Final Environmental Impact Assessment Report:

The establishment of a 75MW solar farm on the farm Grootspruit 252/0, Odendaalsrus RD, Free State Province, South Africa

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Background

H2ON Environmental Specialists is a Bloemfontein based company with expertise in specific environmental fields but also in the coordination of larger environmental management project that involves outside contracted expertise for specialist investigations.

We provide our clients with a professional service and cost effective solutions to their environmental problems to conduct their activities, development or explore natural resources like minerals, surface and ground water, without negatively impacting on the environment.

H2ON endeavours to provide a high quality service and prompt completion of deliverables

Fields of Expertise:

Environmental management	Bio monitoring
ISO14001 implementation and auditing	Pollution control
Water use licence applications	Solid waste management
Environmental impact assessments	Geological and geohydrological
Environmental auditing	investigations
Mining authorization application	Heritage Impact Assessments
Catchment Management	Botanical Surveys
Water Quality Assessments	Rehabilitation
Development and management of	Ground- and surface water monitoring
	programs

Professional Team:

Name	*Qualification*	**Specialist field**
Gys Hoon	B Sc, Geochemistry and Geology1988 B.ScHonors in Geohydrology 1989 Professional Standing: Registered as a professional scientist: *Pr.Sci.Nat* 4 00004/93 SAATCA Registered ISO 14001 environmental management systems auditor: E061	Mining authorization applications ISO 14001:2004, audits, training and implementation Water use right applications Environmental Impact Assessments Groundwater investigations Environmental audits Water quality investigations Catchment management Development of environmental monitoring systems Environmental risk assessments Waste Management Application for mining authorization, water use authorizations and waste Disposal permits
Darius van Rensburg	2007- B.Scspes Botany and Zoology 2008 – B.ScHonors in Botany 2012 – M.Sc. in plant ecology	Ecological Assessments Biodiversity Analysis Environmental Impact Assessments Vegetation Assessments Riparian Vegetation Succulent Vegetation

Refer to Annexure 5 for the expertise (CVs) of the professional team.

EXECUTIVE SUMMARY

Receiving Environment:

The soils of the area contain swelling and shrinking characteristics. Plant available water is low and plant root development is inhibited by the high clay content and compaction of the soils. The study area is of low agricultural potential and can only be used for carefully managed grazing.

The region has a relatively flat topography with slightly undulating plains. The study area itself contains a gradual slope toward the north and a small seasonal stream is located immediately north of the site. The stream is of an annual nature and flows only after heavy rains. The region is currently utilised for extensive agricultural activities. The site itself is currently utilised for grazing by cattle and ostrich.

The vegetation on the site consists of Vaal-Vet Sandy Grassland (Gh 10) with some elements of Highveld Alluvial Vegetation (Aza 5) along the seasonal stream on the property. Vaal-Vet Sandy Grassland is regarded as Endangered (EN) due to transformation for agriculture.

This natural area is relatively isolated and does not form part of a large natural area. It does however function as a refuge for many terrestrial mammals.

The area does not contain a high diversity of bird life but there is a likelihood of several endangered species occurring on the site (Secretary Bird, Melodius Lark and Lesser Kestrel). The proposed facility would essentially transform the site and exclude the area as suitable habitat for these endangered species.

There is a high likelihood that the Giant Bullfrog (*Pyxicephalusadspersus*), which is listed as being Near Threatened, occurs in the area. However, if a buffer zone of 30 meters is respected along the annual stream occurring on the property the impact on the species would be low.

There is a high likelihood that the endangered Sungazer Lizard (*Cordylusgiganteus*) which is listed as Vulnerable (VU) may occur on the site. Though no specimens could be identified on the site the possibility of this species occurring on the site is highly likely.

The site proposed for the solar facility contains a large population of trapdoor spider. These spiders are protected in the Free State Province and are also listed in the IUCN Red List as Data Deficient meaning that not enough data is available to evaluate the status of these species.

The Stone Age archaeological footprint in the region is represented by the occurrence of open-site assemblages none of these occur on or near the site. There are no records of rock engravings in the area and the survey area is situated outside the western periphery of distribution of Late Iron Age settlements in the Free State.

The slope gradient of the region is low with no hills, ridgelines, spurs or steep slopes. For these reasons the facility would only be visible from short distances.

This project could provide additional financial growth to the straggling economy of Matjhabeng Local Municipality. This project is not dependant on mining in any way and will therefore be an investment that will not be manipulated by downscaling of mines in the area. This project will therefore have a major positive impact on the regional economy.

Project Description:

The proposed Grootspruit Solar Farm Project is a project proposal that will include the development of a Photo Voltaic solar farm and related infrastructure to the extent of 180 ha which will include the following (refer to map 4 in **Annexure 2**):

- Solar panels will consist of Photo-Voltaic cells placed on aluminium structures. These panels will be mounted on fixed mounting structures and will have a height of 3.4m.
- Inverter/Transformer enclosures (21m^2 area)
- Grid connection substation (convert 22kV to 132kV)
- Connection to Eskom power grid by means of two 132kV overhead power lines. The electricity produced will connect via the Grootkop-Kutlwanong power line on the site.
- Guard house (26m^2 area).

Excavation of the topsoil will only take place where cables are inserted as well as areas where foundations will be excavated for the construction of the guardhouse, inverters and substation.

The existing farm dirt roads will be utilised to gain access to the site. However, this access road will be upgraded to ensure access of construction vehicles to the proposed site.

General waste will be generated by the construction crew during the construction phase of the development as well as a limited amount of waste during the operational phase. This waste will be collected in containers and removed on a weekly basis to the nearest authorised landfill site (Allanridge/Odendaalsrus).

During construction sewage will be managed by on-site chemical toilets. During the Operational Phase the sewage generated will be managed by the use of a composting toilet which makes use of an aerobic process to treat human waste material. The system would not utilise water for the functioning and would therefore not produce any effluent.

During the Construction Phase water will be used for human consumption by the construction crew, dust control, moisture conditioning of roads and foundations for compaction. It is estimated that these activities will utilise an amount of 4 800 000 litres during the construction phase. During the operational phase the facility will use an approximate amount of 750 000 litres per year. This amount of water will be utilised for the cleaning of the Photo Voltaic solar panels.

The facility will utilise limited electricity for operational activities on the site. This electricity will be sourced directly from the power produced by the plant. The facility will produce electricity for Eskom to the amount of 75 MW. This electricity produced will be fed into the Eskom grid via the Grootkop-Kutlwanong power line on the property concerned.

The construction team will consist of 291 employees of differing responsibilities and expertise. The operational phase will consist of 59 permanent employees of differing responsibilities and expertise.

Alternatives:

In order to minimise the negative impact that the development would have the evaluation of several site and technological alternatives were considered for this development.

All the site alternatives are situated on the farm Grootspruit 252/0, Odendaalsrus RD. All of the alternatives overlap and are situated adjacent to another. Several alternatives have been suggested by the applicant. However, upon investigation it was found that the cultivated cropfields and annual stream would have to be excluded from the development. Exclusion of these features has yielded the preferred development area.

Concentrated Solar Power (CSP) is considered as an alternative technology but due to the high water requirements and the high impact on the birdlife the technology is rendered unfeasible.

Following detailed investigation and analysis, it was found that Dual axis tracking technology is a feasible alternative but not preferred as it produces less power and costs more than fixed structures, for the land area under consideration.

The preferred technological alternative is the use of fixed mounted Photo Voltaic solar panels.

The “no-go” alternative would entail that no development of the area takes place.

Impacts:

The proposed development will have a low-moderate impact on the Geology and Soils, Topography, Land use, agricultural potential and soil capacity.

The impact on the natural vegetation is rated as being moderate. Although the facility will be situated within an Endangered vegetation type (Vaal-Vet Sandy Grassland), the area contains a relatively low diversity and no rare, endangered or protected plant species and therefore the impact is rated as moderate.

The impact on the mammal population, avifauna and amphibians would be low-moderate as long as the seasonal stream is excluded from development as this would entail a high impact.

The impact on the reptile population is rated as moderate-high due to the high likelihood that the Endangered Sungazer Lizzard (*Cordylusgiganteus*) occurs in the area. Recommended mitigation measures should be strictly adhered to, to ensure the smallest impact on the likely Endangered species.

The impact on the Arachnid populations is rated as moderate due to the high density Trapdoor Spider (*Stasimopus sp.*) population in the area. This is a protected species in the Free State Province. Mitigation measures should be strictly adhered to, to minimise the impact on this population.

The impacts on the surface- and groundwater are rated as low as long as the seasonal stream on the property is excluded from the development.

The visual impact of the development is rated being low-moderate. This is primarily due to the low population density and isolation from any residential areas and major roads.

The socio-economic impacts are a major positive impact on the surrounding area due to the large amount of job opportunities and well developed socio-economic development strategy.

In conclusion it can be said that the development does not present an overall high impact, but some elements are regarded as having moderate and moderate to high negative impacts and in these cases the recommended mitigation measures would have to be strictly adhered to and bio monitoring would have to be enforced.

TABLE OF CONTENT

1 INTRODUCTION

1.1 The Applicant

Name: Solairedirect Southern Africa (Pty) Ltd

Registration Nr: 2009/010518/07

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Contact person: Reggie Niemand (Project developer)

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1.2 Name and address of the property owner

Name: GrootspruitFamilie Trust

Registration Nr: TMP 2471

Postal address: P.O.Box 226, Bothaville, 9660

Contact person: Tertius de Jager

Tel. Nr: 056 515 1658

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1.3 Name and address of the Environmental Assessment Practitioner

Name: H2ON Environmental Specialists

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Contact person: Darius van Rensburg

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Fax Nr: 086 697 6132

E-mail: darius@h2on.co.za

1.4 The property

Property description

Farm name and number: Grootspruit 252

Farm portion: Remainder

Area: 689.7224 ha

Title deed: T22485/1879

Surveyor General Code: F02400000000025200000

Province: Free State Province

District Municipality: Lejweleputswa

Local Municipality: Matjhabeng

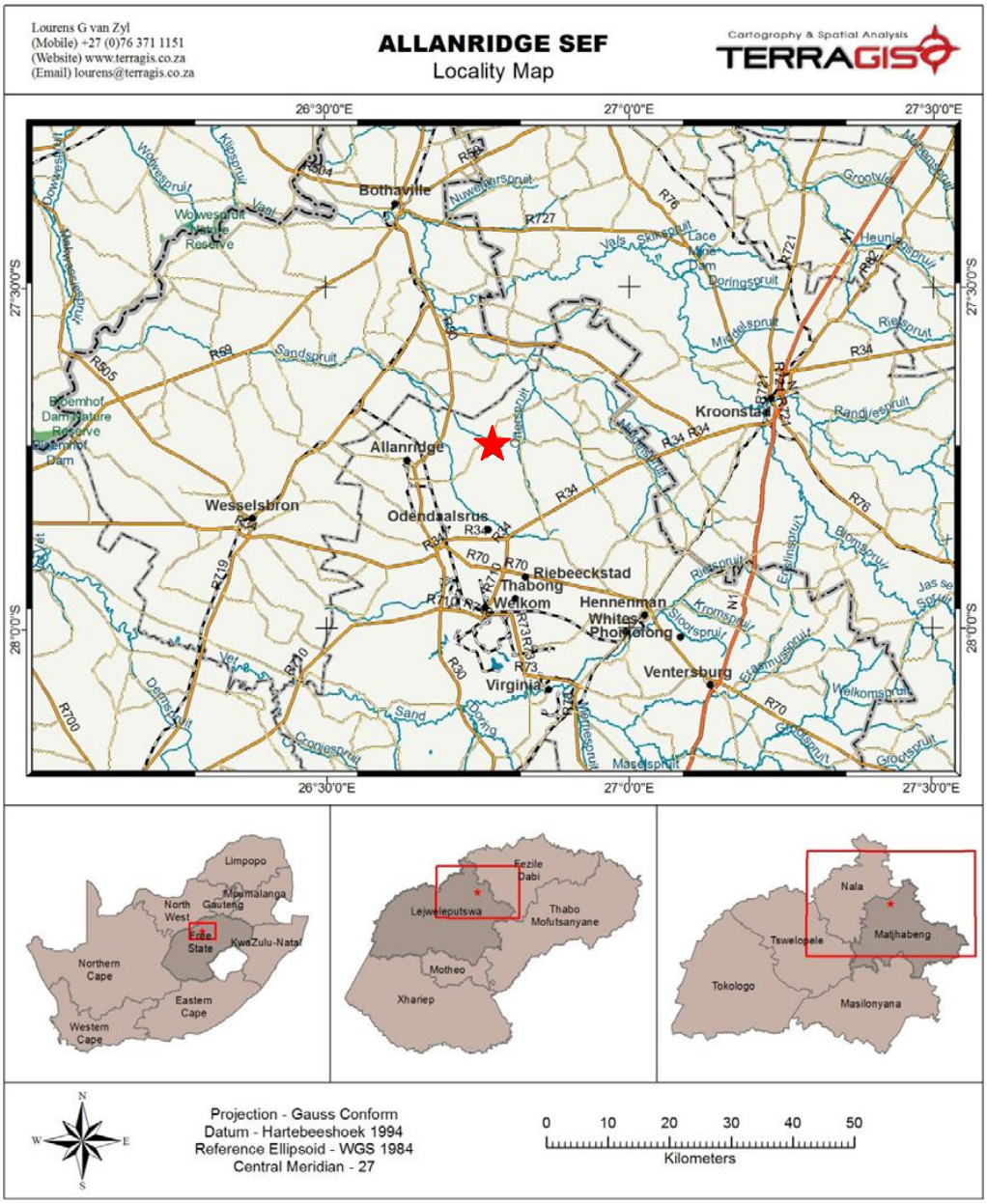


Figure 1: Location of the proposed development.

1.4.1 Direction to the nearest towns

The site is located 16km from the town of Allanridge (Map 1 & 3). This town also constitutes the nearest industrial area to the site. The site may be reached from this town by taking the R30 Provincial Road north towards Bothaville (8.3km) and turning off on the S940 Gravel Road (7.7km) towards the property.

The town of Odendaalsrus is also located near the site but further than Allanridge. The site may be reached from Odendaalsrus by taking the R34 Provincial Road east (16.1km) and turning off on the S173 Gravel Road (12.3km).

1.4.2 Surface infrastructure

Surface infrastructure on the farm Grootspruit 252/0 is limited to farming sheds, aboveground diesel tanks, cattle crush-pen, water troughs, windmills, boreholes and three farm workers houses.

1.4.3 Roads

The following gravel roads occur adjacent to the property:

The S940 Gravel Road is located to the west of the site and passes through the farm property. This gravel road services the farms in the area and is used by the farmers and farming vehicles.

The S161 Gravel Road is located to the north of the site; it does not transect the property. This gravel road services the farms in the area and is used by the farmers and farming vehicles.

The S173 Gravel Road is located to the east of the site; it does not transect the property. This gravel road services the farms in the area and is used by the farmers and farming vehicles.

1.4.4 Water

Groundwater is currently utilised for limited stock watering on the property. This is classified as 'n Schedule 1 water use in terms of Section X of the National Water Act, 1998 (Act 36 of 1998) and does not require a water use license or registration.

1.4.5 Presence of servitudes

The Grootkop-Kutlwanong Eskom transmission line occurs on a portion of the property (Map 4). This 132kV Eskom Powerline has a 22m servitude.

1.4.6 Land tenure and use of immediately adjacent land

The farm Grootspruit 252/0 is bordered by other farming properties. The land use on these farms is primarily associated with maize cultivation. These neighbouring properties are as follows:

Table 1: Detail of landowners adjacent to Grootspruit 252/0

Owner	Farm name and number	Farm portion
Leeuwkuil Trust	Leeuwkuil 41	Remainder
Mr. J.C.F. Taljaard	Zooikraal 101	Portion 1
Mr. J.C.F. Taljaard	Langverwacht 281	Remainder
Bob Moolman Trust	Langverwacht 281	Portion 1
National Government of the Republic of South Africa	Melkkraal 458	Portion 4
Thabong Farmers Communal Property Association	Paradijs 23	Portion 1
Ramatogo Isaac &Modiegi Elizabeth Ranotsi	Paradijs 23	Portion 4
H D P Investments (Pty) Ltd	Weltevreden 171	Remainder
GrootspruitFamilie Trust	Paradijs 23	Portion 3

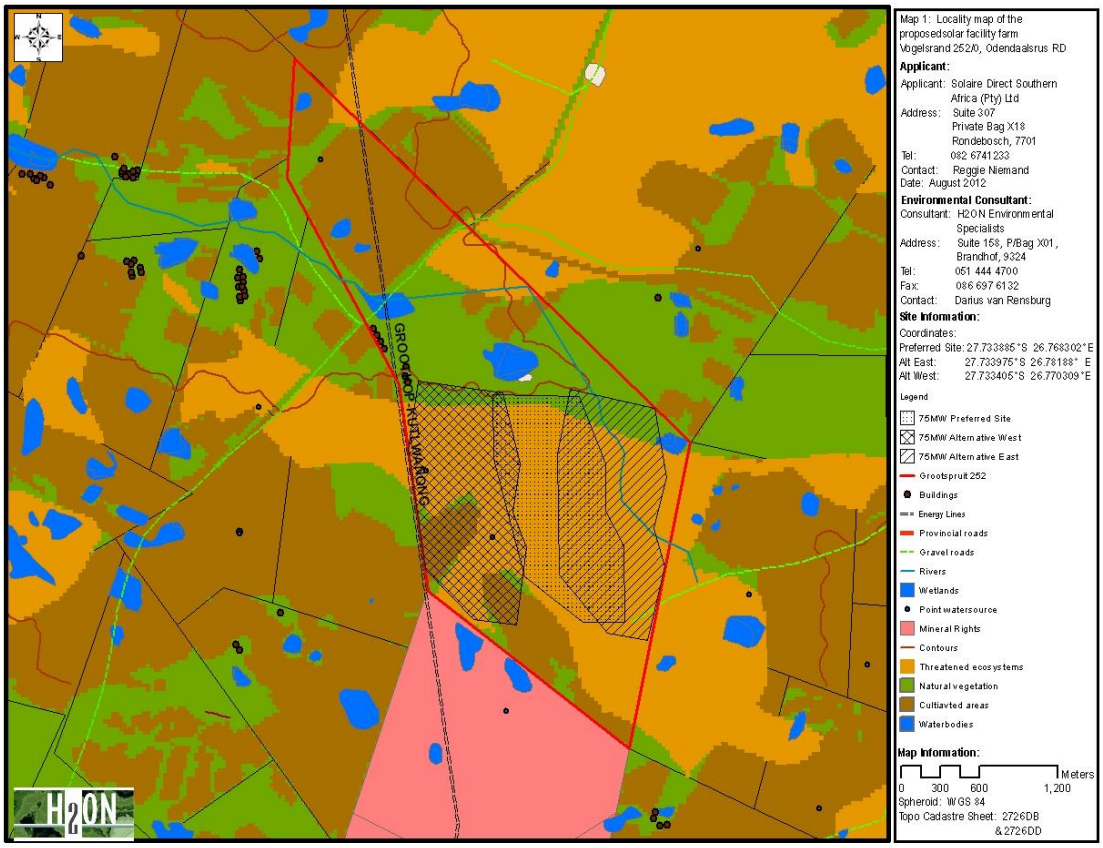


Figure 2: Map illustrating extensive crop cultivation and remaining natural areas (See Map 2: Annexure 2).

2 DETAILED DESCRIPTION OF THE PROJECT

The proposed Grootspruit Solar Farm Project is a project proposal that will include the development of a Photo Voltaic solar farm and related infrastructure to the extent of 180 ha which will include the following (refer to map 4 in **Annexure 2**):

Photo Voltaic solar panels

(i) Solar modules of 300Wp each mounted on aluminium structures (2m^2 area) (Fig. 3). Solar panels will consist of Photo-Voltaic cells placed on aluminium structures. These panels will be mounted on fixed mounting structures. The height of these panels and mounting structures are 3.4m. The specifications of these panels and associated structures are discussed in Table 2.

Table 2: Description of the solar panel specifications and associated structures.

Structure/component	Specification	Dimensions	Amount
Solar panels	SD 1-0612-M modules (mono crystalline cells)	L – 1975mm x W – 990mm x H – 50mm	316 800
Inverters	Not specified	L – 7m x W – 3m x H – 3.5m	73
Distribution transformers	Rated power of 630Kw each at peak operation	H – 3.3m	37
Panel mounting structures	Aluminium fixed mounting structures	L – 18.724m x W – 4.741m x H – 3.3m	Not specified
Guardhouse	Not specified	H – 3m	1
Fencing		H – 2.8m	N/A

Fig. 3 

(ii) Aluminium structures mounted on screw-foot- or concrete foundations as soil conditions dictate(Fig. 4). The applicant has indicated that screw-foot foundations will be used for this project. However, where unforeseen bedrock occurs the use of concrete foundations will be necessitated.

Fig. 4 

(iii) Array enclosures (1m^2 area) (Fig. 5).

Fig. 5 

(iv) Inverter/Transformer enclosures (21m^2 area) (Fig. 6). The inverters that are connected to the array enclosures convert the Direct Current (DC) into Alternating Current (AC). The transformers transform low voltage AC (350V) from the inverters to medium voltage AC (22kV) for connection to the grid connection substation.

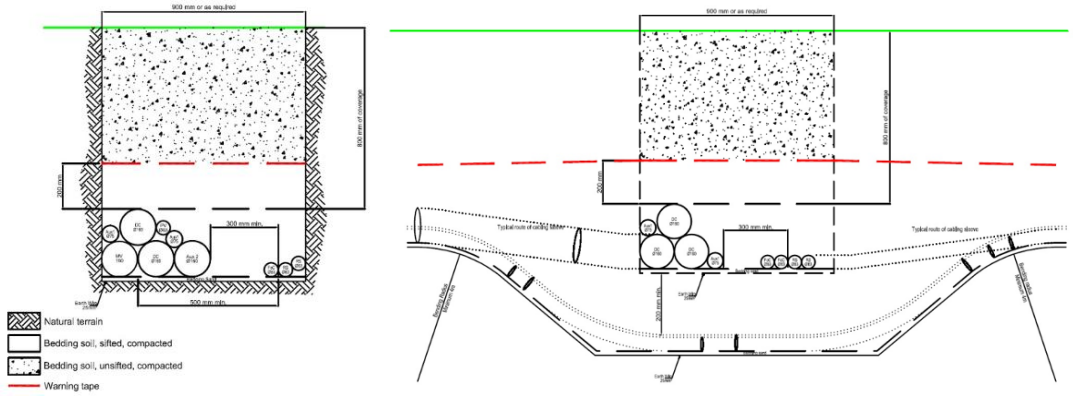
Fig. 6 

Trenches (Fig. 7)

(i) Cabling sleeves installed in trenches. Trenches will be excavated for the installation of cable networks as part of the Civil Works. No blasting will form part of the excavation process. Trenches will be in accordance with SABS standards and in accordance with the following guidelines:

- Cables shall be installed at a minimum of 800mm below finished ground level;
- Cables shall have a minimum of 200mm cover with sifted bedding sand to avoid sleeve/cable damage when trenches are closed;
- Only cables connected in parallel may be installed inside the same cabling sleeve;
- Medium- and low-voltage cables may not be installed inside the same cabling sleeve;
- Data cables (RS485) shall not be installed closer than 300mm to any low-voltage (LV) cables;
- Data cables (RS485) shall not be installed in the same trench as Medium-Voltage (MV) cables. If this cannot be avoided the RS485 cables shall be installed no closer than 500mm from the MV cables, whilst still maintaining the 300mm space between RS485 and Low-Voltage cabling;
- Three strips of warning tape (yellow plastic tape with the words “Warning: electric cables” printed on it) shall be placed on top of the layer of sifted bedding sand before the trench is closed. These strips shall be place on either side and in the middle of the trench.

Fig. 7



Associated infrastructure

(i) A safety firebreak band and roadway around the perimeter of the site.

(ii) Grid connection substation (convert 22kV to 132kV) (Fig. 8). The grid connection substation is a brick building that will contain medium voltage (22kV) circuit breakers that will combine the power generated by each inverter/transformer enclosure. The combined power will then be transformed from medium voltage (22kV) up to high voltage (132kV) for connection to the Eskom grid substation by power transformers. These power transformer units shall be two 40MW power transformers or three 25MW power transformers.

Fig. 8

(iii) Connection to Eskom power grid by means of two 132kV overhead power lines. The electricity produced will be fed into the Eskom grid via the Grootkop-Kutlwanong power line on the site. The new powerlines to be constructed will only have a length of approximately 500m as

indicated by the Final Layout Map (Map 4 in Annexure 2). These newly constructed powerlines will also have a servitude of 22m (11m to each side of the power lines).

(iv) Diesel generator for power supply to security and monitoring systems in case of grid failure.

(v) Security system

(vi) Fencing to the height of 2.8m.

(vii) Access control

(viii) Fire detection system

(ix) Weather monitoring equipment

(x) Plant monitoring equipment and associated telecommunication links.

(xi) Air-conditioning inside inverter/transformer enclosures to regulate operating temperature.

(xii) Guard house (26m^2 area).

Temporary land use during construction

Excavation of the topsoil will only take place where cables are inserted as well as areas where foundations will be excavated for the construction of the guardhouse, inverters and substation. This will necessitate a soil heap where topsoil can be safely stored. Topsoil will be replaced on top of trenches when re-filling. Any remaining topsoil will be utilised on the site during rehabilitation of the site. The size of this temporary soil heap is anticipated to be approximately 6000m².

No blasting will take place as part of the construction process.

A temporary laydown area of approximately 4 800m² will be utilised during the construction period. This temporary laydown area will be utilised for chemical toilets, offices, access control and changing rooms. Dangerous and hazardous substances such as diesel for construction vehicles will also be housed in this area. However, the amount stored will be low (never exceeding 1m^3) and it is therefore not considered necessary to apply for activity 13 (GN R544, 18 June 2010): the storage of dangerous goods with a combined capacity between 80 and 500 cubic metres. The area will be rehabilitated on completion of construction.

Transport of components and equipment to site

- Delivery of panels to the site via 200 loads consisting of 18.9 tons each on 12m long trailers.
- Delivery of electrical equipment and components to the site via 28 loads of approximately 20 tons each.
- Delivery of aluminium mounting frames to the site via 21 loads of approximately 20 tons each.

Roads

Access to the farm Grootspruit 252/0 is via the S940 Gravel Road turning off from the R30 Provincial Road (refer to Map 3 in **Annexure 2**). The farm is located approximately 8 km from the tarred road. There is an extensive dirt road network on the farm itself.

The public dirt roads giving access to the farm also services the surrounding farms. Farmers in the area utilise these roads to transport produce to the surrounding towns as well as for their day-to-day activities. These roads will carry a high load during the construction phase of the project as a result of the delivery of construction materials. It is imperative that the applicant, Solairedirect Southern Africa (Pty) Ltd, commit to maintaining the current condition of the public dirt roads that will be utilised by them.

The existing farm dirt roads will be utilised to gain access to the site. However, this access road will be upgraded to ensure access of construction vehicles to the proposed site. This upgraded road design will be determined within detailed engineering in accordance with SABS standards and South African requirements (e.g. compacted road layer works and crushed stone surfacing). The final width of the access road will be 6m. A perimeter road will be constructed around the facility. This perimeter road will have a width of 5m and will also act as a firebreak around the facility.

General Waste

General waste will be generated by the construction crew during the construction phase of the development. This waste will be collected in containers and removed on a weekly basis to the nearest authorised landfill site (Allanridge/Odendaalsrus).

A limited amount of general waste will be generated by the maintenance team on-site during the operational phase. This waste will be collected in refuse bins and removed to the nearest authorised landfill site (Allanridge/Odendaalsrus).

Since this development is not located on the municipal waste collection route the removal of waste will be the responsibility of the applicant.

Construction Solid Waste

During construction it is not anticipated that a large amount of construction waste will be generated. However, any amount of construction solid waste produced will be kept in suitable containers (skips) on the site and will be removed to the authorised landfill site in Allenridge/Odendaalsrus.

During the operational phase it is not foreseen that any construction solid waste will be generated. However, in the event that construction solid waste is produced during the operational these will be managed as during the construction phase.

Should decommissioning occur in future it is anticipated to produce a large amount of construction solid waste. These should be managed as stipulated in the Draft Decommissioning Plan (Attached in Annexure 4).

Hazardous Waste

During the construction phase of the project a limited amount of hazardous waste will be produced. This is associated with the construction activities and maintenance of construction vehicles on the site. All hazardous waste should be stored in acceptable containers and disposed of at a registered hazardous waste disposal site (As stipulated in the Draft Environmental Management Programme in Annexure 4).

Sewage

During construction sewage will be managed by on-site chemical toilets. These facilities will be maintained on a regular basis by the contractor supplying them.

During the Operational Phase the sewage generated will be managed by the use of a composting toilet which makes use of an aerobic process to treat human waste material (Fig. 9). Such a composting toilet is able to manage the waste produced by eight people, the number of toilets will therefore be adjusted accordingly to the number of personnel on the site.

ECOSAN WATERLESS TOILET - TECHNICAL SPECIFICATIONS

Length	2450 mm
Width	630 mm
Height	750 mm above floor level - Toilet bowl 1120 mm - Height of catchment drum at back
Material	LDPE - Low Density Poly-Ethylene
Weight	90 Kg's

INSTALLATION DIAGRAM

Installation is very easy. Once the trench is completed it is a matter of lowering the toilet into it, ensuring that the toilet is level, and filling up the trench with sand.

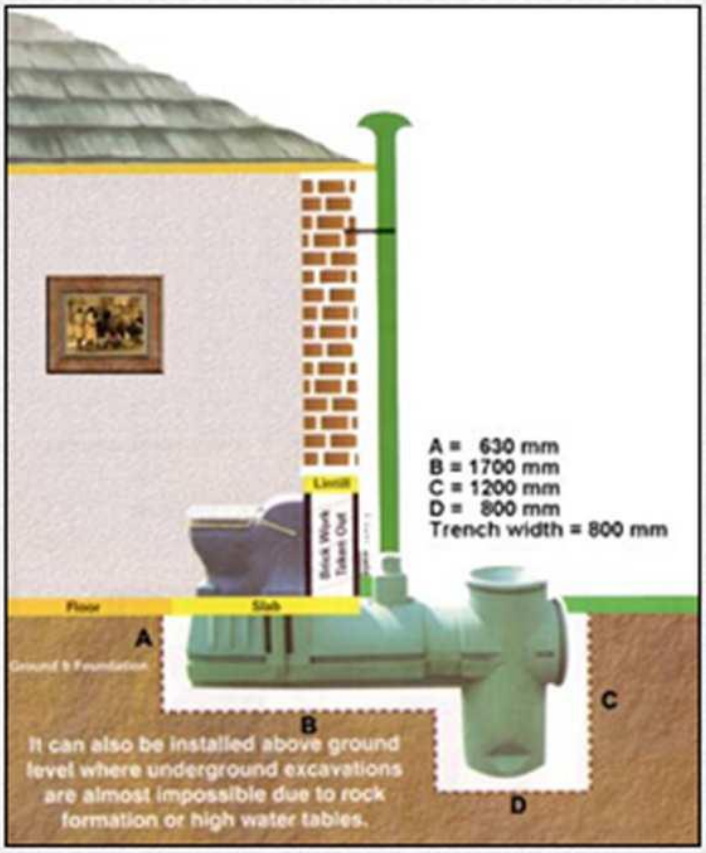


Figure 9: Illustration of the Ecosan Waterless Toilet which is a type of composting toilet.

The system would not utilise water for the functioning and would therefore not produce any effluent. The following are characteristics of this toilet system:

- Completely closed system.

- No sewage pipes or treatment plants required.
- No effluent seepage into groundwater resources.
- No obnoxious odours.
- Minimum monthly operating costs.
- Plumbing free solution.
- Waterless.
- Does not use any chemicals for operation.
- No septic tank required.
- Environmentally friendly.
- Organic sanitation.

The dry waste produced by these toilets are manageable and can be used to make compost, can be disposed of as municipal waste or can be used as a source of fuel. The contracting company supplying the composting toilets will also be responsible for the removal and disposal of the waste. It is the responsibility of the applicant to ensure that the contractor hired is accredited and has the necessary permits to remove the sewage.

Water Use

During the Construction Phase water will be used for human consumption by the construction crew, dust control, moisture conditioning of roads and foundations for compaction. It is estimated that these activities will utilise an amount of 4 800 000 litres. This will require three water trucks per day during the first 60 days of construction and one water truck during the following 60 days (each truck will have a capacity of 20 000 litres).

The approximate daily use will amount to 60 000 litres with a total water use during construction of 5 400 000 litres. Water will be supplied by the property owner.

During the operational phase the facility will use an approximate amount of 750 000 litres per year. This amount of water will be utilised for the cleaning of the Photo Voltaic solar panels. Dust accumulating on the panels decreases the solar capturing capacity of the panels. Washing will be done by a window washer type of device. The drinking water utilised by the staff is also included in this figure given above. However, treatment of the water may have to be done to make it suitable for human consumption.

Water use during the operational phase will be provided by boreholes on the site. The farm Grootspruit 252 falls within the C25B Water Management Area and is entitled to 75m^3 per hectare according to the General Authorisation as per Section 21 of the National Water Act, 1998. The farm has a size of 689.72ha and therefore it is entitled to 51 729 000 litres of water per year. This makes ample provision for the low amount of 750 000 per year. This amount will be procured from the property owner.

The property owner has applied for a registration of General Authorisation with the Department of Water Affairs (DWA). Please see attached a copy of the water use registration as submitted to DWA in Annexure 6: Additional Applications and Information.

Electricity

The facility will utilise limited electricity for operational activities on the site. The activities that will require electricity will be the operating of the guardhouse as well as the perimeter lighting. This electricity will be sourced directly from the power produced by the plant. The facility will produce electricity for Eskom to the amount of 75 MW. This electricity produced will be fed into the Eskom grid via the Grootkop-Kutlwanong power line on the property concerned. The connection to the Grootkop-Kutlwanong power line will be made by the construction of two 132kV overhead power lines with a length of approximately 500m. These newly constructed power lines will also contain a servitude of 22m (that is 11m to either side of the power line). Please refer to the Final Layout Map for a visual illustration of this portion of newly constructed power line (Map 4 in Annexure 2).

Figure 10: The Grootkop-Kutlwanong power line on the property concerned where the solar facility will connect to the Eskom grid.

Financial implications

It is estimated that the total costs for the construction of the facility will amount to approximately R1 350 000. The expected yearly income is dependant on the competitive tariff proposed to the Department of Energy (DoE) in the bid process. The construction period will take approximately 24 months up to completion. The construction team will consist of 291 employees of differing responsibilities and expertise as stipulated in Table 3. The value of these employment opportunities will accrue to R67.5 million. Approximately 75% of these job opportunities will consist of previously disadvantaged individuals. The conditions of the contract between Solairedirect and its subcontractors will include requirements for Local Enterprise Development and Preferred Procurement. The operational phase will consist of 59 permanent employees of differing responsibilities and expertise as stipulated in Table 3. The value of these employment opportunities during the initial 10 years of operation is estimated at R59 million.

Table 3: Number of job opportunities and the specific field of construction and operation involved in.

Construction phase		Operational phase	
Description	**Number of job opportunities**	**Description**	**Number of job opportunities**
Site management	**22**	General administration & maintenance	**30**
Civil works	**27**	Compliance related activities	**3**
Frames & foundations	**18**	Performance monitoring of the PV power facility	**2**
PV modules	**93**	Security	**24**
Electrical systems & components	**44**		
Total	**204**	Total	**59**

Future Development of the Facility

The solar panels utilised for the facility has a lifespan of approximately 25 years. The applicant, Solairedirect Southern Africa (Pty) Ltd, intends to renew the solar panels after this lifespan and continue to produce electricity. The renewal of the panels will be subject to the available technology at that time. Although the applicant has an excellent track record, is internationally established and has a good financial standing it is not definite that the facility will continue in future and decommissioning of the facility may occur at a later stage although this is considered unlikely. For this reason a Draft Decommissioning Plan has been included in Annexure 4. It must however be kept in mind that rehabilitation techniques and waste classification will change over time and that the conditions as stipulated in the Decommissioning Plan may not be applicable at the time of closure of

the facility. For this reason it is recommended that the Decommissioning Plan only be used as a guideline for the compilation of a Final Decommissioning Plan at the time of closure.

Cumulative Effect due to Established or Proposed Solar Farms in the Vicinity

It is not known that any other Solar Farms exist in the area (Approximately 20km radius). A small 10MW facility is proposed immediately adjacent to this 75MW facility. These two facilities would share a border and together would have a capacity of 85MW. The combined area covered by these facilities will then be 199.9ha (180ha for 75MW and 19.9ha for the 10MW facility).

Currently it is not known that any Solar Farms are proposed in the area where this Solar Farm will be developed. Therefore there will not be any cumulative effect as a result of any other existing or proposed solar farms in the area other than the small 10MW facility bordering on this proposed facility.

3 MOTIVATION FOR THE PROPOSED PROJECT

3.1 Motivation for the proposed project from a national perspective

The current shortage of electricity supply in South Africa has resulted in regular power failures over the last 3 years with power cuts in an attempt to manage the shortage in electricity supply capacity. Considering the current population growth and expansion of urban areas which leads to a demand for an increase in service delivery, the demand for electricity supply will increase. Additional electricity generation infrastructure is thus required to supplement the general electricity need. Furthermore, the proposed solar farm will be ideally situated in an area that currently exercises a heavy burden on the Eskom network due to large scale mining activities. The establishment of this solar farm should alleviate the current strain of the mines on the electricity supply.

According to the White Paper on Renewable Energy (2003) the South African Government has set a target of sourcing 10 000 GW from renewable energy projects by 2013. Furthermore, South Africa's Integrated Resource Plan (IRP 2012) has set a target for reduction of CO_2 emissions by 34% by 2020. It is therefore clear that solar farms have a definite role to play in electricity producing sector.

One priority in terms of rural and urban development for the Free State is to focus on meeting basic needs which include the improvement of infrastructural sectors such as energy supply (First Draft Free State Development Plan, 2002-2005).

The majority of existing power stations are coal-fired. This method of electricity generation is harmful to the environment and high in emissions. According to the Department of Environmental Affairs, South Africa is committed to implement strategies to reduce greenhouse gas emissions as per the country's obligations under the United Nations Framework convention on Climate Change (UNFCCC). The establishment of solar farms instead of coal-fired power stations to address the current electricity need are therefore more desirable to limit South Africa's general carbon footprint.

The SolaireDirect Group is a leading international solar power producer specializing in the development, installation and operation of solar panels for the primary purpose of electricity generation and is the largest privately owned solar power producer in France. The SolaireDirect Group will have successfully completed over 100MWp of solar power projects at the start of 2012. Headquartered in Paris, France,

the SolaireDirect Group has power generation subsidiaries around the globe including Southern Africa, Northern Africa, India and South America.

SolaireDirect Southern Africa (Pty) Ltd (SDSA) is a subsidiary of the international group and differs in that it applies a proven Integrated Power Producer (IPP) business model that can be adapted to suiting the Southern African context in terms of energy production strategies and local economic development. The IPP model compliments the technical experience of the SolaireDirect Group with context-specific market knowledge and the commercial expertise of local people and investors. The fundamental objective of SDSA is to provide a complete solar service to the South African energy market in an attempt to diversify the country's energy sector and empower local communities.

While the parent company is based in France - rapid growth since 2006 has culminated in the formation of five subsidiaries spanning across three continents. The establishment of the South African subsidiary company set in motion following changes to South African energy legislation and the decision by national government to introduce a feed-in tariff for renewable energy.

SDSA is dedicated to the manufacture, construction and operation of solar photovoltaic farms and rooftop solar panel installations. Energy production capacity ranges from 5 MWp to 75 MWp and a few KWh to 1 MWp respectively. The company has found great success in creating partnerships with investors and local business enterprises in a number of African countries including Namibia, Botswana and Mozambique. Moreover, SDSA is uniquely positioned as one of the only integrated solar energy producers known to extract their raw materials and human capital from the local market for optimum business operation and local economic development.

In this regard, the construction of a photovoltaic panel production plant in Cape Town in 2008 (Solaire Direct Technologies) exemplified the SDSA's commitment to the South African market and exhibited an intent to pursue further business ventures within the country. Solaire Direct Technologies has an annual generating capacity of 35 MWp and is exclusively dedicated to meeting the needs of the SolaireDirect Group (parent company) and that of the South African energy market.

SDSA currently has a pipeline of approximately 500MWp of other solar PV projects under development in South Africa. The projects are located in the Northern, Western and Eastern Cape Provinces as well as the Free State Province in areas of high solar irradiation and good electrical grid infrastructure.

3.2 Socio-Economic Development Motivation

The Project Company will contribute 1% of revenue towards Socio-Economic Development Contributions.

These funds will be paid into the account of the Local Community Trust and in turn will be administered in accordance with the Socio-Economic Development Strategy, described in detail below.

Vision & Approach

The objective of the shareholders is to make a tangible difference to the lives of the people in the Local Community for not only the 20 year life of the project but beyond. In order to achieve this the shareholders believe that it is key to work with existing systems and structures that determine the socio-economic priorities of the Local Community, rather than trying to create a parallel or alternative structure.

Each Municipality is required under the terms of the Municipal Systems Act 2000 to develop and publish an Integrated Development Plan (IDP) and to review this plan on an annual basis. This plan essentially maps out a five (5) year development plan for the municipal area. It is a requirement of the IDP process that public consultation and stakeholder engagement take place, specifically including Local Communities, to arrive at a consensus with respect to the broader development priorities of the Municipal area.

The comprehensive and inclusive nature of the IDP stakeholder engagement process employed by the Municipality makes it the ideal mechanism for determining the socio-economic development priorities for the Trust.

Local Development needs

- Unemployment
- Joblessness
- Lack of Housing
- Social decline
- Education

- Reducing the backlog in basic needs such as water, sanitation and housing;
- Improving basic services such as health, education and social services;
- Reducing the HIV/AIDS prevalence rate;
- Creating employment opportunities;
- Reducing the crime rate; and
- Empowering vulnerable groups.

The core aim of the Trust's SED Program will be to provide funding to projects that address these needs.

Mechanism

The shareholders of the Solar Project intend to set up a Local Community Trust (the ''Trust'') upon successful award of Preferred Bidder status. The Trust will be given a 2.5% shareholding in the Project Company.

The Trust will be administered by a Board of Trustees made up of key local stakeholders. The Trustees will include persons representing the following organizations:-

- Solar Project (the ''Project Company'')
- A local Accountant
- A local Lawyer
- 3x NGO's

Funding of the Trust

The Trust will essentially benefit from two sources of revenue.

1. Dividends

As a 2.5% shareholder in the Project Company the Trust will receive dividends.

2. Socio-economic contribution payments

The Project Company has committed, as part of its bid response, to making a socio-economic contribution payment of 1% of Gross Revenue to the Trust.

This method of having the same entity as both a shareholder of the Project Company and the recipient of the socio-economic contributions from the Project Company mean that the Trust will have funds available from an early stage in the project life, rather than having to wait for what could be several years for dividend payments if it were only a shareholder.

Distribution of funds

The Trust will issue a request for socio-economic project proposals on an annual basis. The criteria for selection will be fully developed and detailed in the relevant documentation and interested parties will be invited to present their proposal in person to the Trustees.

Project proposals will be adjudicated and awarded by all Trustees in a fair and equitable manner, ensuring that the needs of the community are being met.

Based on the assessment of the Trustees the Trust will then make a formal offer of financial assistance to the relevant project initiators, including the agreed contract terms and payment milestones.

Summary

The shareholders of the Project Company believe that the proposed socio-economic development strategy has the following key advantages:-

- The Trust is independent of any political involvement
- Although independent of the local municipality, the trust will still be able to assist in addressing the needs of the community. Constant engagement with the municipality will ensure this occurs
- The Trust makes use of an existing transparent, inclusive and locally focused method of determining socio-economic priorities
- The funding mechanism allows for an immediate flow of funds into the Trust, in turn allowing for an immediate ability to fund socio-economic projects

4 CONSIDERATION OF ALTERNATIVES

In order to minimise the negative impact that the development would have the evaluation of several site and technological alternatives were considered for this development.

4.1 Site alternatives

Three alternative sites were identified for the proposed project:

4.1.1 First Alternative (Preferred Alternative)

The **first alternative (Preferred alternative)** is situated in an area of natural grassland (Refer to Map 3 in Annexure 2). This grassland consists of Vaal-Vet Sandy Grassland which is regarded as an endangered vegetation type. The likelihood exists that this area may contain endangered species (Refer to the Ecological Specialist Report in Annexure 3 for detail on these species). Several protected species occur on the site (Refer to the Ecological Specialist Report in Annexure 3 for detail on these species). The impact of the development on this area is considered to be high. If appropriate mitigation measures are developed and adhered to, the development will have a moderate impact on this natural area.

4.1.2 Second Alternative

The **second alternative** is situated on natural grassland as well as cultivated cropland. The grassland consists of Vaal-Vet Sandy Grassland which is regarded as an endangered vegetation type. The likelihood exists that this area may contain endangered species (Refer to the Ecological Specialist Report in Annexure 3 for detail on these species). Several protected species occur on the site (Refer to the Ecological Specialist Report in Annexure 3 for detail on these species). The impact of the development on this area is considered to be high. If several mitigation measures are adhered to the development will have a moderate impact on this natural area. It is likely that the area consisting of cultivated cropland proposed for this alternative contains high yield agricultural potential. The Department of Agriculture, Forestry and Fisheries has a strict policy against the conversion of high yield agricultural cropfields for the development of solar farms. For this reason the cultivated areas must be excluded from the developmental area. Exclusion of the cultivated areas has yielded the preferred alternative.

4.1.3 Third Alternative

The **third alternative** is situated in natural grassland and in a natural annual stream. The grassland consists of Vaal-Vet Sandy Grassland which is regarded as an endangered vegetation type. The likelihood exists that this area may contain endangered species (Refer to the Ecological Specialist Report in Annexure 3 for detail on these species). Several protected species occur on the site (Refer to the Ecological Specialist Report in Annexure 3 for detail on these species). The impact of the development on this area is considered to be high. If several mitigation measures are adhered to the development will have a moderate impact on this natural area.

The Free State has a strict no-wetland-loss policy and therefore the inclusion of this annual stream within the development would not be feasible. The exclusion of this annual stream has yielded the preferred alternative.

4.1.4 Conclusion

All the alternative sites considered by the applicant are situated on the farm Grootspruit 252/0, Odendaalsrus RD. All of the alternatives overlap and are situated adjacent to another. However, upon investigation it was found that the cultivated cropfields and annual stream would have to be excluded from the development. Exclusion of these features has yielded the preferred site alternative for the development.

4.2 Technological Alternatives

Three technological alternatives will be considered for this development namely Concentrated Solar Power (CSP), fixed mounted Photo-Voltaic (PV) solar panels and dual axis tracking PV solar panels.

4.2.1 Concentrated Solar Power (CSP)

Concentrated Solar Power (CSP) is considered as alternative to PV solar. This technology requires high volumes of water thus presenting a major constraint for the utilisation of this technology type. While the irradiation values are high enough to generate sufficient solar power, the water constraints render this alternative unfeasible. Furthermore, CSP solar is deemed as having a far larger impact on birds than do PV solar (BLSA). This is caused by the associated central receiver tower, standby focal points and heliostats of CSP solar plants.

4.2.2 Fixed mounted PV solar panels

Fixed mounted PV solar panels are affixed to a triangular aluminium structure that is fixed in place and does not contain any moving parts. Although being the simplest technological alternative it is anticipated to have the highest yield per surface area with the least associated impacts. Because the technology does not contain any moving parts the costs are considerably less than the other alternatives. The maintenance costs are also considerably less as no movable parts require maintenance. In addition, the electricity output of the panels is transferred to the Eskom network without the subtraction of additional electricity utilised for electrical moving parts. The panels are placed so that they do not have a shadow effect on the adjacent panel and therefore surface area usage is maximised. The height of the mounting structures are 3.4m which is considerably less than the 8m required for the dual axis tracking mountings, therefore the visual impact of this technological alternative would also be considerably less.

4.2.3 Dual axis tracking PV solar panels

The use of dual axis tracking is also considered as alternative technology. This technology makes use of an electric motor, mechanical parts, and solar irradiation sensors to track the movement of the sun ensuring that light coming into contact with the PV panels is optimised.

Tracking PV systems are mounted on a single pole-type structure on a concrete foundation. The spacing of the mountings must be undertaken to ensure minimum inter-shading between structures. Because of the movement of the structure, however, the distance between structures are much greater than with fixed structures, as the maximum height of a tracking structure could be up to 8m, depending on the exact model chosen. The implication of this is that less power can be installed on the same size of land when compared to fixed structures. Furthermore, the solar tracking motors consume power in order to move the solar PV modules. The consumed power will have to be deducted from the total generated power. Visual impact of the structures is high due to the overall height.

In calculations that were performed, a solar tracking-based system generated 7% less power per installed kW (peak) than a comparative fixed structure installation. This is mainly due to the power consumption of the tracking structures themselves.

The total cost of a solar tracking structure is roughly double the cost of a fixed structure. The fixed structure requires virtually no maintenance, but a tracking structure will require maintenance seeing as it is a moving structure. If these units are mounted in a sandy environment, maintenance requirements will increase.

4.2.4 Conclusion

Following detailed investigation and analysis, it was found that tracking technology is a feasible alternative but not preferred for the land area under consideration as it produces less power and costs more than fixed structures.

After consideration of these technological alternatives it was found that the most advantageous method with the lowest environmental impact would be the use of fix-mounted Photo Voltaic panels. The following reasons are given:

- The technology would not utilise as much water as CSP technologies.
- The technology does not pose as large a threat to birdlife as does CSP technologies.
- The mounting height of fixed-mounted PV panels (3.4m) are considerably less than dual axis tracking modules (8m) which considerably lowers the visual impact that the panels will have.
- The surface area utilised for dual axis tracking modules are considerably more due to the effect of panel shading.
- Dual axis tracking utilises electrical motors as movable parts to rotate the panels. These motors consume a portion of the electricity produced. Due to this dual axis tracking systems produce approximately 7% less energy than fixed-mounted panels.
- Due to the moving parts of dual axis tracking systems the maintenance costs are considerably higher than fixed-mounted panels.

4.3 "No project" Alternative

This alternative would entail that no development of the area takes place. This would entail that the area of natural vegetation would remain intact. This will result in minimal impacts on the natural environment.

However, the alternative would also entail that the strain on the national electricity supply would not be alleviated. The alternative would also entail the loss of substantial job opportunities.

5 DESCRIPTION OF THE RECEIVING ENVIRONMENT

For photographs, panoramas and photo-montages of the site, surroundings and receiving environment please refer to the various specialist assessments in Annexure 3: Specialist Reports.

5.1 Geology and Soil (Refer to Specialist Report in Annexure 3)

The sedimentary rocks underlying the survey area are made up of grey to black silty shale with thin, usually bioturbated, siltstone and sandstone lenses and beds of the Upper EccaVolksrust Formation. It is generally accepted to be Middle Permian in age. The formation is a predominately argillaceous unit which interfingers with the overlying Beaufort Group and underlying Vryheid Formation (Ecca Group). It represents a transgressive sequence consisting largely of mud deposited from suspension when large, swampy deltas were formed after Gondwana started to drift from the Antarctic region and rivers flowing into the inland Karoo Sea deposited large amounts of sediment along its shorelines.

The study area contains three soil forms. These are the Valsrivier (Va), Sepane (Se) and Clovelly (Cv) soil forms.

- The Valsrivier soil form occurs over the majority of the site and comprises an orthic A-horizon that overlies a pedocutanic B-horizon and unconsolidated material without signs of wetness.
- The Sepane soil form only occurs near the seasonal stream on the property and only marginally forms part of the proposed site. It comprises an orthic A-horizon that overlies a pedocutanic B-horizon and unconsolidated material with signs of wetness as a result of the proximity to the seasonal stream.
- The Clovelly soil form only occurs in a small portion of the site in the south western corner of the site. It comprises an orthic A-horizon that overlies a yellow brown apedal B-horizon and unspecified material.

The soils of the area are defined by the pedocutanic B-horizon. Swelling and shrinking characteristics occur. These poorly permeable layers impede water infiltration, internal drainage and flow out of the profile. Plant available water is low and plant root development is inhibited by the high clay content and compaction of the soils.

The study area is of low agricultural potential and can only be used for carefully managed grazing. Overgrazing will lead to soil erosion and the removal of the sandy orthic A-horizon.

Figure 11: Map illustrating soil forms present on the site.

5.2 Climate

The study area receives maximum precipitation during the months of October to April. Temperatures also fluctuate accordingly with January being the hottest at a mean temperature of 22.8˚C and July being the coldest at a mean temperature of 9˚C.

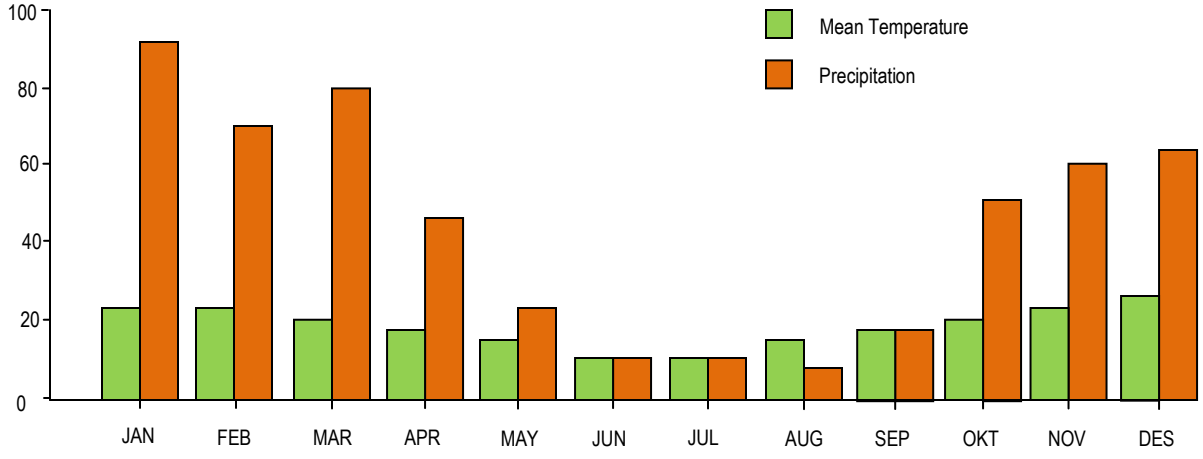


Figure 12: Climate diagram for Allanridge illustrating the monthly mean temperatures and precipitation.

As can be seen from the climate diagram January is the month with the highest rainfall followed by March. The temperature trend follows the rainfall pattern to a large extent.

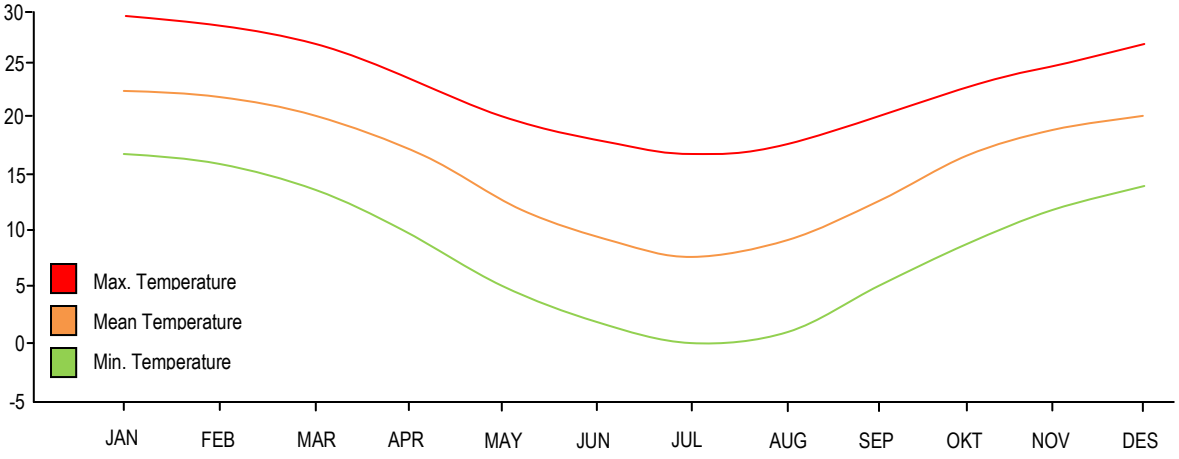


Figure 13: Graph illustrating the monthly maximum and minimum temperatures.

5.3 Topography

The region has a relatively flat topography with slightly undulating plains. The site itself contains a gradual slope toward the north and a small seasonal stream is located immediately north of the site (See map 2). This stream forms a tributary of the Sandspruit. The area does not have a variety in altitude due to the relatively flat topography. Altitude in the area ranges from 1338m to 1323m.

5.4 Land use and Capability (Refer to Specialist Report in Annexure 3)

The region is currently utilised for extensive agricultural activities. Extensive areas have been transformed for crop production. The crop of choice in most areas is maize. The site itself is currently utilised for grazing by cattle and ostrich. The site consists of natural vegetation. It must be stated that the nearest industrial area to the site is located in the town of Allanridge a distance of approximately 15km from the site.

The site falls mainly into the grazing land capability according to the definitions of the Chamber of Mines of South Africa, 1981.

The poorly permeable layers that characterise the Valsriver and Sepane soil forms impede water infiltration, internal drainage and flow out of the profile. Plant available water is low in these soils owing to the high matrix potential exhibited by the pedocutanic B-horizons. Plant root development is inhibited by the high clay content and compaction of the soils. The horizons that show swelling and shrinking characteristics compact naturally in the dry state and this may lead to root pruning.

The site is of low agricultural potential and can only be used for carefully managed grazing. Overgrazing will lead to soil erosion.

The farm Grootspruit 252/0 has a size of 690 ha and is currently zoned and used for agriculture. The farm is owned by the Grootspruit Family Trust. Approximately 530 ha is being utilised as natural grazing for cattle and ostrich while approximately 160 ha is being utilised for the cultivation of maize.

The area to be utilised for the construction of the proposed solar farm would have to be rezoned to include solar farm as an approved activity, i.e. agriculture with solar farming.

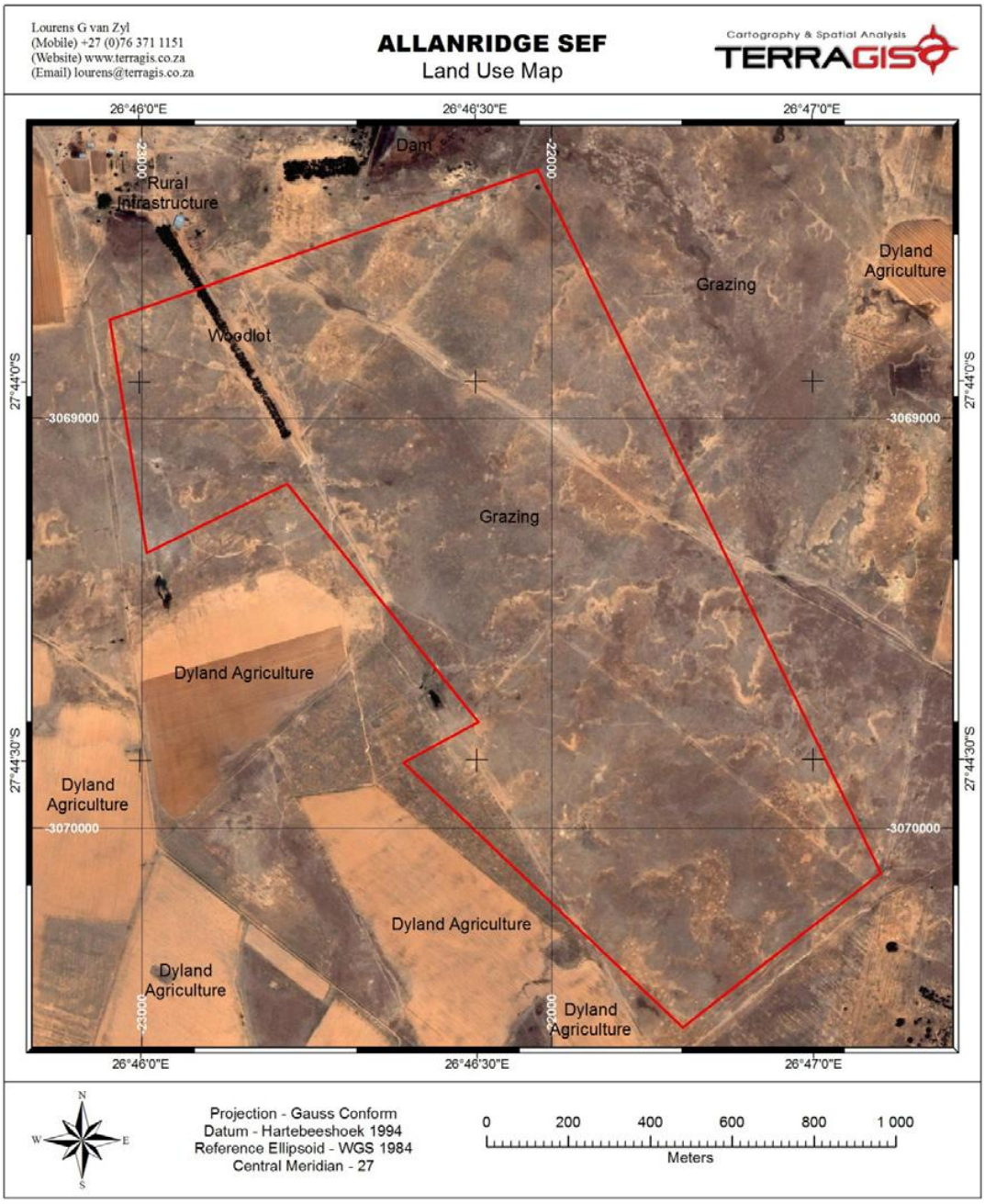


Figure 14: Map illustrating existing land uses on the site and surrounding area.

5.5 Natural vegetation (Refer to Specialist Report in Annexure 3)

5.5.1 Description of the vegetation

The vegetation on the site consists of Vaal-Vet Sandy Grassland (Gh 10) with some elements of Highveld Alluvial Vegetation (Aza 5) along the seasonal stream on the property. Vaal-Vet Sandy Grassland is regarded as Endangered (EN) due to transformation for agriculture.

The vegetation structure consists exclusively of a grass layer. Isolated specimens of the tree, *Acacia karroo*, occur in the grassland but these are rare.

Disturbance of the grassland on the site is limited to grazing by domestic stock. The grassland seems to be in a relatively good condition. The grassland forms areas of shallow depressions. These depressions are not regarded as wetland systems due to a lack of wetland species and a lower moisture regime. These depressions are formed by the erosion of the sandy topsoil layer. Although these areas are subject to erosion they are considered to be of natural occurrence as indicated by the species composition.

Several weeds are also interspersed within the grassland. These are thought to be the result of overgrazing and other previous agricultural activities. These weeds are all annual and most are exotic species. These weeds include *Conyza albida, Pseudognaphalium luteo-album, Schkuhria pinnata* and *Berkheya sp.*

A stream is situated to the north and east of the proposed development (Map 2). The stream is not located on the proposed site but it is considered highly likely that this stream would be influenced by the proposed development and therefore it is included in the assessment. The stream is of an annual nature and flows only after heavy rains. The stream is small and not easily discernable in areas. The vegetation composition of this area does however substantiate the wetland nature of this stream. A large artificial dam is situated north of the site in this annual stream. The dam acts as a weir whereby runoff from the stream is captured.

This stream and artificial dam contains numerous wetland species. These species include the following sedges *Cyperus esculentus, Juncus rigidus, Mariscus congestus, Schoenoplectus corymbosus* and *Scirpoides dioecus*.

Figure 15: Panorama of the proposed site for the solar facility. The area consists predominately of natural grassland.

5.5.2 Description of fauna on the site

5.5.2.1 Terrestrial mammals

This natural area is relatively isolated and does not form part of a large natural area. It does however function as a refuge for many terrestrial mammals. The area is connected via several corridors to other areas of natural vegetation and mammals should be able to move between these areas. Many of the mammals in the area have also become adapted to these isolated areas close to human dwellings where disturbance is common.

Owing to the size of the developmental footprint (180 ha) the area contains a relatively large mammal population.

The following species occur on the site and are regarded as protected in the Free State Province: Antbear, Yellow Mongoose and Suricate. These species are all widespread and common.

List of Red Data terrestrial mammals that could occur in the region:

Pangolin	*Manis temminckii*
South African Hedgehog	*Atelerix frontalis*
Aardwolf	*Proteles cristatus*
African Wild Cat	*Felis lybica*
Small-Spotted Cat	*Felis nigripes*
Bat-Eared Fox	*Otocyon megalotis*
Striped Weasel	*Poecilogale albinucha*

There is a real likelihood that some of these species may occur in the area proposed for development.

5.5.2.2 Avian fauna

The area contains several species of waterfowl that are associated with the water bodies on the site. As long as the development does not occur within 30 meters of the stream on the site the impact on these waterfowl is anticipated to be low. Furthermore, the use of photo voltaic solar power does not pose large impacts on the water birds of the area. The area does not contain a high diversity of bird life.

However, the site consists of natural grassland in a good condition and therefore provides suitable habitat in an area where the grassland has largely been transformed for crop cultivation.

The main impact on the avian fauna as a result of the proposed solar farm is perceived to be the transformation of suitable habitat. A Photo Voltaic facility would have the lowest impact on the birdlife with regard to the impact caused by collisions. Furthermore as there will only be a short extension of the existing power lines (500m) this collision impact will also be low.

There is a likelihood of three endangered species occurring in the area. These are the Secretary Bird (*Sagitarius serpentarius*), Melodius Lark (*Mirafra cheniana*) and the Lesser Kestrel (*Falco naumanni*). The area is situated along the western distribution border of the African Grass Owl (*Tyto capensis*), although the habitat does not seem ideal for this species and it is considered a low likelihood that this species would occur in the area.

The development would negatively affect the avian population in regard to the transformation of the natural grassland and the exclusion of suitable habitat. This is especially relevant to likely endangered species.

5.5.2.3 Amphibians

The area was not surveyed for amphibians as most amphibians in the highveld grasslands are dormant during the winter season (Assessment undertaken on 11 July 2012).

There is a high likelihood that a number of amphibians would occur in this area due to the artificial dam and annual stream on the property. However, only one species known to occur in this area is listed as a threatened species. The Giant Bullfrog (*Pyxicephalus adspersus*) is listed as being Near Threatened due to urbanisation and agricultural activities.

The species occurs in depressions such as pans, wetlands or streams that contain water only during the rainy season in open grassland areas. Therefore there is a high likelihood that this species may occur in the area. However, if a buffer zone of 30 meters is respected along the annual stream occurring on the property the impact on the species would be low should it occur on the site.

5.5.2.4 Reptiles

Since reptiles are inactive during the winter months the area could not be surveyed for reptiles as the survey was undertaken on 11 July 2012. It is also not known that a large number of endangered reptiles occur in this area. However, one species of concern is known to occur within this area.

This species is the Sungazer Lizard (*Cordylus giganteus*) which is listed as Vulnerable (VU). According to the property owner this species has been sighted on the property concerned. During the survey numerous burrows were identified that could be inhabited by this species but due to the time of year it could not be ascertained if any specimens were present.

The species is threatened by loss of habitat due to agriculture, mining, urban expansion and illegal collecting. Sungazers are endemic to South Africa and are only found in a relatively small area in the eastern Free State. The species normally occur in small colonies and inhabits burrows with a distinctive entrance. Though no specimens could be identified on the site the possibility of this species occurring on the site is highly likely.

Due to the conservation status of the species the impact would be high should the species occur in the area.

5.5.2.5 Arachnids

The Arachnids are a poorly understood class of organisms. For this reason not many of them are protected or regarded as endangered. Some have however received attention from conservation bodies as they are exploited for the pet trade or are known to have restricted distribution ranges. These arachnids include scorpions, Baboon Spiders and Trapdoor Spiders.

The site proposed for the solar facility does not contain any Scorpion species or Baboon Spiders but a large population of trapdoor spider does occur in the area.

These Trapdoor Spiders belong to the genus *Stasimopus*. Although the species could not be identified it can only be one of eight species namely *S. bimaculatus, S. coronatus, S. dreyeri, S. gigas, S. minor, S. nanus, S. nigellus*and *S. oculatus*. All of these species are protected in the Free

State Province. All of these species are also listed in the IUCN Red List as Data Deficient meaning that not enough data is available to evaluate the status of these species.

5.5.3 Site specific results

Habitat diversity and species richness:

Habitats on the site are restricted to a grass layer. The annual stream on the property will not be included in the development and therefore contributes to habitat diversity outside the developmental area. The eroded clay depressions on the site contribute to habitat diversity. As a whole the area does not have a high habitat diversity and is considered to be moderate. Due to the size of the developmental footprint the area contains relatively high number of plant species but seen in context it cannot be said that the area has a high species diversity.

Presence of rare and endangered species:

The area does not contain a high diversity of plant species and no species of concern that is rare, protected or endangered could be identified on the site. It is considered unlikely that any species of concern would occur on the site.

Ecological function:

The ecological function of the area is intact. Disturbances to the area are limited to overgrazing and agricultural impacts associated with stock farming. The ecological function of the grassland is not vital to the surrounding ecosystem but the grassland functions as a refuge for wildlife in an area that has been extensively transformed for crop cultivation. The grasslands also functions as part of the catchment of the adjacent annual stream. The runoff from the grassland flows into the annual stream. Therefore, should the grassland be subjected to erosion the eroded sediments will be washed into this stream. This adjacent annual stream plays a vital role in water transportation, bio-remediation and flow regulation. The ecological function of the grassland is considered to be moderate and that of the annual stream to be high.

Degree of rarity/conservation value:

The vegetation type occurring on the site is regarded as Endangered. This is due to the extensive transformation of this grassland for crop cultivation. However, this area does not form part of one of the focus areas for the Free State Highveld Grasslands in the National Protected Areas Expansion Strategy (NPAES) as it is not deemed a viably large natural area for protection. The likely occurrence

of any Sungazer specimens would deem the conservation value of the area as high. The area also contains three protected mammal species and one protected Trapdoor Spider species. These contribute to the conservation value of the site.

Percentage ground cover:

The majority of the area has a high percentage ground cover due to a dense grass cover. The areas consisting of eroded clay depressions contain a much lower percentage ground cover. Consequently the percentage ground cover for the area is considered moderate.

Vegetation structure:

The vegetation structure consists of a grass layer. The vegetation structure is in a natural state and the occurrence of trees in this area would be a disturbance induced feature.

Infestation with exotic weeds and invader plants:

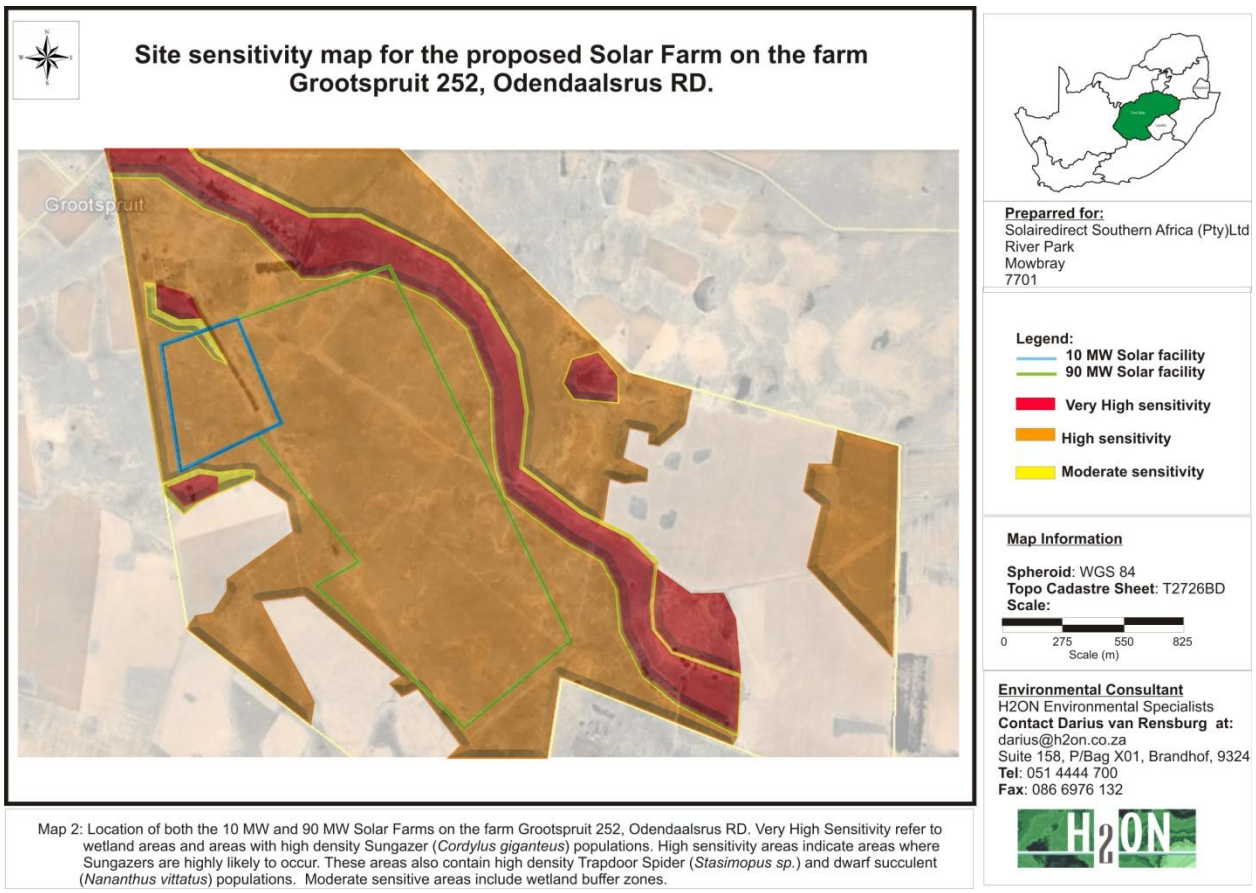
Several exotic weeds occur on the site but these are never dominant.

Degree of grazing/browsing impact:

Grazing on the site is extensive but does not exceed the carrying capacity of the area and consequently this impact can only be rated as moderate.

Signs of erosion:

Some sheet erosion takes place but this is not extensive. Erosion can be regarded as moderate. It must be said that the erosion potential of the area is relatively high. Therefore erosion- and stormwater control should be adequate; the vegetation cover should also be disturbed as little as possible during construction.



Map 2: Location of both the 10 MW and 90 MW Solar Farms on the farm Grootspruit 252, Odendaalsrus RD. Very High Sensitivity refer to wetland areas and areas with high density Sungazer (*Cordylus giganteus*) populations. High sensitivity areas indicate areas where Sungazers are highly likely to occur. These areas also contain high density Trapdoor Spider (*Stasimopus sp.*) and dwarf succulent (*Nananthus vittatus*) populations. Moderate sensitive areas include wetland buffer zones.

Figure 16: Site sensitivity map for the site and surroundings.

5.6 Surface water (Refer to Specialist Report in Annexure 3)

The farm Grootspruit 252/0 is situated in the Upper Vaal Water Management Area (WMA 8) in quaternary drainage region C25B. A tributary of the Sandspruit flows through the farm. This tributary is annual in nature and flows for short periods during the rainy season. The Sandspruit flows into the Sand River from where it joins the Vaal River.

The surrounding extensively cultivated areas have a pronounced influence on this small annual stream. Sediment release from ploughed fields is transported into this stream by means of surface flow. Together with sediments a large amount of fertiliser is also transported into this stream. This has a negative impact on the ecology of the annual stream.

The annual stream is indicated on Figure 7. The annual stream is a sensitive element of the surrounding ecosystem and provides a vital service in the form of water transportation, bio-remediation and flow regulation. A small wetland also occurs to the west of the site and is regarded

as moderately sensitive due to its small size and transformed state as well as its isolation from other water systems.

A buffer zone of 30 meters should be implemented around the annual stream and wetland on the property (Map 2). This buffer will ensure that the runoff that is generated from the solar facility will be retarded by the natural vegetation in this buffer zone. This will decrease possible erosion of the annual stream and the natural vegetation in the buffer zone will also aid in suspended sediment load capture.

5.7 Groundwater

Two separate groundwater systems occur in the region. These systems consist of:

- A shallow aquifer in the near surface weathered Karoo formations.
- A deep aquifer in the Witwatersrand and Ventersdorp sequences which contains saline water.

The shallow aquifer has developed in the weathered zone of Karoo sandstone and shale which outcrops over areas in the region. The underlying geology consists of the Beaufort sediments and the underlying Ecca Group. Groundwater flow patterns in this shallow groundwater aquifer closely follow the surface topography of the area with flow taking place toward the low points in the landscape, occupied by pans and watercourses. This close correspondence between topography and groundwater flow indicates that negligible vertical leakage occurs between the shallow and deep aquifers.

The deep aquifer occurs within fractures rocks of the Witwatersrand Group and Ventersdorp Supergroup that are located hundreds of meters below surface. The deep aquifer is characterised by highly mineralized “fossil” water with a sodium chloride signature. The poor quality of this water limits its usage.

Current water use in the area is limited to livestock water and no extensive irrigation occurs in the area.

The farm Grootspruit 252/0 is situated in the Upper Vaal Water Management Area (WMA 8) in quaternary drainage region C25B and has a water use capacity of 51 729 m^3 per year.

The farm contains several boreholes of which two are located on or near the site. The coordinates for these boreholes are S 27.74009˚, E 26.77380˚ and S 27.735179˚, E 26.767129˚.

5.8 Air quality and noise

The only air and noise polluting agents in the region is associated with cultivation activities. Air quality and noise pollution is affected mainly by farming machinery such as tractors and combine harvesters associated with the cultivation of maize.

5.9 Heritage of the area (Refer to Specialist Report in Annexure 3)

5.9.1 Regional Palaeontology and Archaeology

Although there are no records of fossil occurrences from the Volksrust Formation in the vicinity of the study area, the formation is characterised by the presence of plant fossils, with six genera. A pelecypod bivalve has been described from the distal sediments of a prograding delta, at the Beaufort-Ecca Group boundary and beetles have been recorded from the formation in Kwazulu-Natal. Reptile records are absent from the formation.

Numerous Late Neogene fossil localities are known from the region. The alluvial deposits of the Vaal and a number of its ancient tributaries, including the Vet and Sand Rivers are well known for their unique record of the Palio-Pleistocene. Further exploratory surveys along the Sand and Vet Rivers show moderately fossiliferous overbank sediments that frequently contain fossil remains of a variety of Quaternary-aged mammals.

The Stone Age archaeological footprint in the region is represented by the occurrence of open-site assemblages mostly located near river drainages. There are no records of rock engravings in the area and the survey area is situated outside the western periphery of distribution of Late Iron Age settlements in the Free State.

5.9.2 Site specific Palaeontology and Archaeology

The affected area is capped by unconsolidated topsoils with little or no sign of Volksrust Formation outcrop. The absence of rocky outcrop is largely attributed to a lack of topographical relief in the area. There is no indication for the accumulation and preservation of intact fossil material within the Quaternary sediments (unconsolidated topsoils). There is no evidence of intact or capped Stone Age or Iron Age archaeological material within the confines of the footprint. There are no indications of prehistoric structures or rock engravings within the footprint area. Historical buildings or structures older than 60 years are absent from the site. Two small graveyards occur on the property, but they

are located outside the development footprint. No graves or graveyards occur within the confines of the affected area.

Figure 17: Map showing locality of two farm cemeteries near the affected area (1 = S 27˚ 43' 43.9" E 26˚ 46' 13.8"; 2 = S 27˚ 44' 44.1" E 26˚ 47' 06.9").

5.10 Visual exposure (Refer to Visual Assessment in Annexure 3)

The region consists of slight undulating plains. The slope gradient of the region is low with no hills, ridgelines, spurs or steep slopes. For these reasons the facility would only be visible from short distances. High points such as ridges and hills are visible from greater distances and determine the horizon effect. These features are more prominent and visible from greater distances.

The area does not contain any prominent topographic features or other scenic features such as scenic routes, protected areas or game farms. Therefore the visual sensitivity of the area is relatively low.

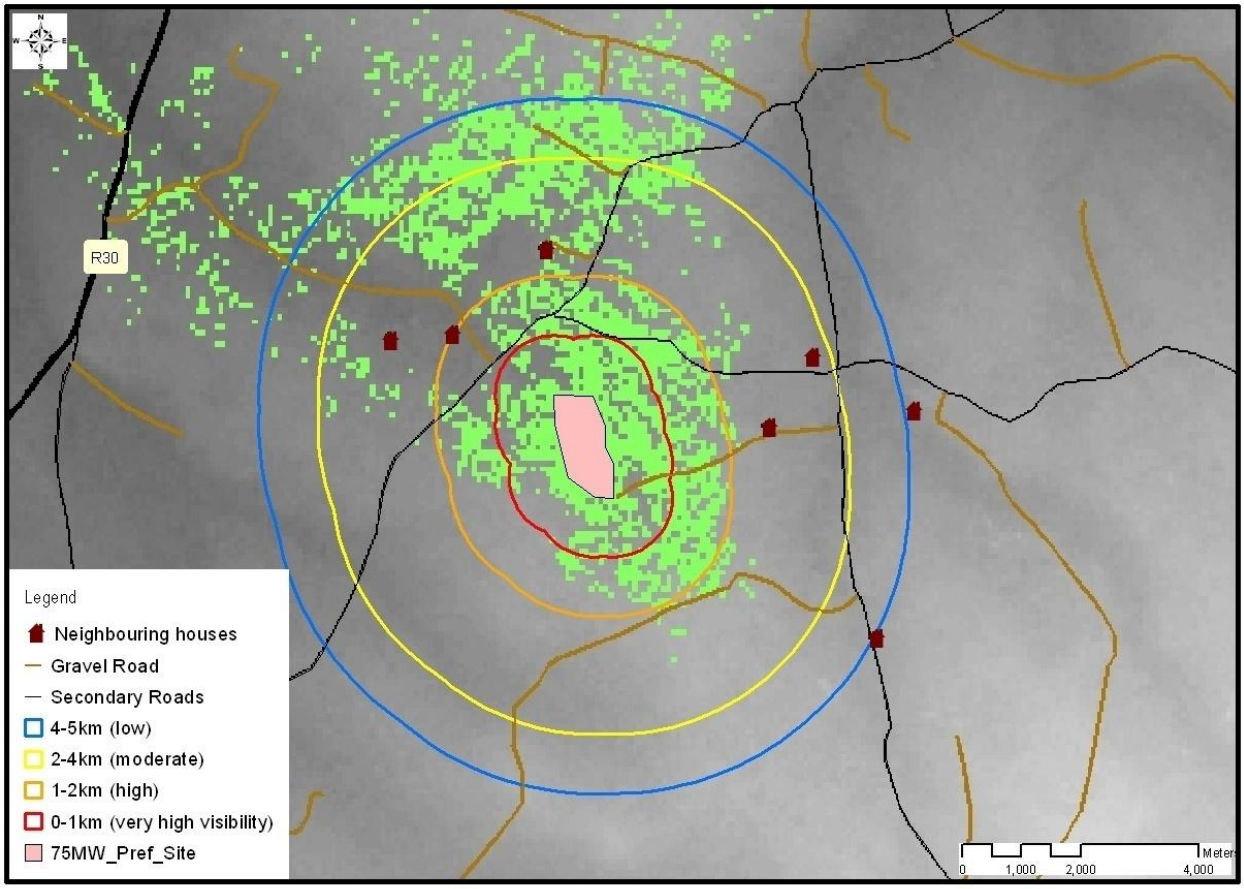
The visual exposure is directly coupled to the distance of the sensitive viewpoints from the solar facility. Some of the viewpoints associated with the development are situated close to the facility and are associated with the public gravel roads around the facility. The visual exposure of these areas is relatively high. However, due to the viewer potential it cannot be regarded as a concern to the development.

The visual exposure coupled to the residential viewpoints is much less due to the increase in distance from the facility. None of the residential viewpoints are located within 1km of the facility. This is ranked as moderate but due to the topography of the area it cannot be considered as a concern to the development.

The site where the facility is to be constructed consists of natural grassland. However, the surrounding environment consists of extensive cultivated fields (extensive maize cultivation) and natural areas are rare. The area cannot be said to consist of extensive natural areas of natural vegetation or recreational areas and therefore the sense of place is not regarded as sensitive.

The area surrounding the proposed solar farm contains several dirt roads. These are the S940, S161 and S173 dirt roads. These roads service the farming properties of the area and consequently the amount of road users are low. Due to the low amount of road users as well as the duration of interaction with this visual area the impacts are rated as moderate to low. Aspects such as the visual exposure, -sensitivity and sensitivity of the dirt road receptors are relatively low and as a result the visual impact on the adjacent dirt roads is rated as being low to moderate.

The surrounding area only contains a low amount of residential farmsteads. Consequently visual receptors are few and not located near the development. As seen from the viewshed (Figure 18) the area within a 5km radius of the facility contains only 8 residences. As indicated in Figure 18, the residences are not located within the viewshed and would not be affected by the development. Consequently the significance of the visual impact on the residences is regarded as relatively low.



An indication of the visibility of the solar farm on the farm Grootspruit 252/0, from the neighbouring farm settlements

Figure 18: The viewshed of the site in relation to surrounding visual receptors. Green areas indicate areas that are located within the viewshed of the development.

5.11 Regional socio-economic structure (Refer to Socio-Economic Assessment in Annexure 3)

This project could provide additional financial growth to the straggling economy of Matjhabeng Local Municipality. The area is in desperate need of investment, and the proposed project will fulfil this need. This project is not dependant on mining in any way and will therefore be an investment that will not be manipulated by downscaling of mines in the area. This project will therefore have a major positive impact on the regional economy. Although the project is not of a scale to cause large regional economic growth it will nonetheless promote economic growth in the area.

The area has experienced a radical economic decline in recent times. The Matjhabeng Local Municipality contributed 57% to the total economic income of the Free State Province during 1990. This economic contribution has declined to a mere 18.3% in 2004. This decline is thought to be

largely attributable to the recent mining closures. To put this in context: this was the only major urban area in South Africa where a negative economic growth rate was recorded for this period. According to data from 2002 the area was the urban area in South Africa with the largest percentage people living in poverty (52%) and it is also the area with the lowest per capita income (less than 50% of any other secondary city in South Africa).

The area has in recent times lost 35% of available jobs in just 8 years due to mining downscaling. It is clear that job losses have occurred at an alarming rate over time. The number of unemployment in the Matjhabeng Local Municipality has risen from 22% in 1996 to 47% in 2001.

Business closures within the area are common and there have been more business closures than openings.

The area also shows a declining population trend due to mining closures and this is coupled to a decrease in the skills base. Many of the former black townships are expanding and this is proof that many of the retrenched mine workers have opted to settle in the immediate area.

Due to mine downscaling many of the retrenched mine workers were unable to maintain the payments on their houses. There is also a low demand for these houses and consequently many of these houses remain empty. Low housing prices in the area indicate a low investor confidence and it is evident that pricing of residential property is not comparable with that of other cities/towns.

The downscaling of mines in the area has had a large impact on the funding of the Matjhabeng Local Municipality. This is due to increasing problems with the recovering of tax debts from home owners and the large numbers of retrenched mine workers who are unable to pay for their services. Due to this lack of funding the municipality is unable to maintain infrastructure and consequently many areas have infrastructure that is in disrepair.

Since the downscaling of mining several studies, structure plans, agencies, etc. have been established to mitigate the financial impacts of mining downscaling. These methods of re-thinking are given as: The Welkom Structure Plan of 1989, The Deloitte PimGoldby Industrial Study (1990 – 1992), The Free State Goldfields Development Centre (FSGDC) of 1992, The Matjhabeng Marketing and Investment Company and The Lejweleputswa Development Agency. Most of these bodies had as a core aim the encouragement of investment in the area.

Since 2008, South Africa experienced a marked reduction in the National Generation reserve margin. As such, the country is faced with having to save energy through energy reduction campaigns (Demand Side Management Renewable Energy and Energy Efficiency). Through this

programme, carbon emission reduction and climate change mitigation have become local priorities. To this end, the Matjhabeng Local Municipality is striving to become a leader in the field of climate change mitigation, the reduction of harmful greenhouse gases and the identification and implementation of alternative fuel sources. Renewable energy, proper energy efficient measures and the successful institutionalisation of climate change mitigation in all spheres of business form part of this commitment (Matjhabeng Local Municipality IDP Draft 2012).

6 PUBLIC PARTICIPATION

The Public Participation Process (PPP) has been included in this process to allow consultative dialogue between the Environmental Assessment Practitioner (EAP) and Interested and Affected Parties (I&AP's). The PPP allows parties such as directly affected landowners, neighbouring landowners, stakeholders, communities, interested parties, key stakeholders as well as authorities to raise concerns and provide comments on the proposed project. The PPP also allows the EAP to provide these interested and affected parties with detailed information regarding the project as well as respond to concerns and comments. This PPP was conducted as per Regulation 27 of Government Notice R.540 of 18 June 2010 in terms of NEMA, 1998.

The phases incorporated into the PPP can be summarised as follows:

- Initiation of the PPP involves the notification of all I&AP's including neighbouring landowners, general public, stakeholders and authorities. A Background Information Document (BID) is also supplied to all I&AP's so that they have a better informed notification of the proposed project. Notification allows I&AP's the opportunity to raise concerns and provide comments. An I&AP register is opened where all contact details and comments and concerns are logged. This register is kept opened during the duration of the EIA process.
- During the Scoping and EIA processes all registered I&AP's are provided with the opportunity to comment on the draft and final reports.
- After the competent authority has reached a decision and issued an Environmental Authorisation (EA) (positive or negative) the applicant and I&AP's are notified. Both parties are given an opportunity to appeal the decision to the MEC of Environmental Affairs within the stipulated timeframes.

According to the EIA regulations the following pertains to the registered I&AP's:

- May participate in the EIA process.
- May comment on any written submissions made to the competent authority by the applicant or EAP.
- Must comment within the timeframes as stipulated in the EIA regulations.

- Must send a copy of all comments to the applicant or EAP if the comments were submitted directly to the competent authority.
- Must disclose any direct business, financial, personal or other interests that the person has in the application being granted or refused.

The following actions were taken as part of the PPP initiation of the project during the Scoping phase:

- Placing site notices at the entrance of the property, Grootspruit 252/0 Odendaalsrus RD, considered for the proposed development.
- Placing an advertisement on 26 July 2012 in the Vista local newspaper which is distributed free of charge to the local community in the Goldfields area.
- Providing directly affected landowners, neighbouring landowners, stakeholders, key stakeholders as well as authorities with a written notice informing them of the proposed development, the environmental authorisation process, the Public Participation Process as well as an invitation to register, request information or comment.
- Notifications were given to the above mentioned parties via fax, e-mail or registered mail.
- A BID was also given to all of the above mentioned parties.

All issues raised or comments given were incorporated into the Draft Scoping Report. The Final Scoping Report was then made available to all registered I&AP's. Refer to Annexure 1 for the Comments and Response Report.

The Scoping Phase of the project was approved by DEA dated 11/12/2012. Thereafter the Draft Environmental Impact Report (DEIR) was made available to all registered I&AP's. The Final Environmental Impact Report (FEIR) was made available to all registered I&AP's for a period of 21 days. Refer to Annexure 1 for the Comments and Response Report.

Table 4: Authorities, stakeholders and I&AP's comments and responses on the Scoping Phase as well as the Draft and Final Environmental Impact Report (DEIR) (Refer to Annexure 1 for proof of notification, submissions and comments and responses).

I&AP's	Notifications and submissions	Comment and Response
Lejweleputswa District Municipality (Ms.Nontsikilelo Aaron – Municipal Manager)	The municipality was informed of the development via a fax notification and BID on 20/07/2012. A copy of the Final Scoping Report was also sent to the municipality on 28/09/2012 via registered mail. A copy of the DEIR was sent to them on 21/02/2013. They were also reminded of the conclusion of the commenting period via fax on 04/04/2013.A copy of the Final EIR will also be supplied to them.	No comments have been received up to date.
Matjhabeng Local Municipality (Mr. Thabo Petersen – Municipal Manager)	The municipality was informed of the development via a fax notification and BID on 20/07/2012. A copy of the Final Scoping Report was also sent to the municipality on 28/09/2012 via registered mail. A copy of the DEIR was sent to them on 21/02/2013. They were also reminded of the conclusion of the commenting period via fax on 04/04/2013. A copy of the Final EIR will also be supplied to them.	No comments have been received up to date.
Municipal Ward Councillor (Mr. Andre Steiger – Ward 36)	The ward councillor was informed of the development via a fax	No comments have been received up to date.

I&AP's	Notifications and submissions	Comment and Response
	notification and BID on 20/07/2012.	
South African Heritage Resources Agency (SAHRA) (Mr. Andrew Salomon)	SAHRA was informed of the development via a fax notification and BID on 20/07/2012. A Heritage Impact Assessment was conducted by Dr. Lloyd Rossouw during August 2012. An electronic copy of the report was sent to SAHRA on 10/09/2012. A copy of the Final Scoping Report was sent to SAHRA via e-mail and registered mail on 30/10/2010. A copy of the DEIR was sent to SAHRA on 21/02/2013. SAHRA was also reminded of the conclusion of the commenting period on 04/04/2013. A copy of the Final EIR will also be supplied to them.	SAHRA commented on 16/08/2012 that they require a first phase heritage assessment be conducted. SAHRA requested a copy of all relevant reports be sent to them on 26/10/2012. SAHRA responded on the reminder of the conclusion of the commenting period on the DEIR that they did not receive a report (refer to correspondence in Annexure 1). A response was given that the report was collected by SAHRA according to the tracking number of the report (RD816051829ZA). They were also reminded that would be able to comment on the Final EIR (refer to correspondence in Annexure 1).
Department of Water Affairs (DWA) (Mr. George Nel)	DWA was informed of the development via an e-mail notification and BID on 20/07/2012. A copy of the Final Scoping Report was supplied to the department on 28/09/2012 via registered mail. A copy of the DEIR was sent to DWA on 21/02/2013. DWA was also reminded of the conclusion of the commenting period on 04/04/2013. A copy of the Final EIR will also be	In general DWA does not have any objection towards the project; however, they request that several conditions be adhered to (refer to the letter attached in Annexure 1 for these conditions).The conditions as stipulated by DWA have been included in the EIR and EMPr.

I&AP's	Notifications and submissions	Comment and Response
	supplied to them.	
ESKOM (Ms. Renee de Bruin)	Eskom was informed of the development via an e-mail notification and BID on 20/07/2012. A copy of the Final Scoping Report was supplied to Eskom on 28/09/2012 via registered mail. A copy of the DEIR was sent to Eskom on 21/02/2013. Eskom was reminded of the conclusion of the commenting period on 04/04/2013. A copy of the Final EIR will also be supplied to them.	No comments have been received up to date. Proof of application for renewable generation and independent power producer projects: independent power producers (IPP's) have been received.
Free State Department of Economic Development, Tourism and Environmental Affairs (DETEA) (Me. Grace Mkhosana)	DETEA was informed of the development via an e-mail notification and BID on 20/07/2012. A copy of the draft and final Scoping Report was supplied to the department on 17/08/2012 and 28/09/2012. A copy of the DEIR was sent to DETEA on 21/02/2013. DETEA was reminded of the conclusion of the commenting period on 04/04/2013. A copy of the Final EIR will also be supplied to them.	A representative of DETEA was taken on a site visit on 11/10/2012. DETEA requires a summary of all protected and endangered species on the site. A summary of all protected and endangered species as well as the biodiversity report was sent to DETEA. The department was also ensured that they would receive a copy of the draft and final EIR which would address these concerns in more detail. Upon reviewing the Final Scoping Report DETEA is satisfied with the report and supports the project. The DETEA requests extensive

I&AP's	Notifications and submissions	Comment and Response
		mitigation pertaining to fauna on the site (refer to attached letter in Annexure 1).
Free State Department of Agriculture (Mr. Izak Venter – Range and Forage Science)	The department was informed of the development via a fax notification and BID on 20/07/2012. A copy of the draft and final Scoping Report was supplied to the department on 28/09/2012 and 18/10/2012. A copy of the DEIR was sent to them on 21/02/2013. They were reminded of the conclusion of the commenting period on 04/04/2013. A copy of the Final EIR will also be supplied to them.	The department has concluded their investigation and has forwarded their recommendation to DAFF, DCGTA & DETEA. The recommended mitigation measures have been included in the EIR and EMPr. The department has also provided a letter of no objection stating that this project will not endanger food security and will have several advantages impacts (refer to documents attached in Appendix 1).
Department of Agriculture, Forestry & Fisheries (DAFF) (Ms. Serah Masala Muobeleni – Directorate: Land Use and Soil Management)	The department was informed of the development via a fax and e-mail notification and BID on 20/07/2012. A copy of the draft and final Scoping Report was supplied to the department on 28/09/2012 and 18/10/2012. A copy of the DEIR was sent to them on 21/02/2013. They were reminded of the conclusion of the commenting period on 04/04/2013. A copy of the Final EIR will also be supplied to them.	An acknowledgement letter of application was received on 02/08/2012. DAFF requested more information regarding the project on 17/08/2012. Additional information was supplied to DAFF on 20/08/2012. DAFF replied that information was adequate. DAFF does not grant consent for this development (03/04/2013). Reasons for DAFF not being able to grant consent is disputed as the Agricultural & Soil Specialist clearly states that the area is of low

I&AP's	Notifications and submissions	Comment and Response
		agricultural potential. The project is currently in process of re-submission to DAFF (refer to Appendix 1).
Endangered Wildlife Trust (EWT) (Ms. Megan Diamond)	A copy of the DEIR was sent to EWT on 21/02/2013. EWT was reminded on the conclusion of the commenting period on 04/04/2013. A copy of the final EIR will also be supplied to them.	EWT commented that the report was delayed by mail services. We responded that the commenting period would be extended to allow them to make their comments on the DEIR. Comments from EWT were received on 10/04/2013. These comments were addressed in the FEIR and the comments were also attached to the FEIR.
BirdLifeSA (Ms. Samantha Ralston)	A copy of the DEIR was sent to BirdLifeSA on 21/02/2013. BirdLifeSA was reminded of the conclusion of the commenting period on 04/04/2013.	No comments have been received up to date.
Neighbouring Landowners	All neighbouring landowners were informed of the development telephonically whereupon a notification letter and BID was sent to the landowners on 20/07/2012 via E-mail and registered letters.	No comments have been received up to date.
Interested Public Party (Mr.SelloMohlopholi)	Mr. Mohlopholi reacted on the advertisement placed in the Vista local newspaper. A copy of the Scoping Report was supplied to Mr. Mohlopholi on 01/10/2012.	Mr.Mohlopholi requested more information on the proposed project on 06/08/2012. He requested information regarding the benefits in terms of job creation. A detailed

I&AP's	Notifications and submissions	Comment and Response
	A copy of the DEIR was sent to Mr. Mohlopholi on 21/02/2013. Mr. Mohlopholi was reminded of the conclusion of the commenting period on 04/04/2013. A copy of the Final EIR will also be supplied to him.	description of the job opportunities and socio-economic development strategies was sent to Mr. Mohlopholi on 24/08/2012. Mr. Mohlopholi requested the contact details of the applicant on 26/09/2012.The contact details of the applicant were supplied to Mr. Mohlopholi.

As an ongoing process the Public Participation Process will be extended throughout the Environmental Impact Phase and all Registered I&AP's will continue to play an integral part in this process.

7 ENVIRONMENTAL IMPACT ASSESSMENT

7.1 Assessment methodology

The environmental significance assessment methodology is based on the following determination:

Environmental Significance = Overall Consequence x Overall Likelihood

7.1.1 Determination of Consequence

Consequence analysis is a mixture of quantitative and qualitative information and the outcome can be positive or negative. Several factors can be used to determine consequence. For the purpose of determining the environmental significance in terms of consequence, the following factors were chosen: **Severity/Intensity, Duration and Extent/Spatial Scale.** Each factor is assigned a rating of 1 to 5, as described below and in tables 6, 7, 9 and10.

Determination of Severity

Severity relates to the nature of the event, aspect or impact to the environment and describes how severe the aspects impact on the biophysical and socio-economic environment.

Table 5 will be used to obtain an overall rating for severity, taking into consideration the various criteria.

Table 5: Rating of severity

Type of criteria	Rating				
	1	2	3	4	5
Quantitative	0-20%	21-40%	41-60%	61-80%	81-100%
Qualitative	Insignificant / Non-harmful	Small / Potentially harmful	Significant / Harmful	Great / Very harmful	Disastrous Extremely harmful
Social/ Community response	Acceptable / I&AP satisfied	Slightly tolerable / Possible objections	Intolerable/ Sporadic complaints	Unacceptable / Widespread complaints	Totally unacceptable / Possible legal action
Irreversibility	Very low cost to mitigate/ High potential to mitigate impacts to level of	Low cost to mitigate	Substantial cost to mitigate / Potential to mitigate impacts / Potential to	High cost to mitigate	Prohibitive cost to mitigate / Little or no mechanism to mitigate impact Irreversible

Type of criteria	Rating				
	1	2	3	4	5
	insignificance / Easily reversible		reverse impact		
Biophysical (Air quality, water quantity and quality, waste production, fauna and flora)	Insignificant change / deterioration or disturbance	Moderate change / deterioration or disturbance	Significant change / deterioration or disturbance	Very significant change / deterioration or disturbance	Disastrous change / deterioration or disturbance

Determination of Duration

Duration refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention e.g. remedial action takes place.

Table 6: Rating of Duration

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

Determination of Extent/Spatial Scale

Extentrefer to the spatial influence of an impact be local (extending only as far as the activity, or will be limited to the site and its immediate surroundings), regional (will have an impact on the region), national (will have an impact on a national scale) or international (impact across international borders).

Table 7: Rating of Extent / Spatial Scale

Rating	Description
1: Low	Immediate, fully contained area
2: Low-Medium	Surrounding area
3: Medium	Within Business Unit area of responsibility
4: Medium-High	Within Farm Boundary area
5: High	Regional, National, International

Determination of Overall Consequence

Overall consequence is determined by adding the factors determined above and summarised below, and then dividing the sum by 4.

Table 8: Example of calculating Overall Consequence

Consequence	Rating
Severity	Example 4
Duration	Example 2
Extent	Example 4
SUBTOTAL	10
TOTAL CONSEQUENCE:(Subtotal divided by 4)	3.3

7.1.2 Likelihood

The determination of likelihood is a combination of Frequency and Probability. Each factor is assigned a rating of 1 to 5, as described below and in Table 9 and Table 10.

Determination of Frequency

Frequency refers to how often the specific activity, related to the event, aspect or impact, is undertaken.

Table 9: Rating of frequency

Rating	Description
1: Low	Once a year or once/more during operation/LOM
2: Low-Medium	Once/more in 6 Months
3: Medium	Once/more a Month
4: Medium-High	Once/more a Week
5: High	Daily

Determination of Probability

Probability refers to how often the activity/event or aspect has an impact on the environment.

Table 10: Rating of probability

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

Overall Likelihood

Overall likelihood is calculated by adding the factors determined above and summarised below, and then dividing the sum by 2.

Table 11: Example of calculating the overall likelihood

Consequence	Rating
Frequency	Example 4
Probability	Example 2
SUBTOTAL	6
TOTAL LIKELIHOOD (Subtotal divided by 2)	3

Determination of Overall Environmental Significance

The multiplication of overall consequence with overall likelihood will provide the environmental significance, which is a number that will then fall into a range of LOW, LOW-MEDIUM, MEDIUM, MEDIUM, MEDIUM-HIGH or HIGH, as shown in the table below.

Table 12: Determination of overall environmental significance

Significance or Risk	Low	Low-Moderate	Moderate	Moderate-High	High
Overall Consequence X Overall Likelihood	1 - 4.9	5 - 9.9	10 - 14.9	15 – 19.9	20 - 25

Qualitative description or magnitude of Environmental Significance

This description is qualitative and is an indication of the nature or magnitude of the Environmental Significance. It also guides the prioritisations and decision making process associated with this event, aspect or impact.

Table 13: Description of the environmental significance and the related action required.

Significance	Low	Low-Moderate	Moderate	Moderate-High	High
Impact Magnitude	Impact is of very low order and therefore likely to have very little real effect. Acceptable.	Impact is of low order and therefore likely to have little real effect. Acceptable.	Impact is real, and potentially substantial in relation to other impacts. Can pose a risk to the company	Impact is real and substantial in relation to other impacts. Pose a risk to the company. Unacceptable	Impact is of the highest order possible. Unacceptable. Fatal flaw.
Action Required	Maintain current management measures. Where possible improve.	Maintain current management measures. Implement monitoring and evaluate to determine potential increase in risk. Where possible improve	Implement monitoring. Investigate mitigation measures and improve management measures to reduce risk, where possible.	Improve management measures to reduce risk.	Implement significant mitigation measures or implement alternatives.

7.2 Environmental Impact Assessment:

7.2.1 Geology and Soils

According to the soil assessment (attached hereto in Annexure 3) the soil profile exhibit swelling and shrinking properties, these poorly permeable layers impede water infiltration, internal drainage and flow out of the profile. Plant available water is low in these soils owing to the high matrix potential exhibited by the pedocutanic B-horizons. Plant root development is inhibited by the high clay content and compaction of the soils. The horizons that show swelling and shrinking characteristics compact naturally in the dry state and this may lead to root pruning.

The study area is of low agricultural potential and can only be used for carefully managed grazing. Overgrazing will lead to soil erosion and the removal of the sandy orthic A-horizon.

The proposed development might lead to higher surface runoff. It must be kept in mind that surface runoff is already high in the area and that the proposed development, especially if screw-foot foundations are used in construction, will not lead to substantially higher runoff rates. Care should be taken not to impact the topography of the study area. To combat erosion and higher sediment loads in runoff water, attenuation ponds, swales and berms can be put in place.

Cumulative Impact: Erosion of the soil surface may lead to sedimentation of the adjacent annual stream. These sediments would than be washed downstream.

Disturbance, compaction and degradation of the soil surface due to heavy machinery during construction

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	4	3	3	3.33	4	2	3	9.99	7
Second Alternative	5	5	5	5	4	4	4	20	17.33
Third Alternative	5	5	4	4.66	4	4	4	18.64	14
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	3	5	3	3.67	4	3	3.5	12.85	9
Fixed Mounted PV Solar	2	4	3	3	4	2	3	9	8.01
Dual Axis Tracking	2	4	5	3.67	4	3	3.5	12.85	11.01

PV Solar									

Alternatives and their respective impacts:

- The **first alternative** would have the lowest impact since it will not entail the compaction and degradation of portions of high yield cultivated cropland and it will also not lead to the disturbance and degradation of the annual stream on the property.
- The **Fixed Mounted PV Solar technology** would have the lowest impact as it will utilise a smaller surface area for the same efficiency as the other technologies. In this manner the area of impact will be minimised.

Mitigation measures:

- Vegetation will only be removed where the panels are to be installed. Since panels will be anchored by screw-foot the vegetation underneath and in-between the panels will be left intact. However, trampling by construction vehicles would still have an impact on the vegetation but since the vegetation and consequently topsoil will not be removed the seedbank will be left intact.
- Removal of vegetation will be restricted to excavation of trenches for installation of cables as well as the construction of a substation and inverters.
- Construction activities will be limited to the site where the panels and substation will be established.
- Topsoil should be removed from foundation areas prior to the commencement of construction.
- Keep topsoil separate and stockpile in an area not prone to erosion.
- Solar panel frames will be anchored by means of anchor screws which do not necessitate the removal of topsoil and will lead to the least disturbance to the soil surface.
- Earthworks will be limited to the construction of the substation, guardhouse and other buildings.
- Topsoil removed for the excavation of trenches for the installation of cables will be kept separate and will be replaced in original sequence.
- Any excess topsoil will be used to rehabilitate the area after construction has ceased.
- Maintain machinery in a good working condition.
- The correct management of storage, disposal and spills of any hazardous material as stipulated in the Environmental Management Program (EMPr).

Erosion of the soil surface due to the proposed development

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	4	2	4	3.33	4	3	3.5	11.66	9
Second Alternative	4	4	4	4	4	3	3.5	14	11.01
Third Alternative	5	4	4	4.33	5	4	4.5	19.49	17.32
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	4	3	5	4	5	3	4	16	10
Fixed Mounted PV Solar	3	2	3	2.67	5	3	4	10.68	6
Dual Axis Tracking	4	3	5	4	5	3	4	16	10

PV Solar									

Alternatives and their respective impacts:

- The **first alternative** would have the lowest impact since it will lead to the least probability of soil erosion. The second alternative contains portions of cultivated cropland that would not contain vegetation and would consequently be more susceptible to water and wind erosion. The third alternative would be situated within the annual stream on the site and this would considerably exacerbate the water erosion of the soil.
- The **Fixed Mounted PV Solar technology** would have the lowest impact as it will utilise a smaller surface area for the same efficiency as the other technologies. In this manner the surface area would be smaller and therefore the impact on erosion would also be smaller than the other technological alternatives.

Mitigation measures:

- Vegetation will only be removed where the panels are to be installed. Since panels will be anchored by screw-foot the vegetation underneath and in-between the panels will be left intact. However, trampling by construction vehicles would still have an impact on the vegetation but since the vegetation and consequently topsoil will not be removed the seedbank will be left intact.
- Removal of vegetation will be restricted to excavation of trenches for installation of cables as well as the construction of a substation and inverters.
- Construction activities will be limited to the site where the panels and substation will be established.
- Keep topsoil separate.
- Solar panel frames will be anchored by means of anchor screws which do not necessitate the removal of topsoil and will cause a lower likelihood of soil erosion.
- Earthworks will be limited to the construction of the substation, guardhouse and other buildings.
- Topsoil removed for the excavation of trenches for the installation of cables will be kept separate and will be replaced in original sequence.
- Any excess topsoil will be used to rehabilitate the area after construction has ceased.
- Ensure that the slope of the stockpiled material is such that surface runoff is minimal.
- Additions of stabilising agents to stockpiles such as organic material or vegetative cover should be considered.
- Soils must be stockpiled for the minimum period before re-use.
- Surface structures such as swales and berms must be implemented to prevent erosion; the use of attenuation ponds must also be investigated.

7.2.2 Topography

The region has a relatively flat topography with slightly undulating plains. The site itself contains a gradual slope toward the north and a small seasonal stream is located immediately north of the site.

The area does not have a variety in altitude due to the relatively flat topography. Altitude in the area ranges from 1338m to 1323m.

The topography will not be affected by the development and earthworks and levelling will be restricted to the area where the substation, guardhouse and other buildings will be erected.

Cumulative Impact: None, since the topography will not be altered to a large extent and construction will be confined to the development footprint.

Impact and alteration of the topography of the site

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	2	1	2	1.67	2	2	2	3.34	2.66
Second Alternative	2	1	2	1.67	2	2	2	3.34	2.66
Third Alternative	4	3	4	3,67	4	3	3.5	12.85	11.66
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	4	4	4	4	4	3	3.5	14	14
Fixed Mounted PV Solar	2	2	2	2	2	2	2	4	2
Dual Axis Tracking PV Solar	3	3	2	2.67	2	2	2	5.36	2

Alternatives and their respective impacts:

- The **first** and **second alternative** will have the lowest impacts since the impact on the topography will be restricted to the earthworks involved with the construction of the substation, guardhouse and other buildings. The third alternative contains an annual stream and the proposed development is anticipated to have a moderate impact on the topography of this stream.
- The **Fixed Mounted PV Solar technology** and **Dual Axis Tracking PV Solar technology** will have the lowest impacts as it will not require the levelling and contouring of the site and consequently the impact of these technologies will be low-moderate as apposed to the Concentrated Solar Power technology.

Mitigation measures:

- Earthworks must be restricted to the substation, guardhouse and other buildings.
- Levelling of the site will be limited to the construction areas where foundations will be required to keep the topography of the site intact.

7.2.3 Land use, agricultural potential and soil capacity (Refer to Specialist Report in Annexure 3)

The region is currently utilised for extensive agricultural activities. Extensive areas have been transformed for crop production. The crop of choice in most areas is maize. The site itself is currently utilised for grazing by cattle and ostrich. The site consists of natural vegetation.

The site falls mainly into the grazing land capability according to the definitions of the Chamber of Mines of South Africa, 1981. During the construction phase the area would not be available as

grazing and this would have an impact on the agricultural activities on the farm. However, during the operational phase the area would be available as grazing and the impact on agricultural land use would be negligible.

The poorly permeable layers that characterise the Valsriver and Sepane soil forms impede water infiltration, internal drainage and flow out of the profile. Plant available water is low in these soils owing to the high matrix potential exhibited by the pedocutanic B-horizons. Plant root development is inhibited by the high clay content and compaction of the soils. The horizons that show swelling and shrinking characteristics compact naturally in the dry state and this may lead to root pruning.

The site is of low agricultural potential and can only be used for carefully managed grazing. Overgrazing will lead to soil erosion. Therefore the impact on agricultural potential will remain low as long as the cultivated cropfields are excluded from the development.

The farm Grootspruit 252/0 has a size of 690 ha and is currently zoned for agriculture. The farm is owned by the Grootspruit Family Trust. The current land use is agriculture. Approximately 530 ha is being utilised as natural grazing for cattle and ostrich while approximately 160 ha is being utilised for the cultivation of maize.

The area to be utilised for the construction of the proposed solar farm would have to be rezoned to include solar farm as an approved activity, i.e. agriculture with solar farming.

Cumulative Impact: None, as long as construction activities are confined to the development footprint and as long as the area is available as grazing during the operational phase.

Impact on the agricultural potential and soil capacity

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	3	4	3	3.67	4	3	3.5	12.85	6.99
Second Alternative	5	5	5	5	5	5	5	25	22.5
Third Alternative	4	4	5	4.33	4	4	4	17.32	11.66
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	3	4	4	3.67	4	2	3	11.01	11.01
Fixed Mounted PV Solar	3	4	3	3.33	4	2	3	9.99	8.01

Dual Axis Tracking PV Solar	2	4	5	3.67	4	2	3	11.01	11.01

Alternatives and their respective impacts:

- The **first alternative** is preferred since it will not entail the loss of high yield agricultural soil or the degradation of the soil capacity of the annual stream. The second alternative contains cultivated croplands and the impact on these areas would be high.
- The **Fixed Mounted PV Solar technology** is preferred as it will utilise a smaller surface area for the same efficiency as the other technologies. In this manner the area of impact will be minimised.

Mitigation measures:

- Vegetation will only be removed where the panels are to be installed. Since panels will be anchored by screw-foot the vegetation underneath and in-between the panels will be left intact. However, trampling by construction vehicles would still have an impact on the vegetation but since the vegetation and consequently topsoil will not be removed the seedbank will be left intact.
- Removal of vegetation will be restricted to excavation of trenches for installation of cables as well as the construction of a substation and inverters.
- Construction activities will be limited to the site where the panels and substation will be established.
- Solar panel frames will be anchored by means of anchor screws which do not necessitate the removal of topsoil and will lead to the least disturbance to the soil surface.
- Grazing will remain a viable land use during the operational phase since the removal of vegetation on the site will be limited to the guardhouse, substation and inverters.

7.2.4 Natural vegetation (Refer to Specialist Report in Annexure 3)

The vegetation on the site consists of Vaal-Vet Sandy Grassland (Gh 10) with some elements of Highveld Alluvial Vegetation (Aza 5) along the seasonal stream on the property. Vaal-Vet Sandy Grassland is regarded as Endangered (EN) due to transformation for agriculture.

Disturbance of the grassland on the site is currently only limited to grazing by domestic stock. The grassland seems to be in a relatively good condition.

Habitats on the site are restricted to a grass layer.

As a whole the area does not have a high habitat diversity. Due to the size of the developmental footprint the area contains relatively high number of plant species but seen in context it cannot be said that the area has a high species diversity. No plant species of concern that is rare, protected or endangered could be identified on the site (Refer to the Specialist Report in Annexure 3). It is considered unlikely that any species of concern would occur on the site.

The vegetation type occurring on the site is regarded as Endangered. This is due to the extensive transformation of this grassland for crop cultivation. However, this area does not form part of one of the focus areas for the Free State Highveld Grasslands in the National Protected Areas Expansion Strategy (NPAES) as it is not deemed a viably large natural area for protection.

The impacts on the vegetation are associated with the degradation and trampling of the grassland especially during the construction phase of the project. The installation of solar panels would also cause a shade effect and this would cause transformation of the grassland species composition, this would become more pronounced during the operational phase.

The area also contains a dwarf succulent, *Nananthus vittatus*, and although this species is protected or endangered and it is considered that it does have some conservation value. Trampling of the grassland would lead to the eradication of this species on the site.

Cumulative Impact: The degradation and transformation of the grassland on the site would decrease the available grassland vegetation in the surrounding area.

Impact on the natural vegetation on the site

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	3	4	4	3.67	4	3	3.5	12.85	10
Second Alternative	2	4	3	3	4	3	3.5	10.5	8.01
Third Alternative	4	5	4	4.33	5	4	4.5	19.49	17.32
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	3	3	4	3.33	4	3	3.5	11.66	9.99
Fixed Mounted PV Solar	3	3	3	3	4	3	3.5	10.5	6.99
Dual Axis Tracking PV Solar	4	3	4	3.67	4	3	3.5	12.85	11.01

Alternatives and their respective impacts:

- The **second alternative** would have the lowest impact because it contains portions of cultivated cropland and the impact on the natural vegetation would not be as high. The first alternative would have a higher impact than the second alternative but this would still be considered as moderate.
- The **Fixed Mounted PV Solar technology** would have the lowest impact as it will utilise a smaller surface area for the same efficiency as the other technologies. In this manner the area of impact will be minimised. The Concentrated Solar Power and Dual Axis Tracking PV Solar would utilise a larger surface area and therefore the impact on the vegetation

would be higher.

Mitigation measures:

- Vegetation will only be removed where the panels are to be installed. Since panels will be anchored by screw-foot the vegetation underneath and in-between the panels will be left intact. However, trampling by construction vehicles would still have an impact on the vegetation but since the vegetation and consequently topsoil will not be removed the seedbank will be left intact.
- Removal of vegetation will be restricted to excavation of trenches for installation of cables as well as the construction of a substation and inverters.
- Construction activities will be limited to the site where the panels and substation will be established.
- Solar panel frames will be anchored by means of anchor screws which do not necessitate the removal of topsoil and will lead to the least disturbance to the vegetation.
- Topsoil removed for the excavation of trenches for the installation of cables during construction will be kept separate and will be replaced in original sequence. This will ensure that the soil seedbank is kept intact and that germination of the natural vegetation occurs within a short period. The stored soil will be utilised to level and rehabilitated disturbed areas after construction activities have ceased.
- A portion of the dwarf succulent (*Nananthusvittatus*) population should be kept intact. During construction, areas in between panels where this species occurs in high density should be demarcated and no construction should be allowed in these areas (see visual representation of mitigation measure in Figure 19). This will keep a proportion of the population intact.

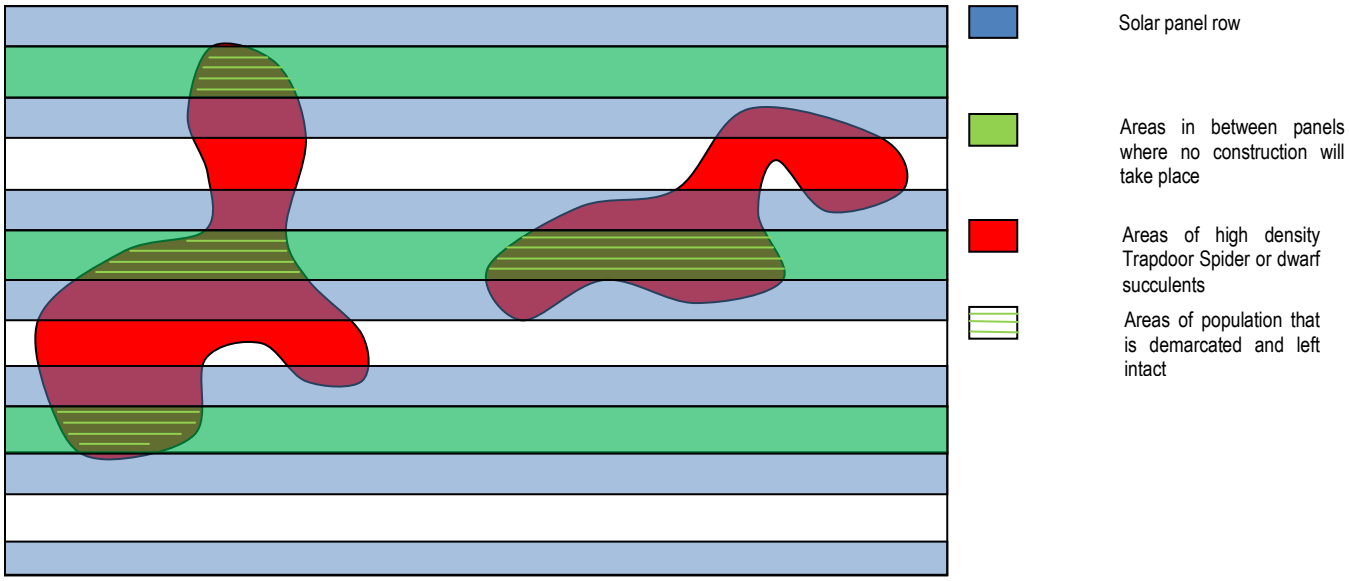


Figure 19: Visual illustration of the areas of high density Trapdoor Spider (*Stasimopus sp.*) and the mitigation measure that will ensure a portion of the population remains intact.

7.2.5 Terrestrial mammals (Refer to Specialist Report in Annexure 3)

This natural area of the study area is relatively isolated and does not form part of a large natural area. It does however function as a refuge for many terrestrial mammals. The area is connected via several corridors to other areas of natural vegetation and mammals should be able to move between these areas. Many of the mammals in the area have also become adapted to these isolated areas close to human dwellings where disturbance is common.

Owing to the size of the developmental footprint (180 ha) the area contains a relatively large mammal population.

The following species occur on the site and are regarded as protected in the Free State Province: Antbear, Yellow Mongoose and Suricate. These species are all widespread and common.

The main impact on the mammals on the site would the exclusion and transformation of suitable habitat. The surrounding area has already been heavily fragmented by extensive crop cultivation and this would add to the fragmentation of available habitat.

Cumulative Impact: The degradation and transformation of available grassland habitat would lead to further fragmentation and exclusion of suitable habitat in a region where the grassland has already been extensively transformed.

Impact on the terrestrial mammals on the site

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	3	3	4	3.33	3	4	3.5	11.66	9
Second Alternative	2	3	3	2.67	3	4	3.5	9.35	6.99
Third Alternative	4	5	4	4.33	4	4	4	17.32	17.32
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	3	4	4	3.67	4	3	3.5	12.85	9
Fixed Mounted PV Solar	2	4	2	2.67	4	3	3.5	9.35	6
Dual Axis Tracking PV Solar	4	4	4	4	4	3	3.5	14	10

Alternatives and their respective impacts:

- The **second alternative** would have the lowest impact because it contains portions of cultivated cropland and the

impact on the mammal population would not be as high. The first alternative would have a slightly higher impact than the second alternative but this would still be considered as low-moderate. Due to the annual stream present on the third alternative site the impact on the mammals on this site would be moderate-high.

- The **Fixed Mounted PV Solar technology** would have the lowest impact as it will utilise a smaller surface area for the same efficiency as the other technologies. In this manner the area of impact will be minimised. The Concentrated Solar Power and Dual Axis Tracking PV Solar would utilise a larger surface area and therefore the impact on the mammal population would be higher.

Mitigation measures:

- Vegetation will only be removed where the panels are to be installed. Since panels will be anchored by screw-foot the vegetation underneath and in-between the panels will be left intact. However, trampling by construction vehicles would still have an impact on the vegetation but since the vegetation and consequently topsoil will not be removed the seedbank will be left intact.
- Removal of vegetation will be restricted to excavation of trenches for installation of cables as well as the construction of a substation and inverters.
- Construction activities will be limited to the site where the panels and substation will be established.
- Burrows on the site will not be filled in as far as possible during the initial 6 months of construction. This will allow the mammalian occupants to vacate the area to surrounding natural areas.
- The colony of protected Suricate (*Suricatasuricatta*) (S 27.73647˚ E 26.77241˚) will be demarcated prior to construction and no construction will be allowed within the area for 6 months during the initial construction. This will allow the colony ample time to vacate the area. An inspection of this colony must be done prior to construction to ascertain if the colony is still present. Inspections will be done regularly to establish when the colony has vacated the area.
- The fence surrounding the facility will allow for small mammals to enter the area, this will ensure that the area remains as available habitat for several species. Openings of 30cm x 30cm should be sufficient to allow passage to small mammals.
- No hunting, capturing or harming of any faunal species on the site will be allowed.

7.2.6 Avian fauna (Refer to Specialist Report in Annexure 3)

The area contains several species of waterfowl that are associated with the water bodies on the site. These species are dependant on the water source and do not occur within the grassland. As long as the development does not occur within 30 meters of the stream on the site the impact on these water fowl is anticipated to be low.

The use of PV Solar Power would have considerably lower impacts on the birdlife as apposed to the high impacts that Concentrated Solar Power has.

The area does not contain a high diversity of bird life but there is a likelihood that several Red Listed species may occur on the site. These species include the Secretarybird, Melodius Lark and Lesser Kestrel which are sensitive to habitat degradation and transformation. The proposed facility would

essentially transform the area and exclude the area as suitable habitat and would consequently cause displacement of these species.

A short distance (approximately 400m) of new power lines will be constructed to connect to the existing Eskom power lines. The placement of bird flappers along the entire length of this proposed power line must be done. It has been shown that this could reduce collision frequency by at least 50-60%.

The development would negatively affect the avian population in regard to the transformation of the natural grassland and the exclusion of suitable habitat. This is especially relevant to likely endangered species.

Cumulative Impact: The natural habitat would be transformed and degraded and this decrease suitable habitat and would add to the already extensively fragmented surroundings. The construction of a short length (approximately 400m) of new power lines would add the impact of the existing power lines. However, the placements of bird flappers along the entire length of this new power line should mitigate this impact.

Impact on the avian fauna on the site

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	4	4	3	3.67	3	4	3.5	12.85	11.66
Second Alternative	3	4	3	3.33	3	4	3.5	11.66	9.31
Third Alternative	5	5	4	4.67	4	5	4.5	21.02	19.49
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	5	5	4	4.67	4	5	4.5	21.02	21
Fixed Mounted PV Solar	3	5	3	3.67	3	4	3.5	12.85	10.98
Dual Axis Tracking PV Solar	4	5	4	4.33	4	4	4	17.32	15.16

Alternatives and their respective impacts:

- The **second alternative** would have the lowest impact because it contains portions of cultivated cropland and the impact on the birdlife would not be as high, it is rated as having a moderate-low impact. The first alternative would have a slightly higher impact than the second alternative and is rated as having a moderate impact.The annual stream situated on alternative 3 forms habitat to many water birds, therefore the impact on these species would be moderate-high.

- The **Fixed Mounted PV Solar technology** would have the lowest impact as the impact on the birdlife of the area would be moderate. According to BirdlifeSA the use of Concentrated Solar Power is not preferred due to the high negative impact this technology has on the birdlife due to the associated central receiver tower, standby focal points and heliostats which cause collisions and disorientation of birds.

Mitigation measures:

- Vegetation will only be removed where the panels are to be installed. Since panels will be anchored by screw-foot the vegetation underneath and in-between the panels will be left intact. However, trampling by construction vehicles would still have an impact on the vegetation but since the vegetation and consequently topsoil will not be removed the seedbank will be left intact.
- Removal of vegetation will be restricted to excavation of trenches for installation of cables as well as the construction of a substation and inverters.
- Construction activities will be limited to the site where the panels and substation will be established.
- The facility will maintain a 30 meter buffer from the annual stream on the site. This will mitigate the impact on water fowl in the area.
- No hunting, capturing or harming of any faunal species on the site will be allowed.
- Bird flappers must be attached to the entire length of new overhead power lines to be constructed. This has been shown to decrease collision frequency by at least 50-60%.
- The placement of the proposed new section of power line should be such that the impact on bird life is kept to a minimum.
- Monitoring of bird fatalities must be carried out. Employees must be educated to perform basic acquisition of fatality data. Data accumulated must be submitted to the relevant organisation such as BirdLifeSA.
- Removal of nests should only take place during the winter months when limited breeding of birds take place.
- The installation of artificial nest sites should be considered. These nests should be placed on elevated structures away from the surrounding power lines. The perimeter fence or surrounding trees should be considered for these artificial nests. The nests should cater for owls (boxes) as well as raptors (platforms).
- Only that portion of the exotic Blugum Trees (*Eucalyptus camaldulensis*) situated within the development footprint should be removed, the remainder should be kept intact. Although the species is listed as a category 2 invader it provides nesting and roosting opportunities to birds.

7.2.7 Amphibians (Refer to Specialist Report in Annexure 3)

There is a high likelihood that a number of amphibians would occur in this area due to the artificial dam and annual stream on the property. However, only one species known to occur in this area is listed as a threatened species, i.e. the Giant Bullfrog (*Pyxicephalus adspersus*). This species is listed as being Near Threatened due to urbanisation and agricultural activities.

The species occurs in depressions such as pans, wetlands or streams that contain water only during the rainy season in open grassland areas. Therefore there is a high likelihood that this species may occur in the area. However, if a buffer zone of 30 meters is respected along the annual stream occurring on the property the impact on the species would be low should it occur in the area.

Cumulative Impact: None, as long as a buffer zone is respected along the annual stream on the property.

Impact on the amphibians on the site

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	2	2	2	2	2	2	2	4	1.67
Second Alternative	2	2	2	2	2	2	2	4	1.67
Third Alternative	4	4	5	4.33	4	4	4	17.32	12.83
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	3	2	3	2.33	3	3	3	6.99	6.68
Fixed Mounted PV Solar	2	1	2	1.67	2	3	2.5	4.18	3.34
Dual Axis Tracking PV Solar	3	2	3	2.67	3	3	3	8.01	6.68

Alternatives and their respective impacts:

- The **first alternative** and **second alternative** has the lowest impact because it does not occur within a watercourse or within 30 meters of any watercourse or wetland and therefore the impact on the amphibians of the area is considered relatively low. Alternative three has a moderate impact as it would occur within the annual stream on the site.
- The **Fixed Mounted PV Solar technology** has the lowest impact as it would utilise a smaller surface area to produce the same amount of electricity as apposed to the other technological alternatives. Therefore the likely impact and extent would be smaller.

Mitigation measures:

- Vegetation will only be removed where the panels are to be installed. Since panels will be anchored by screw-foot the vegetation underneath and in-between the panels will be left intact. However, trampling by construction vehicles would still have an impact on the vegetation but since the vegetation and consequently topsoil will not be removed the seedbank will be left intact.
- Removal of vegetation will be restricted to excavation of trenches for installation of cables as well as the construction of a substation and inverters.
- Construction activities will be limited to the site where the panels and substation will be established.
- The facility will maintain a 30 meter buffer from the annual stream on the site. This will mitigate the impact on amphibians in the area.
- No hunting, capturing or harming of any amphibian species on the site will be allowed.
- Excavation of topsoil will be restricted to the construction of substation, guardhouse, other buildings and cable trenches. This will mitigate the impact on dormant amphibians in the topsoil.

7.2.8 Reptiles (Refer to Specialist Report in Annexure 3)

Since reptiles are inactive during the winter months the area could not be surveyed for reptiles (Survey conducted on 11 July 2012). It is also not known that a large number of endangered reptiles occur in this area. However, one species of concern is known to occur within this area. This species is the Sungazer Lizard (*Cordylusgiganteus*) which is listed as Vulnerable (VU). According to the property owner this species has been sighted on the property concerned. During the survey numerous burrows were identified that could be inhabited by this species but due to the time of year it could not be ascertained if any specimens were present.

The species is threatened by loss of habitat due to agriculture, mining, urban expansion and illegal collecting. Sungazers are endemic to South Africa and are only found in a relatively small area in the eastern Free State. The species normally occur in small colonies and inhabits burrows with a distinctive entrance. Though no specimens could be identified on the site the possibility of this species occurring on the site is highly likely.

The area constitutes suitable habitat and the highest impact would be the degradation and transformation of suitable habitat.

Cumulative Impact: The development would add to degradation and fragmentation of an already extensively fragmented area.

Impact on the reptiles on the site

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	5	4	5	4.67	4	4	4	18.68	16
Second Alternative	4	4	4	4	4	4	4	16	13.33
Third Alternative	5	4	5	4.67	4	4	4	18.68	16
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	5	4	5	4.67	4	4	4	18.68	16
Fixed Mounted PV Solar	4	4	4	4	4	4	4	16	13.33
Dual Axis Tracking PV Solar	5	4	5	4.67	4	4	4	18.68	16

Alternatives and their respective impacts:

- The **second alternative** would have the lowest impact as it contains portions of cultivated cropland which cannot be included as possible habitat for the endangered Sungazer species. It must be noted that the likelihood of this species

occurring within the area is high although it could not be confirmed.

- The **Fixed Mounted PV Solar technology** would have the lowest impact as it would utilise a smaller surface area to produce the same amount of electricity as apposed to the other technological alternatives. Therefore the likely impact and extent on the likely endangered species would be smaller.

Mitigation measures:

- Vegetation will only be removed where the panels are to be installed. Since panels will be anchored by screw-foot the vegetation underneath and in-between the panels will be left intact. However, trampling by construction vehicles would still have an impact on the vegetation but since the vegetation and consequently topsoil will not be removed the seedbank will be left intact.
- Removal of vegetation will be restricted to excavation of trenches for installation of cables as well as the construction of a substation and inverters.
- Construction activities will be limited to the site where the panels and substation will be established.
- No hunting, capturing or harming of any reptile species on the site will be allowed.
- It is recommended that a survey be conducted prior to any construction activities on the site to determine if any specimens of Sungazer (*Cordylusgiganteus*) are present on the proposed site and what the extent of the population is.
- Should any specimens or colonies be found on the site during this survey they should be removed by means of a search-and-rescue operation. Any specimens that are removed from the site should be re-located to a similar habitat on the portion of the property that will not be developed.
- No illegal collecting of any Sungazers must be permitted.
- The re-locating of any Sungazers should not be done without a permit to do so.
- If re-location of Sungazers takes place a monitoring program should be initiated to monitor the health of the re-located population.

7.2.9 Arachnids (Refer to Specialist Report in Annexure 3)

The site proposed for the solar facility does not contain any Scorpion species or Baboon Spiders but a large population of trapdoor spiders does occur in the area.

These Trapdoor Spiders belong to the genus *Stasimopus*. Although the species could not be identified it can only be one of eight species namely *S. bimaculatus, S. coronatus, S. dreyeri, S. gigas, S. minor, S. nanus, S. nigellus*and *S. oculatus*. All of these species are protected in the Free State Province. All of these species are also listed in the IUCN Red List as Data Deficient meaning that not enough data is available to evaluate the status of these species.

Impact on the arachnids on the site

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	4	3	4	3.67	4	3	3.5	12.85	11.67

Second Alternative	3	3	4	3.33	4	3	3.5	11.66	10.5
Third Alternative	4	3	4	3.67	4	3	3.5	12.85	11.67
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	4	3	5	4	4	3	3.5	14	11.67
Fixed Mounted PV Solar	3	3	4	3.33	4	3	3.5	11.66	10.5
Dual Axis Tracking PV Solar	4	3	5	4	4	3	3.5	14	11.67

Alternatives and their respective impacts:

- All the alternatives would have relatively the same moderate impact on the Trapdoor Spider population on the site. The second alternative would have a slightly lower impact as it contains a portion of cultivated lands where the species could not occur but is still rated as having a moderate impact.
- The **Fixed Mounted PV Solar technology** would have the lowest impact as it would utilise a smaller surface area to produce the same amount of electricity as apposed to the other technological alternatives. Therefore the likely impact and extent on the protected Trapdoor Spider species would be smaller.

Mitigation measures:

- Vegetation will only be removed where the panels are to be installed. Since panels will be anchored by screw-foot the vegetation underneath and in-between the panels will be left intact. However, trampling by construction vehicles would still have an impact on the vegetation but since the vegetation and consequently topsoil will not be removed the seedbank will be left intact.
- Removal of vegetation will be restricted to excavation of trenches for installation of cables as well as the construction of a substation and inverters.
- Construction activities will be limited to the site where the panels and substation will be established.
- No hunting, capturing or harming of any spider species on the site will be allowed.
- During construction, areas in between panels where Trapdoor Spiders (*Stasimopus sp.*) occur in high density should be demarcated and no construction activities should be allowed in these areas (see visual representation of mitigation measure in Figure 20). This will keep a proportion of the population intact.
- A permit should be acquired for the destruction of any portion of the Trapdoor Spider population.

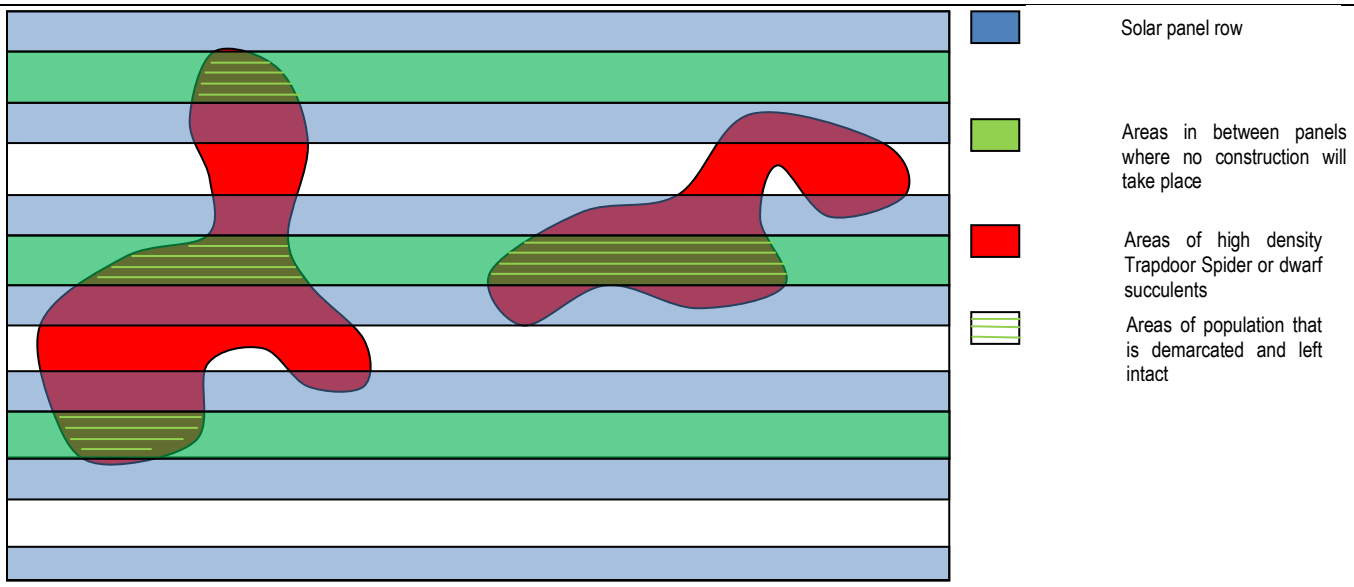


Figure 20: Visual illustration of the areas of high density Trapdoor Spider (*Stasimopus sp.*) and the mitigation measure that will ensure a portion of the population remains intact.

7.2.10 Surface water

A tributary of the Sandspruit flows through the farm (Refer to Annexure 2). This tributary is annual in nature and flows for short periods during the rainy season.

The annual stream is a sensitive element of the surrounding ecosystem and provides a vital service in the form of water transportation, bio-remediation and flow regulation. A small wetland also occurs to the west of the site (Refer to Annexure 2 as well as the Ecological Report in Annexure 3) and is regarded as moderately sensitive due to its small size and transformed state as well as its isolation from other water systems.

The most likely impact on this seasonal stream is the spillage of pollutants from the site (especially during the construction phase) into the stream. This may be a negligible impact as long the possible pollutants are stored, used and disposed of strictly as stipulated within the EMPr. The stream will be heavily degraded if construction vehicles or personnel are allowed in the stream, however, this impact will be negligible if the 30 meter buffer along the stream is respected and the stream is designated a no-go area.

Cumulative Impact: Any pollution of the stream would be washed downstream and would affect the water quality downstream of the site.

Impact on the surface water of the annual stream.

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	4	1	3	2.67	3	2	2.5	6.68	2.5
Second Alternative	4	1	3	2.67	3	2	2.5	6.68	2.5
Third Alternative	5	4	5	4.67	5	4	4.5	21.02	21
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	4	3	5	4	4	3	3.5	14	7.5
Fixed Mounted PV Solar	3	2	3	2.67	3	3	3	8.01	3.34
Dual Axis Tracking PV Solar	4	3	5	4	4	3	3.5	14	7.5

Alternatives and their respective impacts:

- The **first alternative** and **second alternative** would have the lowest impact as they will not be located near the adjacent annual stream and small wetland and would not have a marked impact (low). The third alternative will be situated within the annual stream and would consequently have a high impact.
- The **Fixed Mounted PV Solar technology** would have the lowest impact as it would utilise a smaller surface area to produce the same amount of electricity as apposed to the other technological alternatives. Therefore the likelihood would be lower that this technology would have an effect on the adjacent annual stream.

Mitigation measures:

- Vegetation will only be removed where the panels are to be installed. Since panels will be anchored by screw-foot the vegetation underneath and in-between the panels will be left intact. However, trampling by construction vehicles would still have an impact on the vegetation but since the vegetation and consequently topsoil will not be removed the seedbank will be left intact.
- Removal of vegetation will be restricted to excavation of trenches for installation of cables as well as the construction of a substation and inverters.
- Construction activities will be limited to the site where the panels and substation will be established.
- Appropriate storm water management measures (e.g. diversion channels, berms) will be implemented to manage the flow of clean storm water on the site under construction.
- A buffer zone of 30 meters will be implemented around the annual stream and wetland on the property. No construction or any other activities associated with the development will be allowed within this buffer zone.
- The annual stream and any other wetlands as identified in the Specialist Report (Annexure 3) should be designated no-go areas.
- The use, storage and disposal of any possible pollutants should be done strictly according to conditions as stipulated in the EMPr.

7.2.11 Groundwater

Two separate groundwater systems occur in the region. These systems consist of:

- A shallow aquifer in the near surface weathered Karoo formations.
- A deep aquifer in the Witwatersrand and Ventersdorp sequences which contains saline water.

Current water use in the area is limited to livestock water and no extensive irrigation occurs in the area.

The farm Grootspruit 252/0 is situated in the Upper Vaal Water Management Area (WMA 8) in quaternary drainage region C25B and consequently the farm has a water use capacity of 51 729 m^3 per year.

The approximate daily use will amount to 60 000 litres with a total water use during construction of 5 400 000 litres.During the operational phase the facility will use an approximate amount of 750 000 litres per year. Water for use for the facility during construction and operation will be abstracted from groundwater. The farm contains several boreholes of which two are located on or near the site. The coordinates for these boreholes are S 27.74009˚, E 26.77380˚ and S 27.735179˚, E 26.767129˚. An application for a General Authorisation has been lodged with the Department of Water Affairs (Refer to application in Annexure 6).

The most likely impact would be the depletion of the water table on the site. This is however highly unlikely as the amount of water to be abstracted is low especially during the operational phase. The water use is also far below the allocated amount of available water for this property.

Cumulative Impact: Depletion of the water table in the surrounding area. This is highly unlikely since the water use will be a low amount.

Impact on the ground water of the area

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	1	2	1	1.33	1	1	1	1.33	1.33
Second Alternative	1	2	1	1.33	1	1	1	1.33	1.33

Third Alternative	4	4	3	3.67	3	4	3.5	12.83	12.83
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	5	5	5	5	4	5	4.5	22.5	22.5
Fixed Mounted PV Solar	1	2	1	1.33	1	2	1.5	2	2
Dual Axis Tracking PV Solar	1	2	1	1.33	1	2	1.5	2	2

Alternatives and their respective impacts:

- The **first alternative** and **second alternative** would have the lowest impact as they will not be located near the adjacent annual stream and small wetland and it is likely that they would have a negligible effect on the groundwater system associated with this watercourse. The third alternative would have a higher likely long-term impact as it would be situated within the annual stream and would likely impact on the groundwater system associated with this watercourse.
- The **Fixed Mounted PV Solar technology**and **Dual Axis Tracking PV Solar** would have the lowest impact as they would not utilise a large amount of groundwater during the operational phase. The Concentrated Solar Power technology is regarded as unfeasible as it will use a large amount of groundwater during the operational phase for generating electricity.

Mitigation measures:

- The water sourced from the landowner must comply with Section 21 of the National Water Act (Act 36 of 1998).
- An application for a General Authorisation has been lodged with the Department of Water Affairs (Refer to Annexure 6).

7.2.12 Air quality and noise

The only air and noise polluting agents in the region is associated with cultivation activities. Air quality and noise pollution is affected mainly by farming machinery such as tractors and combine harvesters associated with the cultivation of maize.

The surrounding farming activities already contribute to air and noise pollution and it is not anticipated that the air and noise pollution contributed by the construction of the solar facility would cause a large impact. However, some mitigation should still be implemented to reduce this air and noise pollution. Air pollution would primarily be associated with the construction phase and the construction vehicles on the site that would liberate dust and soil. During the maintenance phase air pollution is anticipated to be negligible. Noise pollution would also be primarily associated with the construction phase and would be caused by the construction vehicles and construction activities. Noise pollution during the operational phase would be minimal and the operation of the solar panels and associated infrastructure do not emit any noise above that of the ambient.

Cumulative Impact: Noise and air pollution would add to that of the surrounding farming activities but this would primarily be during the construction phase of the project.

Impact on the air quality and noise pollution of the area

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	2	2	2	2	3	2	2.5	5	3
Second Alternative	2	2	2	2	3	2	2.5	5	3
Third Alternative	2	2	2	2	3	2	2.5	5	3
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	3	2	3	2.67	3	1	2	5.34	5.33
Fixed Mounted PV Solar	2	2	2	2	3	1	2	4	3
Dual Axis Tracking PV Solar	3	2	3	2.67	3	1	2	5.34	5.33

Alternatives and their respective impacts:

- **All three alternatives** would generate the same amount of noise and dust. This is rated as a low impact for all three alternatives and consequently is not of a big concern.
- The **Fixed Mounted PV Solar technology** would have the lowest impact as it will have the lowest impact on air quality and noise pollution. Necessitating a larger surface area and removal of vegetation due to associated foundations, the Dual Axis Tracking PV Solar technology as well as the Concentrated Solar Power technology would produce a marginally larger amount of dust and noise pollution.

Mitigation measures:

- Apply dust control measures such as water sprinkling.
- Restrict construction times to daylight hours to limit disturbance due to elevated noise levels during construction to neighbouring residents.

7.2.13 Heritage of the area including archaeology and palaeontology (Refer to Specialist Report in Annexure 3)

The affected area is capped by unconsolidated topsoils with little or no sign of Volksrust Formation outcrop. The absence of rocky outcrop is largely attributed to a lack of topographical relief in the

area. There is no indication for the accumulation and preservation of intact fossil material within the Quaternary sediments (unconsolidated topsoils) of the study area. There is no evidence of intact or capped Stone Age or Iron Age archaeological material within the confines of the footprint. There are no indications of prehistoric structures or rock engravings within the footprint area. Historical buildings or structures older than 60 years are absent from the site. Two small graveyards occur on the property, but they are located outside the development footprint. No graves or graveyards occur within the confines of the affected area. Therefore it is not anticipated that the proposed development will impact on any element of historical importance.

Cumulative Impact: None.

Impact on the heritage of the area

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	1	3	3	2.33	1	1	1	2.33	2.33
Second Alternative	1	3	3	2.33	1	1	1	2.33	2.33
Third Alternative	1	3	3	2.33	1	1	1	2.33	2.33
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	1	3	4	2.67	1	1	1	2.67	2.67
Fixed Mounted PV Solar	1	3	3	2.33	1	1	1	2.33	2.33
Dual Axis Tracking PV Solar	1	3	4	2.67	1	1	1	2.67	2.67

Alternatives and their respective impacts:

- **All three alternatives** would entail the same low impact on the heritage, including archaeology and palaeontology, of the area. The two grave sites on the property are not situated within the footprints of any of the alternatives and will not be impacted upon if construction activities are confined to the development area.
- The **Fixed Mounted PV Solar technology** would have a marginally lower impact on the archaeology and palaeontology of the area since it would occupy a smaller footprint area.

Mitigation measures:

In the event of any archaeological or palaeontological material noticed during construction:

- Stop construction immediately and contact an archaeologist or palaeontologist.
- Contact the South African Heritage Resources Agency and notify of any findings.

7.2.14 Visual impact (Refer to Visual Assessment in Annexure 3)

The region consists of slight undulating plains. The slope gradient of the region is low with no hills, ridgelines, spurs or steep slopes.

The area surrounding the proposed solar farm contains several dirt roads. These roads service the farming properties of the area and consequently the amount of road users are low. Due to the low amount of road users as well as the duration of interaction with this visual area the impacts are rated as moderate to low.

The surrounding area only contains a low amount of residential farmsteads. Consequently visual receptors are few and not located near the development.

Impact on the visual perception of the area

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	3	4	3	3.33	3	3	3	10	9
Second Alternative	3	4	3	3.33	3	3	3	10	9
Third Alternative	3	4	3	3.33	3	3	3	10	9
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	4	4	5	4.33	4	3	3.5	15.16	15.16
Fixed Mounted PV Solar	3	4	3	3.33	3	3	3	10	9
Dual Axis Tracking PV Solar	4	4	4	4	4	3	3.5	14	14

Alternatives and their respective impacts:

- **All three site alternatives** would amount to the same low-moderate visual impact as they are all situated adjacent to one another.
- The **Fixed Mounted PV Solar technology**is preferred as it would have the lowest visual impact. Dual Axis Tracking PV Solar would be mounted to a height of 8m and would be much more visible than Fixed Mounted PV Solar technology. Concentrated Solar Power technology would also have a high visual impact as a result of the heliostats and receiver tower.

Mitigation measures:

- The vegetation on the site of the disturbed areas should be allowed to re-establish after construction. This will soften the visual impact that the facility will have. Should re-vegetation not be deemed adequate a hydro-seeding program should be implemented.
- A visual buffer of 500m but preferably 1000m fromthe surrounding dirt roads should be respected from the border of the

development. This will considerably mitigate the visual impact of the facility.

- Cables should be placed underground as far as possible. Cables from the panels should be fastened to the mounting structure.
- The design of any buildings associated with the facility (e.g. guardhouse) should fit the design of the surrounding rural buildings.
- Signs associated with the facility should be restricted to the entrance gates. No billboards should be allowed on the site or adjacent to the dirt roads.
- External lighting should be carefully chosen to minimize the visual impact associated with artificial lighting. Aspects that should be investigated include the height of the lighting fixtures, fitting of reflectors to avoid light spillage, directing and shielding lighting away from the surroundings and using designs that minimise the upward scattering of light. The lighting on the facility should not exceed the minimum required for safety and security.
- The construction camp and laydown area should be situated as far away as possible from the surrounding public dirt roads.
- The management of building rubble and other wastes associated with the construction and operation of the facility should comply with best practise principles and should be removed from the site.
- Use materials, coatings and paint that do not reflect.

7.2.15 Regional Socio-Economic impact (positive impact)(Refer to Socio-Economic Assessment in Annexure 3)

The Project Company will contribute 1% of revenue towards Socio-Economic Development Contributions.

These funds will be paid into the account of the Local Community Trust and in turn will be administered in accordance with the Socio-Economic Development Strategy, described in detail under heading 4.2 (page 35).

The construction period will take approximately 24 months up to completion. The construction team will consist of 291 employees of differing responsibilities and expertise as stipulated in Table 4. The value of these employment opportunities will accrue to R67.5 million. Approximately 75% of these job opportunities will consist of previously disadvantaged individuals. The conditions of the contract between Solairedirect and its subcontractors will include requirements for Local Enterprise Development and Preferred Procurement. The operational phase will consist of 59 permanent employees of differing responsibilities and expertise as stipulated in Table 4. The value of these employment opportunities during the initial 10 years of operation is estimated at R59 million.

In general, this project will result in a positive impact on the local community and economic upliftment of the local municipal area. After construction the job opportunities associated with this phase will be

discontinued as is the nature of a construction phase. This is considered a negative impact but is considered a low impact. During the operational phase the development will provide stable, long-term job opportunities. Although the development has a lifespan of 25 years it is highly likely that the facility will be refit and operation will continue. In the unlikely event that the facility closes after 25 years the permanent job losses will cause a negative impact on the community.

Impact on the socio-economy of the area (positive impact)

Site Alternative	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance before mitigation	Significance after mitigation
First Alternative	3	3	3	3	5	4	4.5	13.5	15
Second Alternative	3	3	3	3	5	4	4.5	13.5	15
Third Alternative	3	3	3	3	5	4	4.5	13.5	15
Technological Alternative	**Severity**	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance before mitigation**	**Significance after mitigation**
Concentrated Solar Power	3	3	3	3	5	4	4.5	13.5	15
Fixed Mounted PV Solar	3	3	3	3	5	4	4.5	13.5	15
Dual Axis Tracking PV Solar	3	3	3	3	5	4	4.5	13.5	15

Alternatives and their respective impacts:

- **All three site alternatives** would amount to the same moderate-high **positive** impact on the socio-economic structure of the surrounding area. This is due to the high amount of job opportunities as well as the proposed Socio-Economic Development Strategy.
- **All three technological alternatives** will have the same moderate-high **positive** impact on the socio-economic structure of the surrounding area. This is due to the high amount of job opportunities as well as the proposed Socio-Economic Development Strategy.

Mitigation measures:

- Clear and consistent communication needs to be maintained with community leaders to ensure the community is aware of the status of planning and feasibility.
- A Socio-Economic Development Strategy as proposed by the applicant should be implemented (see heading 4.2 for details of this strategy).
- The conditions of the contract between Solairedirect and its subcontractors will include requirements for Local Enterprise Development and Preferred Procurement.
- The local community will receive 1% of the revenue and a 2.5% share in the development company.
- A Local Community Trust will be established to administer the income of which the structure is stipulated as under heading 4.2 (page 35).
- During the lifespan of the project the employees should acquire sufficient skills to increase their employment mobility.

7.3 Summary of impacts (Significance after mitigation)

	First Alternative	Second Alternative	Third Alternative	Concentrated Solar Power Technology	Fixed Mounted PV Solar Technology	Dual Axis Tracking PV Solar Technology

Disturbance, compaction and degradation of the soil surface	7	17.33	14	9	8.01	11.01
Erosion of the soil surface	9	11.01	17.32	10	6	10
alteration of the topography	2.66	2.66	11.655	14	2	2
Agricultural potential and soil capacity	6.99	22.5	11.655	11.01	8.01	11.01
Natural vegetation	10	8.01	17.32	10	6.99	11.01
Terrestrial mammals	9	6.99	17.32	9	6	10
Avian fauna	11.66	9.31	19.49	21	10.98	15.16
Amphibians	1.67	1.67	12.83	6.68	3.34	6.68
Reptiles	16	13.33	16	16	13.33	16
Arachnids	11.67	11.67	11.67	11.67	11.67	11.67
Surface water	2.5	2.5	21	7.5	3.34	7.5
Groundwater	1.33	1.33	12.83	22.5	2	2
Air quality and noise	3	3	3	5.33	3	5.33
Heritage including archaeology and palaeontology	2.33	2.33	2.33	2.67	2.33	2.67
Visual impact	9	9	9	15.16	9	15.16
Regional socio-economic structure (positive impact)	15	15	15	15	15	15
Total	27%	32%	60%	46%	24%	34%

7.4 Conclusion

The proposed development was conducted in accordance with the Environmental Impact Assessments Regulations of 18 June 2010 in terms of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998). The Environmental Impact Assessment (EIA) process consisted of several phases:

- The notification stage in which directly affected landowners, neighbouring landowners, stakeholders, communities, interested parties, key stakeholders as well as authorities were notified of the proposed development. Initial information in the form of a Background Information Document was also supplied to these parties. A communication channel was initiated with these parties to obtain queries and concerns and also to provide information to these parties.
- The Scoping phase incorporates all concerns from I&AP's and potential impacts relating to the development and identifies the specialist need within the process. A Plan of Study (POS) outlines the procedure and process that the EIA will follow.
- The EIA stage wherein the specialist input is incorporated and the likely impacts arising from these are considered in respect of the proposed development. The phase includes the development of mitigation measures and the development of an Environmental Management Program (EMPr).

According to the White Paper on Renewable Energy (2003) the South African Government has set a target of sourcing 10 000 GW from renewable energy projects by 2013. Furthermore, South Africa's Integrated Resource Plan (IRP 2012) has set a target for reduction of CO_2 emissions by 34% by 2020. It is therefore clear that solar farms have a definite role to play in electricity producing sector.

According to the financial policies of the Matjhabeng Integrated Development Plan (First Draft 2010/2011) it is recommended that practises and procedures are implemented to reduce waste, carbon dioxide emissions, and reliance on non-renewable resources, promote recycling and reuse, and minimise employee exposure to hazardous materials. The establishment of this proposed solar facility will aid in the realisation of this policy.

Since 2008, South Africa experienced a marked reduction in the National Generation reserve margin. As such, the country is faced with having to save energy through energy reduction campaigns (Demand Side Management Renewable Energy and Energy Efficiency). Through this programme, carbon emission reduction and climate change mitigation have become local priorities. To this end, the Matjhabeng Local Municipality is striving to become a leader in the field of climate change mitigation, the reduction of harmful greenhouse gases and the identification and implementation of alternative fuel sources. Renewable energy, proper energy efficient measures and the successful institutionalisation of climate change mitigation in all spheres of business form part of this commitment (Matjhabeng Local Municipality IDP Draft 2012).

Three site alternatives and three technological alternatives were considered for this development. After consideration of the Environmental Impact Assessments the following conclusions are drawn.

All the identified alternative sites are situated on the farm Grootspruit 252/0, Odendaalsrus RD. All of the alternative sites overlap and are situated adjacent to another. However, upon investigation it was found that the cultivated cropfields and annual stream would have to be excluded from the development. Exclusion of these features has yielded the preferred development.

Following detailed investigation and analysis, it was found that tracking technology is a feasible alternative for the land area under considerationbut not preferred as it produces less power and costs more than fixed structures.

After consideration of these technological alternatives it was found that the most advantageous method with the lowest environmental impact would be the use of fix-mounted Photo Voltaic panels. The following reasons are given:

- The technology would not utilise as much water as CSP technologies.
- The technology does not pose as large a threat to birdlife as does CSP technologies.
- The mounting height of fixed-mounted PV panels (3.4m) are considerably less than dual axis tracking modules (8m) which considerably lowers the visual impact that the panels will have.
- The surface area utilised for dual axis tracking modules are considerably more due to the effect of panel shading.
- Dual axis tracking utilises electrical motors as movable parts to rotate the panels. These motors consume a portion of the electricity produced. Due to this dual axis tracking systems produce approximately 7% less energy than fixed-mounted panels.
- Due to the moving parts of dual axis tracking systems the maintenance costs are considerably higher than fixed-mounted panels.

The “no-go” alternative would entail that no development of the area takes place. This would entail that the area of natural vegetation would remain intact. This will result in minimal impacts on the natural environment. However, the alternative would also entail that the strain on the national electricity supply would not be alleviated. The alternative would also entail the loss of substantial job opportunities.

The proposed development will have a low-moderate impact on the Geology and Soils, Topography, Land use, agricultural potential and soil capacity. The area may be sensitive to erosion, but with the implementation of several mitigation measures this may be low-moderate. The topography of the area will not be altered by the development and consequently it would be a low impact. The preferred site does not consist of high yield agricultural soil in contrast to the adjacent cultivated fields and consequently this will be a low impact on the area. The area may still be utilised as grazing, but due to the erodability of the area this must be practised within the acceptable grazing capacity of the area.

The impact on the natural vegetation is rated as being moderate, this is due to the facility being situated within an Endangered vegetation type (Vaal-Vet Sandy Grassland), however, the area contains a relatively low diversity and no rare, endangered or protected plant species and therefore the impact is only rated as moderate. The dwarf succulent, *Nananthus vittatus*, occurring on the site is not protected or endangered but is considered as having some conservation value. The impact on the mammal population, avifauna and amphibians of the area is rated as low-moderate. All mammal species occurring in the area are widespread. However, the area is considered a natural refuge in an area that has been extensively transformed and therefore the impact is low-moderate. The impact on the mammal population and amphibians would be low-moderate as long as the seasonal stream is excluded from development as this would entail a high impact.

The impact on the avian fauna would be moderate as a result of the possible occurrence of endangered species as well as the transformation of the available, suitable grassland habitat.

The impact on the reptile population is rated as moderate-high due to the high likelihood that the Endangered SungazerLizzard (*Cordylusgiganteus*) occurs in the area. Recommended mitigation measures should be strictly adhered to, to ensure the smallest impact on the likely Endangered species.

The impact on the Arachnid populations is rated as moderate due to the high density Trapdoor Spider (*Stasimopus sp.*) population in the area. This is a protected species in the Free State Province. Mitigation measures should be strictly adhered to, to minimise the impact on this population.

The impacts on the surface- and groundwater are rated as low as long as the seasonal stream on the property is excluded from the development. The impacts on the air quality, noise pollution and heritage of the site are rated as being low.

The visual impact of the development is rated being low-moderate. This is primarily due to the low population density and isolation from any residential areas and major roads.

The socio-economic impacts are a major positive impact on the surrounding area due to the large amount of job opportunities and well developed socio-economic development strategy. After construction the job opportunities associated with this phase will be discontinued as is the nature of a construction phase. This is considered a negative impact but is considered a low impact. During the operational phase the development will provide stable, long-term job opportunities. Although the development has a lifespan of 25 years it is highly likely that the facility will be refit and operation will continue. In the unlikely event that the facility closes after 25 years the permanent job losses will cause a negative impact on the community.

In conclusion it can be said that the development does not present an overall high impact, but some elements are regarded as having moderate and moderate to high negative impacts and in these cases the recommended mitigation measures would have to be strictly adhered to and bio monitoring would have to be enforced. Such impacts as mentioned above are concerned with the likely Endangered SungazerLizzard (*Cordylusgiganteus*) occurrence, the high likelihood of Endagered bird species occurring on the site, the high density protected Trapdoor Spider (*Stasimopus sp.*) population in the area and the Endangered vegetation unit in the area.

The development of numerous job opportunities and the implementation of a socio-economic development strategy are considered a major positive impact.

The implementation of the “no-go” alternative would entail a low impact on the environment but would lead to the loss of numerous job opportunities and the possible upliftment of the surrounding community. Furthermore the establishment of a low emissions, renewable energy supply would not occur.

8 PROPOSED CONDITIONS OF APPROVAL

- Vegetation must only be removed where the panels are to be installed. Since panels will be anchored by screw-foot the vegetation underneath and in-between the panels will be left intact. However, trampling by construction vehicles would still have an impact on the vegetation but since the vegetation and consequently topsoil will not be removed the seedbank will be left intact.
- Removal of vegetation must be restricted to excavation of trenches for installation of cables as well as the construction of a substation and inverters.
- Construction activities must be limited to the site where the panels and substation will be established.
- The vegetation on the site must not be removed during construction. Solar panel frames must be anchored by means of anchor screws as far as possible which do not necessitate the removal of topsoil and will lead to the least disturbance to the soil surface.
- Topsoil removed for the excavation of trenches for the installation of cables must be kept separate and must be replaced in original sequence.
- Any excess topsoil must be used to rehabilitate the disturbed areas after construction has ceased.
- The correct management of storage, disposal and spills of any hazardous material as stipulated in the Environmental Management Program report (EMPr).
- Surface structures such as swales and berms must be implemented to prevent erosion.The use of attenuation ponds must also be investigated.
- An alien vegetation clearing program must be implemented to ensure that weeds do not establish after construction. This program must be continued with throughout the operation of the facility.
- The fence surrounding the facility must allow for small mammals to enter the area, this will ensure that the area remains as available habitat for several species. Openings of 30cm x 30cm should be sufficient to allow passage to small mammals.
- No hunting, capturing or harming of any faunal species on the site must be allowed.
- It is recommended that a survey be conducted prior to any construction activities on the site to determine if any specimens of Sungazer (*Cordylusgiganteus*) are present on the proposed site and what the extent of the population is.
- Should any specimens or colonies of Sungazer be found on the site during this survey they should be removed by means of a search-and-rescue operation. Any specimens that are removed from the site should be re-located to a similar habitat on the portion of the property that will not be developed.

- If re-location of Sungazers takes place a monitoring program should be initiated to monitor the health of the re-located population.
- During construction, areas in between panels where Trapdoor Spiders (*Stasimopus* sp.) occur in high density must be demarcated and no construction activities should be allowed in these areas (see visual representation of mitigation measure in Figure 19). This will keep a proportion of the population intact.
- A permit must be acquired for the destruction of any portion of the Trapdoor Spider population.
- A buffer zone of 30 meters will be implemented around the annual stream and wetland on the property. No construction or any other activities associated with the development will be allowed within this buffer zone.
- The water sourced from the landowner must comply with Section 21 of the National Water Act (Act 36 of 1998) and no water use must occur without the possession of necessary authorisations from DWA.
- Apply dust control measures such as water sprinkling during construction.
- The applicant, Solairedirect Southern Africa (Pty) Ltd, must commit to maintaining the current condition of the surrounding public dirt roads utilised by construction and transportation vehicles.
- The perimeter firebreak must be maintained at all times.
- All necessary measures must be implemented to prevent veld fires.
- Restrict construction times to daylight hours.
- In the event of any archaeological or palaeontological material noticed during construction:
    - Stop construction immediately and contact an archaeologist or palaeontologist.
    - Notify the South African Heritage Resources Association (SAHRA).
- A Socio-Economic Development Strategy as proposed by the applicant should be implemented (see heading 4.2 for details of this strategy).
- The conditions of the contract between Solairedirect and its subcontractors will include requirements for Local Enterprise Development and Preferred Procurement.
- A Local Community Trust will be established to administer the income of which the structure is stipulated as under heading 4.2 (page 35).
- An independent ECO (Environmental Control Officer) must be employed to monitor compliance with the EMPr and Final Environmental Impact Report (EIR) during the construction and operational phases.

- The EMPr should form part of the contract with the contractors contracted to construct and maintain the facility in order to ensure compliance with all environmental aspects of the development.
- All mitigation measures as stipulated in this report and all attached specialist reports must be implemented to reduce the potential environmental impacts the facility will have.
- All relevant required permits must be applied for. These include but are not limited to authorisation from Civil Aviation Authority (CAA), Department of Water Affairs, Department of Agriculture, Forestry & Fisheries, etc.

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