: using less materials (for example by reducing the thickness of the silicon wafers);
- Re-use: recycling of materials; and
- Replace: using materials that generate less CO_2. (Greenpeace, 2011)

Higher system efficiencies for converting solar energy into electricity and continuous improvements in the manufacturing processes will contribute to further decrease the EPBT. (Greenpeace, 2011)

Water Consumption

Unlike other technologies, PV power generation require very little water during their operation for cleaning purposes and use by personnel on site. This makes PV a sustainable electricity source in places where water is scarce like in the Northern Cape. Some water is used during the production and construction process. Most of the water indirectly used for PV production comes from the electricity consumption of PV factories (conventional power generation uses water, amongst others, for cooling). Hence, an increased share of PV in the electricity mix would lower the water requirements during the production process of PV modules. (Greenpeace)

Recycling

PV modules are designed to generate clean, renewable energy for at least 25 years. The PV industry is working to create solutions that reduce the impact of PV on the environment at all stages of the product life cycle: from raw material sourcing through end-of life collection and recycling. (Greenpeace, 2011)

In 2007, leading manufacturers embraced the concept of producer responsibility and established a voluntary, industry-wide take-back and recycling programme. Now the PV CYCLE association (www.pvcycle.org) is working towards greater environmental sustainability. (Greenpeace, 2011)

Recycling technologies exist for almost all types of photovoltaic products and most manufacturers are engaged in recycling activities. The environmental benefits and burdens of recycling have been assessed through the Chevetogne (Belgium) recycling pilot project. The project shows that the environmental benefits of recycling clearly outnumber the additional environmental burdens (heat, chemical treatment to recover the basic materials enclosed in the modules) that recycling of the modules demands. (Greenpeace, 2011)

PV Modules

PV modules contain materials that can be recovered and reused in either new PV modules or other new products. Industrial recycling processes exist for both thin-film and silicon modules. Materials such as glass, aluminium, as well as a variety of semiconductor materials, are valuable when recovered.

	Recycling not only benefits the environment by reducing the volume of waste, but also helps to reduce the amount of energy required to provide raw materials and therefore the costs and environmental impacts of producing PV modules. By recycling end-of-life modules, the PV industry enables the sustainable use of PV technology, furthering PV's ability to help meet the energy needs while protecting the environment.

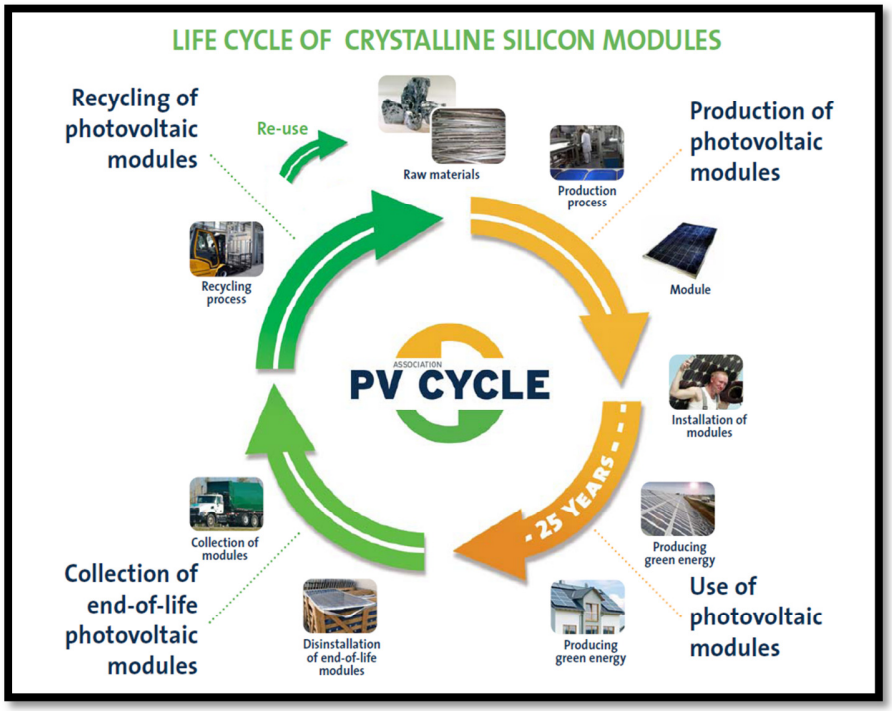


Figure 12: Processes developed by PV CYCLE

Various recycling for PV panels' process are currently being implemented, the following model is the most frequently used:

Stages of Recycling of PV Panels

Activity	Description
Collection	The modules are collected in hoppers and loaded by forklift into a shredder.
Shredder	The modules are reduced in size in a two-step process. Step one uses a shredder to break the modules into large pieces.
Hammer mill	Step-two, the hammer mill, crushes the broken glass into 4-5mm pieces, small enough to ensure the lamination bond is broken.
Film Removal	The semiconductor films are removed by the addition of acid and hydrogen peroxide in a slowly rotating, stainless steel drum.
Solid-Liquid Separation	The drum is slowly emptied into a classifier where glass is separated from the liquids. A rotating screw conveys the glass up an incline, leaving the liquids behind.
Glass-Laminate Material Separation	A vibrating screen separates the glass from the larger pieces of laminate material (which formerly sealed the two pieces of glass together).
Glass Rinsing	The glass is rinsed to remove any residual semiconductor material that physically remains on the glass. The cleaned glass is packaged for recycling.
Precipitation	The metals-rich liquid is pumped to the precipitation unit. The metal compounds are precipitated in three stages at increasing pH.
Dewatering	The precipitated materials are concentrated in a thickening tank. The resulting unrefined semiconductor material is packaged for processing by a third party to create semiconductor material for use in new modules.

3.	Will the land use / development have any benefits for the local communities where it will be located?	**YES**	~~NO~~
4.	Explain:		
	Social Factors • Creates employment opportunities • Promotes the sustainable development of the region • Uses local resources • Safe technology • Stable technology • Produces no dangerous waste • Ideal for remote installations electricity supply **Employment** PV products create employment along the entire value chain, from the production of PV products and equipment needed for their production, through the development and installation of the systems, the financing, operation and maintenance of solar power plants, and their decommissioning and rehabilitation. While manufacturing jobs are concentrated in production hubs, the downstream jobs (related to installation, operation and maintenance, financing and power sales) would be mainly local. (Greenpeace, 2011) During the construction, operational and maintenance phases the local economy would be stimulated and job opportunities created, with the security business as one of the main beneficiaries. Local resources would, where possible, be utilised from the planning through the construction, operational and maintenance phases.		

10. APPLICABLE LEGISLATION, POLICIES AND/OR GUIDELINES

List all legislation, policies and/or guidelines of any sphere of government that are applicable to the application as contemplated in the EIA regulations, if applicable:

Title of legislation, policy or guideline:	Administering authority:	Date:
Constitution of the Republic of South Africa (Act No 108 of 1996)	National Government	1996
National Environmental Management Act (Act 107 of 1998)	National and Provincial Department of Environmental Affairs	1998
National Environmental Management: Waste Act (Act No 59 of 2008)	Department of Environmental Affairs	2008
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Department of Environmental Affairs	2004
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	Department of Environmental Affairs	2004
Environment Conservation Act (Act No 73 of 1989)	Department of Environmental Affairs	1989
National Water Act (Act No 36 of 1998)	Department of Water Affairs	1998
National Heritage Resources Act (Act No 25 of 1999)	South African Heritage Resources Agency	1999
Conservation of Agricultural Resources Act (Act No 43 of 1983)	National Department of Agriculture (DAFF)	1983
National Veld and Forest Fire Act (Act No 101 of 1998)	National Department of Agriculture, Forestry and Fisheries (DAFF)	1998
National Forests Act (Act No 84 of 1998)	DAFF	1998
Northern Cape Nature Conservation Act(Act No 9 of 2009)	Northern Cape Department of Environment and Nature Conservation	2009
Promotion of Access to Information Act (Act No 2 of 2000)	National Department of Environmental Affairs	2000
Advertising on Roads and Ribbon Development Act (Act No 21 of 1940)	Department of Roads and Public Works	1940
Subdivision of Agricultural Land Act (Act 70 of 1970)	DAFF, Local Authorities	1970
Fencing Act (Act No 31 of 1963)	DAFF	1963
South Africa Civil Aviation Regulation Act (Act 13 of 2009)	SACAA	2009

11. WASTE, EFFLUENT, EMISSION AND NOISE MANAGEMENT

11(a) Solid waste management

Will the activity produce solid construction waste during the construction/initiation phase?	**YES**	~~NO~~
If yes, what estimated quantity will be produced **per month**?	~ 100 m^3	

How will the construction solid waste be disposed of (describe)?

By truck

Where will the construction solid waste be disposed of (describe)?

The general construction waste, which cannot be re-used or re-cycled, would most probably be disposed of at the Douglas Local Municipality Waste Disposal Site.

Will the activity produce solid waste during its operational phase? **Note:** Most of the waste would be packaging and cabling off cuts etc. which should mostly be recyclable.	**YES**	~~NO~~
If yes, what estimated quantity will be produced **per month**?	~15 m^3	

How will the solid waste be disposed of (describe)?

Depending of the amount of waste, it will either be removed by a truck or a pick up vehicle.

Where will the solid waste be disposed if it does not feed into a municipal waste stream (describe)?

NA

If the solid waste (construction or operational phases) will not be disposed of in a registered landfill site or be taken up in a municipal waste stream, then the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

Can any part of the solid waste be classified as hazardous in terms of the relevant legislation?	~~YES~~	**NO**

If yes, inform the competent authority and request a change to an application for scoping and EIA.

Is the activity that is being applied for a solid waste handling or treatment facility?	~~YES~~	**NO**

If yes, then the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

11(b) Liquid effluent

Will the activity produce effluent, other than normal sewage, that will be disposed of in a municipal sewage system?	~~YES~~	**NO**
If yes, what estimated quantity will be produced per month?	m^3	
Will the activity produce any effluent that will be treated and/or disposed of on site?	~~YES~~	**NO**

If yes, the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

Will the activity produce effluent that will be treated and/or disposed of at another facility?	~~YES~~	**NO**

If yes, provide the particulars of the facility:

Facility name:			
Contact person:			
Postal address:			
Postal code:			
Telephone:		Cell:	
E-mail:		Fax:	

Describe the measures that will be taken to ensure the optimal reuse or recycling of waste water, if any:

Currently the applicant investigates the feasibility of installing enviro-loo products which would eliminate sewage disposal.

11(c) Emissions into the atmosphere

Will the activity release emissions into the atmosphere?	~~YES~~	**NO**
If yes, is it controlled by any legislation of any sphere of government?	~~YES~~	~~NO~~

If yes, the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.

If no, describe the emissions in terms of type and concentration:

During construction the only emissions would be that from vehicles and machinery. That is controlled by legislation. PV power stations convert solar energy to electricity. To do this not any natural resources such as fuel is used for operation. During the operational phase it does not emit any emissions into the air.

11(d) Generation of noise

Will the activity generate noise?	~~YES~~	**NO**
If yes, is it controlled by any legislation of any sphere of government?	YES	~~NO~~

If yes, the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.
If no, describe the noise in terms of type and level:

During construction noise will be generated by vehicles and construction machinery during working hours. During operational phase not any noise will be generated.

12. WATER USE

Please indicate the source(s) of water that will be used for the activity by ticking the appropriate box (es)

municipal	water board	groundwater	river, stream, dam or lake	other	the activity will not use water

If water is to be extracted from groundwater, river, stream, dam, lake or any other natural feature, please indicate the volume that will be extracted per month: 0 litres

Does the activity require a water use permit from the Department of Water Affairs? ~~YES~~ **NO**

If yes, please submit the necessary application to the Department of Water Affairs and attach proof thereof to this application if it has been submitted.

Note: The applicant is currently applying for a water allocation for construction and operation from the Siyancuma Local Municipality who are a registered Water Service Provider.

13. ENERGY EFFICIENCY

Describe the design measures, if any, that have been taken to ensure that the activity is energy efficient:

This is a photovoltaic generation application which would affect energy efficiency locally and possibly regionally.

Describe how alternative energy sources have been taken into account or been built into the design of the activity, if any:

The provision of security lighting and electricity at offices and other buildings would be sourced from ESKOM.

SECTION B: SITE/AREA/PROPERTY DESCRIPTION

Important notes:

1. For linear activities (pipelines, etc.) as well as activities that cover very large sites, it may be necessary to complete this section for each part of the site that has a significantly different environment. In such cases please complete copies of Section C and indicate the area, which is covered by each copy No. on the Site Plan.

Section C Copy No. (e.g. A): [ ]

2. Paragraphs 1 - 6 below must be completed for each alternative.

3. Has a specialist been consulted to assist with the completion of this section? ~~YES~~ **NO**

If YES, please complete the form entitled "Details of specialist and declaration of interest" for each specialist thus appointed:
All specialist reports must be contained in **Appendix D**.

Property description/physical address:	PV Power Station: Remaining Extent of the Farm Kwartelspan Nr. 25 Evacuation Line: Portion 1 (Remaining Extent) of the Farm Kwartelspan nr 25 Both farms are situated next to each other approximately 60 km from Douglas on the road to Prieska.
	(Farm name, portion etc.) Where a large number of properties are involved (e.g. linear activities), please attach a full list to this application.
	Siyancuma Local Municipality, Douglas Pixley ka Seme District Municipality (Main offices situated in De Aar)
	In instances where there is more than one town or district involved, please attach a list of towns or districts to this application.
Current land-use zoning:	Agriculture
	In instances where there is more than one current land-use zoning, please attach a list of current land use zonings that also indicate which portions each use pertains to , to this application.

Is a change of land-use or a consent use application required? **YES** ~~NO~~

Note: Suntrace Africa is in the process of applying for a re-zoning in terms of the Northern Cape Planning and Development Act (Act 7 of 1988) from the Siyancuma Municipality. This is a parallel process to the EIA.

Must a building plan be submitted to the local authority? **YES** ~~NO~~

Locality map: An A3 locality map must be attached to the back of this document, as **Appendix A**. The scale of the locality map must be relevant to the size of the development (at least 1:50 000. For linear activities of more than 25 kilometres, a smaller scale e.g. 1:250 000 can be used. The scale must be indicated on the map.) The map must indicate the following:

- an indication of the project site position as well as the positions of the alternative sites, if any;
- road access from all major roads in the area;
- road names or numbers of all major roads as well as the roads that provide access to the site(s);
- all roads within a 1km radius of the site or alternative sites; and
- a north arrow;
- a legend; and
- locality GPS co-ordinates (Indicate the position of the activity using the latitude and longitude of the centre point of the site for each alternative site. The co-ordinates should be in degrees and decimal minutes. The minutes should have at least three decimals to ensure adequate accuracy. The projection that must be used in all cases is the WGS84 spheroid in a national or local projection)

1. GRADIENT OF THE SITE

Indicate the general gradient of the site.

Alternative S1:

Flat	~~1:50 – 1:20~~	~~1:20 – 1:15~~	~~1:15 – 1:10~~	~~1:10 – 1:7,5~~	~~1:7,5 – 1:5~~	~~Steeper than 1:5~~

Alternative S2 (if any):

Flat	1:50 – 1:20	1:20 – 1:15	1:15 – 1:10	1:10 – 1:7,5	1:7,5 – 1:5	Steeper than 1:5

Alternative S3 (if any):

Flat	1:50 – 1:20	1:20 – 1:15	1:15 – 1:10	1:10 – 1:7,5	1:7,5 – 1:5	Steeper than 1:5

2. LOCATION IN LANDSCAPE

Indicate the landform(s) that best describes the site:

2.1 Ridgeline
2.2 Plateau
2.3 Side slope of hill/mountain
2.4 Closed valley
2.5 Open valley
2.6 Plain
2.7 Undulating plain / low hills
2.8 Dune
2.9 Seafront

3. GROUNDWATER, SOIL AND GEOLOGICAL STABILITY OF THE SITE

Is the site(s) located on any of the following (tick the appropriate boxes)?

	Alternative S1:		Alternative S2 (if any):		Alternative S3 (if any):	
Shallow water table (less than 1.5m deep)	~~YES~~	**NO**	YES	NO	YES	NO
Dolomite, sinkhole or doline areas	~~YES~~	**NO**	YES	NO	YES	NO
Seasonally wet soils (often close to water bodies)	~~YES~~	**NO**	YES	NO	YES	NO
Unstable rocky slopes or steep slopes with loose soil	~~YES~~	**NO**	YES	NO	YES	NO
Dispersive soils (soils that dissolve in water)	~~YES~~	**NO**	YES	NO	YES	NO
Soils with high clay content (clay fraction more than 40%)	~~YES~~	**NO**	YES	NO	YES	NO
Any other unstable soil or geological feature	~~YES~~	**NO**	YES	NO	YES	NO
An area sensitive to erosion	~~YES~~	**NO**	YES	NO	YES	NO

Note: The soil and geological stability has been covered within the Agriculture Specialist Study in Appendix D6.

If you are unsure about any of the above or if you are concerned that any of the above aspects may be an issue of concern in the application, an appropriate specialist should be appointed to assist in the completion of this section. (Information in respect of the above will often be available as part of the project information or at the planning sections of local authorities. Where it exists, the 1:50 000 scale Regional Geotechnical Maps prepared by the Council for Geo Science may also be consulted).

4. GROUNDCOVER

Indicate the types of groundcover present on the site:

The location of all identified rare or endangered species or other elements should be accurately indicated on the site plan(s).

Natural veld - good condition[E]	**Natural veld with scattered aliens[E]**	Natural veld with heavy alien infestation[E]	Veld dominated by alien species[E]	Gardens
Sport field	Cultivated land	Paved surface	Building or other structure	**Bare soil**

If any of the boxes marked with an "[E] "is ticked, please consult an appropriate specialist to assist in the completion of this section if the environmental assessment practitioner doesn't have the necessary expertise.

Note: Ecology and agriculture specialist studies have been conducted (Appendix D1 and D6).

5. LAND USE CHARACTER OF SURROUNDING AREA

Indicate land uses and/or prominent features that does **currently occur** within a **500m radius** of the site and give description of how this influences the application or may be impacted upon by the application:

5.1 Natural area
5.2 Low density residential
5.3 Medium density residential
5.4 High density residential
5.5 Informal residential[A]
5.6 Retail commercial & warehousing
5.7 Light industrial
5.8 Medium industrial [AN]
5.9 Heavy industrial [AN]
5.10 Power station
5.11 Office/consulting room
5.12 Military or police base/station/compound
5.13 Spoil heap or slimes dam[A]
5.14 Quarry, sand or borrow pit
5.15 Dam or reservoir
5.16 Hospital/medical centre
5.17 School
5.18 Tertiary education facility
5.19 Church
5.20 Old age home
5.21 Sewage treatment plant[A]
5.22 Train station or shunting yard [N]
5.23 Railway line [N]
5.24 Major road (4 lanes or more) [N]
5.25 Airport [N]
5.26 Harbour
5.27 Sport facilities
5.28 Golf course
5.29 Polo fields
5.30 Filling station [H]
5.31 Landfill or waste treatment site
5.32 Plantation
5.33 Agriculture
5.34 River, stream or **wetland** (A pan is situated nearby that has been identified as a no-go area. Subsequently the Access Road Option 2 has been relocated south to follow an existing fence. This can also act as a firebreak between farms.)
5.35 Nature conservation area

5.36 Mountain, koppie or ridge
5.37 Museum
5.38 Historical building
5.39 Protected Area
5.40 Graveyard
5.41 Archaeological site
5.42 Other land uses (describe): Electricity transmission infrastructure such as a substation and transmission lines of 132 kV. A 10 MW PV power plant has been authorised adjacent to the study area and construction might possibly commence in 2012 or 2013.

If any of the boxes marked with an "N "are ticked, how will this impact / be impacted upon by the proposed activity?

If any of the boxes marked with an "An" are ticked, how will this impact / be impacted upon by the proposed activity?
If YES, specify and explain:
If YES, specify:

If any of the boxes marked with an "H" are ticked, how will this impact / be impacted upon by the proposed activity.
If YES, specify and explain:
If YES, specify:

6. CULTURAL/HISTORICAL FEATURES

Are there any signs of culturally or historically significant elements, as defined in section 2 of the National Heritage Resources Act, 1999, (Act No. 25 of 1999), including Archaeological or palaeontological sites, on or close (within 20m) to the site?	~~YES~~	**NO**
	Uncertain	
If YES, explain:		
If uncertain, conduct a specialist investigation by a recognised specialist in the field to establish whether there is such a feature(s) present on or close to the site.		
Briefly explain the findings of the specialist:	An Archaeological Impact Assessment (AIA) Phase 1 (Appendices D3) has been conducted at the study area (exemption from Palaeontological Desktop Study) and no significant heritage resources have been identified. Mitigation measures, which are to be taken in the event of any future discoveries of archaeological or paleontological features, have been addressed in the EMP (Appendix F).	
Will any building or structure older than 60 years be affected in any way?	~~YES~~	**NO**
Is it necessary to apply for a permit in terms of the National Heritage Resources Act, 1999 (Act 25 of 1999)?	~~YES~~	**NO**

If yes, please submit or, make sure that the applicant or a specialist submits the necessary application to SAHRA or the relevant provincial heritage agency and attach proof thereof to this application if such application has been made.

SECTION C: PUBLIC PARTICIPATION

1. ADVERTISEMENT

The EAP conducting a public participation process took into account any guidelines applicable to public participation as contemplated in section 24J of the Act and gave notice to all potential interested and affected parties of the application which is subjected to public participation by—

(a) fixing a notice board at the entrance gate to the Greefspan Substation, next to the R 357 between Douglas and Prieska, conspicuous to the public at the boundary of—
  (i) the site where the activity to which the application relates is or is to be undertaken (at the entrance gate to the farm Kwartelspan) on the gravel road off the R 357as well as at the Siyancuma Local Municipality and at the garage at Prieska; and
  (ii) any alternative site mentioned in the application;

(b) giving written notice to—
  (i) the owner or person in control of that land if the applicant is not the owner or person in control of the land;
  (ii) the **occupiers** of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
  (iii) owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
  (iv) the municipal councillor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;
  (v) the municipality which has jurisdiction in the area;
  (vi) any organ of state having jurisdiction in respect of any aspect of the activity; and
  (vii) any other party as required by the competent authority;

(c) placing advertisements (Afrikaans and English) in—
  (i) one local newspaper **(Crazy Ads)**; or
  (ii) any official *Gazette* that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations;

(d) placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or local municipality in which it is or will be undertaken: Provided that this paragraph need not be complied with if an advertisement has been placed in an official *Gazette* referred to in subregulation 54(c)(ii); and

(e) using reasonable alternative methods, as agreed to by the competent authority, in those instances where a person is desiring of but unable to participate in the process due to—
  (i) illiteracy;
  (ii) disability; or
  (iii) any other disadvantage.

Note: Find proof of the first phase of public participation attached in Appendices E and G2.

2. CONTENT OF ADVERTISEMENTS AND NOTICES

The notice board, advertisement or notices:

(a) indicate the details of the application which is subjected to public participation; and

(b) state—
  (i) that the application has been submitted to the competent authority in terms of these Regulations,
  (ii) applied to the application, in the case of an application for environmental authorisation;
  (iii) the nature and location of the activity to which the application relates;
  (iv) where further information on the application or activity can be obtained; and
  (iv) the manner in which and the person to whom representations in respect of the application may be made.

3. PLACEMENT OF ADVERTISEMENTS AND NOTICES

Where the proposed activity may have impacts that extend beyond the municipal area where it is located, a notice must be placed in at least one provincial newspaper or national newspaper, indicating that an application will be submitted to the competent authority in terms of these regulations, the nature and location of the activity, where further information on the proposed activity can be obtained and the manner in which representations in respect of the application can be made, unless a notice has been placed in any *Gazette* that is published specifically for the purpose of providing notice to the public of applications made in terms of the EIA regulations.

Advertisements and notices must make provision for all alternatives.

Note: It is not foreseen that the proposed PV power station would have any regional impact beyond the municipal area where it is located. An advert was placed, according to stipulations in regulations, in the Crazy Adds, a local newspaper in the area. (Appendix G 2g)

4. DETERMINATION OF APPROPRIATE MEASURES

The practitioner must ensure that the public participation is adequate and must determine whether a public meeting or any other additional measure is appropriate or not based on the particular nature of each case. Special attention should be given to the involvement of local community structures such as Ward Committees, ratepayers associations and traditional authorities where appropriate. Please note that public concerns that emerge at a later stage that should have been addressed may cause the competent authority to withdraw any authorisation it may have issued if it becomes apparent that the public participation process was inadequate.

5. COMMENTS AND RESPONSE REPORT

The practitioner must record all comments and respond to each comment of the public before the application is submitted. The comments and responses must be captured in a comments and response report as prescribed in the EIA regulations and be attached to this application. The comments and response report must be attached under **Appendix E**.

6. AUTHORITY PARTICIPATION

Please note that a complete list of all organs of state and or any other applicable authority with their contact details must be appended to the basic assessment report or scoping report, whichever is applicable.

Note: Complete list with contact particulars in Appendix G 2i.

Authorities are key interested and affected parties in each application and no decision on any application will be made before the relevant local authority is provided with the opportunity to give input.

List of authorities informed:

- *National Government Representatives*:
  - Department of Environmental Affairs;
  - Department of Agriculture;
- *Provincial Government Representatives (Northern Cape)*:
  - Department of Environment and Nature Conservation;
  - Department of Agriculture and Land Reform,
  - Department of Forestry (DAFF);
  - Department of Roads and Public Works;
  - Department of Water Affairs;
  - Department of Labour;
  - Department of Mineral Resources;
  - Department of Energy;
  - Department of Sports, Arts and Culture; and
  - Department of Tourism
- *Local and District Authorities*:
  - Pixley ka Seme District Municipality;
  - Siyancuma Local Municipality and Ward Councillor; and
- *Other authorities*:
  - South African Heritage Resources Agency;
  - Northern Cape Provincial Heritage Resources Agency; and
  - South African Civil Aviation Authority;
- *Environmental Non-Governmental Organisations*:
  - Endangered Wildlife Trust; and
  - Wildlife and Environment Society of South Africa
- *Parastatals*:
  - Eskom; and
  - Telkom;
- *Surrounding landowners*.

List of authorities from whom comments have been received:

South African Heritage Resources Agency

Note: Comments are being attached in Appendix G 2f

7. CONSULTATION WITH OTHER STAKEHOLDERS

Note that, for linear activities, or where deviation from the public participation requirements may be appropriate, the person conducting the public participation process may deviate from the requirements of that subregulation to the extent and in the manner as may be agreed to by the competent authority.
Proof of any such agreement must be provided, where applicable.

Has any comment been received from stakeholders?	**YES**	~~NO~~

If "YES", briefly describe the feedback below (also attach copies of any correspondence to and from the stakeholders to this application – **Appendix G 2f**):

SAHRA
In terms of the National Heritage Resources Act, no 25 of 1999, heritage resources, including archaeological or palaeontological sites over 100 years old, graves older than 60 years, structures older than 60 years are protected. They may not be disturbed without a permit from the relevant heritage resources authority. This means that before such sites are disturbed by development it is incumbent on the developer to ensure that a Heritage Impact Assessment is done. This must include the archaeological component (Phase 1) and any other applicable heritage components. (Appendix G2f)

Telkom
Acknowledge receipt of notification and BID.
Telkom Ref: SR/002 804
Application is approved in terms of Section 22 of the Electronic Communications Act No. 36 of 2005.
The approval is for a period of 6 months only, after which re-application must be made if the work has not been completed.
Telkom SA overhead plant will be affected by this proposal.
Damages occurred during construction will be repaired at the customer's account.
Telkom SA overhead route is marked in PINK on sketches attached to the comments in Appendix G has a **VERY IMPORTANT CABLE** and subscriber's infrastructure.
A repayable project would be required to re-locate this existing infrastructure.
The relocation and or alteration would be to the account of the developer.
Mr **Bennie Pienaar** must be contacted at **053 839 3486/081 411 2515** before any commencement of work.

SECTION D: IMPACT ASSESSMENT

The assessment of impacts must adhere to the minimum requirements in the EIA Regulations, 2010, and should take applicable official guidelines into account. The issues raised by interested and affected parties should also be addressed in the assessment of impacts.

1. ISSUES RAISED BY INTERESTED AND AFFECTED PARTIES

List the main issues raised by interested and affected parties.

Rockwell Diamonds

(Roelien Oosthuizen) Request to be registered.

Occupants of neighbouring farms of which Trans Hex Operations is the owner.

Urge to send notice to Trans Hex Operations. Holder of Converted Prospecting Rights over the properties applied for. It makes up part of the reserves to keep the mine alive for several years.

Mining Rights have been applied for on the properties of which the applications are in the process.

Biggest concern in terms of this development would be the dust created by various mining operations in the nearby vicinity of the proposed solar project.

(Glenn Norton) Inform EAP that Rockwell has not been consulted as an I&AP. Ensure that Rockwell is consulted with a face to face meeting whereby the intention of Suntrace is adequately explained and how Suntrace intends to source water for the plant

Response from the practitioner to the issues raised by the interested and affected parties (A full response must be given in the Comments and Response Report that must be attached to this report as Annexure E):

Registered Rockwell Diamonds.

Sent notice and BID to Trans Hex Operations.

After the telephonic conversation kmz files were sent to Ms Oosthuizen to establish if the areas where the PV Power Plants are being proposed are underlain by reserves.

Wind and dust fallout data was also requested from Ms Oosthuizen. She could supply wind data but does not have any dust fallout data available.

Request the prospecting permit, registered to the said farms, to the EAP. (not yet received)

Asked if they have started with an environmental impact assessment. (no answer)

Inform applicant that Rockwell Diamonds request a meeting regarding the proposed project.

The applicant had a meeting with Mr Glenn Norton as representative of Rockwell Diamonds in December 2011 and email communication took place in March 2012 between the two parties regarding the proposed PV power station development.

1. This is the 1st PPP that commenced as part of the Basic EIAs for two 15 MW PV Power Plants proposed to be developed by Suntrace Africa.
2. This PPP notifies all possible I&APs and stakeholders that Suntrace Africa has submitted applications for authorisation to the competent authority.
3. All info has been sent to Roelien Oosthuizen, Environmental Manager of Rockwell Diamonds.
4. She has requested Rockwell Diamonds to be registered that has been done.
5. Mr Norton confirmed that she will remain the contact person for Rockwell Diamonds. All future communication will be sent to her.
6. The applicant has been informed regarding Mr Norton's request for a personal meeting.
7. The water use aspect shall be addressed in the Basic EIA Report.

2. IMPACTS THAT MAY RESULT FROM THE PLANNING AND DESIGN, CONSTRUCTION, OPERATIONAL, DECOMMISSIONING AND CLOSURE PHASES AS WELL AS PROPOSED MANAGEMENT OF IDENTIFIED IMPACTS AND PROPOSED MITIGATION MEASURES

List the potential direct, indirect and cumulative property/activity/design/technology/operational alternative related impacts (as appropriate) that are likely to occur as a result of the planning and design phase, construction phase, operational phase, decommissioning and closure phase, including impacts relating to the choice of site/activity/technology alternatives as well as the mitigation measures that may eliminate or reduce the potential impacts listed.

2.1 IMPACT ASSESSMENT

An environmental impact matrix (Appendix G5) was used to identify possible positive and negative environmental issues for the planning, construction, operation and maintenance, and decommissioning phases. The following issues were identified:

- water resources;
- soil and agricultural potential (risk of erosion linked to topography of area, land use potential and restriction of land use);
- ecology and biodiversity (impacts on ecology, flora and fauna and especially avifauna);
- social aspects on the macro-, meso-, and microlevel;
- visual quality and aesthetics;
- economic impacts (mostly positive);
- traffic impacts (construction, upgrading and decommissioning phases);
- noise (construction, upgrading and decommissioning phases);
- air quality;
- heritage resources; and
- tourism activities.

The identified possible impacts and possible cumulative effects are being discussed in detail in the Report. Regulatory and mitigatory measures with regard to these impacts have also been stipulated in a comprehensive Environmental Management Programme (EMP) (Appendix F), which forms part of the Report.

2.1.1 Construction and Operational Phase Impacts

Many impacts associated with the project would only be effected during the construction phase and the action would thus be temporary in duration. However, actions performed during the construction phase may cause pollution that would have longer lasting effects on the environment. Construction phase impacts are therefore investigated further during this phase, especially with a view to limit and mitigate lasting effects.

2.1.1.1 Water Resources

Construction-related activities that could have an impact on the water resources of the study area include:

- land clearing;
- construction of access and internal service roads;
- operation of construction camps and storage of materials required for construction;
- operation and maintenance of construction vehicles and machinery (petrochemicals, oils and lubricants [POL]);
- construction of bases for the support structures; and
- sewage storage and disposal measures.

Operation-related activities that could have an impact on the water resources of the study area include:

- maintenance activities and maintenance of vehicles;
- presence of impermeable surfaces; and
- operational water use activities such as cleaning of PV modules and potable use.

Potential impacts associated with these activities include:

- surface water pollution/quality degradation;
- groundwater pollution/quality degradation;
- impact on sustainability of aquifers/groundwater of the area; and
- hydrology:
    - impact on infiltration;
    - change in storm water drainage;
    - catchment areas;
    - ponding; and
    - change in amount and velocity of runoff.

As other PV power stations are also proposed and authorised in the vicinity of Douglas, the cumulative impact of the water usage must be assessed should **all** the PV power stations' water requirements be sourced from the Orange and/or Vaal River. The worst case scenario has to be planned for.

The temporary water usage during the construction phase is mainly for construction of concrete foundations and service water. A concrete batching plant could possibly be erected on site or pre-mixed concrete obtained from an external supplier. The distance to the site from Douglas and Prieska would however be a limiting factor. Concrete would be required for the bases of the support structures as well as for anchoring and foundations of the entire ancillary infrastructure such as pylons, fencing, poles, buildings etc.

The total amount of water is mainly determined by the total amount of concrete. The total amount of concrete depends on the selected technology. The geotechnical survey during preconstruction phase will finally determine the preferred foundation type, either pile driven

profiles or concrete foundations. In case concrete foundations are required about 10 000 m3 of concrete have to be mixed. The volume of water required to mix the concrete, for general construction processes, for dust control and for potable use is about 10 000 m3. (Suntrace, 2012)

Potable water would be supplied via trucks or small trailers where personnel are working.

A PV power station does not require much water for operation. It requires water for the cleaning of the PV modules as well as potable water for the operational and security personnel. The yearly water consumption for module cleaning is 10 m3 per MW and wash cycle, in total 600 m3 per year. Furthermore, the water consumption of potable water is estimated with 600 l per day, in total 219 m3 per year. The total water consumption is estimated at 820 m3 per year for the operation of a 15 MW PV plant. (Suntrace, 2012)

The Siyancuma LM, a water services provider, has been consulted by the developer for possible water supply during the construction and operational phases and an application for water is in process.

Should groundwater be considered at any stage, a water use authorisation should be obtained from the Department of Water Affairs (DWA). An application for this license should be submitted well in advance (6-12 months before commencement of the construction phase).

The quaternary drainage region F40A is excluded from General Authorisations (GA) for taking of water from a [ground] water resource [as extended under Notice 837 in the Government Gazette of 23 September 2010]. Note that energy developments are not part of small industrial users and as such cannot be entitled to the water use allowance set aside for small industrial users as determined by the GA. A full licensing process would be applicable.

The sustainable yield rates of aquifers within the study area would then need to be established to ascertain the amount of water that would be available to this development, taking into account other possible uses within these aquifers.

Geohydrology

Dolomitic and related carbonate rocks of the Postmasburg Group, Campbell and Griquatown Sequence, all forming part of the Griqualand West Sequence, occupy the north eastern lobe of the Lower Orange WMA. Dolomites, limestones and related sedimentary rocks (often iron or manganiferous ore bearing) make up this broad lithostratigraphic unit. (Pretorius, 2004)

These aquifers are typical dual porosity or secondary aquifers associated with weathering and fracturing of the matrix. (Pretorius, 2004)

Groundwater utilisation is of importance in the area surrounding the study area and it is mainly used for rural domestic supplies, stock watering and water supplies to towns. As a result of the low rainfall, recharge of groundwater is limited and only small quantities can be abstracted on a sustainable basis.

Groundwater use is extensive. Some farming communities are solely dependent on groundwater for potable and livestock watering supply.

The PV modules would usually be cleaned during the early morning or late afternoon, by a high pressure spray of demineralised water from a vehicle, or manually with squeegees, which is labour intensive and would therefore provide temporary employment opportunities for women. The water would probably run off the modules onto the ground below.

Electrical conductivity of borehole water in this area range between 93 mS/m and 400 mS/m (DWA, n.d.), indicating a wide range from good to poor quality for domestic water use (DWAF et al., 1998: 58-59). Ph concentrations in borehole water in this area range from 6.9 to 8.1, which is suitable for both potable and livestock watering use (DWAF et. al., 1998: 61).

Salinity of water used for concrete batching must be low to ensure that the strength and compaction of the concrete complies with set standards required for PV panels and other structures.

Point and Diffusive Pollution

Fractured aquifers are more vulnerable to pollution than aquifers where the storage and transmission of groundwater is primarily intergranular, due to the higher rates of groundwater movement and lower attenuation potential. Once polluted, such aquifers are difficult and expensive to remediate. Soluble pollutants are likely to travel downwards to the water table together with recharging water, and then move with the water in the direction of regional groundwater flow. Recharge mechanisms in this area are not fully understood, but are thought to be episodic, following sporadic heavy rainfall.

The following possible risks to the groundwater have been identified:

- leaching of herbicides that might be needed for alien plant control into the subsurface;
- migration of hydrocarbon fuel spillages (chemical contamination) as well as oils and lubricants by construction vehicles and machinery into the subsurface;
- contamination due to broken or defective PV modules; and
- sewage storage and disposal.

In all instances the spatial scale of contamination is likely to be localised, i.e. encompassing the zone between the source and the Orange River. The duration of this impact is likely to be either long-term (between 15 and 30 years) or permanent. Mitigation (other than natural mitigation) is likely to be difficult, expensive and time-consuming. Prevention would therefore be better than cure.

Groundwater gradients at the study area are not known with any certainty, but it is assumed that they slope in the direction of the Orange River. Any contaminants in the groundwater will therefore form a plume from the source towards the Orange River.

The likelihood of such an impact actually occurring is improbable should all the measures, as stipulated in the EMP, be implemented.

Hydrology (Surface Water)

There are two rivers of importance flowing through the Pixley ka Seme District, namely the Orange River, forming the northern boundary, and the Vaal River, to the north-west of the district, which joins the Orange River in the Siyancuma municipal area (Douglas). (Pixley ka Seme, 2008)

The utilisation of these water resources are complicated by the following factors (Pixley ka Seme, 2008):

- the highly intermittent flow of the rivers;
- weakening water quality; and
- the wide variety of consumers within the system, varying from users who need a high degree of assurance for continuous supply, such as commercial/progressive farmers, to users who can adapt to various levels of supply. (Pixley ka Seme, 2008)

The regional economy depends on the existence of the Orange and Vaal Rivers and therefore any activity that would possibly reduce their flow must be considered.

Most of the water needed by the proposed PV power stations would be required during the construction phase and the duration of the use is short-term. The time of use is important as the agricultural sector in this area is highly dependent on the water from the Orange and Vaal Rivers for irrigation purposes, especially during the summer, which is the active growth season for most crops.

Due to the highly fluctuating nature of the rivers and the high number of different water users within this region, requiring water during different periods, an estimate of the availability of water is not part of this study. The Siyancuma LM is a registered Water Service Provider and receives a water allocation from the DWA, which also calculates the percentage needed for the environment (approximately 5 %). The water is then allocated to users according to set rules and standards and monitored closely.

The installation of a PV power station would create some impervious areas such as buildings, infrastructure and roads. This would cause local changes to infiltration at the scale of the building, but storm water drainage would disperse this on site. The PV modules might cause small-scale ponding under individual structures in the event of a very heavy storm, but it is highly unlikely that any such effect would have an impact outside the study area.

Infiltration is also affected by disturbance and sealing. Agricultural activities result in the sealing of the soil surface, which leads to reduced infiltration. Furthermore, vehicular activity during construction and operation and maintenance of the PV Power Station could cause disturbance and compaction, which would further reduce infiltration. Sands however are particularly resistant to compaction and sealing.

The runoff generated by rainfall on a soil surface is dependent on the intensity and duration of the rainfall, combined with the infiltration capacity of the soil. Due to the low infiltration rates of the soils at the study area, combined with the topography of the area, sloping slightly to the southwest, surface runoff would drain in that direction, especially for long return period heavy rainfalls. It is not likely that the development of a PV power station would have an impact on runoff, as most of the site would retain its soil and topographical characteristics. When runoff occurs in this arid environment, it occurs as storm flow, subsiding quickly, with the stream channel reverting to its normal dry condition. Thus it is also likely that there would be no effect on stream flow.

Mitigation Measures

Mitigation measures pertaining to water resources are contained in the following sections of the Environmental Management Programme (Appendix F)

- Preconstruction phase
  - Planning of layout
- Construction and operational phase
  - handling stockpiles
  - oil and chemicals
  - cement and concrete batching
  - provision of storage facilities for dangerous and toxic materials
  - bulk storage of fuels and oils
  - use of dangerous and toxic materials
  - toilets and ablution facilities
  - waste management
  - workshop equipment, maintenance and storage
  - erosion and sedimentation
  - no-go/sensitive areas
  - access road
  - internal service roads
  - hydrology
  - soil

2.1.1.2 Soil and Agriculture

Construction-related activities that could have an impact on the soil and agricultural potential of the study area include:

- land clearing;
- construction of access road and internal service roads;
- construction of the evacuation line;
- excavation activities;
- operation and maintenance of construction camps, construction vehicles and machinery;
- stockpiling;
- batching plant; and
- dust suppression.

Operation-related activities that could have an impact on the soil and agricultural potential of the study area include:

- Operation and maintenance of
  - access roads;
  - infrastructure including ancillary infrastructure; and
  - vehicles.

Potential impacts associated with the construction and operational phases include:

- soil pollution;
- soil degradation;
- soil erosion;
- compaction of soils;
- impacts on topography or slope;
- impacts on land use potential or capability;
- impacts on agricultural potential or capability; and
- restriction of land use.

Soils

Wind and water erosion are the major natural causes of soil degradation in the Northern Cape, while changes in species composition, loss of plant cover, and bush encroachment, due to commercial farming, are the most frequent forms of vegetation degradation. (DEAT, 2006) The Agriculture Impact Assessment (Appendix D6) classified wind and water erosion at the study area as follows:

Wind erosion

According to Schoeman (2004), as cited in Lubbe (2012), soils with less than 20% clay are regarded as potentially wind erodible and grouped into the following classes:

- Low 15-20%,
- Medium 7-15% and
- High 0-7%, where the sand grade is very fine to medium.

According to this classification, the area is highly susceptible to wind erosion.

Water erosion

Schoeman et al (2002), as cited in Lubbe (2012), developed a water erodibility index where values were subtracted from a basic index of 10.Criteria used were:

- Clay content,
- Leaching status,
- Structure and transition and
- Soil depth.

Based on soil properties, the index for this site is 2, indicating high susceptibility to water erosion.

Based on the evaluation of the wind data at the Postmasburg weather station for the period 2000-2009, winds blow predominantly from the north-easterly sectors with a wind speed of 5.6m/s or less. Winds exceeding 5.6m/s predominate for the east, east southeast, and south southwest to north. Dust nuisance emanating from the construction site would therefore not cross the R 357. Not any residents, that might be impacted upon are located to the immediate south-west of the study area.

The highest threat to this vegetation type is overgrazing or unsound grazing/farming methods coinciding with prolonged droughts. Overgrazing and other unsound farming practices exacerbate changes in the vegetation composition and prolong droughts. With the predicted global warming or climate change the desertification of this vegetation type is expected to continue. (Mucina & Rutherford, 2006) *Acacia mellifera* (woody shrub) increases when overgrazing takes place over a prolonged period of time.

Soil pollution could take place due to spillage of hazardous chemicals such as petrochemicals that would be stored and used on the construction site.

Soil degradation takes place through the removal, alteration or damage to soil and soil forming processes by land clearing, dust suppression and compaction of soil at roads and development footprints. The direct impacts of degradation and accelerated wind erosion of soil during and after the land clearing activities have been considered.

The potential for soil to erode is the likelihood that erosion will take place when soils are exposed to water and/or wind due to construction activities. The potential for erosion is increased in areas with low-plasticity and fine-grained soils. Due to the flat gradient, percentage of vegetation cover and geology/soil composition of the site together with the mitigation measures proposed in the EMP it would be possible to prevent soil erosion.

The proposed activities would cause dust nuisance and limit visibility in the vicinity of the location of the study area. However it is not located in the direct vicinity of farm residences or directly next to any provincial roads with the closest road the R357 (more than 1 km away). However a PV power station of 10 MW has been authorised directly to the east of this site. Dust suppression will suffice as a mitigation measure during the construction phase to prevent dust nuisance to the nearby planned PV power station or the R 357 and farm residences that is located further from the planned 15 MW PV power station.

After the rehabilitation of construction areas at the onset of the operational phase the potential for wind erosion would still be high due to the low precipitation of this area, but as rehabilitation and the establishment and succession of the plant communities commence, the potential for erosion would be lowered accordingly. Should this not be the case mitigation measures should be implemented as stipulated in the EMP (Appendix F).

Agriculture

A specialist agricultural study has been conducted and is included in Appendix D6. In general, the site visited was found unsuitable for commercial cultivation by the specialist due to limiting factors such as the:

- Low annual rainfall, high evaporation and extreme temperatures restrict dry land cultivation.
- The very shallow soil depth with its limited water holding capacity restricts root development.
- The soils have carbonate-rich B-horizons. The use of Calcic soils is limited by climate (low rainfall and high evaporation), shallow soil depth, high pH, low plant available P and trace elements (especially Fe), toxic levels of extractable B and stoniness. All calcic soils are highly susceptible to water erosion.
- The very fine sand grade of top soil influences the stability and increases erodibility potential.
- Low clay percentage results in low water holding capacity and low nutrient availability, resulting in low soil fertility.

The areas visited could be and are utilized as grazing, but the grazing potential is low (21-25 Large Stock Unit) and the loss of grazing would be negligible.

Mitigation Measures

The construction and operation of the PV power stations would, in general, not impact on the agricultural potential of the surrounding area.

Mitigation measures pertaining to soil and agricultural resources are contained in the following sections of the Environmental Management Programme (Appendix F):

- Preconstruction phase
  - Site demarcation and development
  - Planning of layout
- Construction and operational phase
  - handling stockpiles
  - oil and chemicals
  - provision of storage facilities for dangerous and toxic materials
  - bulk storage of fuels and oils
  - use of dangerous and toxic materials
  - dust
  - erosion and sedimentation
  - no-go/sensitive areas
  - access roads
  - internal service roads
  - hydrology
  - soil

2.1.1.3 Ecology and Biodiversity

Construction-related activities that could have an impact on the ecology and biodiversity of study area include:

- land clearing;
- construction of access road;
- evacuation power line from the distribution centre to the Eskom Greefspan Substation;
- implementation of associated infrastructure;
- possible excavation of borrow pits and establishment of spoil areas, if necessary for concrete batching, as the necessary materials might be bought from an existing authorised sand and crushed stone supplier within the region; and
- soil and/or water contamination through the use and storage of petrochemicals.

Operation- and maintenance-related activities that could have an impact on the ecology and biodiversity of the study area include:

- use of access roads;
- operation and maintenance of main and associated infrastructure;
- presence of the overhead transmission line;
- presence of impermeable surfaces; and
- maintenance of vegetation in the area (veld management).

Potential impacts associated with the construction and operational phases include:

- habitat transformation and/or degradation;
- loss of sensitive/pristine local and regional habitat types;
- ecological and corridor function due to fencing;
- increase in local and regional fragmentation;
- isolation of habitat (long-term impact);
- invasion of alien flora and fauna on disturbed land;
- vegetation destruction (loss of economic use of vegetation);
- depletion of natural resources (e.g. grazing capacity and quality loss);
- destruction of red data/threatened flora spp. (high ecological value);
- floristic species changes;
- destruction of protected tree spp.;
- impacts on threatened faunal spp.;
- impacts on common faunal spp.;
- faunal interactions with structures, servitudes and personnel;
- impacts on surrounding habitats and spp.;
- impacts on South Africa's conservation obligations and targets;
- impacts on avifauna:
    - disturbance;
    - roosting/nesting;
    - perching;
    - nuisance (faeces);
    - collisions;
    - electrocutions; and
    - issues with regard to associated infrastructure.

Areas that are considered to be sensitive are:

- untransformed natural vegetation;
- high diversity or habitat complexity;
- areas containing Red Data species; and
- systems that is vital to sustain ecological functions.

Areas that have low sensitivity are transformed areas that are of little or no importance for the functioning of ecosystems.

Development (or change in land use) usually contributes to habitat loss and degradation in many biodiversity important areas. Much of the impact can be minimized through careful planning and avoidance of sensitive areas. In many areas it is not the direct use of biological resources such as subsistence harvesting (especially of medicinal plants) and illegal collection for commercial trade (particularly of groups such as succulents) that is threatening their sustainability, but rather indirect pressures such as changing of land use, land degradation, clearing of indigenous vegetation, overgrazing, invasion of land by alien species, informal settlements, urban development, industrial and agricultural pollution, mining, impoundments, cultivation, water abstraction and climate change. Loss of habitat is therefore regarded as the foremost cause of loss of biodiversity. (Van Rooyen, 2012)

Direct impacts especially relate to the construction phase and the development footprint and include the destruction of threatened and protected flora species, as well as sensitive/pristine regional habitat types, and direct impacts on common as well as threatened fauna species.

Impacts that relate to the operational phase and the surrounding environment include potential floristic species changes in the development area, faunal interactions with all components of the development, and impacts on surrounding habitats and species. Cumulative impacts include impacts on national conservation obligations and targets, increases in or continuation of local and regional fragmentation or isolation of habitats, as well as increases in or continuation of environmental degradation.

An ecological specialist study has been conducted on the study area by Dr Noel van Rooyen (Ekotrust cc) attached in Appendix D1.

An assessment of the significance of the impacts on the terrestrial ecosystems, aquatic ecosystems, rare and protected plant species and fauna was done. The significance of impacts was assessed by means of the criteria of certainty, severity (intensity and duration), direction (negative, neutral or positive) and scale (extent). The significance rating is determined by a combination of the impact and sensitivity ratings. (Van Rooyen, 2012)

Vegetation

Approximately 4% of the Northern Upper Karoo vegetation type has been cleared for cultivation or irreversibly transformed by building dams. This vegetation type is classified as least threatened. Therefore a low sensitivity and ultimately a low significance of impact rating were allocated. (Van Rooyen, 2012)

Biogeographically important taxa include the tall shrub *Gymnosporia szyszylowiczii* subsp. *namaensis* and the herb *Convolvulus boedeckerianus*. Endemic taxa include the shrubs *Atriplex spongiosa, Galenia exigua*, the succulent shrubs *Lithops hookeri* and *Stomatium pluridens*, and the herb *Manulea deserticola*. None of the abovementioned taxa were recorded on site. (Van Rooyen, 2012)

The site under investigation is not located in a protected area according to the system of protected areas in South Africa (sections 9 to 15 of NEMA:PAA, 2003 as cited in Van Rooyen, 2012).

The mean species richness for Kwartelspan is 28 plant species per community and is slightly lower than the mean number of species per community found for a number of sites in the region, i.e. 33 plant species per community (Van Rooyen, 2012)

Endemic plant species

The site falls on the southern boundary of the Griqualand West Centre of Endemism (Van Wyk & Smith 1998 as cited in Van Rooyen, 2012). The term endemic refers to a species that is restricted in its distribution and therefore occurs only in a specific region. None of the non-succulent or succulent endemic plant species of the GWC were recorded on site. (Van Rooyen, 2012)

The southern Kalahari endemic plant species found on site were the protected tree *Acacia haematoxylon* and the dwarf shrub *Plinthus sericeus*. (Van Rooyen, 2012)

Terrestrial plant communities

The impact of the proposed development on the terrestrial habitats is rated as low, and with a very low sensitivity, the overall significance rating is low. Although the area is fairly undisturbed, there are not any sensitive habitats or significant numbers of rare and protected flora and fauna on site. (Van Rooyen, 2012)

Aquatic plant communities

The pans/depressions in the area fall outside the proposed core site. Although the sensitivity of the pans is rated as low, they should be excluded from any development, e.g. roads. The overall significance rating is therefore low. (Van Rooyen, 2012)

Protected flora and Rare plant species

Red Data Lists are a source of information for decision-makers, to improve the monitoring of the rate of loss of biodiversity, and should include an assessment of the cause of a species' conservation status. Species threatened by habitat destruction need to be conserved through mechanisms that conserve the entire ecosystem, where possible. (Van Rooyen, 2012)

A number of trees and shrubs of the protected *Boscia albitrunca* occur scattered in communities 7, 8 & 9. These communities fall outside the core site and will only be influenced if access roads are planned through that area. One individual of *Acacia haematoxylon* (community 2) was recorded but it is located outside the proposed development sites. Additionally, according to NFA legislation (as cited in Van Rooyen, 2012) protected trees may not be removed or damaged without permits issued by the relevant authorities. (Van Rooyen, 2012) Access road option 3 would not have an impact on the identified protected plants.

Other NCNCA (as cited in Van Rooyen, 2012) Schedule 2 protected plant species on site, i.e. *Nerine laticoma*, *Colchicum laticoma*, *Trachyandra laxa* and *Ruschia intricata* should be conserved if possible. Permits are required to remove these species. The geophytes *Nerine laticoma* may be transplanted to nearby areas of similar habitat. The geophyte *Colchicum laticoma* was recorded in the pan/depression (community 6) and will be conserved by conserving the habitat. (Van Rooyen, 2012)

National Environmental Management Act: Biodiversity Act (Act No. 10 of 2004) (TOPS lists). None of the plant species recorded on site is listed in the NEMA:BA (TOPS) lists of critically endangered, endangered or vulnerable species. (Van Rooyen, 2012)

Red List of South African Plants (Raimondo et al. 2009). All plant species recorded on site are considered as 'Least Concern'. (Van Rooyen, 2012)

CITES classification (2009 lists, Appendices I, II, & III). Appendix II of the Ecology Study lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. None species recorded. (Van Rooyen, 2012)

Alien plant species

The alien plant species on site, especially Category 1 invasive species such as *Prosopis glandulosa* and *Argemone ochroleuca*, should be eradicated. The establishment and spread of declared alien weeds and invader plant species during construction of the proposed development should be prevented/controlled. (Van Rooyen, 2012)

Fauna

The habitat on site is in moderate to good condition due to a good grass cover on the deep sandy soils in most areas. The predominantly deep soils in the southern parts of the site are suitable for large burrowing animals such as the aardvark, porcupine and the Cape ground squirrel. The dense patches of woody species in the north and around watering points and kraals, and a well-developed dwarf shrub layer, provide some browse and cover for faunal species. (Van Rooyen, 2012)

Species presence on site was mainly attained by means of direct or indirect sighting methods (animal, spoor, burrows, scats) whilst traversing the area on foot or by vehicle. The species lists can be found in the Ecology Report that is attached in Appendix D1b.

The broader site is fairly undisturbed and natural and only used for livestock farming. The fauna on site will probably be displaced from the core site but the area is surrounded by habitat in similar condition and without any fragmentation. However, the indigenous and endemic trees and shrubs should be protected as far as possible because they form important food sources and habitats for various fauna. The underbrush normally associated with these species also forms an important microhabitat for a number of animal species. Therefore the sensitivity and significance of the impact of the proposed development on the fauna will be low. (Van Rooyen, 2012)

Red data mammals

Based on Mills & Hes (1997), Friedmann & Daly (2004) and Skinner & Chimimba (2005), and the type of habitat on site, the habitat requirements of the species and personal observations of Dr Van Rooyen during the field survey, no Red Data Book (RDB) species with a status higher than LC was recorded during the survey in June 2012. The aardvark may occur to the north of the site where some duneveld with deep sandy habitats are found. The aardvark (*Orycteropus afer*), previously listed as Vulnerable, is now listed as "Least Concern" (Friedmann & Daly 2004). (Van Rooyen, 2012)

Indirect impacts on fauna could occur due to loss of habitat and faunal interactions with the structures, servitudes and personnel.

Contact would inevitably occur between personnel and animals, especially during the construction phase, when a large number of people would be required on the site. Although larger faunal species would tend to move away from the site and avoid contact with humans, encounters with snakes, scorpions, spiders and possibly larger predators would remain likely. The likelihood of animals being killed by means of snaring, poaching, poisoning, trapping and vehicles would inevitably increase due to the presence of humans in areas of natural habitat and measures should be taken to prevent and mitigate these impacts.

Consequences of the construction phase may be the fragmentation of populations, reduction of area of occupancy and loss of genetic variation of affected species.

While animals generally avoid contact with humans and human structures, they do grow accustomed to structures, and some species even to humans, after some time. Animals such as baboons and monkeys can climb on structures and possibly cause damage to structures. These animals are not likely to occur at this study area as water and high features, providing protection against predators, are limited or unavailable. These species normally occur nearer to the river systems where food, water and protection are more readily available.

As the development would be fenced, specific impacts that would result from the type of fencing should be considered. Aardvarks burrow below fencing. This could create an entry point for perpetrators and could possibly be a security risk.

Avifauna and Chiroptera

An avifaunal specialist study has been undertaken by Ms Beryl Wilson to assess the potential impacts on local avifauna (birds) and Chiroptera (bats) associated with the development of the photovoltaic power station near the Greefspan Substation, Northern Cape. (Appendix D2b) The approach taken by the specialist was to identify any avifaunal and bat species of conservation concern that could occur in the development areas and immediate surrounds and that may use the sites for some purpose. Literature sources, museum records and databases containing distribution records for all species were consulted to compile a list of species of conservation concern that have a likelihood of occurring on the sites. Species with a distribution range that included the sites were evaluated to determine whether the sites are likely to contain habitat important for each species.

The results indicated an approximate total of six bird - and no bat species of potential conservation significance, none of which were considered to be permanently resident at the actual site. Since birds and bats are highly mobile and often only transient out of breeding season, it is not envisaged that the majority of species expected to be present would be significantly influenced by the PV station and associated structures.

It should be noted that the Blue Crane and all the Vulture species are listed as Vulnerable in the RDB, but also as Endangered in the ToPS.

Loss of habitat, displacement and disturbance of fauna, and interactions with various electrical infrastructures were the main identified impacts that were taken into consideration with regard to management proposals.

With any proposed project it is likely that there would be a number of direct and indirect impacts on the fauna occurring in the area. While direct impacts include the death of individuals, removal/destruction of nests, nesting or roosting sites etc., this would be largely experienced at the construction phase and then later during routine monitoring to remove problem species (e.g. semi- or permanently nesting or roosting on the structures). The extent to which the electrical infrastructure has already impacted on the resident birds in terms of collisions and electrocutions is indeterminable. Indirect effects such as disturbance and displacement may be less significant, and probably limited to common species in the area. No complete localized extinctions of avifauna or bats are predicted. However, evidence suggests that displaced individuals do suffer a much greater mortality rate.

Although the factors identified and discussed could negatively impact on avifaunal species, the investigated area is not unique in terms of species diversity and ecostatus within the region as a whole. Development of this specific site would not have significant impact on the overall distribution, the survival or dynamics of the encountered avifaunal or Chiroptera species. (Wilson, 2012)

Feasible and practical management proposals include (Wilson, 2012):

- reducing the impact on the ecology of the area with appropriate management practices as recommended by ecological specialists;
- preventing the unnecessary destruction of vegetation in areas prone to soil erosion;
- monitoring the area and associated ecosystems for significant negative changes such as pollution, erosion etc. and taking immediate action to rectify these changes;
- minimising and limiting the destruction or disturbance of vegetation within the areas of activity, as well as in the surrounding areas, thus circumventing the need for an offset area;
- staying clear of drainage areas and sensitive areas such as pan habitats and maintaining an appropriate buffer zone between these areas and the erected structures;
- using already established access roads, or preferring the shortest new option possible to minimise ground-clearing disturbances;
- reducing noise, air, soil and water pollution as far as possible;
- removing weeds and other plant growth below the structures mechanically rather than using long-lasting chemical methods. This will allow for plant re-establishment and habitat recreation after the termination of the project;
- prohibiting the intentional killing of birds and bats through onsite supervision and worksite rules;
- educating employees to minimise accidental killings of birds and bats during routine construction and maintenance activities;
- transmission lines should be orientated parallel to known flight paths of bird flocks;
- monitoring all electrical infrastructures weekly for bird mortalities (collisions and electrocutions)
- modifying any bird-unsafe electrical pylon structures to insulate dangerous live components, cutting a gap in the earth wire and installing perch deterrents can also be installed to keep birds away from the dangerous areas on the structure;
- minimising bird collisions on newly constructed electrical features by implementing the standard anti-collision devices and diverters currently in use by Eskom
- giving preference and consideration to underground cabling rather than any new overhead structures;
- discouraging nesting, either by removing nests as they are built, or by supplying suitable alternative structures, and by avoiding infrastructure construction designs such as flat or trellised surfaces near key structures; and
- discouraging roosting bats by closing any roosting sites at night once the bats have left for foraging, and by avoiding infrastructures that encourage roosting.

The management proposals listed here are aimed at preventing unnecessary habitat destruction and the subsequent disturbance and displacement of birds and bats in the area, and maintaining suitable habitat and resources where possible. Passive and active discouragement measures are suggested. Emphasis is placed on the safety of conservation-worthy species regarding possible interactions with the various types of electrical infrastructure. Many of the bird species are in fact on the Red Data List due to these fatal contacts. (Wilson, 2012)

Furthermore, given the size and scope of this project, no cumulative effect greater than what is already being experienced in the local areas is envisaged. Any of the proposed locations are deemed suitable unless there are terrain and habitat aspects that have not been brought to the attention of the specialist. Relocation and rescue measures of existing avifauna and Chiroptera are considered unnecessary. (Wilson, 2012)

Electrical fencing is generally not a cause for concern with regard to avifauna and bats. Certain species such as Raptors, Crows, Pigeons and Doves build nests on electrical structures. These nests pose a fire hazard and can cause power disruptions and should be removed regularly. (Wilson, 2012)

Despite the use of anti-collision devices and bird diverters, and insulated wires, there can be no guarantee that isolated avifaunal incidents can be totally avoided. With adequate monitoring, these incidents can be identified and remedied as far as possible.

Sensitivity

An ecological sensitivity analysis was conducted by the ecologist, Dr Noel van Rooyen that can be found on page 45 of the Ecology Report in Appendix D1b.

The plant communities on site were evaluated and ranked in terms of sensitivity (very low, low, moderate, high and very high sensitivity). The sensitivity rating for the flora and faunal component is based on the presence of rare and/or threatened flora and fauna on site and is a

subjective assessment of the sensitivity on a scale ranging from very low (1) to very high (5) (see sensitivity ranking and rating scale above). The flora and fauna sensitivity is rated as low provided the protected tree species on site is conserved and offset land is available for dispersal of fauna. (Van Rooyen, 2012)

Presence of biodiversity offset areas

Biodiversity offsets are conservation actions intended to compensate for the residual, unavoidable harm to biodiversity caused by development projects or other harmful activities, so as to ensure no net loss of biodiversity (Table 5, CSIR 2005, De Witt et al., 2006 as cited in Van Rooyen, 2012). The need to consider a biodiversity offset is only triggered when residual biodiversity impacts of moderate to higher significance are evident.

Mitigation Measures

Mitigation measures pertaining to ecology and biodiversity aspects are contained in the following sections of the Environmental Management Programme (Appendix F):

- Preconstruction phase
  - Site demarcation and development
  - Biodiversity off-set agreements
  - Planning of layout
- Construction and operational phase
  - Fires
  - Erosion and sedimentation
  - Fauna
  - Flora
  - No-go/sensitive areas
  - Access routes/haul roads
  - Ecological specialist findings

During the pre-construction phase detailed on site surveys and delineation need to be conducted by a suitably qualified land surveyor that will include an assessment of the site specific topography, the micro siting footprint of the PV panel supporting structures as well as all associated infrastructure. This will be done in collaboration with a suitably qualified ecologist or botanist that will ensure that any environmental sensitive aspects identified during the EIA investigation is taken into consideration.

The development should be contained within the proposed footprint of the solar facility and unnecessary disturbance adjacent to the site should be avoided. The denuded and disturbed site should be re-vegetated as soon as possible. (Van Rooyen, 2012)

All declared alien invasive plant species should be destroyed. Establish a monitoring program for the early detection and control of alien invasive plant species. No alien plant species should be used in landscaping or gardens around the site. (Van Rooyen, 2012)

Disturbance should be contained in the footprint of the proposed access road and unnecessary disturbance to the surrounding vegetation adjacent to the route be restricted. Run-off channels should be maintained to prevent erosion. A speed limit should be enforced to prevent excessive dust or road kills and places to turn about should be created. (Van Rooyen, 2012)

Disturbance should be contained to the access (inspection) road of the evacuation power line and proposed footprint of the pylons and unnecessary disturbance adjacent to the line be avoided. Power line should be placed with caution and minimum damage should occur along the route of the power line during the construction phase. Any declared invasive species should be controlled. Rehabilitate disturbed areas as soon as possible following construction of the infrastructure. Establish a monitoring program for the early detection and control of alien invasive plant species. Power line construction should take fauna into account, especially birds, and important mitigation measures must include 'flappers' to make the power lines more visible to the birds. (Van Rooyen, 2012)

Access Roads

The options relating to the access roads and internal roads, the relevant specialist inputs have been discussed in point 1.4.2. The preferred option for the access route would be Option 3 (Appendix A2).

Power line

Power line Option B is recommended as it is the shortest leg to the current power line. Along the proposed power line Option A there is a small population of the protected geophyte *Nerine laticoma* (Appendix A7b) and they could be endangered by the development. The GPS position of this population is indicated in Appendix C and in Figure 23 of the Ecology Report (Appendix D1b). If power line Option A is considered the exact route should take the position of this plant population in consideration. However, if necessary these plants could be transplanted to nearby similar habitat. The power line construction should take avifauna into account, and an important mitigation measure must include the installation of 'flappers' or other objects to make the power lines more visible to the birds and to prevent collisions. (Van Rooyen, 2012)

Trees

It is recommended that the presence of tall and/or protected trees is assessed once a decision is made on the precise location of an access road and power line to the core site. The indigenous and endemic trees and shrubs should be protected as far as possible because they form important food sources and habitats for various fauna.

Alien plants

The alien invader *Prosopis glandulosa* should be controlled on site. Introduction of other alien plants during construction should be prevented. Alien plant control should be continued after the construction of the site.

Pan community

The small pan to the east of the core site should be avoided during and after development and considered a no-go site (Appendix A7). The protected *Colchicum melanthoides* was recorded in the pan.

Fauna

The core site is surrounded by similar habitat and displaced fauna should be able to move away from the development site. However, it is important that all power lines be clearly marked to prevent bird collisions.

2.1.1.4 Social Environment

The main social challenges experienced within the district include:

- low economic growth rate that limits the material needs of communities;
- negative population growth rate due to urbanisation;
- lack of job creation and training institutions in the province resulting in high unemployment rates;
- primary education;
- a desperate need for social activities, services, and youth development; and
- lack of basic services including sanitation.

Potential impacts associated with the construction and operational phases include:

- Macrosystem
  - impact on country
  - economic growth
  - long-term social benefits
  - development/transfer of technology
- Mesosystem
  - safety and security
  - daily movement patterns
  - socio-economic impacts (social investment, job creation, job seekers, population increase, increased services demand, social problems)
  - impact on urban expansion
  - impact on tourism and recreation
  - economic impact
  - distance to residential areas
- Microsystem (physical presence of infrastructure)
  - health and safety of workers and public
  - sense of place (tourism and recreation)
  - land use impacts (cultivation and grazing)
  - traditional/cultural conflicts

The sphere of influence of the proposed PV power station has been assessed within the macrosystem, the mesosystem and the microsystem.

Social impacts at the macrosystem level derive from the fact that the power station would boost the development of solar power technology. In the long term it would assist in reducing South Africa's dependence on non-renewable energy sources. It would therefore ensure significant environmental benefits that would in turn have positive social impacts, as environmentally-related living conditions would not be degraded further and could even be improved. The macro-economic benefits of the PV power station would be to assist Eskom in meeting South Africa's peak electricity demand.

Social impacts at the mesosystem level include all or part of the district or local municipality's area of responsibility. The impacts of the project on employment opportunities and demand for infrastructure have been assessed.

Impacts at the microsystem level are caused by the physical presence of the PV power station and ancillary infrastructure, and are confined to the occupants of the study area or directly adjacent to this infrastructure.

Macrolevel Impacts

The project is likely to have high long-term, indirect social impacts that might extend to a regional and possibly a national scale. These large-scale social impacts would stem from the experience in the utilisation of solar power that would be gained by constructing and operating the PV power station. This experience and technology could be employed in the future construction of other, similar plants in South Africa. In addition, the project would impact positively on Eskom's capacity to supply electricity.

The benefits of solar power are compelling: environmental protection, economic growth, job creation, diversity of fuel supply and rapid deployment, as well as the global potential for technology transfer and innovation. On climate change, a solid international consensus now clearly states that business-as-usual is not an option and the world must move swiftly towards a clean energy economy. Solar power is a prime choice in developing an affordable, feasible, global energy source that is able to substitute for fossil fuels in the sunbelts around the world. (Greenpeace, 2003)

One of the major benefits of solar power is that it has little environmental impact, with none of the polluting emissions or safety concerns associated with conventional electricity generation technologies. Increased reliance on solar power could therefore help to slow the pace of global climate change.

Although the proposed PV power station could assist to meet electricity demand in South Africa, energy prices would not be reduced over the short term. Indications are that PV power would cost more than Eskom's current price of coal power for the foreseeable future.

Over the longer term, with increasing shortages in fossil fuels, the economic benefits of solar power are likely to become more apparent. As more experience is gained in the utilisation of PV technology, this technology is likely to become more cost-effective.

Increased reliance on solar power would have significant environmental and economic benefits over the long term. Both of these effects would translate into social impacts in the form of increased human wellbeing and prosperity

Mesolevel Impacts

Employment opportunities created by the construction phases would have short-term positive impacts that in turn would improve the lives of individuals and families, but would also cause intrusion by specialist and other workers from outside the community. The magnitude of this impact would depend on the number of construction workers to be employed, either by the developer itself or by contractors. Sourcing of construction workers from the local labour pool is likely to be limited to unskilled workers. However, the construction of PV structures is relatively uncomplicated and therefore some of the employment opportunities created during the construction phases would be offered to local workers, with contractors importing their core teams of management and specialist skilled staff. This could have some economic benefits for surrounding communities, although only of a temporary nature.

The construction phase is expected to last approximately six months. In addition to creating employment opportunities for construction workers, the project might also offer other sources of temporary employment such as fencing and other ancillary works.

Due to employment opportunities becoming available, the area surrounding the study area might experience an influx of employment seekers. The magnitude of this impact would depend on the severity of unemployment in surrounding areas. The unemployment rate of this district is very high (32% in 2008). Unfortunately most unemployed people in this district are unskilled. Poverty is a widespread problem in the Northern Cape. The possible influx of employment seekers into the area might influence the immediate social environment. This population increase could impact on the surrounding local and district municipalities in terms of additional demand for services and infrastructure that is already not sufficient. Meeting these demands might need capital expenditure on the part of the municipality. The municipality's IDP planning process might possibly have to be revised to take into account the positive economic growth and resultant population increase.

The project would offer socio-economic benefits in the form of employment opportunities. These benefits might be augmented by social investment activities initiated by Suntrace Africa. The effectiveness of such initiatives would be determined by their ability to meet the needs of local communities, and their relation to other, existing development initiatives in the area. Coordination of new initiatives with those that are already being undertaken would be essential to avoid unnecessary overlap and fragmentation of efforts. It is therefore recommended that social investment initiatives be planned in close collaboration with local community structures as well as with representatives of the local municipality that are involved with Local Economic Development (LED).

The construction of the PV power station would result in an increase in traffic volumes. Local roads could be damaged and increased traffic could possibly have an influence on the safety and daily movement patterns of residents in surrounding communities. The magnitude of this impact would also depend on current traffic volumes and the increase in traffic volumes that would be associated with construction activities.

A void would be left in the local community after the construction phase when workers have departed, but skills development might partially mitigate this impact.

The operational phase of the power station would result in the creation of some employment opportunities in fields such as security and maintenance services. Whether the benefits of these employment opportunities would accrue to surrounding communities would depend on the availability of the necessary skills in these communities. The development would thus not substantially reduce the unemployment rate of the area but it could still help some households to recover from dire financial situations. Some local procurement of goods, materials and services could occur, which would result in positive indirect socio-economic impacts.

Should workers and contractors be situated in Douglas, transportation of workers and delivery of goods would have a low impact, as distances are relatively short, and a minimal and intermittent impact would be effected on the workers' and communities' daily living and movement patterns.

The influx of employment seekers during the construction phase might spill over to the start of the operational phase. Communication with the local and district municipalities and in the local newspapers would keep the population informed about the proceedings of the project as well as the type and number of contracts and employment opportunities that would be available.

The proposed project would put extra pressure on the local and district emergency and fire-fighting services. The district municipality would need to amend its emergency and response plan to incorporate and make provision for the PV power station.

Microlevel Impacts

The physical presence of the construction plant and construction activities would cause direct impacts to the area immediately surrounding the study area. These impacts might be experienced by landowners and residents in the area immediately surrounding the study area.

The construction phase might impact on the safety and security of surrounding communities by giving rise to crime as well as an increase in traffic volumes.

Impacts at the **microsystem** level during the operational phase would be caused by the physical presence of the PV power station and ancillary infrastructure, and would be confined to people living at the study area or directly adjacent to the proposed infrastructure.

A positive aspect of the PV power station is that it does not produce any atmospheric emissions. The concerns regarding air quality and health impacts that would be associated with a coal-fired power plant are therefore absent in this study. The presence of the power station might still impact on the safety and security of surrounding communities by giving rise to crime as well as an increase in traffic volumes.

The presence of the PV power station would have a visual impact on surrounding communities. Greefspan Substation is situated in a rural area close to Douglas, which is relatively sparsely populated. Therefore little impact is expected. The PV power station would have an impact on people's sense of place – a term used to denote the personal emotions and memories that individuals or communities associate with a landscape, as well as the sense of connectedness that they feel towards it.

Mitigation Measures

It is recommended that the percentages of local labour as prescribed by EPWP (Expanded Public Works Programme) be considered and included in the contract between the developer and the contractor. It is important to establish the number of skilled labourers in the area, as well as the types of skills they have, through liaison with the municipality. This can be conducted through the appointment of a community liaison officer (CLO) through consultation with the local authority. The possible influx of employment seekers could be controlled by making reliable information available to the region through advertisements in local papers and communication with municipalities regarding the proposed development and the type of employment opportunities available.

Theft and crime would be mitigated by erecting the perimeter fence and security systems at commencement of construction as stipulated earlier in this report.

Suntrace Africa will propose detailed investment activities during the IPP Procurement Programme bid, which has set deliverables concerning this. Close communication with local and district authorities from different departments might be necessary to coordinate these activities and ensure successful implementation during the pre-construction and construction phase.

The impacts associated with the higher traffic volumes could be accommodated by proper site management, e.g. controlling the size of orders that would be transported to the site at any given time, and by notifying the public through local and regional radio stations when large numbers of freight-carrying vehicles would be on the roads.

Communication should be maintained with the local and district municipalities, and with the public through the local newspapers, to keep the surrounding communities informed about the proceedings of the project as well as the type and number of contracts and employment opportunities that would be available.

There will be local people employed for security and maintenance roles in the operational phase. The contractor would train some of these personnel during the construction phase. More detailed information would be communicated on authorisation of the development in order to keep the municipalities informed and enable them to amend and address changes in the LED, IDP, SDF, and Disaster Management Plan, which includes emergencies and responses, as well as other relevant management procedures.

Mitigation measures pertaining to the social environment are contained in the following sections of the Environmental Management Programme (Appendix F)

- Preconstruction phase
  - Communication with stakeholders and I&APS
- Construction and operational phase
  - Cognisance of other developments
  - Employment opportunities for local communities
  - Capacity building in local communities
  - HIV/Aids education
  - Crime, safety and security

Educational Trust

In terms of the bid requirements for the IPP procurement programme each project will have its own separate Education Trust.

2.1.1.5 Economic Impacts

Potential impacts associated with the construction phase include:

- financial and economic impacts;
- stakeholder interest;
- business risk/benefit; and
- damage to property (landowner and developer).

Positive economic and financial impacts have been sufficiently addressed in the social environment section.

Local content

The bulk of the steel for the structures would possibly be sourced from South African suppliers. The electrical reticulation, the civil and building works, the perimeter fencing and security systems will all be supplied and installed by South African companies.

While a high level of both stakeholder and business risk is involved, there are also great potential benefits. Planning and several applications are currently in process. There is thus a high level of financial input, while the developer is not at all assured that leave would be granted to implement the proposed development.

This impact could only be mitigated by internalising the externalities and clearly identifying and defining aspects related to this development. The purpose of the EIA as a whole is to assist in addressing these aspects very early in the planning phase. The EIA will continue to do so as the project planning (critical project timeline) of the proposed development progresses.

The risk to the landowner, Eskom and the developer with regard to physical damage to infrastructure is moderate and has been taken into consideration in the EIA matrix. Mitigation measures would include good management control and housekeeping, as well as safety and security infrastructure and personnel.

The study area has a grazing capacity of 21-25 ha/large stock unit and is best suited for low to medium density grazing activities. The economic gains of a PV power station on the same land would be higher, with more employment opportunities than would be afforded by solely using it for agricultural purposes.

Mitigation Measures

Mitigation measures have been addressed in the following sections of the Environmental Management Programme (Appendix F):

- Preconstruction phase
  - Project contract and programme
  - Appointments and duties of project team
- Construction and operational phase
  - Crime, safety and security

2.1.1.6 Traffic Impacts

During the construction phase traffic impacts would be high as trucks would be needed to transport materials and equipment to the study area, with only the R357 from either Douglas or Prieska as access point. All parts of the infrastructure needed for the proposed development, including support structures, grids for PV modules, PV modules, lightning conduction infrastructure, evacuation lines and large amounts of ancillary infrastructure, as well as machinery must be transported to and from the study area from various locations in the region. It would definitely have an impact on the traffic volumes of the region as well as on the condition of the different roads from where the infrastructure, machinery and construction vehicles would be brought to the study area. The highest impact would be on the R357 and access roads immediate to the site.

During the operational phase traffic would be less, with trucks only needed intermittently to transport infrastructure to the study area during the maintenance and upgrading phases. The PV power station would have an insignificantly low impact on the traffic volumes of the region as well as on the condition of the roads that would be used for bringing the infrastructure to the study area.

Mitigation of traffic impacts would not be necessary during the operational phase. When upgrades or expansions are to be conducted on a large scale, activities and associated mitigation would revert back to the construction phase.

Possible impacts of traffic on the immediate communities have been discussed in the social environment section and traffic noise etc will be discussed in the section on noise that is to follow.

Mitigation Measures

Traffic to and from the study area would have to be monitored and controlled closely by the project manager to ensure that congestion and blocking of roads would not occur or continue for long periods of time.

Further mitigation measures are stipulated in the following sections of the EMP:

- Preconstruction phase
  - Site demarcation and development
  - Planning of the layout
- Construction and operational phase
  - Access route and haul roads
  - Traffic impacts
  - Visual impact

2.1.1.7 Noise

Potential impacts associated with the construction phase include:

- nuisance;
- health and safety of workers and public;
- traffic volumes; and
- noise sensitive areas.

Potential impacts that have been investigated with regard to the operational phase include:

- nuisances;
- health and safety of employees and the public;
- traffic volumes; and
- noise sensitive areas.

Noise associated with the proposed development would mostly be generated during the construction phases and, to a lesser extent, during the decommissioning phase, and would be limited to noise levels generally associated with construction.

As the development would be situated more than 1 km from the provincial road carrying low traffic volumes within a sparsely populated area, noise generated by the development during the operational phase is not expected to have a significant impact on the noise levels in the area. Noise during the operational phase would involve possible humming from transformers, wind whistling from overhead evacuation lines and across the PV modules, and guards' radios.

The main noise sources currently affecting the study area are road traffic from the R357 and general farming operations. The construction and operation of the planned PV power station would constitute additional sources of noise. The surrounding farm residences are considered to be noise sensitive and might potentially be affected by the PV power station during the construction phase. The residual (existing) noise climate of the areas surrounding the study area is typical of a rural/agricultural noise environment. The noise climate in areas close to the R357 carries a noise nuisance factor when vehicles pass.

The construction phase of the PV power station and ancillary infrastructure would alter the noise climate and increase the noise footprint of the study area in the short term. The noise offset area would depend on the intended periods and intensity of operation of the construction phase.

The total volume of traffic generated during the operational phase will be negligible to the volume of traffic on the R357.

Mitigation Measures

Mitigation measures pertaining to the noise impacts are contained in the construction and operational phase noise section of the Environmental Management Programme (Appendix F).

2.1.1.8 Air Quality

Impacts on air quality would mostly occur during the construction and decommissioning phases and could involve dust nuisance and emissions by vehicles and construction equipment. Air quality impacts during the operational phase would be limited to vehicle emissions. Mitigation measures are included in the dust section of the construction and operational phase section of the EMP.

2.1.1.9 Visual and Aesthetical Impacts

Construction-related activities would have an immediate and obvious impact on the visual and aesthetical aspects of the study area and surrounding areas. Impacts on observers close to the study area, especially those travelling along the R357, as well as impacts on potentially sensitive receptors such as landowners and homesteads located within areas of potential visual exposure, have been considered by Axis Landscape Architecture cc (Appendix D5). The expected sudden increase in heavy vehicles utilising the roads to the study area might also cause a visual nuisance to other road users and landowners in the area. Dust nuisance would add to the visual impact during construction.

The presence of the proposed PV power station, including its ancillary infrastructure, would have an impact on the visual and aesthetical aspects of the study area and surrounding areas especially during the construction phase (Appendix D5).

Potential impacts associated with the construction and operational phases include:

- visual impacts;
- reduction in aesthetic properties;
- littering and housekeeping on the construction site;
- light pollution ; and
- dust nuisance and other impacts related to the construction phase.

The key aspects determining the visual impact of any development include its physical dimensions, colour and texture. PV power station infrastructure might be reflective and mostly stands in contrast with the surrounding environment.

The metal stands and frames of the supporting structures may reflect (Arce, 2010). However, the PV power station would be situated west of the authorised Greefspan I 10 MW PV power station more than 1 km from the provincial road. The visual absorption capacity of the natural vegetation between the road and the proposed location of the PV power station would further mitigate possible reflection from supporting structures.

Due to the distance from the road, the low height of the structures, and the visual absorption capacity of the natural vegetation it is not expected that the supporting structures would cause any impact on road users.

Should it become evident that the reflection of the structures may present a problem to road users during the long-term operational phase of the PV power station; it might be considered to paint the frames in a colour with low reflective properties. The Department of Roads and Public Works would be involved in such assessments during the operational phase and communication would then take place with the project manager.

Solar PV panels are designed to absorb light, rather than reflect it, as reflected light results in a loss of energy output. The modules are dark in colour and have coatings that enable the panel to absorb as much of the available light as possible, thereby increasing energy production. (Arce, 2010)

Solar modules are fitted with high transmission, low iron glass, which absorbs more light and produces smaller amounts of glare and reflection than standard glass. The reflected energy percentage of solar glass is far below that of standard glass and more on the level of smooth water. The smallest amount of light is reflected when the light beam is perpendicular to the collecting surface. Therefore the smallest amount of energy is reflected when the beam is perpendicular to the collecting surface or 0 degrees to the normal. This limits the effect of reflection issues related to PV panels to certain hours during a day i.e. early in the morning and late in the afternoon, where the sun height angles are lower. (Arce, 2010)

Should fixed structures be implemented, it would be orientated northwards and face away from the R357. Reflection off the panels should thus not be an issue.

The reflection generated by PV modules on tracker systems are always directed at the sun and could therefore only be a nuisance to motorists at ground level around sunrise and sunset, and possibly to air traffic. Glint and glare would possibly be visible to motorists traveling south on the R357 at sunrise but the risk is low due to the low height of the structures, the distance from the road and the visual absorption capacity of the natural vegetation.

PV panels near airports present no greater hazard due to reflected sunlight than parking lots filled with cars. Light is specularly reflected from any smooth surface where the index of refraction is different from that of air. The intensity of the reflection is dependent on the angle between the sun and the solar panel, and the index of refraction of the panel. Multiple reflections from the front and back surfaces of the glass are not apparent in solar panels since they are designed to absorb light and convert it into electricity. (Arce, 2010)

Should air traffic cross the project area, glint and glare might potentially be experienced. This would depend on altitude, relationship to the project area and panel position/angle. However, several large-scale solar projects are operated without incident near major airports such as at Nellis Air Force Base in Nevada, US where a 14.2 MWp PV power plant is operated (Figure 12). (Arce, 2010)

Figure 12: Nellis Air Force Base, Nevada, US (USAF, 2010)

There would be a slight potential for an afterimage or flash glare to pilots, resulting from reflected direct sunlight. This is similar to the potential for flash glare due to water. Pilots would typically mitigate glare using glare shields and sunglasses that typically reduce radiation by approximately 80%. Any reflected sunlight from solar panels would then be insignificant. (Arce, 2010)

Wet surfaces may clearly alter reflective properties. However, the PV panels, supporting structures and components would be tilted. Water would thus not accumulate or pool. (Arce, 2010) The area also receives very low rainfall and with the current climate change it is expected to become even lower. It is not expected that this would pose any risk.

The conclusion is that the proposed PV power station would not cause a substantial increase in solar radiation reflectivity compared to the surrounding environment. (Arce, 2010)

In comparison to the infrastructure associated with CSP technology, with power towers of up to 160 m high, where sunlight is collected in mirrors, focused and redirected to an engine, and wind energy technologies, with turbines of up to 125 m high, PV structures with an approximate height of less than 7 m, which are designed to absorb solar energy and convert it directly to electricity, are much less visually intrusive.

The South African Civil Aviation Regulation Act, Act 13 of 2009 controls markings of structures that may influence aviation through the Civil Aviation Technical Standard, SA-CATS-AH 139.01.33 Obstacle Limitations and Markings outside Aerodrome or Heliports.

It states that any structure exceeding 45 m above ground level, or structures where the top of the structure exceeds 150 m above the MEAN ground level. The mean ground level is considered to be the lowest point in a 3 km radius around such structure. Structures lower than 45 m that are considered to be dangerous or potentially dangerous to aviation shall be marked as such if specified. Overhead wires, cables, etc., crossing a river, valley or major road shall be marked, and their supporting towers marked and lighted if an aeronautical study indicates that it could constitute a hazard to aircraft.

The highest structures that would be constructed at the proposed development would be the lightning conductors, which would have a height of 25 m. Cabling would not cross any rivers, valleys or major roads.

The ancillary infrastructure would be situated within the study area and its scale is not expected to exceed that of the PV modules.

The area is not densely populated and the possible impacts due to lighting are expected to be negligible. Security and after-hours operational lighting would not cause any sky glow. Security lighting would be activated by motion detectors and would not be on through the night.

As part of the bid process Suntrace Africa need to obtain SACAA consent for the proposed development. The application to SACAA for this proposed development is being conducted as a parallel process to the EIA.

Mitigation Measures

In most cases, the landscape and visual impacts occurring during the construction phase can be mitigated relatively effectively. Rehabilitation of the disturbed areas would prevent the exposure of soil, which may cause a reduction in the visual quality of the study area. Sensitive positioning of the construction camps and laydown yards should take advantage of the natural screening capacity of the study area by locating the camps outside of the views of sensitive visual receptors.

Mitigation measures pertaining to the visual impacts are contained in the following sections of the Environmental Management Programme (Appendix F):

- Preconstruction phase
  - Site demarcation and development
  - Planning of layout
  - Visual impacts (lighting)
- Construction and operational phase
  - Dust
  - Crew camps
  - Traffic impacts
  - Visual impact
  - Ecological specialist recommendations
  - Visual specialist recommendations

2.1.1.10 Heritage Resources

Archaeological Aspects

A Phase 1 Archaeological Impact Assessment was conducted by Dr Peter Nilssen in July 2012 (Appendix D3b). Dr Nilssen is an accredited archaeologist and a professional member - in good standing - of the Association of South African Professional Archaeologists (ASAPA), including the Cultural Resource Management section of the same association expertise is included within the AIA Report.

Transects were walked across the entire study area and where gravels were exposed transects were closely spaced, but where ground surfaces consisted of Hutton Sands transects were further apart. This strategy was used because archaeological remains occurred more commonly and in higher numbers in areas containing exposed calcrete and gravels than in areas where surface sediments consist of sands. Due to the relatively high numbers of isolated stone artefacts occurring in the study area it was decided to map all identified archaeological occurrences, but to photograph and describe only a representative sample of the recorded specimens. Stone artefact scatters of medium to low density were mapped, described and photographed. (Nilssen, 2012)

The nearly ubiquitous scatter of isolated stone artefacts, or low density artefact scatters, are in a temporally mixed and secondary or derived context and therefore, are considered to be of low to no archaeological significance. These materials are designated a field rating of General Protected C, and because they were adequately documented during this study they do not require further recording before destruction. (Nilssen, 2012)

In addition to the above, five localities with medium to low density stone artefact scatters were recorded (Appendix A8, Figure 4 of the AIA Report). The extents of these scatters vary from about 100m2 to 400m2 and are all associated with exposed gravel deposits. Their archaeological contents include a mix of ESA, MSA and LSA materials with raw materials and artefact types like those described above for the isolated stone artefacts, or low density artefact scatters. In effect, these occurrences are representative of the archaeological record seen in the studied area. (Nilssen, 2012)

The specialist's finding was that, due to their temporally mixed and contextually derived nature, these archaeological occurrences are also considered to be of low significance and are given a field rating of General Protected C. Nevertheless, because they are considered to be representative of the archaeological record of the immediate surroundings, and to compensate for potential future cumulative impacts, it is recommended that waypoints 251, 286, 363 and 367 (Appendix A8) should be avoided by the proposed development. This can be accomplished by avoiding access road "Option 1" and the existing farm road. By using access road "Option 2" these localities can be preserved from further negative impact. (Nilssen, 2012) The access road option 3, a deviated version of option 2 has been chosen to avoid the pan. This would also then accommodate the recommendations of Dr Nilssen. Apart from the above-mentioned archaeological materials, no other heritage related resources or issues were identified during the study (Nilssen, 2012).

Palaeontological Aspects

Exemption was granted by SAHRA (Appendix D4) from a Palaeontological Impact Assessment.

The site is underlain by thin aeolian sands of the Quaternary Gordonia Formation (Kalahari Group) and calcretes. These are in turn underlain at depth by Permocarboniferous age rocks of the Karoo Supergroup – viz. the glacially-related Mbizane Formation (Dwyka Group) and possibly also the post-glacial Prince Albert Formation (lower Ecca Group). This last rock unit is exceptionally fossil-rich in the Douglas region. However, the palaeontological sensitivity of the near-surface sediments at Greefspan is low, the development footprint is small, and extensive bedrock excavations that might intersect Karoo bedrocks are not envisaged. (Almond, 2010)

Should substantial fossil remains be exposed during construction, however, these should be safeguarded – if possible in situ – and SAHRA should be notified by the responsible ECO as soon as possible so that appropriate palaeontological mitigation (fossil sampling and relevant data collection) can be undertaken. (Almond, 2010)

Mitigation measures pertaining to the heritage impacts are contained in the construction and operational phase heritage section of the Environmental Management Programme (Appendix F).

2.1.1.11 Impacts on Eco-Tourism

The Northern Cape Province is a sparsely populated and relatively isolated semi-desert area of South Africa. The area is therefore considered to be suitable for the establishment of PV power plants.

The potential impacts on tourism would include but not be limited to:

- visual impact on established tourism areas and products as well as potential tourists;
- proximity to roads;
- impact on traffic flow to the area; and
- potential for tourism development – impact of the power station on the growth of tourism in the area (positive and negative).

The Pixley ka Seme District Municipality has highlighted the need for economic and tourism injections by the business sector to the district to facilitate economic growth and employment opportunities. The likelihood of the power station developing into a huge leisure tourist attraction is small as it is of a nature that would mostly attract business tourism.

The overall impact of the power station would be positive in this area, as the power station would possibly attract business tourism and therefore bring clients to guesthouses in Douglas, Prieska and their surrounds. In addition, the plant could potentially attract leisure tourists with an interest in solar power. Being one of a few of its kind in the world, and one of the first solar power plants in Africa, the plant would undoubtedly attract interested parties, who would in turn contribute to the tourism sector.

There are no known established tourism facilities in the vicinity of the study area other than the confluence of the Vaal and Orange River systems and the glacial pavements that occur at several locations surrounding Douglas. There are no guesthouses in the area other than within Douglas and Prieska, and the proximity of the Greefspan Substation already acts as a deterrent to the development of tourism in close proximity to the study area, due to the perception of high noise levels. The presence of the PV power station in this area would result in an increase in business tourism in the area, which would have a positive impact on Douglas and Prieska.

All of the land surrounding the substation is privately owned and is currently being used for livestock farming purposes and alluvial mining activities. The small size of the population means that relatively few people would see the plant daily at this site. Traffic to the area is currently very limited would increase dramatically during the construction phase. This would be of a temporary nature. The impact of such a facility on tourism would be low in this instance.

Mitigation measures addressed within the EMP are as follows (Appendix F):

- Pre-construction phase: Site demarcation and development;
- Construction and operational phase: Visual impact.

2.1.1.12 Concrete Batching

To date the proponent has indicated that gravel and sand for concrete batching would be obtained from existing sources and suppliers. The need for large amounts of gravel and sand would have a direct impact on the lead time of this project as well as the planned operational period of those companies' borrow pits or mines, depending on size.

Several new power stations are planned within the region and the aggregate (gravel and sand) for Douglas and/or Prieska would possibly be sourced from commercial sources should mining permits not be registered. Refer to point 1.4.5 for the amounts of concrete that would be needed for the different types of technologies as well as different methods of footing construction.

The environmental impact of the driven pile or concrete pile footing methods would be significantly lower than that of the mass concrete block foundations due to the lower concrete and water requirements. Transport impacts would therefore also be lower as lower amounts of concrete have to be trucked to the study area. The geotechnical study would indicate what type of structure would be suitable.

2.1.1.13 Electromagnetic Compatibility

All the electrical components of the PV plant are rated by the European Standards authorities (CE mark) as safe for electromagnetic interference. This means that they are safe to live with and will not interfere with the TV or radio reception. They should thus not interfere with remote navigational systems. In this regard the largest PV plant in the USA is on an Air-force Base. If the PV plant did interfere with navigational systems it would never have been developed on an Air-force Base. (Figure 12)

Products carrying the CE mark comply with the European Directive 2004/108 regarding Electromagnetic Compatibility (EMC). In Europe, this CE mark is a precondition for sale of the device.

The proposed PV power station would mainly consist of PV modules, support structures, inverters and transformers. The CE mark is on the data sheets regarding the PV modules and all the support structure alternatives that were considered.

3. ENVIRONMENTAL IMPACT STATEMENT

Taking the assessment of potential impacts into account, please provide an environmental impact statement that summarises the impact that the proposed activity and its alternatives may have on the environment after the management and mitigation of impacts have been taken into account, with specific reference to types of impact, duration of impacts, likelihood of potential impacts actually occurring and the significance of impacts.

3.1 Consideration of Alternatives

The site selection process was based on locating sites that matched as many as possible of the ideal criteria for the development of a PV electricity generation plant. These selection criteria, done by Suntrace Africa before commissioning the EIA, filtered out alternative sites which were in some way or other not suitable for the development of a PV electricity generation plant that is environmentally and economically sustainable.

Due to the technical and economical requirements of a PV power station, close proximity to a substation is essential and therefore only one possible site has been identified for the development. The purpose of this study would therefore be to investigate the environmental feasibility of using the proposed site for the development in question, with consideration for alternatives with regard to other factors such as technology and design.

The following alternatives were considered:

- Alternative technologies:
  - Power plant technology
  - Different types of structures (fixed structures, single axis tracker systems and double axis tracker systems)
  - Different types of foundations
  - PV modules
  - Inverters
  - Concentrator boxes
  - Transformation centres
  - Layout of the PV modules with consideration for the aspects identified
  - Electrical grouping configuration
  - Electrical reticulation
  - Trenches
  - Ancillary facilities
    - Access roads
    - Service and perimeter road
    - Buildings and parking area
    - Fencing
    - Lightning protection system
    - Security system
- Timing
- Resources
- Technical competence
- Demand
- Activity/Land use
- Scheduling alternative
- The 'do-nothing' alternative (the option not to proceed with the proposed development)

3.2 Conclusions drawn from the Evaluation of the Proposed Study Area

Impacts that might potentially be associated with the PV power station include impacts on water resources; soil and agricultural potential (risk of erosion linked to topography of area, land use potential and restriction of land use); ecology and biodiversity (impacts on ecology, flora and fauna, and especially avifauna); social aspects on the macro-, meso- and microlevel; visual quality and aesthetics; economic impacts (mostly positive); traffic impacts (construction, upgrading and decommissioning phases); noise (construction, upgrading and decommissioning phases); air quality; visual and aesthetical impacts; heritage resources; and tourism activities.

Most of the potential impacts identified are anticipated to be site-specific. No environmental fatal flaws were identified and the pan that has been identified as a 'no-go' area can be avoided. Mitigation has provided for protected plants and trees to either be avoided (*Boscia* and *Acacia* spp.) or permits obtained to move it or remove it (plants and trees of less importance).

Alternative A (preferred alternative)

3.3 Potentially Significant Issues Related to the Construction and Operational Phase after Mitigation

3.3.1 Impacts on Water Resources

Geohydrology

Groundwater in the wider study area is mainly used for stock watering with some potable use at homesteads on farms. Abstractions are generally low and water quality range widely from moderately potable to poor with high nitrate and TDS levels. The proposed development would probably have a negligible impact on the groundwater quality, as large quantities of petrochemicals would not be stored on site either during the construction or operational phase and this storage and use will be controlled by the correct implementation of measures of the Environmental Management Programme.

If the use of groundwater should be opted for in future, the sustainable yield rate of aquifers within the study area must be established to ascertain the amount of water available to this development, taking into account other possible usages within these aquifers. This would be managed by the DWA. Both existing and newly drilled boreholes, as well as their current and expected use, should be registered at the DWA. As this use would result under industrial usage under the National Water Act (Act 36 of 1998) a Water Use Application should be lodged with DWA.

Hydrology (surface water)

The water for construction and operation would possibly be sourced from the Siyancuma Local Municipality who are a registered Water Service Provider The bulk of the water is required for concrete in the construction phase and Suntrace Africa is in the process of applying for a water allocation of 10 000m3 to the Siyancuma LM. This is a process that is being conducted parallel to the EIA.

3.4 No-go alternative (compulsory)

The 'do nothing' alternative is the option of not undertaking the development of a PV power station at the Farm Kwartelspan. Should this alternative be selected, it would have local and broader impacts.

The identified site, at a local level, would not be impacted on from an environmental perspective and would continue to be utilised for agricultural activities on marginal agricultural land.
Deciding not to proceed with the development would have a negative impact on the regional environment as well as on the socio-economic development of the region. The job creation and poverty alleviation that would have occurred due to the development, would not take place.

The diamond mine located on the Saxendrift property and operated by Rockwell Diamonds obtains its electricity from the Greefspan Substation. Rockwell Diamonds has indicated that it applied for the remaining capacity available at Greefspan Substation (Norton, 2012). In future this mine would possibly not be able to develop further and expand due to the lack of electricity capacity at the Greefspan Substation and surrounding network. The increased demand from other sectors operating in the area also needs to be taken into consideration.

In 2006 South Africa sourced approximately 90% of its energy from fossil fuels (coal, oil, gas). Coal, which is the main contributor to the country's carbon dioxide emissions, is the major primary energy supplier with a contribution of 65.9% to the total primary energy supply in 2006. (Subramoney et. al., 2009) Carbon dioxide is the main greenhouse gas connected with climate change. Hydro and renewable energy supply has seen little change since 2004; hydro supply had an increase of about 0.1% since 2004 while renewable supply declined by 0.4% (Subramoney et. al., 2009).

In order to develop sustainably whilst preparing for growing energy demands, South Africa's future energy supply must therefore be diversified with regard to power generation sources. This is also important in the light of the country's commitment under the Copenhagen Accord to reduce its carbon dioxide emissions by 34% below the "business as usual" level by 2020.

The generation of electricity from renewable energy resources offers many potential socio-economic and environmental benefits for South Africa. It can ensure increased energy security, which is highlighted by the current electricity crisis in South Africa, as well as resource saving, as conventional coal-fired plants are major consumers of water during the cooling process.

The energy demand at the Eskom Greefspan Substation grows annually. The development of small-scale, evenly distributed renewable

energy supply schemes, such as the one proposed at Eskom Greefspan Substation, is strategically important for the diversification of domestic energy supplies and for avoiding possible energy imports in the future.

Without the implementation of this development, renewable options for future power supply would be compromised and fossil fuel-based energy would possibly be used to supply for the growing demand. This could have significant negative environmental and social impacts.

The 'do nothing' alternative is not a preferred alternative in this application.

SECTION E. RECOMMENDATION OF PRACTITIONER

Is the information contained in this report and the documentation attached hereto sufficient to make a decision in respect of the activity applied for (in the view of the environmental assessment practitioner)?	**YES**	~~NO~~

If "NO", indicate the aspects that should be assessed further as part of a Scoping and EIA process before a decision can be made (list the aspects that require further assessment):

If "YES", please list any recommended conditions, including mitigation measures that should be considered for inclusion in any authorisation that may be granted by the competent authority in respect of the application:

All recommendations and mitigation measures that should be included in the authorisation is addressed in the Environmental Management Programme. Should the BAR and EMP be accepted and authorised, all aspects that have been discussed within the report and programme would be addressed.
It is imperative that the implementation of the EMP during pre-construction, construction and operational phase and continued compliance to it be ensured.

Note that the worst case scenarios of possible impacts were assessed in this study. The applicant has not chosen between some alternatives such as the type of supporting structures (trackers or fixed) presented in this study.
Due to the fact that the impacts were assessed on the worst case scenario, the type of infrastructure or associated infrastructure chosen would still fall within the parameters of this study.

Is an EMPr attached?	**YES**	~~NO~~

The EMPr must be attached as **Appendix F**.

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SECTION F: APPENDIXES

The following appendices must be attached as appropriate:

Appendix A: Site plan(s) - GIS Maps of Greefspan Study Area
Appendix A1: Locality Map
Appendix A2: Status Quo
Appendix A3: Site Development Plan
Appendix A4a: Regional Topographic Map
Appendix A4b: Regional Cadastral Map
Appendix A4c: Regional Land Types Map
Appendix A4d: Regional Vegetation Map
Appendix A4e: Regional Satellite Map
Appendix A5a: Digital Elevation Model
Appendix A5b: Slope Analysis
Appendix A6a: Soil Groups
Appendix A6b: Soil Augering Points
Appendix A7a: Vegetation
Appendix A7b: Protected Plants
Appendix A8: Archaeology
Appendix A9: Visibility Analysis
Appendix A10: ToR GIS Information

Appendix B: Photographs

Appendix C: Facility illustration(s)
C1: Overview PV Plant
C2: Overview PV Plant (Google Earth)
C3: Overview Panned

Appendix D: Specialist reports (including **terms of reference**)
Appendix D1a: ToR Ecology
Appendix D1b: Ecology Report
Appendix D2a: ToR Avifauna and Chiroptera
Appendix D2b: Avifauna and Chiroptera Specialist Study
Appendix D2c: CV Beryl Wilson

Appendix D3a: ToR AIA
Appendix D3b: Archaeology Report

Appendix D4: Exemption - SAHRA

Appendix D5a: ToR VIA
Appendix D5b: Visual Impact Assessment
Appendix D5c: CV Gerhard Griesel

Appendix D6a: ToR Agriculture
Appendix D6b: Agricultural Impact Assessment

Appendix E: Comments and Responses Report

Appendix F: Environmental Management Programme (EMP)

Appendix G: Other information

Appendix G1: Communication from DEA
Appendix G2: Public Participation Process Phase 1
- G2a: Distribution of Notification Letters to identified I&APs, stakeholders and government
- G2b: Response Form
- G2c: Background Information Document (BID)
- G2d: Proof of Email Notifications
- G2e: Proof of Distribution of Notification Letters, Response Form, and BID
- G2f: Comments Received & Responses
- G2g: Advertisement (Crazy Ads) dated 23 March 2012
- G2h: On Site and other Notices
- G2i: List of Stakeholders and Registered I&APs

Appendix G3:
Appendix G4a: Title Deed Information
Appendix G4b: Title Deed Information
Appendix G5: Significance Rating Scale Impact Matrix
Appendix G6: Curriculum Vitae – I.B. van Zyl

Appendix A:

Site Plans

ESRI Shapefile/GIS Maps

Appendix B:

Photographs

Appendix C:

Facility Illustrations

Appendix D:

Specialist reports (including **terms of reference**)

Appendix E:

Comments and Responses Report

Appendix F:

Environmental Management Programme

Appendix G1:

Communication from DEA

Appendix G2:

Public Participation Process Phase 1

Appendix G3:

Appendix G4:

Title Deed Information

Appendix G5:

Significance Rating Scale Impact Matrix

Appendix G6:

Curriculum Vitae – I.B. van Zyl