Van Zyl Environmental Consultants cc

2009/073037/23

Environmental Impact Assessment Process

Final Basic Assessment Report

&

Environmental Management Programme

27/2011/3

Proposed Greefspan PV Power Station and

Associated Infrastructure

Pixley ka Seme District Municipality

Northern Cape Province

5 June 2012

NEAS REF No: DEA/EIA/0000845/2011

DEA REF No: 12/12/20/2645

Applicant:

AE AMD renewable energy

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:	**GREEFSPAN PV POWER STATION II**
FILE NUMBER:	**27/2011/3**
DEA REFERENCE:	**12/12/20/2645**
NEAS REFERENCE:	**DEA/EIA/0000845/2011**
REPORT:	**FINAL BASIC ENVIRONMENTAL IMPACT ASSESSMENT REPORT & ENVIRONMENTAL MANAGEMENT PROGRAMME**
FOR:	**PROPOSED CONSTRUCTION AND OPERATION OF A PHOTOVOLTAIC POWER STATION OF UP TO 40 MW AT GREEFSPAN SUBSTATION**
LOCATION:	**REMAINING EXTENT OF PORTION 1, FARM KWARTELSPAN NO. 25, NORTHERN CAPE**
DATED:	**JUNE 2012**
WRITTEN BY:	**VAN ZYL ENVIRONMENTAL CONSULTANTS CC**
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APPOINTED BY:	**AE-AMD RENEWABLE ENERGY (PTY) LTD 2010/004670/07**
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Physical Address:	**P.O. Box 2303, Cramerview, 2060**

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

GENERAL SITE INFORMATION

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

SOLAR PLANT DESIGN SPECIFICATIONS:

TYPE OF TECHNOLOGY:	Photovoltaic Power Generation
STRUCTURE HEIGHT:	6.6 meters
TOTAL EIA STUDY AREA:	100 ha
LAYDOWN AREA: CONSTRUCTION:	68 ha
LAYDOWN AREA: OPERATIONS:	1.5 ha
STRUCTURE ORIENTATION:	North
GENERATION CAPACITY:	44.4 MWp
TOTAL GENERATION CAPACITY AT DELIVERY POINT:	40 MW (MWA)

PUBLIC PARTICIPATION PROCESS

INVITATION TO COMMENT ON THE FINAL BASIC ENVIRONMENTAL IMPACT ASSESSMENT REPORT

The final 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 21 days from **06 June 2012 until 29 June 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:	**Director Environmental Impact Evaluation** **Department of Environmental Affairs**
Telephone:	**012 310 3911**
Facsimile:	**012 322 2682**
Address:	**Private Bag X447** **Pretoria** **0001**
	4th Floor **South Tower** **Fedsure Forum Building** **315 Pretorius Street** **Pretoria**

Please supply a copy of your comments via facsimile, post or email to:

CONSULTANT:	**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 DEA 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 nonliving (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 maneuverability 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	Concentrated 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

AE-AMD Renewable Energy (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 40MW at the Greefspan Substation situated between Douglas and Prieska in the Northern Cape as a result of discussions with ESKOM. The development will have a footprint of approximately 100 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). The size of the study area was approximately 150 ha. The 40MW that is now applied for, that would tie into the network on the transmission level, would be located on the remainder of the area studied.

The authorised scoping and environmental impact assessment study identified and evaluated potential environmental impacts associated with all aspects of the project for detailed study, including specialist studies, on the study area. It contained a detailed description of the nature and extent of a PV power station. Information and input from the proponent, specialists, the authorities and Interested and Affected Parties (I&APs) were used to identify and evaluate potential environmental impacts (both social and biophysical) associated with the proposed project. No environmental fatal flaws were identified with regard to the project applied for.

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 Eskom Greefspan Substation is located on the farm De Rust, of Portion 1 (Remaining Extent) of the farm Kwartelspan No. 25 in the Northern Cape. The farm is situated approximately 60 km south of Douglas on the R357. AE-AMD 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 and downscaling for the proposed development 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 Department of Environment Affairs.

An application was submitted to downscale the application from a scoping and EIA level to a basic assessment level in terms of regulation 20 (4) of the Environmental Impact Assessment Regulations of 18 June 2010. A motivation accompanied this application and was largely based on the fact that the applicable study area has already been studied in full in the previous study and that not any significant environmental or socio-economic issues have been identified. The application was accepted by the competent authority. (Appendix G 1.1)

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. AE-AMD Renewable Energy (Pty) Ltd is currently evaluating the feasibility of constructing another photovoltaic (PV) power station, with a generation capacity of up to 40MW and possibly more, depending on the type of systems used, adjacent to the existing Eskom Greefspan Substation that would tie in at a transmission level. The purpose of the PV power station would be to replace electricity generated and transmitted from distant sources to the local network.

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. AE-AMD selected this site as it conformed to most of the criteria for the development of a PV power station. 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.

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
- Concentrated 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 concentrated 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, concentrated 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	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	The proposed PV power station will tie into the network on the transmission level, which is from 36 kV to 132 kV.
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	22 (ii)	The construction of a road, outside urban areas, where no reserve exists where the road is wider than 8 metres.	A short access road of approximately 10 metres wide could be constructed **should** it be required.
R544, 18 June 2010	29 (i)	The expansion of facilities for the generation of electricity where: the electricity output will be increased by 10 megawatts or more, excluding where such expansion takes place on the original development footprint; or	A 10 MW PV power station has already been authorised at Greefspan Substation. If the authorised power station has been constructed by the time construction of the 40 MW power station, which is currently being applied for, commences, the development could possibly constitute an

	(ii)	regardless the increased output of the facility, the development footprint will be expanded by 1 hectare or more.	expansion of more than 10 MW and more than 1 hectare as the applicant is the same parent company.
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 the 10 m wide access road planned and authorised for the 10 MW PV power station I might need to be lengthened by more than 1 km to provide for access of trucks to offload construction equipment nearer to the area that is currently being applied for.
R545, 18 June 2010	1	The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.	The electricity output of the planned PV power station would be 40 MW.
R545, 18 June 2010	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more	The construction and operation of the planned 40 MW PV power station could be classified as commercial and/or industrial activities and would require an area of approximately 100 hectares of undeveloped land.
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 application reference number 12/12/20/2645 and NEAS reference number DEA/EIA/0000845/2011 has been assigned.

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 Palaeontological Assessment are attached in Appendices D3 and D4. Find SAHRA's comment attached in Appendix G2.8.

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.

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.

Siyancuma Local Municipality confirmed that they will be able to supply approximately 60 kl water per day for the duration of the project. Tenesol, appointed for Engineering, Procurement and Construction (EPC) contractor services, are currently doing further geotechnical tests and field trials to confirm the appropriate foundation types and then would be able to more accurately confirm the construction and operational phase water requirements.

Should the need to utilise groundwater resources at any time in future for the operation of the PV power station this EIA study would be used to support the Water Use Application process for the utilisation of groundwater resources.

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, AE-AMD Renewable Energy (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 AE-AMD Renewable Energy (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 11 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 and downscale application 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 the entire study area of 150 ha. It comprised of:

- a biodiversity/ecology impact study by Mr. B.H. Erasmus (Appendix D1);
- Avifaunal and bat desktop specialist report by Ms Beryl Wilson (Zoology Head of Department, McGregor Museum) (Appendix D2); and
- an archaeological impact study by Mr. David Morris (Appendix D3); and
- a palaeontological impact study by Dr. John Almond (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).

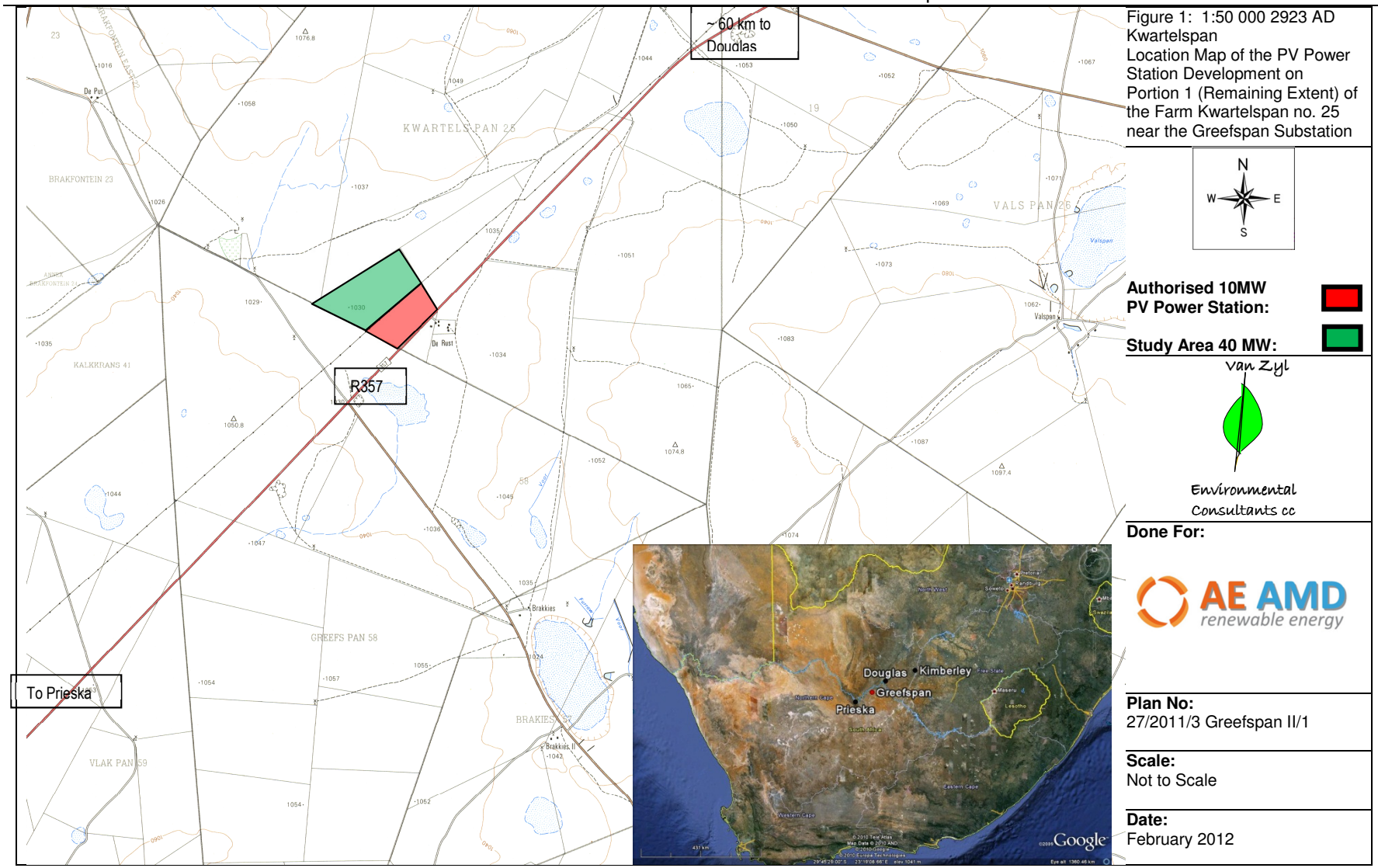

Figure 1: 1:50 000 2923 AD Kwartelspan
Location Map of the PV Power Station Development on Portion 1 (Remaining Extent) of the Farm Kwartelspan no. 25 near the Greefspan Substation

N
W E
S

Authorised 10MW PV Power Station:

Study Area 40 MW:

Van Zyl
Environmental Consultants cc

Done For:

AE AMD renewable energy

Plan No:
27/2011/3 Greefspan II/1

Scale:
Not to Scale

Date:
February 2012

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

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 farm is situated approximately 60 km from Douglas on the R357. The site where the PV power station is proposed to be developed lies to the 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 directly accessible via the R357 with Douglas to the north and Prieska to the south. The study area is approximately 100ha.

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 energy power plants use the 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.

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). Only the parallel sunrays normal to the receiving surface can be concentrated, and is termed Direct Normal Irradiance (DNI), which is measured as a unit of W/m^2. DNI is 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 of typically more than 1 800 kWh/m^2/year of direct solar irradiation, is suitable for the construction of PV power stations. Douglas has one of the higher DNI levels of approximately 2132 kWh/m^2 (AMDA Energia, 2010) per year.

1.3 Project Description

The development of a 40 MW PV power plant at the Greefspan Substation, Douglas, Northern Cape. The proposed PV power station will tie into the network on the transmission level, which is from 36 kV to 132 kV.

1.4 Construction Phase Activities

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

[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.

evacuation power line corridor/servitude, surveying of identified GPS points of PV support structures, and the road servitudes and the internal access roads.

1.4.2 Construction of Access Roads to the Site and Internal Roads

This Greefspan II site will get access through Greefspan I (already authorised) and would use the same access to the R357 provincial road that runs parallel to the site, to Douglas to the north and Prieska to the south. A gate would be implemented in the farmer's fence to access the Greefspan I and II sites.

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 environmental sensitivity has been identified on the study area by the specialist studies already conducted.

1.4.3 Site Preparation and Construction Laydown Areas

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.

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.

1.4.5 Ancillary Infrastructure

The following would be constructed:

- 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

Vegetation would be required to be cleared and areas of the site would need to be levelled. Excavation and laying of foundations of buildings and other structures would be required. Should the area to be constructed be too far from the construction camp, a laydown area to keep building material and equipment would also be required.

In the first phase of development, lightning protection would be provided by galvanised steel masts with a height of up to 25m, which would be founded in excavated holes of 1m x 1m and a depth of 1,5m.

The perimeter fence and security system would be implemented approximately 10m from the nearest PV modules. Holes would be dug up to 600mm and 2,4m fence poles would be concreted into place. The fence would then be erected according to specifications and electrified. Electricity would be supplied underground to the fence and buildings. The type of fencing to be used would be a fence of 2,4m as it is stronger and more intruder proof.

Lampposts would be installed near to the fence and CCTV cameras near to or on the fence.
An infrared detection system would be attached to the lampposts around the perimeter. If not attached to the bottom of lampposts these systems could be installed on low poles. An optic fibre cable could be installed in the fence as a detection system, but this is very expensive. Security systems and personnel would start operating at the beginning of the construction phase.

A concrete batching plant could be erected on site, in Douglas or pre-mixed concrete obtained from an external supplier. The distance to the site from Douglas and Prieska would however be a limiting factor. A large amount of 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.

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

For the authorised projects the water for construction and operation would be sourced from the Siyancuma Local Municipality who are a registered Water Service Provider and this arrangement has been confirmed by DWA. (Appendix G 3.1)

The bulk of the water is required for concrete in the construction phase and in discussions during the week of 5 March 2012 between AE-AMD and the Siyancuma LM about the proposed project, they have confirmed that there is water available at the peak draw down rates of 60 600 l/day, which is AE-AMDs estimated peak construction demand, required for the authorised projects on an on-going basis. (Appendix G 3.1) The same procedure would be followed as has been done for the authorised site and AE-AMD would thus confirm it once they have received updated information on water requirements from Tenesol, the consulting engineer. AE-AMD would then confirm this arrangement with DWA. This is a parallel process to the EIA.

During the construction period chemical toilets would be available on site. A waterborne sewage system or dry "Enviro-Loo's" would be constructed for operational phase. Grey & sewage water would be contained in closed cell tanks with a size sufficient to contain a month's effluent. When the tank is full, sewage would be removed by the developer or preferably by the local municipality to the sewage works at Douglas.

During the construction phase generators would most likely be used for power supply because of the expanse of the construction site. 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.

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 of 36kV

Vegetation would be cleared and areas levelled where pylons would be located for the line of less than 200 m. 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 using a small crane. Guide ropes would be used for the hoisting and positioning of the structural components. The main body of the structure would be positioned on the anchors of the foundation footer. Slings would be used to lift the structure, move it and lower it until it rests securely on the surface of the footing. The grill would then be hoisted up and placed on the structure. (Meca Solar, Undated)

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

Electricity would be generated by the PV modules, transferred to the concentration boxes and transformation centres and then to the distribution centre. It would then be transferred via the 36kV evacuation power line to the substation from where it would be fed into the Eskom transmission network.

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. Approximately 1 000m^3 water/annum would be needed for a 5MW power station, should it be cleaned thrice yearly. The water could be obtained from existing/drilled boreholes or potable water could be transported by water truck from the nearest settlement to the site.

Water will be sourced from the Siyancuma LM during construction but during the development process the possibility of using borehole water for the operational phase would be reviewed. If it is deemed feasible AE-AMD will then conduct the needed studies and applications to DWA for water use licenses.
Should underground water or an aquifer be used to supply water for the operational period, water pump tests should be done on boreholes in the area to establish the daily sustainable yield rate of the aquifer. Water should be tested for potability and a demineraliser or water softener implemented if required.

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. Given the number of employees, the general waste generated would not be more than that generated by one or two average households and is therefore insignificant in quantity. It would be stored at the site office/store buildings and could be carted by the staff transport and disposed of at the closest municipal waste site as and when necessary. Bio-degradable waste can be composted rather than carted away. Office waste such as paper and cardboard could be recycled.

1.7 Decommissioning Phase Activities

If properly maintained, the PV power station is expected to have a lifespan of approximately 25 years. Should it be upgraded at the end of this period, its lifespan might possibly be extended to 50 years. The infrastructure would only be decommissioned once it has reached the end of its economic life. Should it be economically feasible or desirable, the following activities would be applicable.

The access integrity to the site would have to be confirmed to accommodate the required equipment, machinery and vehicles needed to remove the infrastructure.

Infrastructure, including fencing and security systems, would be removed and reused at other areas or sold as second-hand material.

Should brick structures be used, structures would be demolished and rubble removed to the nearest general waste site. It could then be used as cover material or filling for other construction sites. Should containers or corrugated iron structures be used, they could either be moved to other sites or sold. Concrete bases for support structures and lampposts, lightning conductor masts and fencing posts could be removed to the nearest general waste site or, be left in situ on the site.

Compacted areas would be contoured and ripped. If plant growth should not establish, active seeding and planting of vegetation would be conducted.

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. (AE-AMD, 2011)

These selection criteria were applied by AE-AMD 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. (AE-AMD, 2011)

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 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. (AE-AMD, 2011)

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, AE-AMD Renewable Energy considers the study area to be a highly suitable and preferred site for the development of the Greefspan PV power station. 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 direct solar irradiation values. The Northern Cape receives the highest average daily direct normal 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)

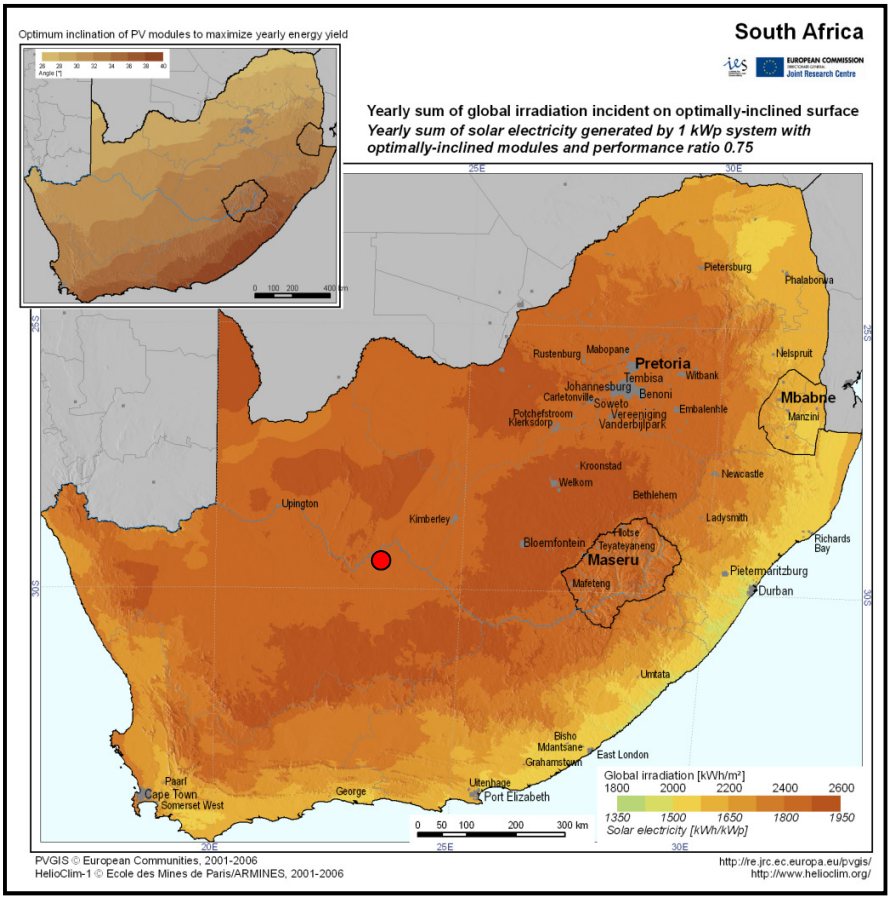

Figure 2: Solar Electricity Potential in South Africa (Huld, 2005)

Availability of Land

A large, open, flat area is required for the development of a PV power station. The generation of 40 MW, which is envisaged in the long term, requires approximately 100ha.

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 directly accessed via the R357 provincial road through the authorised Greefspan I roads (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 A, Figure 2), 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 200 m and would follow alongside the existing servitude of the existing Eskom transmission line to the Greefspan Substation (Appendix C). The cumulative effect of the evacuation line would therefore be very low.

Table 1: Substation names and coordinates:

	WGS-84	
	Latitude	**Longitude**
Greefspan	-29.392307	23.309981
Herbert	-29.003584	23.802972
Welcome Wood	-28.257823	23.437422

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 A Figure 4.4, Appendix D1).

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. A fixed panel system would typically require approximately 2-3 ha/MW, compared to a requirement of approximately 5-6 ha/MW for a PV plant using trackers. Thus a typical 40 MW plant could use approximately 80 to 120 ha, depending mostly on the technology (supporting structures) used. (AE-AMD, 2011)

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 three alternative technological approaches: trough systems, power tower systems, and dish/engine systems.

Advantages

- Storage possible for 6-8 h 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. Only the parallel sunrays normal to the receiving surface of the PV panel can be concentrated. Irradiation received from these parallel sunrays is termed Direct Normal Irradiance (DNI). Sites that receive high levels of DNI, typically more than 1 800 kWh/m^2/year of direct solar irradiation, are suitable for the construction of PV power stations. Douglas has one of the higher DNI levels of approximately 2 132 kWh/m^2 per year (AMDA Energía, 2010).

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 200 m.
- 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. AE-AMD 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. 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. The options that were initially studied included fixed structures, single-axis trackers and double-axis trackers. (AE-AMD, 2011)

The most visible part of the PV power station will be the PV modules, or solar panels, and their associated structures. Two types of structures are being considered, namely fixed structures (Figures 3-8), which are fixed in one position, and tracker systems (Figures 9-11), which move along with the movement of the sun in order to receive as much energy as possible throughout the day and, with some systems, even throughout the year.

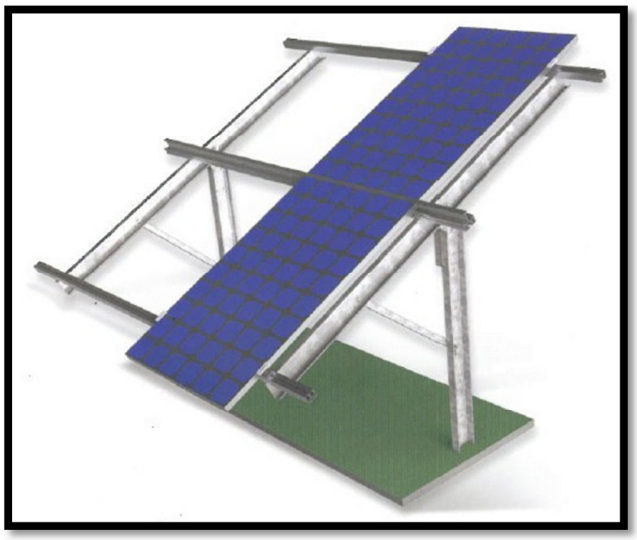

Figure 3: Fixed Structures (HATICON)

Figure 4: Fixed Structures (IDEEMATEC)

Figure 5 and 6: Construction of Fixed Structures (Tenesol)

Figure 7 and 8: PV Solar Plant Consisting of Fixed Structures

Figure 9: MS-10 tracker from Mecasolar (AE-AMD, 2011)

Figure 10: DG-7000NT tracker from Deger (AE-AMD, 2011)

Figure 11: IM ST32 tracker from Ideematec (AE-AMD, 2011)

The materials commonly used in support and PV structures are:

- galvanized steel;
- stainless steel; and
- anodized aluminium. (AE-AMD, 2011)

Foundations

For fixed structures, small concrete footings are cast in the ground.

The following foundation options may be considered for tracker structures (AE-AMD, 2011):

- mass concrete block foundation (Figure 12);
- screw foundation;
- concrete pile foundation; and
- vibratory driven steel pile foundation. (Figure 13) (AE-AMD, 2011)

Figure 12: Foundation option for Mecasolar tracker

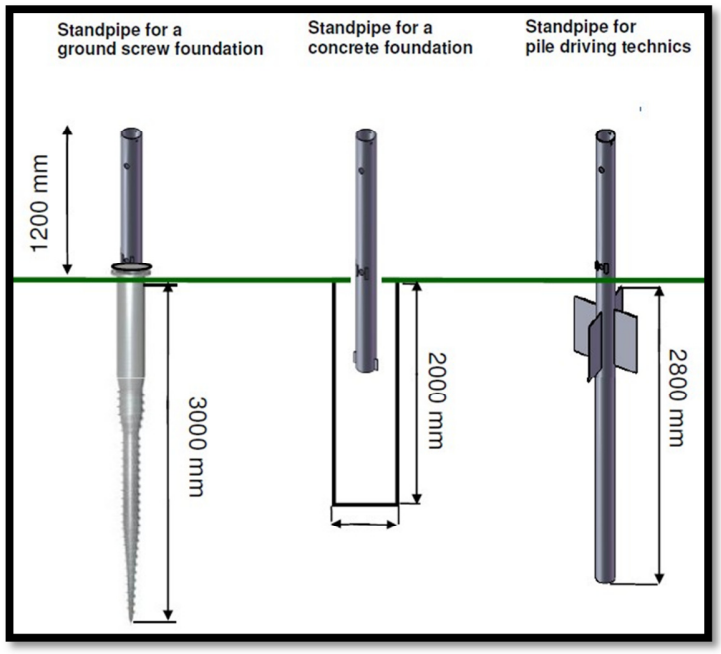

Figure 13: Foundation options for Ideematec tracker (AE-AMD, 2011)

The preferred technology would possibly be the vibratory driven steel pile foundation due to the fact that it does not use any concrete and therefore no water. Depending on the ground conditions a concrete pile might need to be used. A geotechnical study is being carried out in order to provide data for the selection of the foundation. (AE-AMD, 2011)

Both the vibratory driven steel pile foundation and the concrete pile foundation are preferred above the mass concrete foundation, which is situated above ground. After decommissioning, the mass concrete foundation would not be feasible to be removed and would remain a physical and visual obstruction in the veld, while the driven pile and concrete pile would not pose this problem as they would be removed on ground level.

PV Modules

There are various types of PV modules defined according to the materials used (Figure 14):

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

Figure 14: Example of PV Modules (AE-AMD, 2011)

Tenesol PV modules would possibly be selected from the wide range of PV modules available in the market, primarily because they are manufactured in South Africa and the use of these PV modules would therefore boost the local economy and local job creation and benefit the local communities. Tenesol modules are slightly less efficient than Trina Solar modules, but more efficient than those from BP Solar and FiveStar. (AE-AMD, 2011)

Inverters

There are various types of inverters defined according to their technology:

- Multi power stages
- One power stage
- Multi controlled power stages

- Low voltage output
- Medium voltage output

- String inverter
- Central inverter



Figure 15, 16 and 17: Different Inverters (AE-AMD, 2011)

Figure 18: Inverter from Kaco Energy

The following inverter manufacturers were considered (Figure 15-8):

- Xantrex;
- Sun Power; and
- SMA. (AE-AMD, 2011)

SMA inverters would possibly be selected because of their quality and efficiency. The Sunny Tripower model would possibly be used, because it is a string inverter without a transformer, resulting in safer operation and maintenance. These inverters are sufficiently protected to be either fixed to the PV structures or placed separately. (AE-AMD, 2011)

Concentrator Boxes

The concentrator boxes are outdoor switchgear boxes or cabinets where the electrical wires from the PV module group are collected. The concentrator boxes are designed for outdoor conditions and are mounted on a concrete base. (AE-AMD, 2011)

Some of the international manufacturers that provide these devices are (Figure 19):

- ABB
- Schneider Electric
- Ormazabal
- Omron
- PowerTech

Figure 19: Switchgear Boxes

No choice has been made yet.

Transformation Centre

The transformation centre would be a prefabricated concrete structure built to house the transformer and the associated protection devices. In the transformer, the voltage level would be transformed from 0.38 kV to 36 kV. (AE-AMD, 2011)

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

- ABB
- Schneider Electric
- Ormazabal
- Omron
- PowerTech

The transformer that might possibly be used would be manufactured by ABB, which has several factories in South Africa. The prefabricated concrete structure has not been selected yet.

Figures 20-23 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.

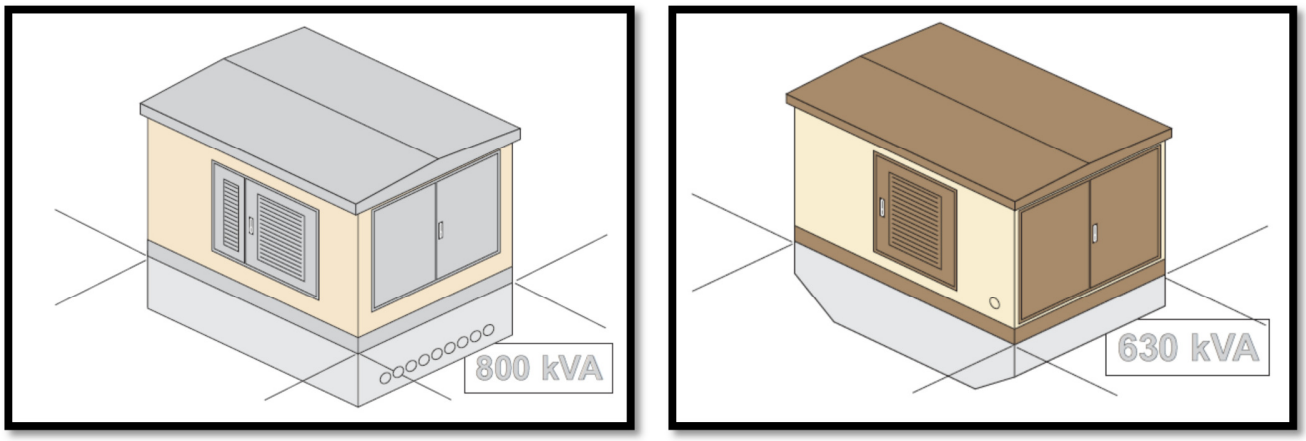

Figure 20 and 21: Prefabricated Transformer Centre

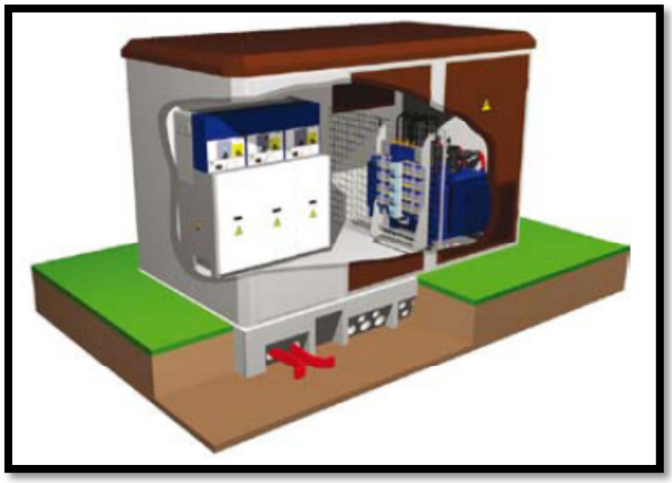

Figure 22 and 23: Prefabricated transformer centre from Ormazabal

Distribution Centre

The distribution centre is where all the medium voltage (MV) lines, coming from the various transformers, are collected. The distribution centre is housed in either a prefabricated or a steel structure (Figure 24). A MV line runs from here to the Eskom substation.

Figure 24: Outdoor distribution centre from PowerTech

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.

Based on the preferred equipment choices above, the following additional design criteria were used to establish the layout of the plant:

- A minimum distance of 13 m in the north-south direction and 13 m in the east-west direction must be maintained between trackers. These distances have been optimised using sun path simulation software.
- Structures must be at least 16 m from the centre of any power lines, whether the power lines are single or double.
- Structures must be at least 60 m from the centre of provincial roads.
- Structures must be at least 16 m from any Telkom line.
- A minimum distance of 10 m must be maintained between the structures and the fence to prevent theft and avoid shadows cast by the fence.
- Internal and perimeter service roads must be 5 m in width.
- The main access road must be 10 m in width. (AE-AMD, 2011)

2.1.4 Electrical Grouping Configuration

For approximately 70 PV modules one inverter is required to transform the direct current generated in the PV modules to alternating current. A group may consist of approximately 620 PV Modules which are all connected to a concentrator box (CB). (AE-AMD, 2011)

Depending on the power of the transformer (800 kVA or 630 kVA), four to five groups is connected to each transformation centre (TC). (AE-AMD, 2011)

The transformation centres (TC) are connected to the distribution centre (DC) using line routes of two or three transformation centres (TC), depending on the layout and power. (AE-AMD, 2011)

2.1.5 Electrical Reticulation

The entire electrical reticulation within the PV plant, from the PV structures through to the distribution centre, would be installed underground. (AE-AMD, 2011)

The connection from the distribution centre to the Eskom substation depends on Eskom's requirements. This line could be overhead or underground. (AE-AMD, 2011) The Greefspan sub-station was chosen because of the capacity of the grid to accept electricity being fed in at this point.

2.1.6 Trenches

The dimensions of the trenches would vary according to the number of cables laid in each trench, as well as their voltage levels. The maximum width is 0.6 m and maximum depth is 1.10 m. The cable would be laid in a suitable bedding material such as sand. 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. (AE-AMD, 2011)

Trenches are usually excavated by means of a TLB, but given the quantity of trenching within the PV plant, specialist trenching machines might be used. (AE-AMD, 2011)

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.

2.1.7 Ancillary Facilities

Access Roads

This Greefspan II site will get access through Greefspan I (already authorised) and would use the same access to the R357 provincial road that runs parallel to the site, to Douglas to the north and Prieska to the south. A gate would be implemented in the farmer's fence to access the Greefspan I and II sites. This access road would be less than 100 meters long and would be designed and constructed according to the standards set by the Dept. of Roads and Public Works. The road surface would be either tar or paving. A width of 10 m is allowed for the access road reserve. (AE-AMD, 2011) (Appendix A, Figure 3 and C)

Sufficient space would be allowed at the access point and security control to ensure that vehicles do not back up on the road while being processed through security.

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.

Preliminary applications have been made to the Provincial Roads Authority and approval to continue with the planning process has been received.

Service and Perimeter Road

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 environmental sensitivity has been identified on the study area by the specialist studies already conducted. 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. (AE-AMD, 2011)

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. (AE-AMD, 2011)

During the operational phase access around the site is generally only required for security and routine inspection. Access for cleaning operations or maintenance is very infrequent, thus the internal service roads need only be tracks. (AE-AMD, 2011)

Service and perimeter road reserve widths would be 5 m. Service and perimeter roads would give access to different groups of structures and corners are designed to accommodate the turning of trucks. (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, a small workshop and a store of 300 to 400 m^2. (AE-AMD, 2011)

There is space allocated in the PV plant layout for the buildings near the entrance to each site.

One option is to build a farm-type shed of approximately 480 m^2 (40 m x 12 m) to house the control room and offices.
Should more than one PV plant be developed in close proximity then the facilities can be rationalised and a central facility set up. There would however have to be facilities for the security personnel on each site.

Services for the buildings would be provided as follows (AE-AMD, 2011):

- Electricity would be sourced from the Eskom substation.
- The control room and the office would have air-conditioning.
- Enviro Loo toilets would most probably be used. These toilets are used in a number of national nature reserves. The toilets do not require a water supply and operate by separating the solid and water waste and then drying the waste by evaporation. The dry solids are removed and can safely be spread as compost in the field.
- The small amount of potable water required for use by the site personnel can be provided from a number of sources.
    - Rainwater can be collected off the roof of the buildings.
    - Borehole water can be obtained from the farmer's existing borehole(s) or new boreholes can be drilled.
    - Potable water can be carted in from the local town. The Siyancuma LM, who is a registered water services provider, has indicated that they would have the water capacity available for this supply in the Douglas area (Appendix G 3.1).

Should the available water need treatment, the appropriate equipment would be used.

Note that the amount of potable water required is well under the limits required to trigger water use applications (20 kℓ/day). The National Water Act, Act 36 of 1998 stipulates that it would constitute an industrial water use though.

There would be a mall hardstand parking/laydown area near the buildings, which would be used during the operational phase.

Fencing

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 get installed and commissioned as soon as practical. This is especially important before the reticulation is operational and hence more difficult to steal. (AE-AMD, 2011)

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. The proposed perimeter fence is a non-lethal electrified fence with a height of 2.4 m. (AE-AMD., 2011)

This type of fencing is very similar to the fencing around many game farms in the area.

Lightning Protection System

To protect the PV plant, equipment and personnel from lightning, a lightning protection system composed of masts and surge arresters would be installed. This system would be designed by a specialist and would comply with the relevant South African laws and standards. (AE-AMD, 2011)

Provision has been made for up to 25 m high masts (AE-AMD, 2011).

Security System

The perimeter, access points and general site would be monitored by CCTV cameras and passive intrusion detection systems. There would be security lighting, which would be linked to the passive intrusion detection systems and would therefore not be on all night. (Figure 25)

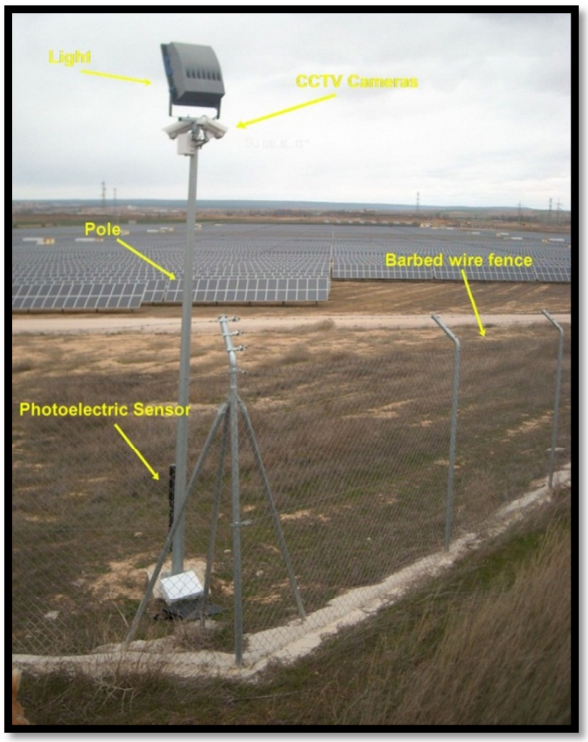

Figure 25: Example of security system elements

2.1.8 Timing

AE-AMD would want to have all the planning and permitting completed by the end of July 2012 to be able to bid in August 2012 in the Renewable Energy Independent Power Producer Procurement Programme. The preferred bidder status would be announced in September or October 2012 and the construction start would possibly during April 2013 if every step mentioned proceed as planned. AE-AMD would need to confirm the construction period.

The following processes also influence the timeframe of the proposed project (Du Plessis, 2010):

- 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;

- financing for BEE partners;
- 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.

2.1.9 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.

Concrete aggregate would be obtained from commercial sources at Douglas and a batching plant established in Douglas or on one of the sites.

2.1.10 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.

2.1.11 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.

2.1.12 Activity/Land Use

The applicable Portion 1 (Remaining Extent) of the Farm Kwartelspan no. 25, Hopetown District is 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.

It is stipulated that vegetation shall be disturbed as little as possible, and this condition would be enforced by the ECO. Should tracking structures be opted for it would be expected that grazing would still be possible on the site after commencement of the operational phase and after rehabilitation of the disturbed areas has been effected to such an extent that sufficient carrying capacity is restored and that the veld would not be degraded further by grazing.

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 AE-AMD need to either introduce or promote suitable ground cover or put down gravel.

A rezoning application is being lodged for this development and the applicant is consulting with a town planner in this regard. This is a parallel process to the EIA. AE-AMD applied for and received a “Special Use” zoning in terms of the Northern Cape Planning and Development Act (Act 7 of 1988) from the Siyancuma Municipality for the Greefspan PV Power Station I project (Appendix G 3.3). The Special Use zoning is a zoning to be used where the proposed land use does not fall under their other categories of zonings. The intended use is then defined in the application and approval. AE-AMD defined the Special Use zoning as a mixed use for Agriculture and PV power plant, with a temporary validity that is only for the generation license period.

2.1.13 Scheduling Alternative

Should the EIA be authorised, it is envisaged that the applicant would bid in the August 2012 IPP Procurement Programme. Should it be the case this proposed development is envisaged to take place in 2013 and 2014 to be operational by 2015. The EIA therefore needs to be completed by mid-July 2011.

2.1.14 '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 and in future possibly mining as a prospecting right has possibly been registered to this property. (Appendix G 2.9)

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 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 grew at a rate of approximately 419kVA per annum from 2007 to 2010 (Du Plessis, 2010).

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.

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

Construction phase activities would include but not be limited to (AE-AMD, 2011):

- site clearing as necessary, which must be kept to a minimum to avoid dust;
- site preparation and construction laydown areas;
- temporary fencing of the construction yard site;
- installation of the perimeter fence;
- construction of access roads to the site and internal service roads;
- delivery of construction materials and equipment;
- foundation excavation;
- installation of foundation piles or concrete;
- installation of electrical reticulation;
- installation of the lightning system;
- assembly of tracking or fixed support structures;
- moving of the assembled support structures to their final positions;
- setting up of electrical equipment;
- construction of a 36 kV evacuation line of less than 200 m;
- construction of buildings;
- installation of the security system; and
- commissioning tests.

The following areas have been defined for construction purposes (AE-AMD, 2011):

- laydown area;
- assembly area;
- spoil heaps; and
- construction traffic area.

2.2.1 Lay Down Area

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.

2.2.2 Assembly Area

The assembly area would be equipped for the safe and quick assembly of the support structures and PV modules. An assembly area has been defined. 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. (AE-AMD, 2011)

2.2.3 Workshop

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.

2.2.4 Spoil and Concrete Batching

Borrow pit areas would not be needed as gravel, stone and sand would be sourced from commercial sources surrounding Douglas or Prieska. Only a small amount of gravel is needed for concrete production for cross-road trenches, building foundations and concentrator box bases. This gravel can be obtained from commercial sources in Douglas and transported by truck to the sites. Given that there are no significant earthworks in the construction process, the only spoil envisaged would be material excavated from the trenches or pile holes that is considered unsuitable to be used as backfilling. These should be relatively insignificant volumes and could be spread on site if possible. Should the volume be larger, landscape features such as screening berms around the substation and PV plant could be created from the spoil. These would be covered with topsoil and vegetated. (AE-AMD, 2011)

2.2.5 Construction Traffic

During the construction phase the traffic would peak at about 10 vehicles and 40 to 50 concrete trucks per day while the footings are being cast and then drop to about 20 to 30 vehicles per day while the electrical reticulation is being installed and the PV support structures are being erected. This number is calculated on worst case scenarios. If the preferred option of vibratory driven piles is adopted, the construction traffic would be greatly reduced. The traffic volumes during construction would probably equate those experienced during the harvesting season on the local farms. (AE-AMD, 2011)

2.2.6 Water Usage and Concrete Batching

For the authorised projects the water for construction and operation would be sourced from the Siyancuma Local Municipality who are a registered Water Service Provider and this arrangement has been confirmed by DWA. (Appendix G 3.1)

The bulk of the water is required for concrete in the construction phase and in discussions during the week of 5 March 2012 between AE-AMD and the Siyancuma LM about the proposed project, they have confirmed that there is water available at the peak draw down rates of 60 600 l/day, which is AE-AMDs estimated peak construction demand, required for the authorised projects on an on-going basis. (Appendix G 3.1) The same procedure would be followed as has been done for the authorised site and AE-AMD would thus confirm it once they have received updated information on water requirements from Tenesol, the consulting engineer. AE-AMD would then confirm this arrangement with DWA. This is a parallel process to the EIA.

The concrete requirements and therefore also the water requirements would be determined by the PV technology selected.

The installation of double-axis tracker systems would require a total of about 33 280 m^3 of concrete for the development of a 40 MW PV power plant, amounting to a water requirement of approximately 12 Mℓ if worked on a worst case scenario (AE-AMD, 2011).

Should the single axis tracker system be used, a vibratory driven pile would possibly be the foundation type, depending the outcome of the geotechnical study, and no concrete would be needed for the foundations. Concrete would therefore only be required for the construction of buildings and other ancillary infrastructure. (AE-AMD, 2011).

However, should the ground conditions not be favourable for the driven pile, a concrete pile would be used. A single pile requires approximately 0.6 m^3 of concrete. This amounts to a total concrete requirement of approximately 4 800 m^3 and a total water requirement of approximately 1.7 Mℓ. This method would require significant lower amounts of concrete and therefore water than mass concrete foundations. It would also require fewer trucks to transport the concrete. For this reason the driven pile or concrete pile foundation types were selected. (AE-AMD, 2011)

The proposal is to establish a single concrete batching plant at a central location and to service all the sites in the Douglas area from there. This central site is most likely to be in the industrial area in Douglas or at the Ovaal site. (AE-AMD, 2011)

The Siyancuma LM has been approached and would be able to provide the water required for the construction phase (Appendix G 3.1). Note that this water use would not affect the water rights of landowners. (AE-AMD, 2011)

2.2.7 Ablution Facilities and Sewage

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.

2.2.8 Electricity Use

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.

2.2.9 General and Hazardous Waste

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.

2.2.10 Construction Phase Job Creation

The contracting of an EPC Contractor is proposed. Such a contractor would probably engage specialist subcontractors. These subcontractors usually have their own core staff, but engage local unskilled labour.

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

Electricity would be generated by the PV modules, converted from DC to AC by the inverters, and transferred to the concentrator boxes and transformation centres, from where it would be transferred to the distribution centre. It would then be transferred via the 36 kV evacuation power line to the substation, from where it would be fed into the Eskom transmission network.

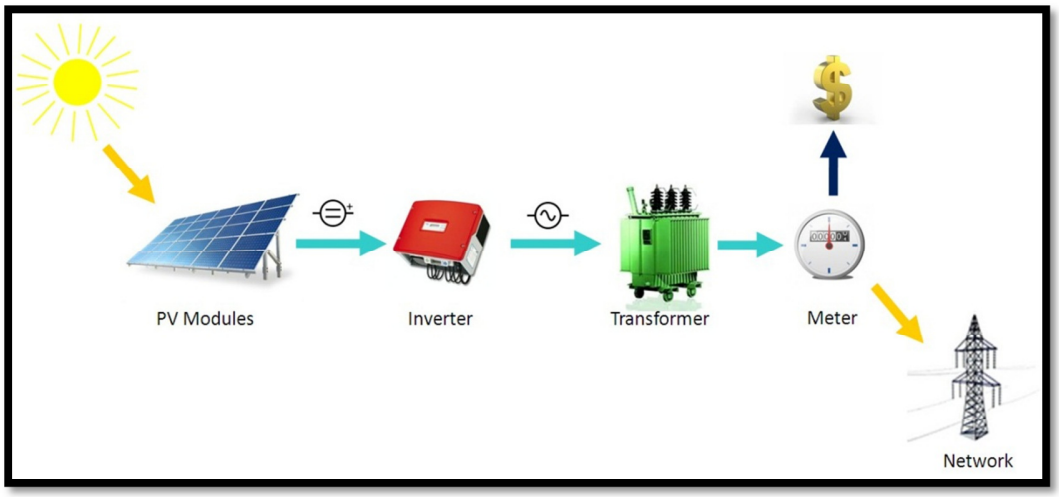

Figure 26: Energy flow in a PV power station with fixed modules (AE-AMD)

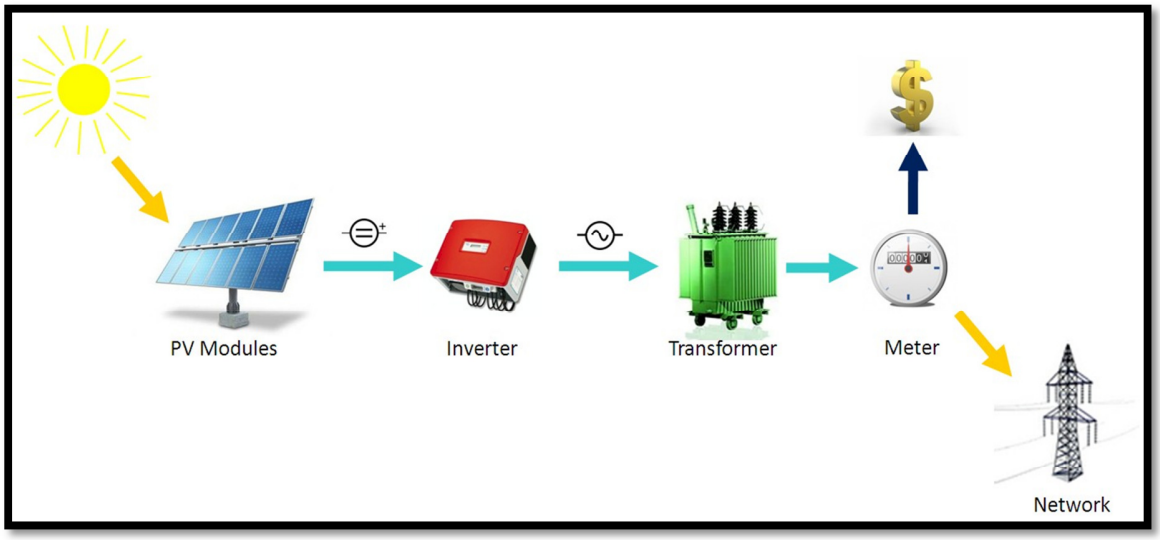

Figure 27: Energy flow in a PV power station with tracking structures (AE-AMD)

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 and feeding it into the Eskom distribution network. (Figure 26-27)

Activities occurring during the operational phase include but are not limited to (AE-AMD, 2011):

- verification of the electricity production;
- maintenance and monitoring of a weather station;
- routine inspection of all equipment and systems;
- periodic maintenance;
- cleaning of PV modules; and
- security operations.

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.

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 panels. The water needed for cleaning is about 75 ℓ per tracker per annum and less than 1 000 ℓ per day would be needed for domestic purposes by the personnel on site. For a 5 MW PV plant the water requirements would therefore not exceed 1 000 kℓ per annum (~8 000 kℓ per annum for a 40 MW PV plant).

It is proposed that two to four security guards should be on site at a time, 24 hrs per day. The operational staff for the three Douglas sites would probably be based in a central control office.

The PV panels would be cleaned approximately trice per year and would need approximately 75 ℓ per tracker per annum for this purpose. If it is assumed that the water required for cleaning the trackers would be transported to site by a water truck equipped with cleaning equipment, the onsite water requirements would be minimal. (Figure 28)

The Siyancuma LM indicated that they have the water capacity available to provide the water required for the operational phase (Appendix G 3.1).

Figure 28: Cleaning PV panels (AE-AMD)

2.4.2 General Waste

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. Given the number of employees, the general waste generated would not be more than that generated by one or two average households and would therefore be insignificant in quantity. It would be stored at the site office or storage buildings, and could be carted by the staff transport and disposed of at the closest municipal waste site as and when necessary. Biodegradable waste can be composted rather than carted away. Office waste such as paper and cardboard could be recycled where possible.

2.4.3 Sewage

A waterborne sewage system or dry Enviro Loos were 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 29-30) 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.

Figures 29 and 30: Enviro Loo System

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 Enviro Loo system is proposed to be used during the operational phase as the climate meets the operational requirements of the system. 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.

2.4.4 Operational Phase Job Creation

A PV power plant would have the following direct onsite staff

- 1 x plant operator – electrical technician
- 1 x security manager – supervisor
- 8 x security guards – NQR

These would be backed up by the following O&M company offsite staff

- 1 x technical manager – electrical engineer
- 1 x financial manager – chartered accountant
- 1 x operations manager – electrical/mechanical engineer
- 1 x admin staff – bookkeeper
- 4 x mechanical technicians – fitters & turners
- 4 x electrical technicians – electrician

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.

2.5 Decommissioning Phase Activities

After 25 years of operation, the PV plant would either be upgraded or decommissioned.

Upgrading the PV power plant would consist of replacing old PV modules with new ones, increasing the total peak power of the plant (a process called "repowering") or increasing the power of the plant by adding new elements such as support structures, PV modules or transformers. (AE-AMD, 2011)

If the plant is to be decommissioned, the site should be returned to a state close to its original state. All of the components of a PV plant, except for the concrete, have an intrinsic value either for reuse or recycling. This value would cover the cost of decommissioning the plant and rehabilitating the site (AE-AMD, 2011):

- The PV panels would be removed from the support structures and sent to special recycling facilities without further disassembly at the site. See the recycling process set out in point 3.3.2.
- The transformers and electrical control devices would either be reused, with or without reconditioning, or sold as scrap after removal of the fluids.
- The electrical power management and conditioning equipment would be recycled or sold as scrap.
- The underground cable runs could be abandoned in place, or removed. As these cables have a very high scrap value, the latter is more probable.
- The steel in the support structures has high scrap value and the structures would therefore be dismantled and removed to be sold as scrap.
- The steel support structure piles can be removed and sold as scrap. Alternatively the steel or concrete piles can be cut off just below ground level and abandoned.
- The gravel or aggregate on the access road, onsite service roads, electrical substations, transformer pads, and building foundations could be removed and recycled for use in other fill operations if not abandoned.
- The buildings can be taken over by the farmer for his operations. Alternatively, all the reusable material can be removed, the shells demolished and the rubble taken away to a municipal waste site.

Disturbed land areas can be rehabilitated, the rubble removed, the soil scarified and reseeded or replanted with indigenous vegetation.

As part of the decommissioning and rehabilitation process, the soil would be inspected for industrial wastes from minor spills or leaks. Such occurrences would be documented and decontaminated as necessary. Soil testing would be conducted after decommissioning if deemed necessary. (AE-AMD, 2011)

Transportation activities during site decommissioning would be similar to but less than those during site development and construction.

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°	23.241‘	23°	18.395‘
~~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	°	‘	°	‘
Alternative S2 (if any)				
• Starting point of the activity	°	‘	°	‘
• Middle/Additional point of the activity	°	‘	°	‘
• End point of the activity	°	‘	°	‘
Alternative S3 (if any)				
• Starting point of the activity	°	‘	°	‘
• Middle/Additional point of the activity	°	‘	°	‘
• End point of the activity	°	‘	°	‘

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.

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)	1 000 000m²
Alternative A2 (if any)	m²
Alternative A3 (if any)	m²

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)	1 000 000m²
Alternative A2 (if any)	m²
Alternative A3 (if any)	m²

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

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	m

Describe the type of access road planned:

This Greefspan II site will get access through Greefspan I (already authorised) and would use the same access to the R357 provincial road that runs parallel to the site, to Douglas to the north and Prieska to the south. A gate would be implemented in the farmer's fence to access the Greefspan I and II sites.

Since the control and other buildings are located close to the provincial roads, these access roads would be less than 100 meters long and would be designed and constructed according to the standards set by the Dept. of Roads and Public Works. The road surface would be either tar or paving. A width of 10 m is allowed for the access road reserve. (AE-AMD, 2011) This access road has already been approved by DEA during the previous EIA process undertaken.

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 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 support structures or trackers to their positions. (AE-AMD, 2011)

Service and perimeter road reserve widths would be 5 m. Service and perimeter roads would give access to different groups of support structures and corners are designed to accommodate the turning of trucks. (AE-AMD, 2011)

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 1 336 000 000	
What is the expected yearly income that will be generated by or as a result of the activity?	~R 192 000 000	
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?	~3320	
What is the expected value of the employment opportunities during the development phase?	~R 47 974 000	
What percentage of this will accrue to previously disadvantaged individuals?	~ 64%	
How many permanent new employment opportunities will be created during the operational phase of the activity?	~ 26	
What is the expected current value of the employment opportunities during the first 10 years?	~ R 3 757 000	
What percentage of this will accrue to previously disadvantaged individuals?	~ 60%	

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?	**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 grassland to exposed soil would diminish the grassland 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 be affected most severely 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 are spread throughout the distribution network in the Douglas and Danïelskuil areas, 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 25 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. (Table 1)
For example, to reach the same production that the Greefspan PV power station would generate over a year, with Gas, Coal or Diesel Generation, CO_2 emissions of respectively 4935 tons, 8931 tons and 6815 tons would be generated as:

- 1 Tep of Natural Gas = 2,1 tons of CO_2;
- 1 Tep of Coal = 3,8 tons of CO_2; and
- 1 Tep of Diesel = 2,9 tons of CO_2. (AE-AMD)

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

AE-AMD Renewable Energy is a member of South African Photovoltaic Industry Association (SAPVIA), who together with GREENCAPE (http://www.green-cape.co.za) is currently actively working on the definition of some collection points for used and end-of-life PV panels to proceed subsequently to their recycling. (AE AMD, 2011)

Tenesol, the preferred PV manufacturers, as well as the other possible suppliers (Solaire Direct and Sunedisson) are members of the association PVCYCLE (http://www.pvcycle.org), which is currently establishing a process for the recycling of PV modules. (AE AMD, 2011) (Figure 2)

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. (AE AMD, 2011)

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. (AE AMD, 2011)

The following process, developed by PVCYCLE will be followed by AE-AMD Renewable Energy for all its projects in South Africa: (Figure 2)

Table 2: CO_2 Emissions Reduced by PV Power Stations (derived from figures supplied by AE AMD)

PV Power Plant	**Greefspan**
Total Power Installed (*including all phases*)	40 MW
Annual Estimated Production [kWh]	109 330 648
Annual Estimated Production [Tep]	9 400
CO_2 emission saved vs. Gas Generation [Tons]	19 740
CO_2 emission saved vs.Coal Generation [Tons]	35 724
CO_2 emission saved vs. Diesel Generation [Tons]	27 264

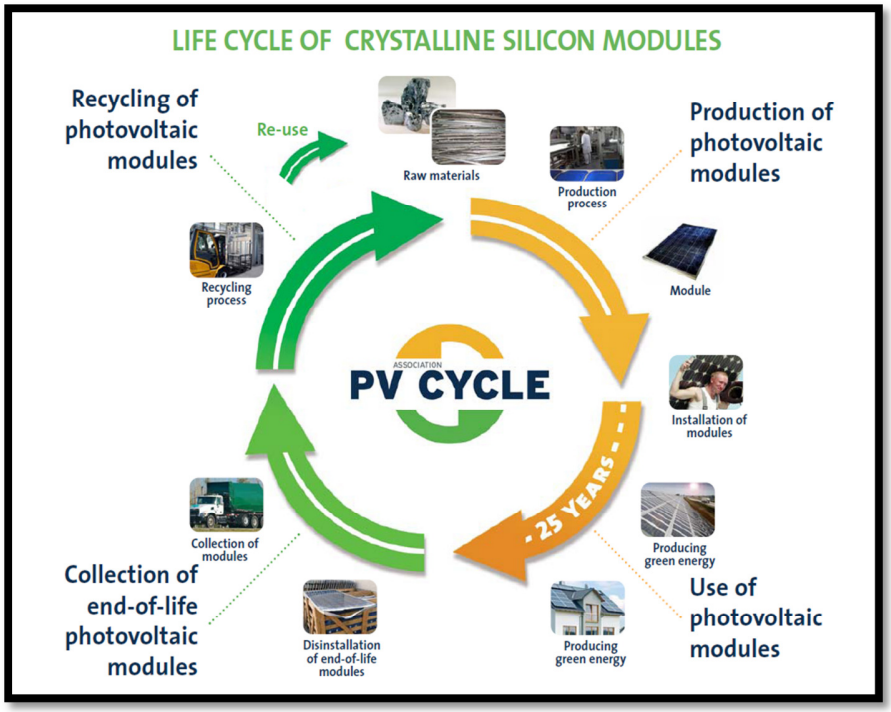

Figure 31: Processes developed by PV CYCLE

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 Africal 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**?	~ 180 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, that 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**?	~20 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: For the authorised projects the water for construction and operation would be sourced from the Siyancuma Local Municipality who are a registered Water Service Provider and this arrangement has been confirmed by DWA. (Appendix G 3.1)
The bulk of the water is required for concrete in the construction phase and in discussions during the week of 5 March 2012 between AE-AMD and the Siyancuma LM about the proposed project, they have confirmed that there is water available at the peak draw down rates of 60 600 ℓ/day, which is AE-AMDs estimated peak construction demand, required for the authorised projects on an on-going basis.
Approximately 8 000m³ water/annum would be needed for a 40 MW power station, should it be cleaned thrice yearly. Water will be sourced from the Siyancuma LM during construction but during the development process the possible use of borehole water for the operational phase would possibly be investigated. If it would be deemed feasible AE-AMD would then conduct the needed studies and applications to DWA for water use licenses.
Should underground water or an aquifer be used to supply water for the operational period, water pump tests should be done to establish the daily sustainable yield rate of the aquifer. Water should be tested for potability and a demineraliser or water softener implemented if required.

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:	Portion 1 (Remaining Extent) of the Farm Kwartelspan nr 25 situated 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: AE-AMD applied for and received a "Special Use" zoning in terms of the Northern Cape Planning and Development Act (Act 7 of 1988) from the Siyancuma Municipality. The Special Use zoning is a zoning to be used where the proposed land use does not fall under their other categories of zonings. The intended use is then defined in the application and approval. AE-AMD defined the Special Use zoning as a mixed use for Agriculture and PV power plant, with a temporary validity that is only for the generation license period. The same application would be submitted for this proposed development. 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). Not any rare or endangered species or other elements have been identified by the specialists.

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
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.

Mr Hennie Erasmus conducted an ecological/biota specialist study for the proposed development (Appendix D1). An overall potential total of 61 mammal, 239 bird, 37 reptile and seven amphibian species may occur in the study area and no Red Data Book (RDB) species were observed. Habitat destruction and fragmentation and the loss of land capability would be the main negative impacts on vertebrate species, while contamination of the genetic integrity of species and an increase in predator-prey interaction would be considered lesser impacts. None of the encountered vertebrate species at the study area is unique to the Northern Cape Province and the power generation would only have a medium-term effect on the vertebrate faunal component at the site. The power generation would not impact negatively on the ultimate survival or dynamics of the encountered taxa.

Ecological effects on plants, if entirely removed during the construction phase, would be high. If minimally removed, it would be minimal. If plants are hardly disturbed, the effects on terrestrial animals would also be minimal, depending on the type of fence that is constructed and the type of restriction the fence places on free movement of these species. Electrification of fences for the restriction of crawling animals is discouraged as this kills many non-target animals such as tortoises and pangolin. If such a fence is considered, the electrical fence contractor must discuss the configuration of the fence with an ecologist. Problems with baboons and monkeys are not foreseen because the area is too far from the river. If however, problems are encountered, measures such as electrical fencing or other non-lethal measures could be implemented. The species that may potentially interfere with or affect the power generation are mainly birds.

An agricultural impact assessment was conducted by Mr Christo Lubbe (Appendix D6). The site was found unsuitable for commercial cultivation due to limiting factors such as the stony nature of topsoil, which makes the use of agricultural machinery impracticable, and very shallow soil depth, restricted by hard setting horizons 20-30 cm below surface, which restrict root development. The fine sand grade of top soils has a very high potential for wind erosion, while the low clay percentage results in low water holding capacity and low nutrient availability.

The area visited could be and is utilised as grazing, but the grazing potential is very low. The development would therefore not render a severe impact on available grazing land.

The construction and operation of the PV power station, in general, would have no high impacts on the agricultural potential of the identified site or the local region, except for an increased possibility of wind erosion of disturbed soil, for which mitigation measures are recommended. The few other impacts found relate to the influence of construction activities on the agricultural community and is of a more socio-economic nature. Mitigation measures are recommended for these impacts as well. Otherwise, commercial agricultural activities could continue normally in the surrounding area.

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 and a Palaeontological Desktop Study (Appendices D3 and D4) have been conducted at the study area 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 as well as at the Siyancuma Local Municipality; 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 G 2.1 to G 2.8.
Find the proof of the 2nd phase of public participation attached in Appendices E and G 2.9.

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 2.5)

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.

Note: During the previous scoping and EIA done for the 10MW PV power station authorised by DEA at Greefspan Substation, a public meeting was held. Interest was very weak and therefore a public meeting would possibly not be conducted during this process. Stakeholders and registered I&APs did not raise any serious issues during that process. It was evaluated who the target public and stakeholders were and found that due to the lack of interest a public meeting would not add any value during this process. Meetings are being conducted by the applicant with the main stakeholders such as the Siyancuma Local Municipality from which water is being obtained. Information of the proposed development is being sent to the ward councillor of the area. Ratepayers associations and traditional authorities are not functioning in the surrounding area.

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 2.7.

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, forestry and Fisheries;
- *Provincial Government Representatives (Northern Cape)*:
  - Department of Environment and Nature Conservation;
  - Department of Agriculture, Land Reform and Rural Development;
  - Department of Forestry (DAFF);
  - Department of Roads and Public Works;
  - Department of Water Affairs;
  - Department of Mineral Resources;
  - Department of Energy;
  - Department of Labour; and
  - Department of Sports, Arts and Culture;
- *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 (Northern Cape)
- *Parastatals*:
  - Eskom; and
  - Telkom;
- *Community-based organisations*:
  - Northern Cape Chamber of Commerce and Industry;
  - Orange Vaal Water Users' Association; and
- *Surrounding landowners*.

List of authorities from whom comments have been received:

South African Heritage Resources Agency
DAFF (Forestry)

Note: Comments are being attached to Appendix G 2.8 and G 2.9.

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 2.8 (PPP1) and G 2.9 (PPP2)**):

Comments on the Notification:
All comments have been listed in the comments and response report attached in **Appendix E.**
DAFF (Forestry) is mainly concerned about the potential impact on protected tree species. The developer to assess the possible impact on protected tree spp. & developer to supply the Forestry Dept. with more detailed information regarding the potential impact. Depending on the extent of the impact, a biodiversity offset might be required. The nature of such an offset must be negotiated with the DAFF and the DENC.
The developer to note that an EA issued by DEA does not imply that a Forest Act License will automatically be granted. Forest Act Licenses can be and has been refused in the past.

Comments on the Draft BAR:
Rockwell Diamonds:

1. Prospecting Permit on the Farm De Rust.
2. In terms of prospecting, drilling and bulk sampling: Dust would pose a huge problem for the photovoltaic power station.
3. The sterilization of reserves for the Company would also be non-negotiable as well as access control onto a prospecting area.
4. A water scarce area, reserves in the Orange River limited as well as ground water.

EAP: An agreement was reached between Rockwell Diamonds and AE-AMD.

Telkom:
Telkom Ref: SR002/816
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 GREEN on sketches attached to the comments in Appendix G 2.9.
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 Jan-Louis Cloete must be contacted at 053 839 3442/081 362 8796 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.

Ms J.P. Ferreira (neighbour)
Will the panels be washed?
Where will the water come from?
What will happen with the dirty water?

DAFF (Forestry) is mainly concerned about the potential impact on protected tree species. The developer to assess the possible impact on protected tree spp. & developer to supply the Forestry Dept. with more detailed information regarding the potential impact. Depending on the extent of the impact, a biodiversity offset might be required. The nature of such an offset must be negotiated with the DAFF and the DENC.
The developer to note that an EA issued by DEA does not imply that a Forest Act License will automatically be granted. Forest Act Licenses can be and has been refused in the past.

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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 Jan-Louis Cloete must be contacted at 053 839 3442/081 362 8796 before any commencement of work.

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):

Response to comments of Mr Ferreira
Yes the panels need to be washed.
Currently it is planned to obtain water from the Siyancuma LM who is a registered water services provided and to confirm this with the DWA.
The evaporation rate is so high in this area that it is foreseen that the water that would be used to clean the panels, would evaporate very quickly from the panels or ground.

Response to comments of DAFF
Noted. Information will be provided in the draft basic assessment report (draft BAR) and final BAR.
Should it be needed licenses would be applied for during the pre-construction phase.
It is to be noted that not any trees is growing on the study area.

Response to comments of Rockwell Diamonds
Noted.
Yes, mitigation measures should be implemented for this possible dust pollution.
The applicant indicated that it is in consultation with Rockwell Diamonds regarding this issue.
An application for a water allocation to the Siyancuma Local Municipality is in process.
Find attached in Appendix G 2.9 an agreement between AE-AMD and Rockwell Diamonds.

Response to comments of TELKOM
Applicant/developer to take note
This information has been incorporated into the Final EMP and the developer and ECO should contact Mr. Jan-Louis Cloete at the onset of pre-construction phase to ensure that he is involved as a stakeholder.

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 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. AE-AMD Renewable Energy (Pty) Ltd proposes to set up a concrete batching plant either in Douglas or close by and then deliver the concrete to the sites (Berrington, 2010). The worst case scenario has to be planned for.

For the authorised projects the water for construction and operation would be sourced from the Siyancuma Local Municipality who are a registered Water Service Provider and this arrangement has been confirmed by DWA. (Appendix G 3.1) For this proposed development a similar process are being conducted parallel to the EIA.

The bulk of the water is required for concrete in the construction phase and in discussions during the week of 5 March 2012 between AE-AMD and the Siyancuma LM about the proposed project, they have confirmed that there is water available at the peak draw down rates of 60 600 l/day, which is AE-AMDs estimated peak construction demand, required for the authorised projects on an on-going basis. (Appendix G 3.1) The same procedure would be followed as has been done for the authorised site and AE-AMD would thus confirm it once

they have received updated information on water requirements from Tenesol, the EPC contractor. AE-AMD would then confirm this arrangement with DWA.

If concrete piles are used, the water requirement would decrease as this foundation method requires significant lower amounts of concrete and therefore water. It would therefore also require fewer trucks to transport the concrete to the study area. The footing decided upon would depend on the geotechnical studies that are currently being conducted.

A PV power station does not require much water for operation. The only requirements are water for the domestic needs of the security and operational personnel and for the cleaning of the PV panels. The domestic water needs would be less than 1 000 ℓ per day and approximately 8 000 ℓ of water would be required per year for cleaning purposes.

The water use alternatives/options that were considered included groundwater and potable water obtained from the local authority.

AE-AMD Renewable Energy (Pty) Ltd opted to source water from the Siyancuma LM and water availability has been confirmed by the DWA for the authorised projects. This would be done for the applied projects as well. This application would be conducted parallel to this EIA. (Appendix G 3.1)

The option of utilising groundwater may still be considered in future. 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. The DWA manages the use of groundwater and therefore both existing and newly drilled boreholes, as well as their current and expected use, should be registered with them and water use applications (WUA) submitted.

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 nearest active borehole is situated approximately 100 m east from the study area nest to the road R 357. The aquifer is approximately 30 metres deep. The yield rate is not known. (Pieter van Niekerk, Landowner)

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 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 is 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 uses 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. Activities such as vehicular movement between the structures for cleaning and maintenance purposes might disturb the soil surface. Agricultural activities also result in the sealing of the soil surface, which leads to reduced infiltration. Furthermore, vehicular activity could lead to 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;
- 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)

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.

Erosion potential is very low to low where this vegetation type is found. 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, fine-grained soils such as in this study area. Due to the flat gradient, percentage of vegetation cover and geology/soil composition of the site, the Erosion Susceptibility Map for South Africa rates this area as potentially a low erodibility area (Breedlove, 2000).

The proposed activities would cause dust nuisance and limit visibility near farm residences and in areas next to the R357. Dust suppression will suffice as a mitigation measure during the construction phase.

After the rehabilitation of construction areas at the onset of the operational phase the potential for wind erosion would 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.

Agriculture

A specialist agricultural study has been conducted and is included in Appendix D6. The only areas of high agricultural potential in the surrounds of the study area are the alluvial zones close to the Orange River, starting approximately 10 km to the north and northwest of the site, where irrigation may be practiced. Although the soil potential is high in some areas, land capability of the region is generally poor. This means the land is prone to erosion and degradation and rehabilitates slowly. (Pixley ka Seme, 2008)

In general, the sites visited were found unsuitable for commercial cultivation by the specialist due to limiting factors such as the stony nature of topsoil, which makes the use of agricultural machinery impracticable, and very shallow soil depth, restricted by hard-setting horizons 20-30 cm below surface, which restrict root development. The fine sand grade of top soils has a very high potential for wind erosion, while the low clay percentage results in low water-holding capacity and low nutrient availability.

The areas visited could be and are utilized as grazing, but the grazing potential is low and the proposed development would thus not have a severe impact on available grazing land.

The construction and operation of the PV power stations, in general, would have no high impacts on the agricultural potential of the identified sites or the local region, except for increasing the possibility of wind erosion where soil is disturbed, for which mitigation measures are recommended. The few other impacts found, relate to the influence of construction activities on the agricultural community and are of a more socio-economic nature. For these, mitigation measures are also recommended. Otherwise, commercial agricultural activities could continue normally in the surrounding areas.

According to the Northern Cape Department of Agriculture the grazing capacity of this area is 30 to 32 hectares per Large Stock Unit (Erasmus, 2010) and the area has a low agricultural potential.

The possibility of maintaining some level of grazing between the supporting structures could possibly be considered during the operational phase. Construction activities would cause a loss of grazing but during the decommissioning phase most of these impacts would cease and the land would possibly, over a period of time during the operational phase, return to a state suitable for grazing, as construction phase impacts would lower over time due to the re-establishment of vegetation.

Mitigation Measures

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

Table 3: List of impact descriptions and mitigation measures recommended (Appendix D6)

Impact description	Mitigation measures recommended
Land loss for grazing	Although low in potential, some of the areas are currently used for grazing. It is recommended that any vegetation removed during construction is re-established once the power station is commissioned
Storm water	Should runoff directions be disturbed by construction activities or by the footprint of the power station, the necessary control measures should be implemented to prevent erosion.
Water erosion	Should soil and gradient be disturbed and vegetation removed during construction, soil should be compacted and vegetation re-established.
Wind erosion	Should soil and gradient be disturbed and vegetation removed during construction, soil should be compacted and vegetation re-established. Windblown dust should be prevented by watering down the working areas.
Construction rubble and other waste may spill into rivers or be carried onto neighbouring agricultural land by runoff water.	Rubble and waste should be removed from the construction site regularly.
Degradation of roads (used by farmers) due to heavy construction vehicles.	Maintenance of roads should be undertaken throughout the construction and operational phases.
Increased heavy vehicle traffic due to construction.	Truck drivers and other heavy machinery operators should be made aware of pedestrians, stray animals and stock herders on the roads.
Loss of farm labour to construction	The proponent should refrain from employing farm labourers for construction purposes. It should be explained to such applicants that they would exchange permanent jobs for temporary jobs.
Security risks	All possible measures should be implemented to prevent construction workers from entering neighbouring farms.
Risk of injury to people and animals	The construction site should be fenced in to prevent children and animals entering the site and getting injured.
Potential third party tampering	Permanent security fencing should be erected to prevent ignorant and innocent tampering by third parties.
Depletion of groundwater resources used for stock watering, due to construction activities.	It is recommended that a proper study of the needs for the construction is compared with the needs of local stock farmers and the available groundwater.

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;
- implementation of associated infrastructure:
  - Internal electrical reticulation approximately 500 mm below ground
  - Concentrator boxes with inspection covers, transformation centres and a distribution centre
  - 36 kV evacuation power line from the distribution centre to the Eskom Greefspan Substation
  - 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
- 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 are 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.

An ecological specialist study has been conducted on the study area (Appendix D1). 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.

The authorised 10MW PV power station would not constitute a cumulative in this instance as the specialist studied the entire site of both application areas together and assessed it as a unit regarding the development footprint and anticipated impacts related to the activities in total.

Flora

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. However, none of it is formally conserved (Mucina & Rutherford, 2006) and human settlements are increasing in the north eastern part. The continuous loss of vegetation may lead to increased vulnerability and change in conservation status.

No sensitive areas (Breedlove, 2000) or biodiversity hotspots (DEAT, 2006) have been mapped in the study area or the area directly surrounding the study area.

Uninterrupted habitat is a highly valued commodity, especially in areas that are characterised by moderate and high levels of transformation. Loss of natural habitat, even of small areas, means that biological attributes have permanently lost the ability of occupying that area. A higher premium is then placed on available food, water and habitat resources in the immediate area. In some cases the loss of habitat would cause a proportional decrease in the size of plant or animal populations that can be sustained by the habitat, eventually decreasing beyond a viable population size. The danger of this type of cumulative impact is that its effects are not known or visible with immediate effect. Normally when these effects become visible the damage is beyond repair.

The development would necessitate the removal of flora. The destruction of threatened and protected flora should be avoided where possible, as this would represent a significant impact on the biodiversity of the region.

No threatened or Red Data species were identified during the Ecological Impact Assessment.

No pristine natural regional habitat and atypical or sensitive habitat types (e.g. mountains, ridges, koppies, wetlands, rivers, streams and localised habitat types of significant physiognomic variation and unique species composition that are frequently linear in nature) have been identified during the specialist ecological impact study (Appendix D1).

Floristic species changes would inevitably occur in the development area, as vegetation would be removed and replaced by PV modules, resulting in changes in habitat conditions, such as shade, competition and germination success. Therefore it is expected that the species

composition of the development area would change, and the establishment of habitat types that are not representative of the region is probable. Changes in habitat conditions could also facilitate invasion by exotic and invasive species as well as increases in the populations of encroacher species that are not currently abundant in the area. While this effect is more easily perceived in the floristic component of habitats, faunal occupation of changed habitats would inevitably be affected.

This risk could result in habitat decreases, as well as increased competition which could, in turn, decrease the numbers of endemic biota. The genetic pools of species might be changed by the introduction of non-endemic species.

Depending on the sensitivity of surrounding habitats these impacts could also occur as indirect impacts on the surrounding environment.

Local fragmentation and isolation of habitats, as well as environmental degradation, are inevitable when development occurs. These effects are regarded as cumulative impacts, as they contribute to the local and regional state of the environment. The specific effects of the proposed development should therefore be viewed together with those of existing and possible future developments in the area, and the overall effect on the national conservation obligations and targets should be assessed (Strategic Environmental Assessment).

The disturbance associated with the construction phase may result in the establishment of alien or indigenous invader plants that might cause a loss of indigenous vegetation, changes in and fragmentation of habitat structures and characteristics, changes in plant species composition, changes in the chemical properties of soil and hydrological impacts due to changes in soil cover and runoff. Some invader species are highly flammable and therefore increase the risk of veld fires. Blackthorn is increasing on grazing farms in this vegetation type in the Northern Cape due to various reasons.

Fauna

An overall total of 37 reptile and seven amphibian species, none of which appear in the current Red Data Book for Endangered Species, may occur in the study area. Reptiles that could occur include tent tortoise and leopard tortoise, as well as a wide variety of snakes and lizards. All tortoise species currently enjoy protected status. Amphibians are not expected to occur on the site, as there are no open water bodies. (Erasmus, 2010) (Appendix D1)

A total of 61 mammal species, of which eight were observed during a site visit, could occur in the study area. No Red Data Book (RDB) species were recorded during the survey. Animal life observed in the area include antelope such as klipspringer, as well as small mammals like cape hare, porcupine, springhare, ground squirrel, Bushveld gerbil, yellow mongoose and aardvark. The site does not provide a critical habitat for the aforementioned wildlife and no threatened or endangered species are known to occur on the site. (Erasmus, 2010) (Appendix D1)

As faunal species are able to migrate away from the area of impact, the probability of direct impacts on threatened, near-threatened and common faunal species are regarded as low. No localised habitat occupied by threatened species occurs at the study area or within the wider study area. Most of the threatened fauna species potentially occurring in the study area have relatively wide habitat preferences and ample suitable habitat is presently available in areas surrounding the study area. It is estimated that habitat loss and transformation resulting from non-invasive and often overlooked impacts, such as overgrazing, infestation by invasive shrubs and selective hunting probably contribute more to impacts on most threatened fauna species than power station developments.

The tolerance levels of common animal species occurring in the study area are of such a nature that surrounding areas would adequately supply for the habitat requirements of species forced to move from the areas of impact. Indirect impacts on fauna could occur due to loss of habitat and faunal interactions with the structures, servitudes and personnel. It is however unlikely that the conservation status of common animal species would be affected as a result of direct and/or indirect impacts of the operational phase on these species and their habitats.

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.

Herpetofauna

An approximate total of 37 reptile and seven amphibian species, none of which appear in the current Red Data Book for "Endangered species", may be encountered at the study area. No amphibian species were recorded and it is doubtful whether they would ever occur because no open water is found on site. No reptiles were observed either, but some are sure to be recorded in summer months. All tortoise species currently enjoy protected status. (Erasmus, 2010 (a))

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 photovoltaic power stations near Ovaal, Herbert, Greefspan and Welcome Wood Substations, Northern Cape. (Appendix D2) Following a site visit on 5 November 2010 to Ovaal, near Douglas, a desktop assessment was undertaken to identify the major avifaunal issues associated with this infrastructure. This was considered adequate for assessing the major issues associated with the impacts of the current project activities and those envisaged for the immediate future on the relevant avifauna and bats in the area. A desktop analysis of the avifaunal issues at the other three sites was then undertaken, as well as a desktop investigation into the effect of the projects on bats at all four sites.

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 20 bird and four bat species of potential conservation significance that may occur in the general area of which none were considered to be permanently resident at any of the proposed sites. 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 directly and negatively influenced by the PV stations.

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 these factors that could negatively impact on avifaunal species were identified and discussed, 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.

Feasible and practical management proposals include:

- 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 and maintaining an appropriate buffer zone between these areas and the erected structures;
- reducing noise, air, soil and water pollution as far as possible;
- 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;
- 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.

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.

The specialist also pointed out that Red-billed Quelea could be of some concern in this region, although it is not conservation-worthy. Given the close proximity of the Vaal and Orange Rivers and associated reedbeds adjacent to cultivated lands, it may be possible that extremely large flocks of **Red-billed Quelea** may be present depending on the season and types of planted crops near to the proposed site. A declared problem species often referred to as the "Feathered Locust", it is possible that this quelea may use the panels as alternative perching sites in the absence of reedbeds. Defecation on the panels of this magnitude would certainly interfere with power generation, as opposed to occasional incidental mishaps.

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.

Mammalifauna

Available literature and own research records list a total composition of 61 mammal species for the study area. A number of nine of these species were observed directly or indirectly during the survey of the study area. No Red Data Book (RDB) species were recorded during the survey. (Erasmus, 2010 (a))

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 that will ensure that any environmental sensitive aspects identified during the EIA investigation is taken into consideration.

Habitat destruction and fragmentation and the loss of land capability would be the main negative impacts on vertebrate species, while contamination of the genetic integrity of species and an increase in predator-prey interaction would be considered lesser impacts. (Erasmus, 2010 (a))
None of the encountered vertebrate species at the study area is unique to the Northern Cape Province and the power generation would only have a medium-term effect on the vertebrate faunal component at the site. The power generation would not impact negatively on the ultimate survival or dynamics of the encountered taxa. (Erasmus, 2010 (a))

Ecological effects on plants, if minimally removed would be minimal. If plants are hardly disturbed, the effects on terrestrial animals would also be minimal, depending on the type of fence that is constructed and the type of restriction the fence places on free movement of these species. Electrification of fences for the restriction of crawling animals is discouraged as this kills many non-target animals such as tortoises and pangolin. If such a fence is considered, the electrical fence contractor must discuss the configuration of the fence with an ecologist. Problems with baboons and monkeys are not foreseen because the area is too far from the river. If however, problems are encountered, measures such as electrical fencing or other non-lethal measures could be implemented. (Erasmus, 2010 (a))

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 the majority of employment opportunities created during the construction phases would be offered to local workers, with contractors importing only 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 phases are expected to last approximately six to nine months each. 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 AE-AMD Renewable Energy. 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.

Aspects of the construction phase that might impact upon land use include the following:

- Due to the fact that the construction phase would be phased, grazing would be possible on the sections not yet utilised as well as on the sections where the vegetation cover has been rehabilitated to such a stage that grazing could be accommodated.
- Infrastructure for extracting water from nearby aquifers would have to be implemented if water is not sourced from the local municipality. However, water has been confirmed to be available by the Siyancuma LM who is a registered Water Services Provider.
- Should water be sourced from an aquifer, a pipeline would be needed for transporting the water from the place where it is pumped from the aquifer to the power station. If the pipeline is placed underground, its impact on land use would be limited to the construction phase.
- During construction of the evacuation lines, the land within the servitude would temporarily be lost to grazing.

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.

The physical presence of the plant and ancillary infrastructure would cause direct impacts in the area immediately surrounding the study area. These impacts might extend to landowners and residents in the area immediately surrounding the study area.

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.

Aspects of the operation of the proposed PV power station that might impact upon land use include the following:

- The unused areas would be available for other land uses such as grazing during the operational phase.
- Infrastructure for extracting water from nearby aquifers would have to be implemented if water is not sourced from the local municipality or water board.
- Should water be sourced from an aquifer, a pipeline would be needed for transporting the water from the place where it is pumped from the aquifer to the power station. If the pipeline is placed underground, its impact on land use would be limited to the construction phase.
- The evacuation line linking the power station to the grid would have a length of less than 200 meters and would be located within the footprint of the study area, as the power station would be phased around the Greefspan Substation where the power would be fed into. During operation, the agricultural use of this area could be resumed, as livestock could move between the pylons and PV structures.

Mitigation Measures

It is recommended that the percentages of local labour as prescribed by EPWP 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.

AE-AMD Renewable Energy 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. Communication in this regard has already been established with Siyancuma Local Municipality. 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. Such trusts would have the following purposes:

- to provide scholarships to school leavers in the Northern Cape Province who wish to study engineering, science or maths at tertiary level;
- to subsidise science and maths teachers' salaries at schools in the Northern Cape Province so as to enable those schools to attract good and well-qualified teachers;
- to subsidise the purchase of laboratory equipment and mathematical teaching aids in schools in the Northern Cape Province; and
- to provide support for students from the Northern Cape Province by way of bursaries or scholarships for mathematics, engineering or scientific education at a tertiary institution.

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 PV Modules could possibly be sourced from Tenesol's factory in South Africa. 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. The numerous uncertainties associated with the renewable energy strategy launched by NERSA are also influenced by the requirements of the Department of Energy and the Treasury, as well as those set by the different financial institutions.

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 30 to 32 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. The area could potentially still support agricultural use. (Figures 32-33)

Figure 32: Dual purpose use of grazing land (Energiequelle)

Figure 33: PV Power Station vs. Olive Tree Cultivation

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, masts for lightning conduction, 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.

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.

The impact of noise during the operational phase would be negligible, involving possible humming from transformers, wind whistling from overhead evacuation lines and across the PV modules, and guards' radios.

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 approximately 500 meters 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.

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 directly adjacent to the study area, 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 approximately 500 m 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, the small surface area of the frames, 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. (Arce, 2010)

Figure 34: 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 AE-AMD need to obtain SACAA consent for the proposed development. Find attached a copy of the consents AE-AMD received for the Greefspan PV I project authorised (Appendix G 3.2). The application to SACAA for this proposed development is being conducted as a parallel process to the EIA. Since approval has been granted for the Greefspan PV I project, it is foreseen that the current application would be granted.

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 David Morris of the McGregor Museum, Kimberley in June 2010 and January 2011 (Appendix D3). Dr Morris is an archaeologist accredited as a Principal Investigator by the Association of Southern African Professional Archaeologists. His previous experience includes research and impact assessments in the Northern Cape including the area around Douglas. (Morris, 2011)

The site was examined in detail on foot by Dr Morris in June 2010 and January 2011. With relatively minimal vegetation cover, surface finds were easily located and Dr Morris did not expect that much archaeological material would occur below the modern surface consisting of shallow sand. A low density of artefacts of differing typological character was observed at the surface throughout the area investigated. There remains a slight possibility that sub-surface sites occur, which should be borne in mind during the development phase. (Morris, 2011)

The major destructive heritage impact that could possibly occur as a result of the proposed PV power station development would comprise a direct, once-off event during the initial construction period. An access road to the adjacent power station already exists and secondary

impacts from such a source may therefore be ruled out. With respect to the magnitude and extent of potential impacts, power station construction would involve modification of the landscape surface within the indicated area, involving total surface disturbance corresponding with the footprint of the proposed power station. (Morris, 2011)

The specialist's finding was that, while stone tools were noted across the entire site, they occurred in very low densities and their occurrence there was not of high significance. There were no colonial era built structures in the areas examined and no artefacts of this period (e.g. porcelain, metal) were noted. The substrate exposed on the hill slope appeared to consist of tillite and no shales were noted. (Morris, 2011)

The Phase 1 Archaeological Impact Assessments are attached in Appendix D3 of this report.

Palaeontological Aspects

The Palaeontological Impact Assessment: Desktop Study was conducted by Dr John Almond (see experience in report attached in Appendix D4).

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. Therefore further palaeontological mitigation of this project is not considered necessary.

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)

As the studies were conducted for both the authorised 10MW PV power station and the applied 40MW PV power station study areas as a continuous study area, cumulative impacts are not applicable.

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 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.

All of the land surrounding the substation is privately owned and is currently being used for livestock farming purposes. The small size of the population means that relatively few people would see the plant daily at this site. Traffic to the area, which is currently very limited, would increase dramatically during the construction phase, which 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 all the aggregate (gravel and sand) for Douglas will be sourced from commercial sources in Douglas and the surrounding area. Refer to the section on water usage and concrete batching for the amounts of concrete that would be needed for the different types of technologies as well as different methods of footing construction.

The bulk of the water is required for concrete in the construction phase and in discussions during the week of 5 March 2012 between AE-AMD and the Siyancuma LM about the proposed project, they have confirmed that there is water available at the peak draw down rates of 60 600 l/day, which is AE-AMDs estimated peak construction demand, required for the authorised projects on an on-going basis. (Appendix G 3.1) The same procedure would be followed as has been done for the authorised site and AE-AMD would thus confirm it once they have received updated information on water requirements from Tenesol, the EPC contractor appointed. AE-AMD would then confirm this arrangement with DWA.

The single-axis tracker system, using either driven pile or concrete pile foundations, or fixed structures are options available. These foundation types would require much less concrete and water than the mass concrete block foundation, which is the only type that is suitable for the double-axis tracker system. The environmental impact of the driven pile, concrete pile footing or fixed structure construction method 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, that is currently under way, 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 34)

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, trackers, 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. (AE-AMD, 2011)

These selection criteria, done by AE-AMD 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 by AE- AMD:

- 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 no 'no-go' areas have been identified.

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 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. Should more than 20 kℓ be required and available to be withdrawn per day, a Water Use Application should be lodged with DWA.

Hydrology (surface water)

For the authorised projects the water for construction and operation would be sourced from the Siyancuma Local Municipality who are a registered Water Service Provider and this arrangement has been confirmed by DWA. (Appendix G 3.2)

The bulk of the water is required for concrete in the construction phase and in discussions during the week of 5 March 2012 between AE-AMD and the Siyancuma LM about the proposed project, they have confirmed that there is water available at the peak draw down rates of 60 600 l/day, which is AE-AMDs estimated peak construction demand, required for the authorised projects on an on-going basis. (Appendix G 3.2) The same procedure would be followed for the Greefspan PV II application as has been done for the authorised Greefspan PV I site and AE-AMD would thus confirm it once they have received updated information on water requirements from the EPC contractor. AE-AMD would then confirm this arrangement with DWA. This is a process that is being conducted parallel to the EIA.

The developer proposes the use of the Enviro Loo system, which would not have any notable impacts on the environment.

3.3.2 Impacts on Ecology and Biodiversity (including flora, fauna and specifically avifauna)

The biggest impact would occur during the construction phase of the proposed development. After mitigation measures have been considered, habitat transformation, due to the removal of vegetation remain high.

3.3.3 Socio-economic Impacts

After taking into consideration the mitigation measures as stipulated in the Environmental Management Programme the safety and security and land use issues remain high. An influx of workers can be controlled and mitigated by following the stipulations in the EMP.

3.3.4 Traffic Impacts

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 for long periods of time. The public would have to be notified through local and regional radio stations when large numbers of freight-carrying vehicles would be on the roads. By implementing the mitigation measures proposed, the developer/contractor would be able to limit the traffic impacts on the region and especially the local area.

3.3.5 Visual and Aesthetical Impacts

The PV power station will have a visual impact on users of the roads, farm homesteads in the vicinity, and tourists using the provincial road. This facility would however be much lower than a CSP and wind power plants. It would provide several advantages over

conventional power generating plants: it would use a renewable source of energy to generate power; it would not omit any harmful by-products or pollutants and would not pose any health risks to observers. It would also invoke curiosity and could become a tourist attraction or a landmark within the region. It would therefore be advisable to promote it as such.

It would not be possible to mitigate the visual impact of the PV power station. Housekeeping at the facility should be in order and other aspects such as dust and other nuisances can be mitigated as stipulated in the EMP.

The evacuation line, that would connect the PV power station to the Greefspan Substation, would have a length of less than 200 meter and would be situated within the study area. Therefore all impacts and aspects identified and addressed within the study area also include this evacuation line and other associated/ancillary infrastructure. The evacuation line would possibly be aligned with the existing power line on the study area, which would partially mitigate potential negative impacts.

3.3.6 Impacts on Heritage Resources

An Archaeological Impact Assessment (AIA) Phase 1 as well as a Palaeontological Scoping Study has been conducted at the study area and no heritage resources have been identified. Mitigation measures, which must be implemented in the event of any future heritage findings, have been addressed in the EMP.

3.4 No-go alternative (compulsory)

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 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 at a rate of approximately 419kVA per annum from 2007 to 2010 (Du Plessis, 2010). 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

Figure 1:	Locality Map
Figure 2:	Status Quo
Figure 3:	Site Development Plan
Figure 4.1:	Regional Topographic Map
Figure 4.2:	Regional Cadastral Map
Figure 4.3:	Regional Land Types Map
Figure 4.4:	Regional Vegetation Map
Figure 5.1:	Digital Elevation Model
Figure 5.2:	Slope Analysis
Figure 5.3:	Visibility Analysis
Figure 6:	Soil Groups and Soil Sample Points

Appendix B: Photographs

Photographs 1-3:	Greefspan Substation
Photographs 4-6:	Cabling structures at Greefspan Substation
Photographs 7-8:	Access road to the substation
	Photo series 1: Panoramic view to the north of the site, taken from west to east
Photo series 2:	Panoramic view to the east of the site, taken from north to south
Photo series 3:	Panoramic view to the south of the site, taken from east to west
Photo series 4:	Panoramic view to the west of the site, taken from south to north
Photo series 5:	Junction where the substation access road meets the R357.
Photo series 6:	South eastern corner of the farm Kwartelspan No. 25
Figure 1:	Map with Locations from where Photographs were taken

Appendix C: Facility illustration(s)

Figure 1:	Preliminary Layout Plan – Fixed Structures
Figure 2:	Fixed Structures (Tenesol)
Figure 3:	Preliminary Layout Plan - Trackers

Appendix D: Specialist reports (including **terms of reference**)

Appendix D1: ToR
Letter from the Specialist
Ecological Impact Assessment
Ecological Impact Assessment: Initial Area
Ecological Impact Assessment: Expanded Area
CV: B.H. Erasmus

Appendix D2: ToR
Letter from the Specialist
Avifauna and Chiroptera (Zoology) Study

Appendix D3: ToR
Letter from the Specialist
Phase 1 Archaeological Impact Assessment

Appendix D4: ToR
Letter from the Specialist
Palaeontological Impact Assessment
Appendix D5: ToR
Letter from the Specialist
Visual Impact Assessment
Appendix D6: ToR
Letter from the Specialist
Agricultural Impact Assessment

Appendix E: Comments and Responses Report

Appendix F: Environmental Management Programme (EMP)

Appendix G: Other information

Appendix G1: Authorisation of the 10MW PV Power Station
Communication from DEA
DEA Confirm Receipt of Draft BAR

Appendix G2: Public Participation Process Phase 1
G2.1: Distribution of Notification Letters to identified I&APs, stakeholders and government
G2.2: Response Form
G2.3: Background Information Document (BID)
G2.4: Proof of Distribution of Notification Letters, Response Form, and BID
G2.5: Advertisement (Crazy Ads) dated 20 January 2012
G2.6: On Site and other Notices
G2.7: List of Stakeholders and Registered I&APs
G2.8: Comments Received:
CSIR; JD HIGGS; JA WIID; JP FERREIRA; HERITAGE NC; SAHRA; DAFF (FORESTRY)
G2.9-1: Distribution of Draft BAR – Letters
G2.9-2: Distribution of Draft BAR - Emails
G2.9-3: Proof of Emails sent
G2.9-4: Proof of Registered Post and Courier
G2.9-5: Comments & Responses Received on D BAR
(Telkom, Rockwell Diamonds)
Appendix G3.1: Communication with Siyancuma Local Municipality and DWA Regarding Water Supply
G3.2: SACAA Authorisation
G3.3: Siyancuma Local Municipality Rezoning Authorisation

Appendix G4: 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 of Greefspan Study Area

- Figure 1: Locality Map
- Figure 2: Status Quo
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- Figure 4.1: Regional Topographic Map
- Figure 4.2: Regional Cadastral Map
- Figure 4.3: Regional Land Types Map
- Figure 4.4: Regional Vegetation Map
- Figure 5.1: Digital Elevation Model
- Figure 5.2: Slope Analysis
- Figure 5.3: Visibility Analysis
- Figure 6: Soil Groups and Soil Sample Points

Appendix B:

Photographs of Greefspan Study Area

Appendix C:

Facility Illustrations

Figure 1: Preliminary Layout Plan – Fixed Structures
Figure 2: Fixed Structures (Tenesol)
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Appendix D:

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

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- Letter from the Specialist
- Palaeontological Impact Assessment

Appendix D5: ToR
- Letter from the Specialist
- Visual Impact Assessment

Appendix D6: ToR
- Letter from the Specialist
- Agricultural Impact Assessment

Appendix E:

Comments and Responses Report

Appendix F:

Environmental Management Programme

Appendix G1:

- **Environmental Authorisation of the 10MW PV Power Station**
- **Communication from DEA – Downscale**
- **Receipt Draft BAR**

Appendix G2:

Public Participation Process Phase 1

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Appendix G3:

Communication with Siyancuma Local Municipality and DWA Regarding Water Supply

Appendix G4:

Title Deed Information

Appendix G5:

Significance Rating Scale Impact Matrix

Appendix G6:

Curriculum Vitae – I.B. van Zyl