Draft EIA Report 14/12/16/3/3/2/391

PROPOSED ESTABLISHMENT OF A RENEWABLE ENERGY GENERATION FACILITY ON THE REMAINDER OF THE FARM KLIPDRIFT 20, LETSEMENG LOCAL MUNICIPALITY, XHARIEP DISTRICT MUNICIPALITY, FREE STATE PROVINCE

Short name: Pulida Solar Park

January 2013

Commissioned by: Pulida Energy (Pty) Ltd
Document version 1.0 – Draft

AGES
Purpose with Passion

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Draft EIA Report: **14/12/16/3/3/2/391**

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AGES

Purpose with Passion

Proposed establishment of a renewable energy facility on the Remainder Portion of the Farm Klipdrift 20, Letsemeng Local Municipality, Xhariep District Municipality, Free State Province

January 2013

PROJECT APPLICANT

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[1] the Company name has been changed from ***Pulida Properties*** to ***Pulida Energy*** *with effect from the 23 October 2012*

REPORT DISTRIBUTION LIST

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Municipal Manager	Xhariep District Municipality
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	Registered Interested and Affected Parties

DOCUMENT HISTORY

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14/12/16/3/3/2/391	January 2013	1.0	Draft

PROJECT MAIN FEATURES

Project main features - according to the EIA guidelines
Summary of information included in the report

General site information

Site location	
Farm	**KLIPDRIFT 20 (Jacobsdal Reg. Division)**
Portion	**Reminder Portion**
Surveyor-general 21 digit site	F01800000000002000000
Local Municipality	Letsemeng
District Municipality	Xhariep
Province	Free State

Property details	
Extent	2256.1868 hectares
Land Owner	WEGVAN KLIPDRIFT BOERDERY CC
Diagram deed number	G00/1879
Title deed number	T1126/1968
Registration date	19680314
Current land use	Farming Activities

Site data	
Latitude	29° 02' 40" S (Alternative Location 1) 29° 05' 13" S (Alternative Location 2)
Longitude	24° 55' 30" E (Alternative Location 1) 24° 54' 23" E (Alternative Location 2)
Altitude	1147 m a.m.s.l. (Alternative Location 1) 1164 m a.m.s.l. (Alternative Location 2)
Ground slope	Flat

Adjacent portions	
Farm	**KLIPDRIFT 20**
Portion	**Portion 1**
Surveyor-general 21 digit site	F01800000000002000001
Land Owner	WEGVAN KLIPDRIFT BOERDERY CC
Diagram deed number	T4552/1989
Title deed number	T21795/2007
Registration date	20070816
Extent	2325.4029 hectares
Current land use	Farming Activities
Farm	**DE KALK 71**
Portion	**Portion 0**
Surveyor-general 21 digit site	F01800000000007100000
Land Owner	VAN WYK FAMILIE TRUST
Diagram deed number	T33684/1887
Title deed number	T28144/2009
Registration date	20091223
Extent	1948.1821 hectares
Current land use	Farming Activities
Farm	**BLAAUWBOSCHPAN 70**
Portion	**Portion 1**
Surveyor-general 21 digit site	F01800000000007000001
Land Owner	WANNENBURG ALIDA ELIZABETH
Diagram deed number	T1256/1961
Title deed number	T3860/1969
Registration date	19690716
Extent	1027.8384 hectares
Current land use	Farming Activities

PV power plant design specifications and connection to the Eskom grid

Project data	
Project name	**PULIDA SOLAR PARK**
Technology	**Photovoltaic power plant**
Number of Phases	**1**
Maximum generating capacity at the delivery point	**Up to 75 MW**
Type of PV modules	Thin-film or Mono/Polycrystalline
Type of mounting system	fixed or horizontal single-axis trackers (SAT)
Average annual energy production (*)	up to 162.5 GWh/year with thin film modules mounted on fixed mounting system up to 190.1 GWh/year with mono/polycrystalline modules mounted trackers
Load factor (*)	0.223 with thin film modules mounted on fixed mounting system 0.251 with mono/polycrystalline modules mounted trackers
Full net equivalent hours (EOH) (*)	1950 h/year (Wh/Wp/y) with thin film modules mounted on fixed mounting systems 2200 h/year (Wh/Wp/y) with mono/polycrystalline modules mounted trackers
(*) calculated by PVSYST, simulation professional tool	

Technical specifications	
Installed power capacity - AC side	**up to 75 MW**
Installed power capacity - DC side	**up to 83,349,000 Wp with thin film modules** **up to 86,400,000 Wp with mono/polycrystalline modules**
Number of PV modules	up to 617,400 thin film modules of 135 Wp each up to 288,000 mono/polycrystalline modules of 300 Wp each
Number of structures (PV arrays)	up to 14,700 fixed mounting systems up to 7,200 trackers (SAT)
Minimum structure height	1.0 m above ground level
Maximum structure height	3.1 m above ground level

Other information	
Developed area	220 hectares
Footprint, including internal roads	up to 200 hectares
PV power plant lifetime	25 - 30 years
Construction camp (temporary)	10 hectares
Construction timeframe	up to 15 months

Connection to the Eskom grid (**)	
Connection solution: description	The connection to the Eskom grid will be done according to the Eskom connection solution which entails: (i) one small on-site high-voltage loop-in loop-out substation with one or more high-voltage power transformers and a 132 kV bus bar (switching station) to be connected to the Eskom's 132 kV power line called "Kimberley DS - Skietpan Switching Station", which crosses the project site; (ii) two new small sections of 132 kV power line allowing the Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line to loop in and out of the 132 kV busbar

	of the new on-site substation. The connection solution may also entail intervention on the Eskom's grid and/or on Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line.
Point of connection	Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line
Point of connection (farm, portion)	Reminder Portion of Klipdrift 20
Delivery point: voltage level	132 kV
New sections of power line - overall length	2x100 m
New HV substation inside the property - footprint	approximately 4,000 m^2
Servitudes for new power lines	not required
(**) already included in the current EIA application	

Water requirements	
Water consumption	See on paragraph 4.2.5 - water requirements

Site maps and GIS information

Status quo information - site	***ESRI shape files - see CD-rom attached***
Site	Remainder Portion of Klipdrift 20
Building and other structures	Not applicable
Agricultural field	Not applicable
Natural and endangered vegetation areas	Vegetation and Sensitivity map
Cultural historical sites and elements	Heritage sites
Contours with height references	1m contours
Boreholes	Boreholes
High potential agricultural areas	Not applicable
Eskom's substation(s) / power line(s)	Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line

Development proposal maps	***ESRI shape files - see CD-rom attached***
Project site	Remainder Portion of Klipdrift 20
Developed area	Lease portion
Access road and internal roads	Internal roads
Position of solar facilities	PV arrays
Permanent laydown area footprint	Fenced area
Construction period laydown footprint	Construction camp
River, stream, water crossing	Not applicable
Substation and transformers	HV loop-in loop-out substation
Connection routes	New sections of 132 kV power line
Buildings	MV stations, HV loop-in loop-out substation, Control building, Warehouse
Tree buffer zone	Tree buffer zone

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- PDSP_04_DE_Rev.00/EIA Mounting System – Alternative option 2: horizontal single-axis trackers with polycrystalline modules
- PDSP_05_DE_Rev.00/EIA Medium-voltage stations
- PDSP_06_DE_Rev.01/EIA Control building and medium-voltage receiving station
- PDSP_07_DE_Rev.01/EIA High-voltage loop-in loop-out substation
- PDSP_08_DE_Rev.00/EIA Warehouse
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Annexure B Agricultural Potential Maps:

- Agricultural Potential Map
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Annexure I Heritage Impact Assessment & Paleontological Impact Statement

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ABBREVIATIONS AND ACRONYMS

AGES	Africa Geo-Environmental and Engineering Consultants (Pty) Ltd
BID	Background Information Document
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CSP	Concentrating Solar Power
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DoE	Department of Energy
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIR	Environment Impact Assessment Report
EMP	Environmental Management Plan
ESS	Environmental Scoping Study
FIT	Feed in Tariffs
GHG	Green House Gases
GIS	Geographic Information Systems
GN	Government Notice
GWh	Giga Watt hour
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IPP	Independent Power Producer
kV	kilovolt
MW	Mega Watt
MWp	Mega Watt peak
NEMA	National Environmental Management Act - Act no. 107 of 1998
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act - Act no. 25 of 1999
NWA	National Water Act - Act no. 36 of 1998
PoS	Plan of Study
Property	Remainder Portion of the Farm Klipdrift 20
Project company	Pulida Energy (Pty) Ltd (applicant)
Project site	Remainder Portion of the Farm Klipdrift 20
Pulida Energy	Pulida Energy (Pty) Ltd (applicant)
Pulida Properties	Pulida Properties (Pty) Ltd (previous name of the applicant)
PV	Photovoltaic
REFIT	Renewable Energy Feed-in Tariffs
RFP	Request For Qualification and Proposals For New Generation Capacity under the IPP Procurement Programme
SAHRA	South African Heritage Resources Agency
SANRAL	South African National Roads Agency Limited
SANS	South African National Standard
UPS	Uninterruptible Power Supply

1. INTRODUCTION

Pulida Energy (Pty) Ltd[2] (Reg. N. 2011/010820/07) is proposing the development of a renewable solar energy facility in a key strategic location in terms of the connection to the Eskom grid and in terms of the favourable solar irradiation.

The proposed site is located on **the Remainder of the Farm Klipdrift 20**, Jacobsdal Registration Division, 2256.1868 hectares in extent (Letsemeng Local Municipality, Xhariep District Municipality, Free State Province) for the establishment of a solar energy facility with associated infrastructure and structures.

Site location: Remainder of the Farm Klipdrift 20
Surveyor-general 21 digit site codes:

F	**0**	**1**	**8**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**

The name of the project is **PULIDA SOLAR PARK** and it envisages a **photovoltaic (PV) power plant having a maximum generating capacity up to 75 MW**.
The **footprint** (fenced area) of the proposed development is up to **200 hectares** on an overall area measuring 220 hectares (lease portion), within the Remainder Portion of the Farm Klipdrift 20 (2256.1868 in extent).

The Pulida Solar Park is participating to the IPP Procurement Programme issued on 3 August 2011 by the DoE (Department of Energy).

In order to develop the facility, Pulida Energy (Pty) Ltd must undertake an Environmental Impact Assessment (EIA) process and acquire environmental authorization from the National Department of Environmental Affairs (DEA), in consultation with the Free State Department of Economic Development, Tourism and Environmental Affairs, in terms of the EIA Regulations (2010) published in terms of Section 24(2) and 24D of the National Environmental Management Act (NEMA, Act No. 107 of 1998).

This project has been registered with the **DEA application reference number 14/12/16/3/3/2/391** and with the **NEAS reference: DEA/EIA/0001380/2012**.

As indicated in the Eskom's Cost Estimate letter - dated September 2012 - the Pulida Solar Park will be connected to the **Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line**, which crosses the project site, through two new small sections of 132 kV power line, approximately 100 m long.

The EIA procedure of the Pulida Solar Park **includes the connection to the Eskom grid.** Eskom is the entity which assessed the connection solution included and described in this EIA Report. Eskom also coordinated the necessary liaising between the developer, Eskom Transmission, Eskom Distribution and Eskom Land & Rights Department.

It is important to highlight that all or part of the infrastructure required for the connection (all located inside the site) may be owned and/or operated by Eskom Distribution, this will depend on the Eskom grid code in relation to the IPPs (Independent Power Producers) and on the Connection Agreement to be finalized prior to or simultaneously with the conclusion of the PPA (Power Purchase Agreement) in respect of the options of retaining ownership of the connection works once completed.

The independent Environmental Assessment Practitioners (EAPs) which have been appointed for the undertaking of the detailed environmental studies in compliance with the 2010 EIA Regulations are **AGES (Pty) Ltd.**

[2] the Company name has been changed from ***Pulida Properties*** to ***Pulida Energy*** with effect from the 23 October 2012

With the aim of identifying and assessing all potential environmental impacts related to the development as well as suggesting possible mitigation measures and alternatives, AGES has appointed specialist sub-consultants to compile detailed reports and to study the activities necessary for the assessment of the specific impacts related to their field of expertise.

AGES and the other specialist consultants are in a position of independency from Pulida Energy; therefore they are not subsidiaries or affiliated to the latter. AGES and the specialist consultants have no secondary interest connected with the development of this project or of other projects which may originate from the authorization of the project.

The characteristics, the technology and the extent of the Pulida Solar Park are defined and evaluated in this Draft EIA Report and its annexures.

2. MOTIVATION AND RATIONALE OF THE PULIDA SOLAR PARK IN LIGHT OF THE IPP PROCURMENT PROGRAMME REQUIREMENTS

2.1. THE CHOICE OF THE FREE STATE PROVINCE AND OF THE SITE LOCATION

The Pulida Solar Park will be located in the Free State province. The Free State province has been identified by Pulida Energy as an ideal macro area for establishing a solar PV plant on the basis of several important considerations:

- solar resource is exceptionally high: the *global horizontal irradiation* of the site is 2,094.1 kWh/m^2/year;
- there are few green projects currently under development in Free State and it is clear that the "green energy quota" can be achieved mainly by means of solar projects, considering the high solar resources and the availability of desolate lands with low ecological and agricultural value;
- Free State province and the local municipalities and communities are eager to start establishing an eco-green image in consideration of the burden of CO_2 emissions they have to bear.

In addition to these very favourable characters in terms of desirability of renewable solar energy projects in the Free State province, the site of the Pulida Solar Park has been chosen by Pulida Energy on the grounds of several considerations, in particular:

- the availability of an easy connection solution due to the presence of the Eskom's 132 kV power line, called "Kimberley DS - Skietpan Switching Station", which crosses the project site;
- the flatness of the proposed project site;
- the low agricultural potential of the proposed project site;
- the presence of suitable areas with low / moderate ecological sensitivity on the proposed project site.

Furthermore, in the light of the IPP procurement Programme requirements, the **Pulida Solar Park** has been developed according to the following main characteristics:

- the installed capacity is within the "eligible capacity" defined by the rules of the RFP (from 1 MW to 75 MW);
- the construction phase will last approximately 15 months and the PV plant will be able of beginning commercial operation before the end of 2016.

With specific reference to the Pulida Solar Park, Eskom has indicated that the project does not interfere with Eskom's present and future developments and do not negatively affect the voltage in the area. Eskom, as an interested and affected party, recognized the positive outcome of the project in terms of the possibility of meeting the local growth of the energy consumption that is expected.

2.2. NEED AND DESIRABILITY OF THE PROJECT

South Africa currently relies principally on fossil fuels (coal and oil) for the generation of electricity. At the present date, Eskom generates approximately 95% of the electricity used in South Africa. On the other hand, South Africa has a largely unexploited potential in renewable energy resources such as solar, wind, biomass and hydro-electricity to produce electricity as opposed to other energy types (fuel or coal).

South Africa's electricity supply still heavily relies upon coal power plants, whereas the current number of renewable energy power plants is very limited.
In the last few years, the demand for electricity in South Africa has been growing at a rate of approximately 3% per annum.

These factors, if coupled with the rapid advancement in community development, have determined the growing consciousness of the significance of environmental impacts, climate change and the need for sustainable development. The use of renewable energy technologies is a sustainable way in which to meet future energy requirements.

The development of clean, green and renewable energy has been qualified as a priority by the Government of South Africa with a target goal for 2013 of 10,000 GWh, as planned in the Integrated Resource Plan 1 (IRP1) and with the Kyoto Protocol.
Subsequently the Department of Energy of South Africa (DoE) decided to undertake a detailed process to determine South Africa's 20-year electricity plan, called Integrated Resources Plan 2010-2030 (**IRP 2010**).

The IRP1 (2009) and the IRP 2010 (2011) outline the Government's vision, policy and strategy in matter of the use of energy resources and the current status of energy policies in South Africa. In particular, the IRP 2010 highlights the necessity of commissioning 1200 MW with solar PV technology by the end of 2015.
In order to achieve this goal, the DoE recently announced a renewable energy IPP (Independent Power Producers) Procurement Programme.
The IPP Procurement Programme, issued on 3rd August 2011, envisages the commissioning of 3725 MW of renewable projects (1450 MW with solar photovoltaic technology) capable of beginning commercial operation before the end of 2016.

Therefore, the development of photovoltaic power plants will represent a key feature in the fulfilment of the proposed target goal and the reduction of CO_2 emissions.
The purpose of the Pulida Solar Park is to add new capacity for the generation of renewable electric energy to the national electricity supply in compliance with the IPP Procurement Programme and in order to meet the "sustainable growth" of the Free State province.

The use of solar radiation for power generation is considered as a non-consumptive use and a renewable natural resource which does not produce greenhouse gas emissions. The generation of renewable energy will contribute to the growth of South Africa's electricity market, which has been primarily dominated up to this date by coal-based power generation. With specific reference to photovoltaic energy, and the proposed project, it is important to consider that South Africa has one of the highest levels of solar radiation in the world.

The reasons for the location of the project in the selected area are as follows:

- low requirement for municipal services;
- compliance with national and provincial energy policies and strategies;
- no impact on people health and wellbeing;
- no waste and noise;
- no impact on air quality;
- compatibility with the ecosystem and the surrounding landscape;
- likelihood of social and economic development of marginalized, rural communities; and
- attraction of environmentally aware (green) tourists to the area.

Figure 1 Regional map showing the project site

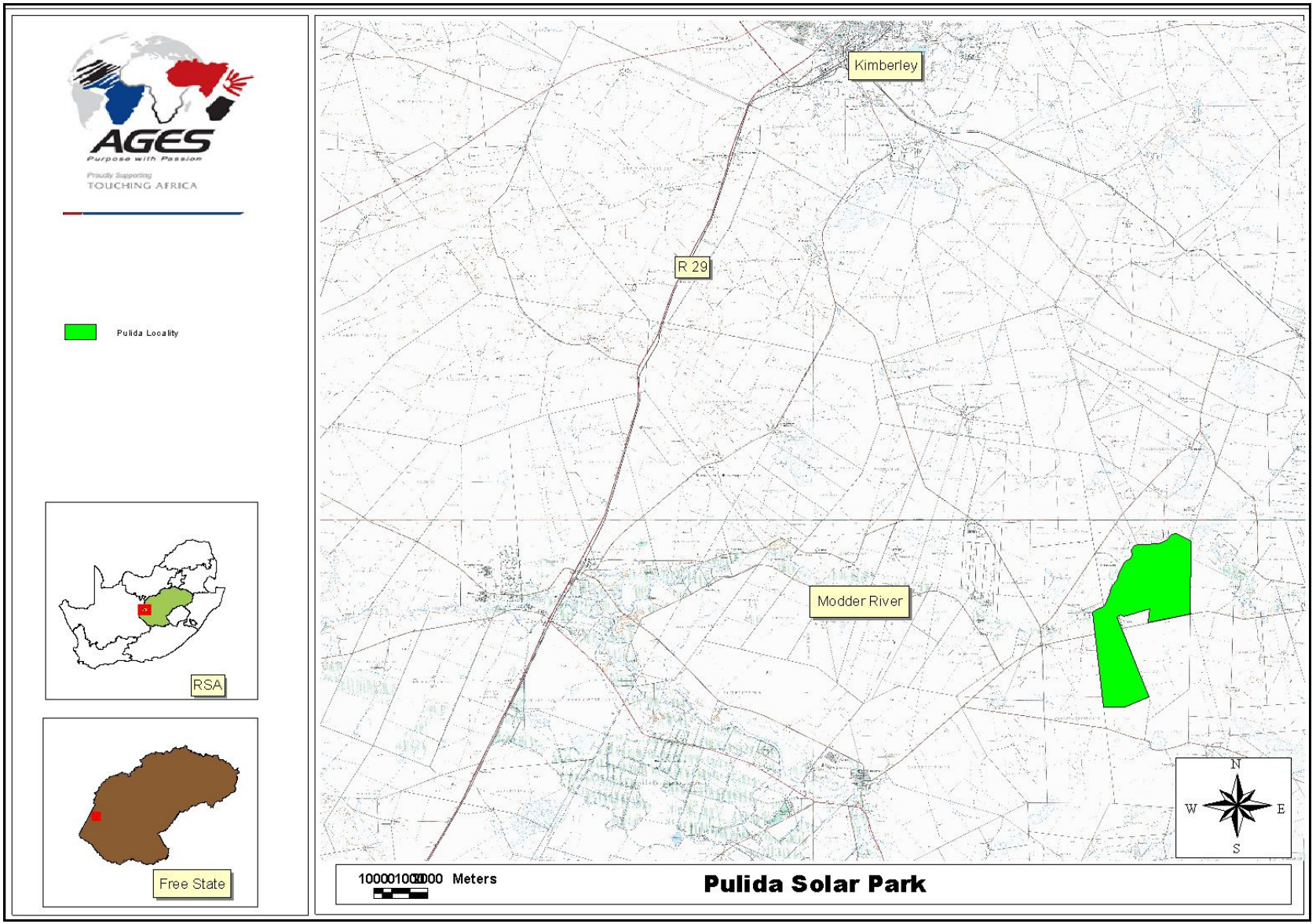
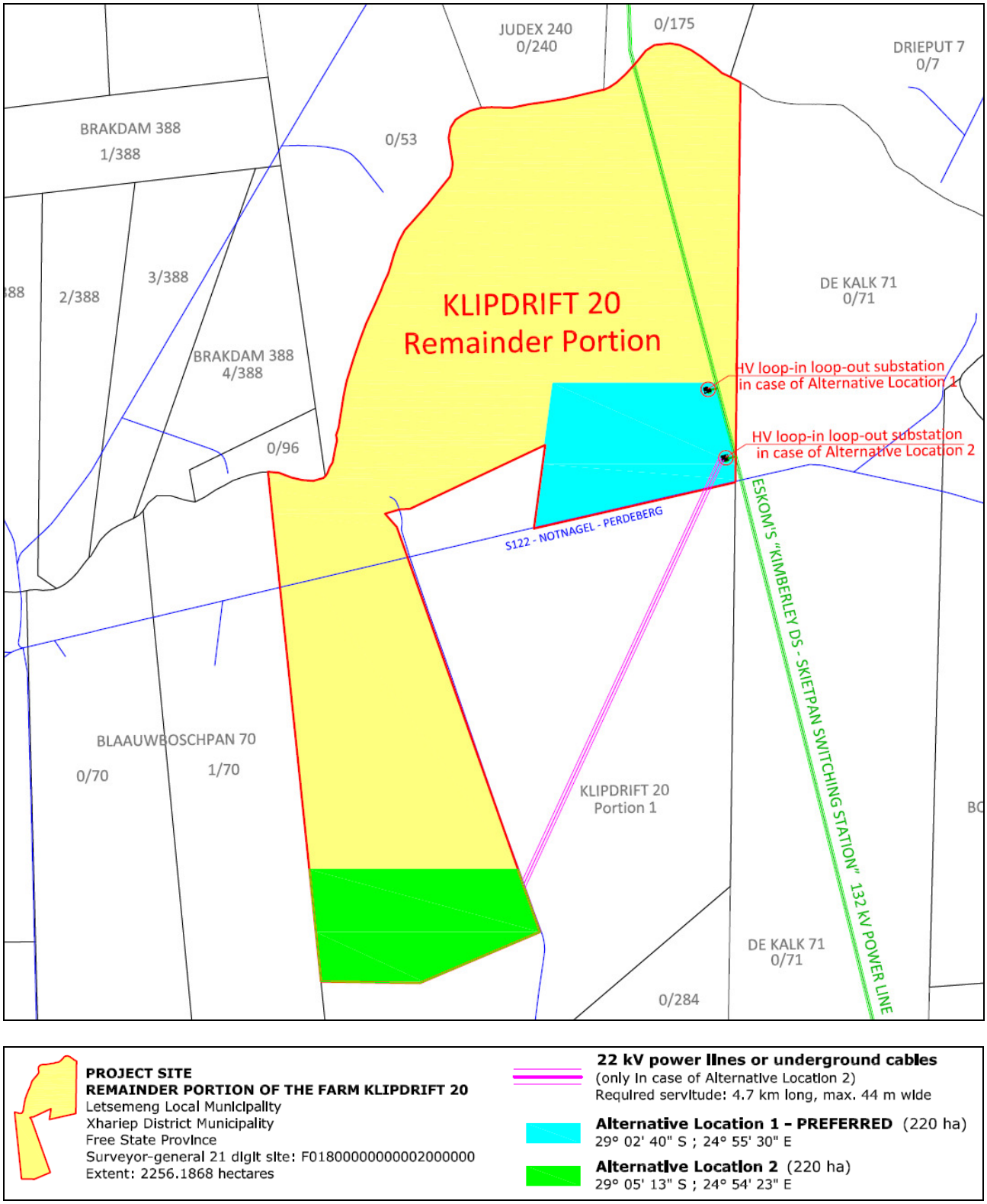


Figure 2 Locality map of the project site, with indication of the alternative locations for the proposed solar park



3. AUTHORITIES, LEGAL CONTEXT AND ADMINISTRATIVE REQUIREMENTS

The legislative and regulatory framework of reference for the solar power plant project includes statutory and non-statutory instruments by which National, Provincial and Local authorities exercise control throughout the development of the same project.
The development and the environmental assessment process of a solar power plant project involve various authorities dealing with the different issues related to the project (economic, social, cultural, biophysical etc.).

3.1. REGULATORY AUTHORITIES

3.1.1. National Authorities

At national level, the main regulatory authorities and agencies are:

- *Department of Energy (DoE):* the Department is competent and responsible for all policies related to energy, including renewable energy. Solar energy is contemplated and disciplined under the White Paper for Renewable Energy and the Department constantly conducts research activities in this respect;
- *Department of Environmental Affairs (DEA):* the Department is competent and responsible for all environmental policies and is the controlling authority under the terms of NEMA and EIA Regulations. The DEA is also the competent authority for the proposed project, and is entrusted with granting the relevant environmental authorisation;
- *National Energy Regulator of South Africa (NERSA):* the Regulator is competent and responsible for regulating all aspects dealing with the electricity sector and, in particular, issues the licence for independent power producers;
- *South African Heritage Resources Agency (SAHRA):* the Agency is responsible for the protection and the survey, in association with provincial authorities of listed or proclaimed sites, such as urban conservation areas, nature reserves and proclaimed scenic routes under the terms of the National Heritages Resources Act (Act no. 25 of 1999);
- *South African National Roads Agency Limited (SANRAL):* the Agency is responsible for all National road routes.

3.1.2. Provincial Authorities

At provincial level, the main regulatory authority is the *Free State Department of Economic Development, Tourism and Environmental Affairs* and this Department is responsible for environmental policies and is the Provincial authority in terms of NEMA and the EIA Regulations. The Department is also the commenting authority for the proposed project.

3.1.3. Local Authorities

At a local level, the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Free State province, Municipalities and District Municipalities are involved in various aspects of planning and the environment related to solar energy facilities development. The Local Municipality is the *Letsemeng Local Municipality,* which is part of the *Xhariep District Municipality*.

Under the terms of the Municipal System Act (Act no. 32 of 2000), all municipalities are deemed to go through an Integrated Development Planning (IDP) process in order to devise a five-year strategic development plan for the area of reference.
The identification of priority areas for conservation and their positioning within a planning framework of core, buffer, and transition areas is the subject of bioregional planning. Priority areas are individuated and defined with reference to visual and scenic resources and their identification and protection is granted through visual guidelines drafted for the area included in bioregional plans.

Local authorities also provide specific by-laws and policies in order to protect visual and aesthetic resources with reference to urban edge lines, scenic drives, special areas, signage, communication masts etc.

Finally, there are also various non-statutory bodies and environmental groups, who are involved in the definition of various aspects of planning and the protection of the environment, which may influence in the development of the proposed project.

3.2. LEGISLATION, REGULATIONS AND GUIDELINES

A review of the relevant legislation involved in the proposed development is detailed in table 1 below.

Table 1 Review of relevant legislation

National Legislation	Sections applicable to the proposed project
Constitution of the Republic of South Africa (Act no. 108 of 1996)	• Bill of Rights (S2) • Rights to freedom of movement and residence (S22) • Environmental Rights (S24) • Property Rights (S25) • Access to information (S32) • Right to just administrative action (S33)
Fencing Act (Act no. 31 of 1963)	• Notice in respect of erection of a boundary fence (S7) • Clearing bush for boundary fencing (S17) • Access to land for purpose of boundary fencing (S18)
Conservation of Agricultural Resources Act (Act no. 43 of 1983)	• Prohibition of the spreading of weeds (S5) • Classification of categories of weeds & invader plants and restrictions in terms of where these species may occur (Regulation 15 of GN R0148) • Requirement and methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R0148)
Environment Conservation Act (Act no. 73 of 1989)	• National Noise Control Regulations (GN R154 dated 10 January 1992)
National Water Act (Act no. 36 of 1998)	• Entrustment of the National Government to the protection of water resources (S3) • Entitlement to use water (S4) - Schedule 1 provides the purposes which entitle a person to use water (reasonable domestic use, domestic gardening, animal watering, fire fighting and recreational use) • Duty of Care to prevent and remedy the effects of water pollution (S19) • Procedures to be followed in the event of an emergency incident which may impact on water resources (S20) • Definition of water use (S21) • Requirements for registration of water use (S26 and S34) • Definition of offences in terms of the Act (S151)
National Forests Act (Act no. 84 of 1998)	• Protected trees
National Environmental Management Act (Act no. 107 of 1998)	• Definition of National environmental principles (S2): strategic environmental management goals and objectives of the government applicable within the entire Republic of South Africa to the actions of all organs of state, which may significantly affect the

	environment • NEMA EIA Regulations (GN R543, 544, 545, 546, & 547 of 18 June 2010) • Requirement for potential impact on the environment of listed activities to be considered, investigated, assessed and reported on to the competent authority (S24 - Environmental Authorisations) • Duty of Care (S28): requirement that all reasonable measures are taken in order to prevent pollution or degradation from occurring, continuing and recurring, or, where this is not possible, to minimise and rectify pollution or degradation of the environment • Procedures to be followed in the event of an emergency incident which may impact on the environment (S30)
National Heritage Resources Act (Act no. 25 of 1999)	• SAHRA, in consultation with the Minister and the Member of the Executive Council of every province must establish a system of grading places and objects which form part of the national estate (S7) • Provision for the protection of all archaeological objects, paleontological sites and material and meteorites entrusted to the provincial heritage resources authority (S35) • Provision for the conservation and care of cemeteries and graves by SAHRA, where this is not responsibility of any other authority (S36) • List of activities which require notification from the developer to the responsible heritage resources authority, with details regarding location, nature, extent of the proposed development (S38) • Requirement for the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites for promotion of tourism (S44)
National Environmental Management: Biodiversity Act (Act no. 10 of 2004)	• Provision for the Member of the Executive Council for Environmental Affairs/Minister to publish a list of threatened ecosystems and in need of protection (S52) • Provision for the Member of the Executive Council for Environmental Affairs/Minister to identify any process or activity which may threaten a listed ecosystem (S53) Provision for the Member of the Executive Council for Environmental Affairs/Minister to publish a list of: critical endangered species, endangered species, vulnerable species and protected species (S56(1) - see Government Gazette 29657 • Three government notices have been published up to the present date: GN R150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R151 (Lists of critically endangered, vulnerable and protected species) and GN R152 (Threatened Protected Species Regulations)
National Environmental Management: Air Quality Act (Act no. 39 of 2004)	• Provision for measures in respect of dust control (S32) • Provision for measures to control noise (S34)
National Environmental Management: Waste Management Act (Act no. 59 of 2008)	• Waste management measures • Regulations and schedules • Listed activities which require a waste licence

Guideline Documents	Sections applicable to the proposed project
South African National Standard (SANS) 10328, Methods for environmental noise impact assessments in terms of NEMA no. 107 of 1998	• Impact of noise emanating from a proposed development may have on occupants of surrounding land by determining the rating level • Noise limits are based on the acceptable rating levels of ambient noise contained in SANS 10103
Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads	• The Guidelines outline rules and conditions related to transport of abnormal loads and vehicles on public roads and detailed procedures to be followed for the grant of exemption permits

Policies and White Papers	Sections applicable to the proposed project
The White Paper on the Energy Policy of the Republic of South Africa (December 1998)	• The White Paper supports investment in renewable energy initiatives, such as the proposed solar power plant project
The White Paper on Renewable Energy (November 2003)	• The White Paper outlines the Government's vision, policy, principles, strategic goals and objectives for the promotion and the implementation of renewable energy in South Africa
Integrated Resource Plan (IRP1) Integrated Resources Plan 2010-2030 (IRP 2010).	• The first Integrated Resource Plan (IRP1) was released in late 2009. Subsequently the DoE decided to undertake a detailed process to determine South Africa's 20-year electricity plan, called Integrated Resources Plan 2010-2030 (IRP 2010). • The IRP1 and the IRP 2010 outline the Government's vision, policy and strategy in matter of the use of energy resources and the current status of energy policies in South Africa. • **In particular, the IRP 2010 highlights the necessity of commissioning 1200 MW with solar PV technology by the end of 2015.**
Request For Qualification and Proposals For New Generation Capacity under the IPP Procurement Programme (3 August 2011)	• The IPP Procurement Progamme, issued on 3rd August 2011 by the DoE, envisages the commissioning of **3725 MW** of renewable projects (**1450 MW with Solar photovoltaic technology**) **capable of beginning commercial operation before the end of 2016**.
Equator Principles (July 2006)	• The Equator Principles provide that future developments with total project capital costs of US$10 million or more shall be financed only if socially and environmentally sustainable

3.3. LISTED ACTIVITIES IN TERMS OF NEMA

The "listed activities" in terms of sections 24 and 24D of NEMA involved (or *potentially* involved) in the proposed development are detailed in table 2 below.

Table 2 Listed Activities in terms of sections 24 and 24D of NEMA involved in the proposed development

Relevant notice:	Activity No:	Description of each listed activity:
R.545, 18 June 2010	**1**	*The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more:* The project will consist of construction, operation and maintenance of a Photovoltaic (PV) Power Plant with a generating capacity up to 75 MW with associated infrastructure and structures on a site, corresponding to the Remainder Portion of the farm Klipdrift 20, measuring approximately 2256 hectares in size, located 40 km South-East from Kimberley. The project will participate in the IPP Procurement Programme, issued by the Department of Energy on 3 August 2011. The facility will comprise several arrays (strings) of PV modules mounted on frames; the associated infrastructure and structures will consist of: (i) internal and external access roads and a small parking area; (ii) fencing of the plant and video security control systems; (iii) foundations / minipiles for the mounted Photovoltaic arrays; (iv) electricity access point for the construction phase, operation phase (if necessary) and UPS (Uninterruptible Power Supply) devices; (v) water access point and/or water extraction on-site from borehole(s), water supply pipelines, water treatment; (vi) sewage system and stormwater collection system; (vii) workshop & warehouse; (viii) offices & administrative areas; (ix) cabling linking Photovoltaic strings and other internal cabling; (x) medium voltage stations designed to host DC/AC inverters and medium voltage power transformers; (xi) medium voltage receiving station(s); (xii) one small on-site high voltage loop-in loop-out substation with one or more high-voltage power transformer(s) and a high-voltage bus bar (switching station) stepping up the voltage to the voltage of the Eskom grid, a busbar with protection an metering devices and a control building ("switching station"); (xiii) two new small sections of line (at 132 kV) allowing the Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line to loop in and out of the 132 kV busbar of the new on-site substation. The connection may also entail interventions on the Eskom grid according to Eskom's connection requirements/solution. During the construction phase, the site may be provided with additional: (i) water access point and water extraction on-site borehole(s) point, water supply pipelines, water treatment facilities; (ii) pre-fabricated buildings; to be removed at the end of construction.

R.545, 18 June 2010	**15**	*Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more except where such physical alteration takes place for:* *(i) linear development activities; or* *(ii) agriculture or afforestation where activity 16 in this Schedule will apply.* The Photovoltaic Power Plant with associated infrastructure and structures will be constructed and operated on a footprint up to 200 hectares.
R.544, 18 June 2010	**10**	*The construction of facilities or infrastructure for the transmission and distribution of electricity:* *Outside urban areas or industrial complexes with a capacity of more than 33 kilovolts but less than 275 kilovolts: or* *Inside urban areas or industrial complexes with a capacity of 275 kilovolts or more* The connection to the Eskom grid will be done according to the Eskom connection solution which may require: (i) one small on-site high-voltage loop-in loop-out substation with one or more high-voltage power transformers and a high-voltage bus bar (switching station) to be connected to the Eskom's 132 kV power line "Kimberley DS - Skietpan Switching Station" which crosses the site; (ii) two new small sections of line (at 132 kV) allowing the Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line to loop in and out of the 132 kV busbar of the new on-site substation. The connection solution may also entail intervention on the Eskom's grid and/or on Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line.
R.544, 18 June 2010	**11**	*The construction of ;* *Canals, channels, bridges, dams, weirs, bulk storm water outlets, marinas, jetties (>50sq.m.), slipways (>50sq.m.), buildings (>50sq.m.), or infrastructure or structures covering 50sq.m. or more,* *Where such construction occurs within a watercourse or within 32m of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line* The project may envisage the building or upgrading of stream crossings
R.544, 18 June 2010	**22**	*The construction of a road, outside urban areas,* *(i) with a reserve wider than 13,5 metres or,* *(ii) where no reserve exists where the road is wider than 8 metres, or* (iii) *for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010* An access road wider than 8 meters or with a reserve wider than 13.5 meters may be constructed. Some internal roads may be wider than 8 meters.

The current EIA procedure of the Pulida Solar Park **includes the connection to the Eskom grid.** Furthermore, a part of the connection infrastructure (the 132 kV busbar of the on-site substation and the two new sections of 132 kV power line) may be executed, owned and operated by Eskom.

Final layout and site plans already drafted by Pulida Energy will be completed once inputs, via public participation have been received, analysed and reviewed. All information acquired will be analysed in order to determine the proposed final development layout and site plans.

Such approach will ensure a holistic view of future requirements of the site and that resources are utilised to their full availability in terms of social and environmental sustainability. It must also be pointed out that this application and all other development applications, in the area, are considered together in order to ensure general sustainability in the Letsemeng Local Municipality and in the Xhariep District Municipality areas.

4. PROJECT DESCRIPTION AND FUNCTIONING

The project envisages the establishment of a solar power plant with a **maximum generation capacity at the delivery point up to 75 MW.**

The construction timeframe is estimated in maximum 15 months, whereas the commissioning date will depend on the IPP Procurement Programme timeframe.

The preferred technical solutions envisage:

- **thin-film modules mounted on fixed mounting systems**
- **polycrystalline modules mounted on horizontal 1-axis trackers.**

A combination of the abovementioned two solutions is also possible.

The estimated annual energy production is calculated in approximately:

- **1,950 kWh/kWp/year** (load factor = 0.223), in the case of thin film modules mounted on fixed mounting systems; or
- **2,200 kWh/kWp/year** (load factor = 0.251) in the case of polycrystalline modules mounted on trackers.

Therefore, the Pulida Solar Park will generate:

- up to **162.5 GWh per year** in the case of thin film modules mounted on fixed mounting systems; or
- up to **190.1 GWh per year** in the case of polycrystalline modules mounted on trackers

The calculation is made by the professional tool "PVSYST" and the simulation is done for 1 MWp (1 "PV field").
The site data (irradiation, temperature, etc.) charged on the database consists of hourly meteo-data registered by NASA satellites (NASA-SSE satellite data 1983-1993, release 6) and the simulation is made for the timeframe of 1 year.
The output (1,950 kWh/kWp/year and 2,200 kWh/kWp/year) is also called “full net equivalent hours”, which represent the average energy injected into the grid per 1 kWp of installed capacity.
The *Global Horizontal Irradiation* of the site is 2,094.1 kWh/m^2/year (NASA-SSE satellite data, 1983-1993, release 6).

The energy generated by the Pulida Solar Park will reduce the quantity of pollutants and greenhouse gases emitted into the atmosphere. The reduced amount of CO_2 will be the emissions that would have been generated by a thermal power plant using fossil fuels for producing the same quantity of energy that it is produced by the Pulida Solar Park.
The quantity of the avoided CO_2 is calculated as follows: the energy produced by the Pulida Solar Park (up to 162.5 GWh/y) or 190.1 GWh/y) is multiplied by the Eskom’s average emission factor which is 1.015 t CO_2/MWh (*source*: Energy Research Centre, University of Cape Town. (2009 *Carbon accounting for South Africa*).
This means that, in the case of the Pulida Solar Park, the **avoided CO_2 emissions** are approximately **164,968 tons of CO_2 per year** in the case of thin film modules mounted on fixed mounting systems, or **192,931 tons of CO_2 per year** in the case of polycrystalline modules mounted on trackers.

Furthermore, considering that 1 kg of coal generates approximately 3.7 kWh (supposing a caloric value of 8000 kcal/kg and a coal plant efficiency of 40%), **the coal saved by the Pulida Solar Park will be of approximately 43,927 tons of coal / year** in the case of thin film modules mounted on fixed mounting systems, or **51,373 tons of coal / year** in the case of polycrystalline modules mounted on trackers.

The detailed description of the characteristic and functioning of the plant and its connection is given in the following paragraphs.

4.1. PROJECT LAYOUT

The layout of the proposed development is the result of a comparative study of various layout alternatives and had been defined in consideration of the results of some specialists studies conducted during the scoping phase.
The PV plant is designed and conceived in order to minimize visual and noise impacts, as well as to operate safely and assuring a high level of reliability, with low water consumption and the need only for easy and quick maintenance and repair for approximately 25-30 years.

The main drives of the chosen layout were:

- to maximize the energy production and the reliability of the PV plant, by choosing proven solar technologies: horizontal 1-axis trackers with polycrystalline solar modules, or thin-film solar modules mounted on fixed mounting systems;
- to develop the PV power plant on flat and low/moderate ecological sensitivity areas;
- to avoid the heritage sites (*low density surface scatter of lithic artefacts*) affecting the property;
- furthermore, a tree buffer zone has been foreseen around the footprint, in order to minimise the visual impact of the proposed development.

As previously indicated in Figure 2, two possible suitable areas were identified for the proposed development during the Scoping Phase:

- **Alternative Location 1 (preferred)**: close to the eastern boundary of the farm, north from the access road, east from the Eskom's 132 kV power line called "Kimberley DS - Skietpan Switching Station". In this case, the lease portion will be of approximately 220 hectares, while the footprint of the solar park will be up to 200 hectares.
- **Alternative Location 2**: on the southern side of the farm. In this case, the lease portion will be of approximately 220 hectares, while the footprint of the solar park will be up to 200 hectares.
  In this case, in order to connect the solar park to the Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line, the following is further required:
  a) A small on-site high-voltage loop-in loop-out substation, to be located close to the eastern boundary of the farm, 100 m far from the Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line. The footprint of the substation will be approximately 4,000 m^2.
  b) Medium-voltage power lines, from the Alterative Location 2 up to the on-site high-voltage loop-in loop-out substation. The MV power lines will cross Portion 1 of the Farm Klipdrift 20 (owned by the same landowner) for approximately 4.7 km. The required corridor will be maximum 44m wide.

As indicated by the Specialist Studies conducted during the Scoping Phase and attached to this EIA Report, **the Alternative Location 1 is the preferred one and the only suitable alternative**, for the following reasons:

a) The Ecological Impact Assessment (Annexure E) assessed that the Alternative Location 2 is undevelopable from the ecological point of view, due to the following considerations:
   (i) the Alternative Location 2 is located further away from the secondary road and the additional impacts that would be created during construction (e.g. dust, clearing of vegetation to gain access to site) would have a detrimental effect on the environment compared to Alternative Location 1 that is located directly adjacent to the secondary road.
   (ii) The choice of the Alternative Location 2 would entail the clearing of additional vegetation to construct medium-voltage power lines from Alternative Location 2 to the high-voltage loop-in loop-out substation, to be established on the North-East, close to the existing Eskom's 132 kV power

line. The medium-voltage power lines would also traverse a sensitive wetland area with pans and calcareous soils with a high erosion potential. The impacts associated with the development of medium-voltage power lines from Alternative Location 2 to the high-voltage loop-in loop-out substation is therefore considered significant and - if compared to the minimal impacts that will be associated with the development of Alternative Location 1 (directly adjacent to the connecting power line) - this option is not considered viable from an ecological point of view.

b) From a geotechnical perspective, both the Alternative Locations 1 and 2 are suitable for the proposed development, with the Alternative Location 1 having the advantage of not having outcrops of very strong rock. The Geo-technical and Geo-hydrological Report (Annexure J) assessed that the Alternative Location 1 is *developable with no geotechnical risk*, while the Alternative Location 2 is *developable with precautions with respect to excavatability*.
c) As fully detailed in the Geo-technical and Geo-hydrological Report (Annexure J), in terms of groundwater availability, Alternative Location 1 is better suited.
d) The Visual Impact Assessment (Annexure K) assessed that, when taking the precautionary vegetation screen into consideration, this precautionary measurement would - in the case of the Alternative Location 1 - wholly contain the visibility of the proposed project components. For this reason, the Alternative Location 1 is the preferred one also from the visual impact point of view.
e) Furthermore, from a technical point of view, the Alternative 2 is more expensive and less reliable than the Alternative 1, because it would require medium-voltage power lines - 4.7 km long - linking the Pulida Solar Park (on the Alternative Location 2) to the HV loop-in loop-out substation, to be necessarily located close to the Eskom power line running within the Alternative Location 1.

The related layout plans are depicted in Figures 3 and 4 and the attached drawings of the Annexure A:

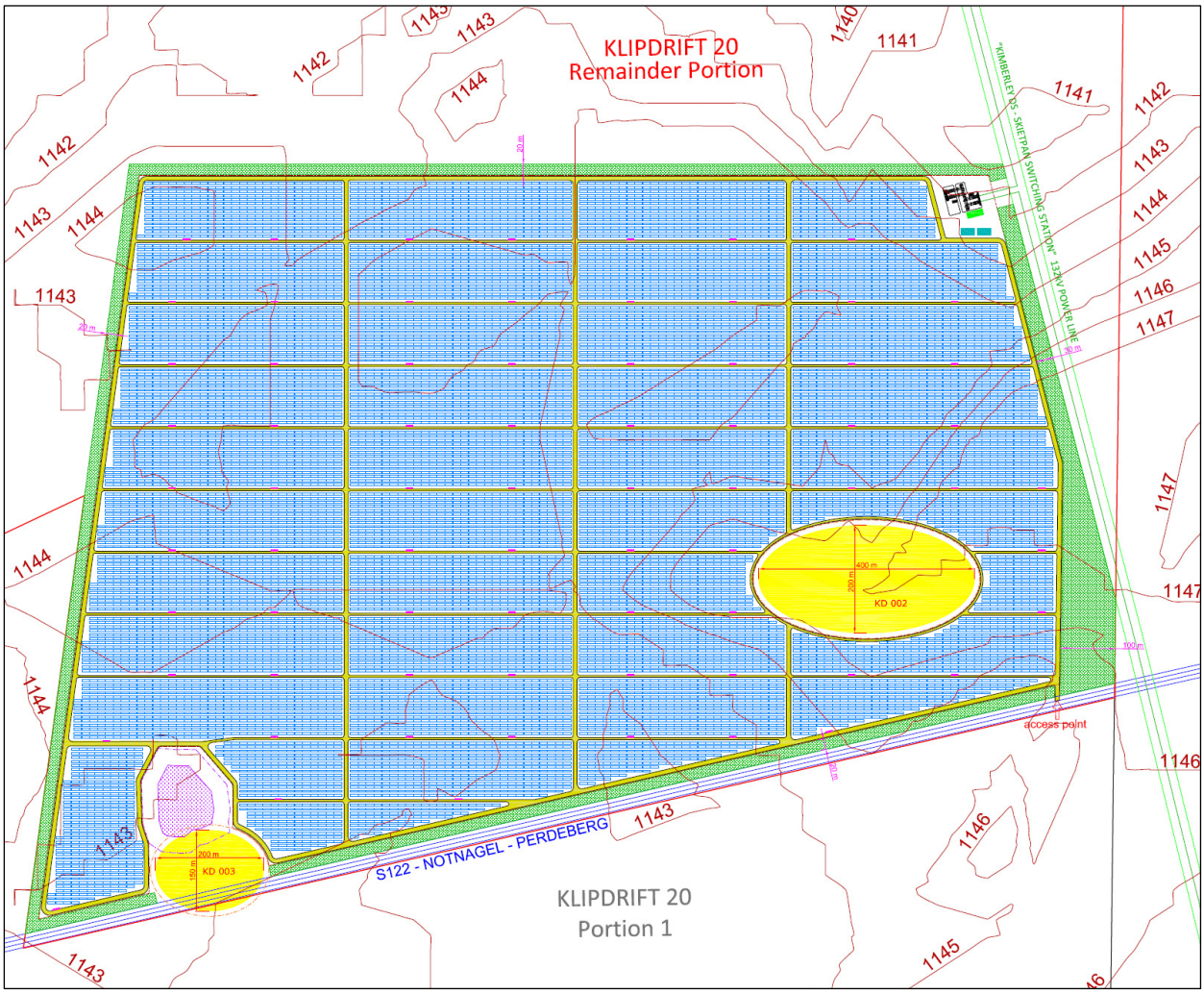
- PDSP_01_DE_Rev.01/EIA Layout of the PV power plant - Alternative location 1 (preferred)
- PDSP_02_DE_Rev.00/EIA Layout of the PV power plant - Alternative location 2

The proposed layout plans (attached in Annexure A and also shown in Figures 3 and 4 below) were drawn using thin-film modules mounted on fixed mounting systems; in the case of polycrystalline modules mounted on trackers, the layout plans do not change, except for the orientation of the PV arrays: north-south instead of east-west.
The required **footprint** - corresponding on the fenced area - will be the same: **up to 200 hectares** within a developed area measuring 220 hectares in extent, and the maximum height of the structures (PV modules and support frames) will be approximately 3.1m above the ground level. Therefore the impacts and mitigation measures will remain exactly the same.

The project layouts and the other plant components are detailed in the following drawings:

- PDSP_00_DE_Rev.01/EIA Locality Map and alternative locations
- PDSP_01_DE_Rev.01/EIA Layout of the PV power plant - Alternative location 1
- PDSP_02_DE_Rev.01/EIA Layout of the PV power plant - Alternative location 2
- PDSP_03_DE_Rev.01/EIA Mounting System – Alternative option 1: fixed mounting systems with thin film modules
- PDSP_04_DE_Rev.00/EIA Mounting System – Alternative option 2: horizontal single-axis trackers with polycrystalline modules
- PDSP_05_DE_Rev.00/EIA Medium-voltage stations
- PDSP_06_DE_Rev.01/EIA Control building and medium-voltage receiving station
- PDSP_07_DE_Rev.01/EIA High-voltage loop-in loop-out substation
- PDSP_08_DE_Rev.00/EIA Warehouse
- PDSP_09_DE_Rev.00/EIA Stormwater management system

Figure 3 Layout of the Pulida Solar Park - Alternative Location 1 (preferred)



PROJECT SITE
REMAINDER PORTION OF THE FARM KLIPDRIFT 20
Letsemeng Local Municipality
Xhariep District Municipality
Free State Province
Surveyor-general 21 digit site: F01800000000002000000
Extent: 2256.1868 hectares

Fenced area (footprint): up to 200 ha

Medium voltage receiving station and control building

PV arrays

Medium voltage stations

High-voltage loop-in loop-out substation
2 X 22 kV /132 kV 40 MVA power transformers

Warehouses

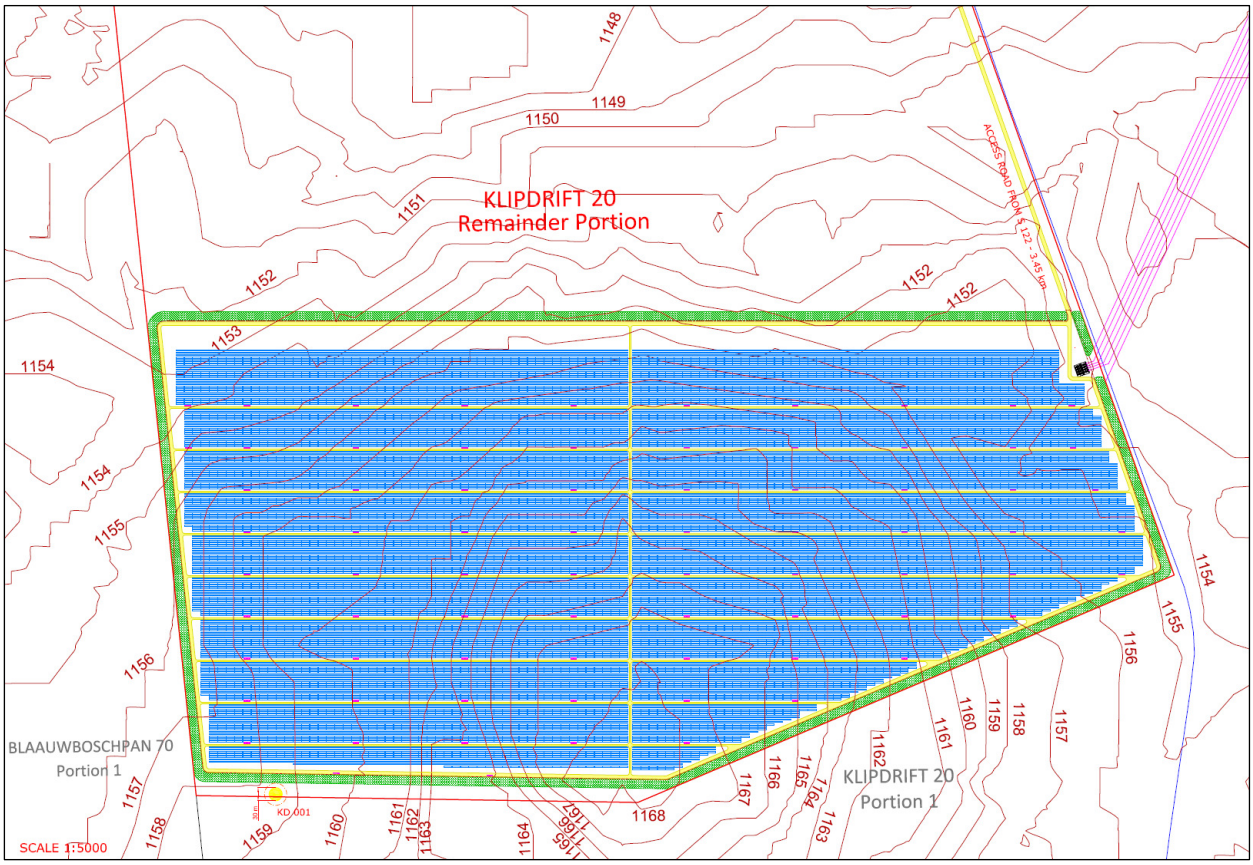
Internal roads

ESKOM's "KIMBERLEY DS - SKIETPAN SWITCHING STATION" 132 kV power line and registered servitude

Tree buffer zone
minimum width: 20 m

Heritage sites and 10 m buffer

Figure 4 Layout of the Pulida Solar Park - Alternative Location 2



PROJECT SITE
REMAINDER PORTION OF THE FARM KLIPDRIFT 20
Letsemeng Local Municipality
Xhariep District Municipality
Free State Province
Surveyor-general 21 digit site: F01800000000002000000
Extent: 2256.1868 hectares

Fenced area (footprint): up to 200 ha

Medium voltage receiving station and control building

PV arrays

Medium voltage stations

High-voltage loop-in loop-out substation
2 X 22 kV /132 kV 40 MVA power transformers

Warehouses

Internal roads

ESKOM's "KIMBERLEY DS - SKIETPAN SWITCHING STATION" 132 kV power line and registered servitude

Tree buffer zone
minimum width: 20 m

Heritage sites and 10 m buffer

4.2. PRIMARY COMPONENTS

The Photovoltaic (PV) Power Plant together with its connection infrastructures and structures will require the installation of the following equipment:

- Photovoltaic modules
- Mounting systems (fixed or trackers) for the PV arrays
- Internal cabling and string boxes
- Medium voltage stations hosting DC/AC inverters and LV/MV power transformers
- Medium voltage receiving station & Control building, with offices and a small parking area
- Workshop & warehouse
- One small on-site high-voltage loop-in loop-out substation with high-voltage power transformers, stepping up the voltage to the voltage of the Eskom's grid, and one high-voltage busbar with metering and protection devices (also called "switching station")
- two new small sections of high-voltage power line allowing the **"Kimberley DS - Skietpan Switching Station" 132 kV power line** to loop in and out of the 132 kV busbar of the new on-site substation
- Electrical system and UPS (Uninterruptible Power Supply) devices
- Storm water collection system
- Lighting system
- Grounding system
- Access road and internal roads
- Fencing of the site and alarm and video-surveillance system
- Water access point and water extraction on-site borehole(s) point, water supply pipelines, water treatment facilities (Ballam Waterslot systems).

4.2.1. Project functioning and connection of the solar park to the Eskom grid

Solar energy facilities using PV technology convert sun energy to generate electricity through a process known as the Photovoltaic Effect, which consists of the generation of electrons by photons of sunlight in order to create electrical energy.

The preferred technical solutions are:

- thin-film modules mounted on fixed mounting systems, and,
- mono or polycrystalline modules mounted on horizontal 1-axis trackers,

which at present represent the best performing options in terms of reliability and costs/efficiency.

The PV technology is in constant and rapid evolution, this means that the final choice of the type of solar modules (thin-film, mono-crystalline or polycrystalline) and mounting system (fixed or tracker) can be taken at the time of the commission date, on the basis of the availability of PV modules and mounting systems, of the worldwide market and of the cost-efficiency curve.

In any case, the required footprint - corresponding on the fenced area - will be up to 200 hectares, and the maximum height of the structures (PV modules and support frames) will be approximately 3.1 m above the ground level. Therefore the impacts and mitigation measures will not change. For further reference please refer to section 5.2.

The following description is referred to both the preferred technical solutions (mono/polycrystalline modules mounted on horizontal single-axis trackers and thin film modules mounted on fixed mounting system or a combination of them).

The required **footprint** (including internal roads) will be **up to 200 hectares,** within a developed area (lease portion) measuring 220 hectares in extent.

PV modules will be assembled on zinced steel or aluminium frames, to form PV arrays. The metal frames that sustain PV arrays are set to the ground by fixed support poles.

A) In the case of thin-film modules mounted on fixed mounting systems:

The PV generator will contain 608,400 thin-film PV modules of 135 Wp each, with a total peak power of **83,349,000 Wp DC side**, corresponding to **75,000,000 W AC side.**

Each mounting frame will host 42 PV modules along three parallel rows each consisting of 14 modules placed side by side, with the position of the PV arrays northwards and at a 20° tilt. The 3 rows are mounted vertically (portrait) one on top of the other, with an overall mounting structure height up to 3.1 meters above ground level.

The 617,400 thin-film PV modules are series-connected outlining strings made of 14 modules each. There will be 44,100 PV strings so that the string voltage fits into the voltage range of the inverters. Branch cables are designed to connect in parallel groups of three strings, to form 14,700 branch strings. Branch strings are set up in order to be connected to DC-connection boxes. Each String Box allows the parallel connection of 14 branch strings (also called “PV sub-field”).

Figure 5 Lateral views of PV arrays mounted on fixed mounting systems

Figure 6 Frontal view of PV arrays mounted on fixed mounting systems

For further details, Please refer to the Figures 5 and 6 above and to the drawing of the Annexure A:

- PDSP_03_DE_Rev.01/EIA *Mounting System – Alternative option 1: fixed mounting systems with thin-film modules*

B) In the case of mono/polycrystalline modules mounted on trackers:

The PV generator will contain 288,000 PV polycrystalline modules of 300 Wp each, with a total installed peak power of **86,400,000 Wp DC side**, corresponding to **75,000,000 W AC side**.
Each PV array is composed of 40 PV modules disposed along three parallel rows each consisting of 13 PV modules placed horizontally side by side; at the end of the PV array, one further module is placed in the vertical position.
Each tracker is composed by several PV arrays North-South oriented and linked by an horizontal axis, driven by a motor. The horizontal axis allows the rotation of the PV arrays toward the West and East direction, in order to follow the daily sun path.

Figure 7 Simulation views of the PV arrays mounted on horizontal 1-axis tracker

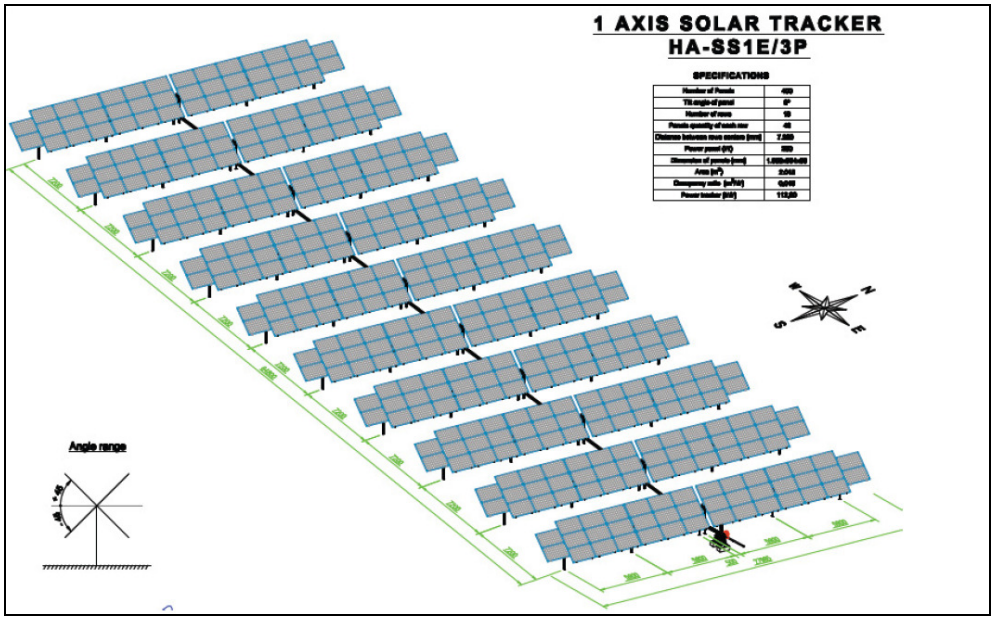


Figure 8 Frontal views of the PV arrays mounted on horizontal 1-axis tracker

For further details, see also the drawing of the Annexure A:

- PDSP_04_DE_Rev.00/EIA *Mounting System – Alternative option 2: horizontal single-axis trackers with polycrystalline modules*

The 288,000 polycrystalline PV modules are series-connected, constituting strings made of 20 modules each. There will be 14,400 PV strings in order that the string voltage fits into the voltage range of the inverters. The strings are set up in order to be connected to DC-connection boxes. Each String Box allows the parallel connection of 12 PV strings (also called "PV sub-field").

C) In both cases:

String Boxes monitor the currents in photovoltaic modules and can promptly diagnose faults. String boxes are also designed with a circuit breaker in order to disconnect the photovoltaic sub-fields from the inverters.

The PV sub-fields are thought to be linked to central inverters, located in **75 medium voltage stations**. Each station comprises two adjacent prefabricate buildings designed to host two **DC/AC inverters**, with a total nominal output AC power of 1,000 kW, and two **medium voltage power transformers** of 500 kVA each. The DC/AC inverters are deemed to convert direct current (DC) into alternate current (AC) at low voltage (270 V); subsequently the AC will pass through a medium-voltage transformer in order to increase the voltage up to 22 kV (or 11 kV).

The medium-voltage stations are detailed in the drawing of the Annexure A:

- PDSP_05_DE_Rev.00/EIA *Medium-voltage stations*

The energy delivered from the 75 medium voltage stations will be collected into one (or more) **medium voltage receiving station**(s), parallel connecting all the 75 PV fields of the PV generator.

From the medium voltage receiving station, the energy will be delivered to two high-voltage power transformers (40 MVA each, plus one as spare), which will step up the electric energy from the medium voltage level (11 kV or 22 kV) to the Eskom required connecting voltage (i.e. 132 kV). The power transformers will be connected to an on-site 132 kV busbar (the so called "***switching station***"), to be equipped with protection and metering devices, according to the Eskom requirements.

The Pulida Solar Park will be connected to the **Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line**, which crosses the project site,
The Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line will loop in and out of the 132 kV busbar ("switching station") of a new on-site substation through two new small sections of 132 kV power line, approximately 100 m long.

The new on-site HV loop-in loop-out substation will need to be equipped with circuit breakers upstream and downstream, in order to disconnect the PV power plant and/or the power line in case of failure or grid problems**.**
Furthermore, two **metering devices and related kiosks** are foreseen inside the layout: one for Eskom, close to the busbar, and one for Pulida Energy, close to the power transformers. The kiosks (2.4 x 4.8 x 3.2m) will contain the peripheral protection and control cabinets and the metering devices.

The on-site HV loop-in loop-out substation, composed of the power transformers, the control building, the 132 kV busbar with protection and metering devices and the kiosks, will have a **footprint of approximately 4,000 m^2**.

The new power line and the busbar (*switching station*) of the on-site HV loop-in loop-out substation will be owned and operated by Eskom Distribution.

The layout of the on-site high-voltage substation as well as of the control building and the subdivision between Eskom's side and Pulida Energy's side are detailed in the drawings included in Annexure A:

- PDSP_06_DE_Rev.01/EIA *Control building and medium-voltage receiving station*
- PDSP_07_DE_Rev.01/EIA *High-voltage loop-in loop-out substation*

The power generation capacity at the delivery point will be up to 75 MW.

4.2.2. Access road and internal roads

As indicated in the Locality Map (Annexure A - PDSP_00_DE_Rev.01/EIA) and in Figure 2, the access to the Pulida Solar Park will be from the road **S122 "Notnagel - Perdeberg"**, from the south-eastern boundary of the developed area (Alternative Location 1).

Internal roads will consist of gravel roads designed in accordance with engineering standards. Main internal roads will have a width of 8.0 meters allowing for the slow moving heavy vehicles. Secondary internal roads will be 4.0 meters wide. As indicated in the Geo-technical and Geo-hydrological Report (Annexure J), calcrete soil present on the Alternative Location 1 is suitable for use as road construction material. The soil is also non expansive and settlement potential is low.

Once the solar farm is in operation, the internal roads will mainly be used for maintenance and inspections.

The vertical alignment of the roads will not present significant challenges due to the flatness of the terrain. The entire development will be contained inside a fenced area and the roads are not intended for public use.

4.2.3. Lighting system

The lighting system will consist of the following equipment:

- Floodlight-towers: maximum 10 meters high, with 6x400W directional lamps, installed around the HV loop-in loop-out substation. Normal lighting: 15 lux; up to 40 lux in case of emergency.
- Street lighting along internal roads, for the stretch from the access point up to the HV substation inside the property: 1 streetlamp, maximum 5.5 meters high, every 20 meters, having a metal-haloids lamp of 400 W.
- 2x400 W spotlights (SAP type) mounted on the top of medium-voltage stations.

The lighting of the MV stations and of the on-site HV substation will be on only in case of intrusion/emergency or necessity to reach the MV stations / HV substation during the night.

During the night, the video-surveillance system will use infra-red (or micro-wave) video-cameras, which do not need a lighting system (which could reduce the functioning). Only streetlamps along internal roads, for the stretch from the main access up to the HV substation inside the property, may be switched on at night.

4.2.4. Storm-water collection system

Drainage occurs as sheet-wash towards the northern side of the property, up to the Modder River. The proposed storm water system, where required, will consist of concrete gully-drains

and possible nominal concrete pipe culverts. The excessive concentration of storm water will be avoided and the existing drainage patterns will be left undisturbed.

As detailed in the drawing of the Annexure A: PDSP_09_DE_Rev.00/EIA *Storm water management system*, concrete gully-drains will be installed along the main internal roads (8 m wide); then the rain water will be collected, filtered by silt traps installed at the confluence points and delivered to the Modder River by means of concrete gully-drains and/or by means of the existing drainage patterns. Open grass lined channels can be used as an alternative of concrete gully-drains.

4.2.5. Water requirements

4.2.5.1. Water requirements during the construction phase

The construction phase will last **maximum 15 months**.

A) Construction of internal gravel roads

- Water is necessary for the construction of internal gravel roads, in order to get the gravel compacted to optimum moisture content (OMC).
- The surface of internal gravel roads will be approximately 137,000 m^2.
- 50 liters of water / m^2 of internal of roads will be required.

B) Workers

- Approximately 100 people are expected to be employed during the construction period, although this number can increase to 150 for short spaces of time during peak periods. This number can be higher in the case Pulida Energy (Pty) Ltd - once being selected as Preferred Bidder by the Department of Energy and having finalized the Connection Agreement with Eskom, where in particular it is agreed the envisaged connection timeline - evaluates to build the Pulida Solar Park in a timeframe shorter than 15 months (i.e. 330 working days). For example, in the case the construction works are planned to last only **6 months** (i.e 132 working days), the average number of workers required on site during construction is **250**.
- Each worker needs 50 liters / 8 working hours for sanitary use.
- Water consumption will be:
  - 100 people x 50 l/person x 330 working days = 1,650 m^3 over 15 months, or:
  - 250 people x 50 l/person x 132 working days = 1,650 m^3 over 6 months.

C) Concrete production

- Concrete is necessary for the basements of the medium-voltage stations, the high-voltage loop-in loop-out substation, the control building and the warehouse and for the foundations of the mounting systems. The overall amount of concrete to be produced will be of approximately 15,000 m^3
- 200 litres of water are needed for 1 cubic meter of concrete.

D) Vehicle cleaning

As mitigation measure, the cleaning of vehicles like excavators, mechanical diggers and pile rammers will be done once or twice per month and no during working days, also in order to not increase the water requirement during the construction activities.
Furthermore, in order not to waste a large amount of water, high pressure cleaners will be used. On the whole, the water requirement for cleaning activity is very low.

The overall and average water consumption during construction is detailed in the following table.

Table 3 Water consumption during the construction phase of the project

WATER REQUIREMENT DURING THE CONSTRUCTION PHASE		
DESCRIPTION	**UNIT**	**TOTAL**
Timeframe of the construction activities	*months*	up to 15
Overall water consumption for internal roads	m^3	6,850
Overall water consumption for sanitary use	m^3	1,650
Overall water consumption for concrete production	m^3	3,000
OVERALL WATER CONSUMPTION DURING CONSTRUCTION	***m^3***	**11,500**

Storage tanks will be sized in order to provide a reserve of water of approximately 200 cubic meters.

4.2.5.2. Water requirements during the operational phase

During operation, water is only required for the operational team on site (sanitary use), as well as for the cleaning of the solar panels.
Further water consumption may be only for routine washing of vehicles and other similar uses.

A) Water for sanitary use

Approximately 35/40 people will be employed during the operation phase of the PV power plant, which will have a lifetime of 25 - 30 years.
The Pulida Solar Park will be in operation 7 days per week; therefore personnel will operate according to shifts. The surveillance team will be present during day-time, night-time and weekends. The average number of people working at the site on the same time will be of **14 people daytime and 6 people at night**.

The average daily water consumption for sanitary use is estimated to be **150 litres** / **day** / **person** per **20 people** (14 people daytime and 6 people at night), The daily water consumption will be approximately **3,000 litres/day.**

B) Water consumption to clean the PV modules

The cleaning activities of the solar panels will take place **once per year**.

We assumed that we need up to 2.0 liters per m^2 of PV panel surface.
Therefore, the amount of water for cleaning is up to **1,700 m^3 per cleaning cycle**.
PV modules cleaning activity can last less than 1 month. If the cleaning activity lasts approximately 4 weeks (24 working days), the daily water consumption will be approximately **71,000 liters/day**, **over 24 days**.

Conclusion

The daily water requirement will be approximately **3,000 liters/day** over 12 months for sanitary use (i.e. **90,000 l/month** and **1,095 m^3/year**).
The water consumption will increase up to **74,000 liters/day** during the cleaning of the solar modules (71,000 liters/day for cleaning activity and 3,000 for sanitary use), which will last less than a month and will occur once per year during the dry period. Indeed PV modules are conceived as self-cleaning with the rain.
It is further proposed that **90,000 l** of water will be stored in **storage tanks** for fire, emergency and washing of panels twice a year.

The overall and average water consumption during operation is detailed in the table below.

Table 4 Water consumption during the operational phase

WATER REQUIREMENT DURING THE OPERATIONAL PHASE		
DESCRIPTION	**UNIT**	**TOTAL**
Average daily water consumption for sanitary use	*l/day*	3,000
Average daily water consumption during cleaning activity (*)	*l/day*	74,000
Average monthly water consumption for sanitary use (over 30 days)	*l/month*	90,000
Annual water consumption for sanitary use	***m^3/year***	**1,095**
Annual water consumption for PV modules cleaning activities (once/year)	***m^3/year***	**1,700**
ANNUAL WATER CONSUMPTION DURING OPERATION	***m^3/year***	**2,795**
ANNUAL WATER CONSUMPTION DURING OPERATION (average over 365 day)	***m^3/day***	**7.66**

(*) over 24 working days, once per year

4.2.5.3. Water provision during construction and operation

The site is located within the **C52L Quaternary**, and is situated in the **Lower Vaal Water Management Area.** No abstraction under General Authorization is allowed for in this quaternary.

The estimated annual groundwater recharge (9.45 mm/m2 per annum) from an average annual precipitation of 377 mm falling on 220 ha (lease portion) will result in **20,790 m^3 of water available**. The maximum annual water requirement for the project is 2,795 m^3 per year. **The scale of abstraction relative to recharge is 13.4% (Category A).**

As indicated in the Geo-technical and Geo-hydrological Report (Annexure J), on the Alternative Location 1 there are no boreholes present. The closest groundwater source is a borehole with wind pump north of the area, indicated as "**Windpump 2**" in the Geo-technical and Geo-hydrological Report and located at 29° 01' 46.64" S ; 24° 55' 07.17" E. It has a yield of 8,000 – 10,000 l/hour and is 50 m deep.

Water for irrigation of two centre pivots across to the river is extracted from the Modder River at the **pump station** located at 29° 01' 31.03" S ; 24° 54' 08.13" E. This pump station has a capacity to extract 40 000 l/hour from the river. The abstraction is licenced.

The Geo-technical and Geo-hydrological Report confirms that the borehole yield of the borehole close to Alternative Location 1 is adequate to support the water needs of the project during both the construction phase (**11,500 m^3 over max. 15 months**) and the operational phase (**2,795 m^3/year**). The Modder River is an alternative surface water source to supplement the borehole during high demand periods if required.

The water quality analysis of the samples collected at the property indicates that there are a number of parameters outside drinking water quality standards (coliform contamination).
Therefore, it is recommended that the drinking water supply for the staff on site be treated through an osmotic water filtration system.

The water used for the cleaning of the PV modules should be treated to reduce the build-up of the inorganic salts on the PV panels, reducing its effectiveness in converting sunlight into electrical energy.

A Water Use Licence application is under drafting and will be submitted to the Department of Water Affairs by Pulida Energy.

4.2.6. Sewerage

Considering that the proposed development will not include formal residential properties there is no need to connect the municipal sewer reticulation system. Sewer reticulation will be handled by the patented and commercially available Lilliput (or similar) sewer treatment system. The sewer system will therefore consist of an installation to serve the office in the control building.

It is foreseen that the system will be installed in line with the requirements of the manufacturer. Most typical systems consist in essence of a conservancy tank (built underground on site), and a patented digester. Most systems require electricity to power the pumps and fans used in aeration process, although some systems use wind power (whirlybird). The only other item worth noting is the fact that some systems could require chlorine tablets available commercially, but systems where effluent is treated with ozone (like the Lilliput system) is getting more common and affordable.

The effluent from these systems will be suitable for irrigation of the tree buffer zone, or re-use in the offices as water for the flushing of toilets, or for fire fighting purposes. This will reduce the overall water requirement of the development substantially.

In this respect, a Water Use License application is under drafting and will be submitted to the Department of Water Affairs by Pulida Energy.

4.2.7. Refuse removal

Pulida Energy will enter into an agreement with the Letsemeng Local Municipality for the PV plant's refuse at the nearby municipal refuse site. No refuse will be buried or incinerated on site.

4.3. CONSTRUCTION SITE

In the case of the Alternative Location 1, the construction site (approximately 10 hectares) will be located close to the access point, on the south-eastern corner of the planned footprint, between the existing Eskom's power line and the planned fence - covering the area where the last 4 MWp are planned. Consequently, the construction site area will be gradually reduced at the completion of the last four PV fields (4 MWp), and at the end of the works all the construction area will be converted into the last PV arrays.

The optimal location of the construction site is an important element of the planning phase also in order to minimize impacts on the surrounding environment.
The site's location has been dictated by the nature of the works to be undertaken, specialist studies, site restrictions, town planning intended uses and access.

The area identified for the construction site had to meet the following requirements:

- sufficient size;
- proximity to existing roads;
- availability of water and energy;
- low environmental and landscape value;
- sufficient distance from residential areas; and
- proximity to the worksite.

In addition, to ensure environmental compatibility, the following factors have been considered:

- restrictions on land use (landscape, archaeological, natural, hydrological, etc.);
- terrain morphology;
- presence of high environmental value areas (e.g. wetlands); and
- sand & stone supply.

The establishment of the construction site will be divided into four distinct phases. The steps individuated hereinafter do not follow a time sequence, but it should be considered as overlapping and simultaneous events.

4.3.1. Phase I

The area will be fenced to prevent intrusion of animals and to protect against materials theft within the site. A video surveillance system will be provided.

4.3.2. Phase II

During the fencing operation as described in Phase I, the most valuable trees, if any, will be removed and placed temporarily in a safe location for future planting at the end of work. This procedure is required for environmental mitigation. The other low value tree species will be cut down and transferred to facilities for wood processing.

4.3.3. Phase III

At completion of the works defined in Phases I and II, the following step will be the site clearing and the construction of internal roads. The internal road network should ensure a two-way traffic of heavy goods vehicles in order to minimize trips. The road system is planned for a width of 8 meters. Roads will be of dry and compacted materials.

The facility will require constant access control, a weigh-house for heavy trucks, removable structures for the storage of yard tools and temporary storage areas.
During Phase III, the installation of MV/LV transformers connected to the Eskom grid is also planned, as well as the laying of underground electrical cables.

4.3.4. Phase IV

Temporary storage areas of materials and workshops will be constructed and used for:
- temporary storage of photovoltaic modules (covered with compacted dry material in order to avoid direct contact with the ground);
- temporary storage for frames and piles of the mounting systems of the PV arrays;
- storage and processing of building material for construction (sand, gravel, concrete batching and mixing plant, steel, etc.);
- drinking water storage for human consumption;
- worker care facilities and site management buildings,
- prefabricated housing modules for workers who may require accommodation inside the site (only key personnel should be allowed to stay overnight);
- technical cabins and management offices;
- medical care unit in a prefabricated module, in order to allow immediate first aid and minor surgical emergency;
- recreation area and canteen (prefabricated modules);
- parking lots for employees (located close to the staff housing), for visiting staff (located close to the offices area), and for trucks and work vehicles during inactivity;
- workshop and storage facilities on the site for contractors;
- electrical network for living units, offices and service structures;
- water supply for living units through polyethylene pipes connected to storage;
- Ballam Waterslot or similar sewer treatment system. The treated water will be used to moisten dusty areas and reduce dust gathering due to windy actions; and
- solid waste collection point.

All facilities present in the construction site will be covered with dry material in order to avoid mud formation in case of rain.

4.3.5. Earthworks

Earthworks will be required during the construction of internal roads. The vertical alignment of the roads will not present any significant challenges due to the flatness of the terrain so that no deep cuts or fills will be required.

Considering a road pavement thickness of 300 mm and an overall road surface of approximately 137,000 m^2, the amount of cut or fill is estimated to be approximately 41,100 m^3.

Further items of earthworks would be required where temporary storage areas will be prepared for the storage of the photovoltaic modules and other equipment during construction of the solar park.

Small earthworks will be required for the installation of the PV modules and of the medium-voltage stations. None of these activities should require earthworks in excess of 500 mm cut or fill.

Only the foundation plate for the small high-voltage substation may require earthworks in excess of 500 mm cut or fill (the footprint will be up to 4000 m^2).
The topsoil stripping will result in temporary spoil heaps which must be spread over the site upon completion of the project.

Concrete necessary for the basements of the medium-voltage stations, the high-voltage substation, the control building and the warehouse and will be manufactured using aggregate and sand from commercial sources in the vicinity of the development (in Kimberley), or from a borrow pit to be exploited on the site.

As indicated in the Geo-technical Desktop Study (Annexure E), the calcareous soils present on the site may be useful as road construction material. Therefore, gravel necessary for the construction of internal roads may be provided from a borrow pit on site.
The material from this borrow pit will only be utilised for work on this particular site only. The position of this borrow pit is not yet finalized. The required area will be approximately 2 hectares. Alternatively, gravel can be provided from the commercial sources in the vicinity of the development (in Kimberley).

4.4. TRAFFIC IMPACT OF THE PROPOSED DEVELOPMENT

4.4.1. Traffic impact – construction phase

During the construction phase of maximum 15 months, there will be at least 70 workers on site.
An accommodation area with prefabricated buildings inside the work site may be foreseen, if accommodation facilities in Kimberley town are not sufficient to accommodate all workers.

Overall traffic to and from the work site will amount to approximately 1000 heavy vehicle trips over the whole 15 months.
The provision of a fuelling area on the work site could reduce the load of heavy vehicles on public roads. The installation of two steel fuel tanks (capacity of 30,000 litres each) is envisaged.

4.4.2. Traffic impact – operation phase

The traffic impact during the operation phase will be insignificant, considering that about 35 people will work on the PV facility, in the following manner:

- during the daytime approximately 14 people;
- during the night-time, 6 people.

4.5. MANAGEMENT OF THE SOLAR PARK DURING OPERATION

Approximately 35/40 people will be employed during the operation phase of the PV power plant, which will have a lifetime of 25 - 30 years.
The Pulida Solar Park will be in operation 7 days per week; therefore personnel will operate according to shifts. The surveillance team will be ensured during day-time, night-time and weekends.

The operational team will consist of the following people:

- 1 person as plant manager
- 1 person for administration
- 4 people as technicians / plant operators
- 8/11 people for electric and generic maintenance
- 21/24 people as guards

The "**fire team**" will be composed of people for generic maintenance, who will attend a comprehensive fire fighting training program. After this training programme, the fire team will be able to drive/use/manage properly the fire extinguishers and the fire fighting vehicle, that will be available on the site.

5. PROJECT ALTERNATIVES

The EIA Regulations, Section 28(1)(c) and NEMA, Section 24(4), require investigation and consideration of feasible and reasonable alternatives for any proposed development as part of the environmental impact assessment process. Therefore, a number of possible alternatives for accomplishing the same objectives must be identified and investigated.

In particular:

- the property on which, or location where, it is proposed to undertake the activity;
- the location within the current identified site;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity;
- the operational aspects of the activity (schedule, process);
- the sustainability of other alternatives, and
- the option of not implementing the activity (No Go Alternative).

5.1. SITE ALTERNATIVES

Several sites have been inspected in order to find out the best solution for the PV power plant. The following selection criteria were applied:

- Connection availability and proximity
- Land availability
- Proper land surface area (at least 200 hectares)
- Current land use
- Low environmental impact (low biodiversity)
- Low agricultural potential
- High solar radiance
- Socio-economic issues (land cost and local community unemployment)

The macro area between Kimberley and Koffiefontein towns was investigated, due to the high value of solar irradiation and to the presence of an Eskom's HV power line (i.e. the Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line).

Several sites - along the Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line - were selected during the feasibility assessment, due to the flatness of the areas, such as:

a) Remainder Portion of the Farm Klipdrift 20 (*preferred*)
b) Portion 1 of the Farm Klipdrift 20
c) Remainder Portion of the Farm De Kalk 71
d) Farm portions north from the Remainder Portion of the Farm Klipdrift 20
e) Farms south from the Remainder Portion of the Farm De Kalk 71

a) **Remainder Portion of the Farm Klipdrift 20** resulted available; two possible project locations within this farm were investigated, being flat and with a low / medium ecological sensitivity and low agricultural potential.

b) **Portion 1 of the Farm Klipdrift 20** resulted available but not suitable for a solar park, due to the presence of several drainages / salt pans affecting this farm portion.

c) **Remainder Portion of the Farm De Kalk 71** resulted not suitable for a solar park, due to the presence of several drainages / salt pans affecting this farm portion.

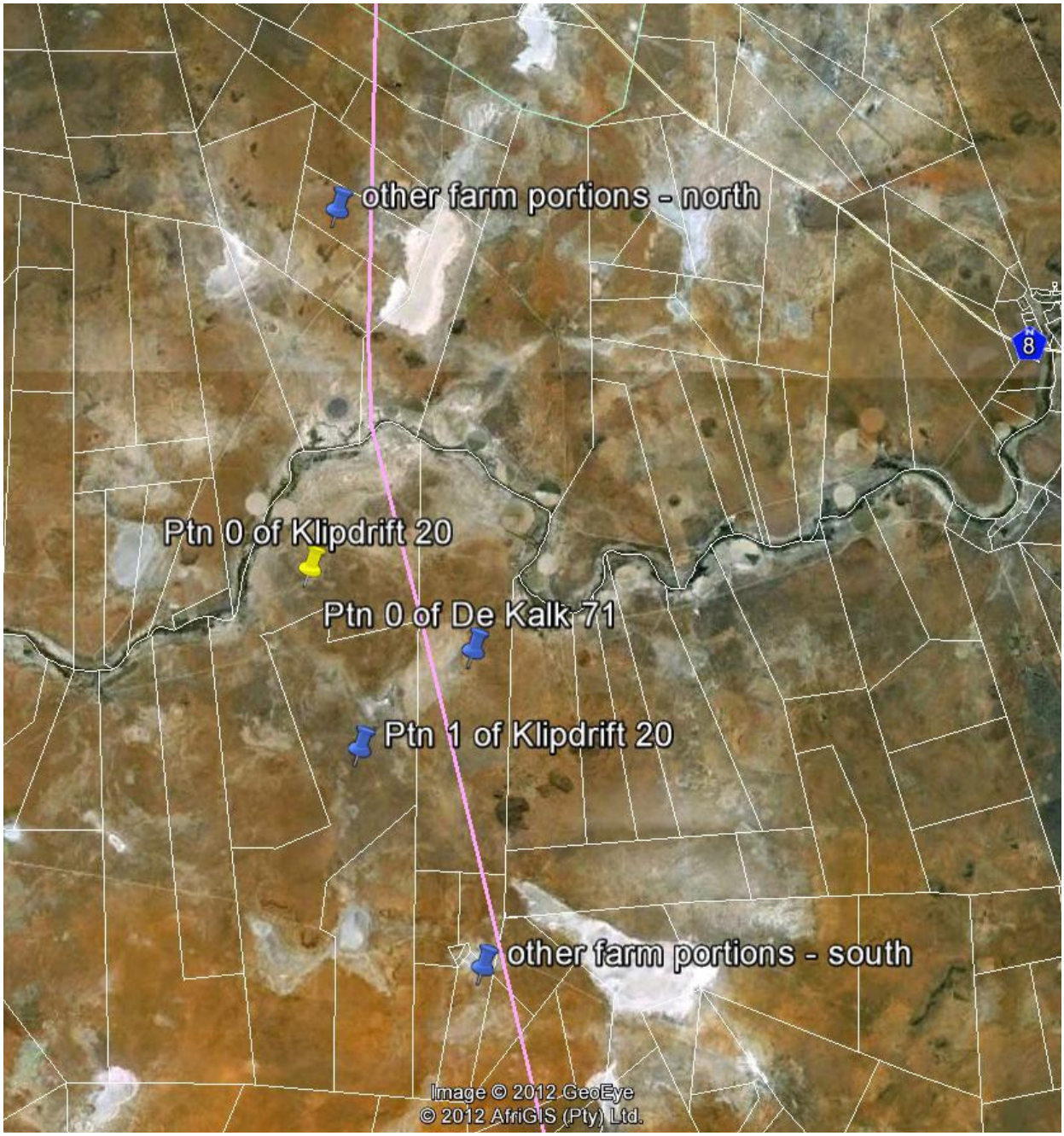
d) All the farm portions north from the Remainder Portion of the Farm Klipdrift 20 are also not suitable for a solar park, due to the presence of several drainages / salt pans affecting these farm portions, and/or due to the small size of these farms.

e) In the same way, the farms south from the Remainder Portion of the Farm De Kalk 71 resulted not suitable, due to the small size and/or due to the presence of several drainages / salt pans affecting these farm portions.

Therefore, the **Remainder Portion of the Farm Klipdrift 20** is the *preferred site* being the only suitable alternative.

The location of the alternative sites is indicated in the Figure 9 below.

Figure 9 Location of the alternative sites



5.2. TECHNOLOGY ALTERNATIVES

5.2.1. PV Plant and Solar Thermal Power Plant

The alternative to PV for producing energy from the sun is the thermal solution.
There are different forms of this technology: linear fresnel, parabolic through or tower. These technologies can also be with or without thermal storage and they can use diathermic oils or, the more sophisticated ones can use water and/or molten salts.

The final choice is the PV option because these kinds of project result in:

- lower construction costs;
- lower operating and maintenance costs (O&M);
- it is a simpler, quicker and more experienced technology; and
- lower environmental impact, considering that, among other factors, the PV solution requires a minor quantity of water.

5.2.2. Solar Photovoltaic Technology – PV

The project envisages a photovoltaic power plant with a generating capacity up to 75 MW, on a footprint up to 200 hectares.

The preferred types of PV modules are:

- **monocrystalline or polycrystalline PV modules** and,
- **thin-film PV modules**,

which currently represent the best performing options in terms of reliability and costs/efficiency.

At present, mono/polycrystalline modules provide a higher solar conversion efficiency (14%), if compared to the thin-film PV modules (9%).
On the other hand, thin-film modules (or amorphous silicon / Cd-Te as well) are cheaper and best performing at high temperatures, having an efficiency degradation of only 0.25 %/°C instead of 0.45 %/°C in the case of mono/polycrystalline modules.

However, it is important to consider the fact that the PV technology is in continuous evolution and it may be possible that thin-film (or amorphous silicon / Cd-Te as well) PV modules achieve a higher solar conversion efficiency in a very short time. Furthermore, it should be kept into account the high volatility of prices of PV modules which depends on the worldwide availability of modules. Therefore the final choice will be taken at the commissioning date, on the basis of the prices and availability of mono/polycrystalline and thin-film / amorphous silicon / Cd-Te PV modules.

The development will not exceed the current planned footprint (approximately 200 hectares). Therefore, the final choice of the type of PV modules, whatever it is, will not imply any additional visual or environmental impacts nor the necessity of specific or different mitigation measures.

5.2.3. Alternatives for the Mounting System of the PV Modules

The preferred technical solutions for the proposed solar park entails PV modules mounted on **fixed mounting systems** or on **horizontal single-axis trackers**.

The tracking solution is the best performing in terms of efficiency, because its energy production is approximately 15% more if compared with fixed systems.
In spite of this, this type of technology is characterized by higher technical complexity and deeper installing and maintenance costs, if compared with the fixed mounting solution.
As previously mentioned, the selected tracking system is the horizontal single-axis tracker (SAT), which doesn't differ from the fixed system, except for the presence of the tracking devices and of the orientation of the rows of the PV arrays (north - south instead of west – east direction).

The technology of mounting systems is under continuous evolution. Consequently, the final decision about the mounting system technology will be taken only at the commissioning date: if addressed toward the fixed mounting system or toward horizontal single-axis trackers, the layout of the PV power plant will not imply any additional visual or environmental impacts nor the necessity of specific or different mitigation measures.

In any case, the development will not exceed the currently planned footprint (200 hectares) and the height of the structures (PV modules and support frames) will be maximum 3.1 m above the ground level.

Both fixed and horizontal single-axis tracking solutions grant the reversibility of the development in respect of the terrain's morphology, geology and hydrogeology. This means that at the end of the PV plant's lifetime, the site can easily be returned to its status prior to the establishment of the PV plant.

5.3. LAYOUT DESIGN AND LOCATION ALTERNATIVES

The site chosen for the establishing of the proposed Pulida Solar Park is the Remainder Portion of the Farm Klipdrift 20. The PV power plant will have a generating capacity **up to 75 MW**, on a footprint up to 200 hectares.

As previously indicated in Figure 2 and in the attached drawing of the Annexure A:

- PDSP_00_DE_Rev.01/EIA *Locality Map and alternative locations*

two possible suitable areas have been identified for the proposed solar park during the Scoping Phase:

- **Alternative Location 1 (preferred)**: close to the eastern boundary of the farm, north from the access road, east from the Eskom's 132 kV power line called "Kimberley DS - Skietpan Switching Station". In this case, the lease portion will be of 220 hectares, while the footprint of the solar park will be up to 200 hectares.

- **Alternative Location 2**: on the southern side of the farm. In this case, the lease portion will be of 220 hectares, while the footprint of the solar park will be up to 200 hectares.
  In this case, in order to connect the solar park to the Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line, it is further required:
  a) A small on site high-voltage loop-in loop-out substation, to be located close to the eastern boundary of the farm, 100 m far from the Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line. The footprint of the substation will be of approximately 4,000 m^2.
  b) Medium-voltage power lines, from the Alterative Location 2 up to the on-site high-voltage loop-in loop-out substation. The MV power lines will cross the Portion 1 of the Farm Klipdrift 20 (owned by the same landowner) for approximately 4.7 km. The required corridor will be maximum 44 m wide.

As indicated by the Specialist Studies conducted during the Scoping Phase and attached to this EIA Report, **the Alternative Location 1 is the preferred one and the only suitable alternative**, for the following reasons:

a) The Ecological Impact Assessment (Annexure E) assessed that the Alternative Location 2 is undevelopable from the ecological point of view, due to the following considerations:

(i) the Alternative Location 2 is located further away from the secondary road and the additional impacts that would be created during construction (e.g. dust, clearing of vegetation to gain access to site) would have a detrimental effect on the environment compared to Alternative Location 1 that is located directly adjacent to the secondary road.

(ii) The choice of the Alternative Location 2 would entail the clearing of additional vegetation to construct medium-voltage power lines from Alternative Location 2 to the high-voltage loop-in loop-out substation, to be established on the North-East, close to the existing Eskom's 132 kV power line. The medium-voltage power lines would also traverse a sensitive wetland area with pans and calcareous soils with a high erosion potential. The impacts associated with the development of medium-voltage power lines from Alternative Location 2 to the high-voltage loop-in loop-out substation is therefore considered significant and - if compared to the minimal impacts that will be associated with the development of Alternative Location 1 (directly adjacent to the connecting power line) - this option is not considered viable from an ecological point of view.

b) From a geotechnical perspective, both the Alternative Locations 1 and 2 are suitable for the proposed development, with the Alternative Location 1 having the advantage of not having outcrop of very strong rock. The Geo-technical and Geo-hydrological Report (Annexure J) assessed that the Alternative Location 1 is *developable with no geotechnical risk*, while the Alternative Location 2 is *developable with precautions with respect to excavatability*.

c) As full detailed in the Geo-technical and Geo-hydrological Report (Annexure J), in the In terms of groundwater availability the Alternative Location 1 is better suited.

d) The Visual Impact Assessment (Annexure K) assessed that, when taking the precautionary vegetation screen into consideration, this precautionary measurement would - in the case of the Alternative Location 1 - wholly contain the visibility of the proposed project components. For this reason, the Alternative Location 1 is the preferred one also from the visual impact point of view.

e) Furthermore, from a technical point of view, the Alternative 2 is more expensive and less reliable than the Alternative 1, because it would require medium-voltage power lines - 4.7 km long - linking the Pulida Solar Park (on the Alternative Location 2) to the HV loop-in loop-out substation, to be necessarily located close to the Eskom power line running within the Alternative Location 1.

The proposed layouts were drawn using thin-film modules mounted on fixed mounting systems; in the case of polycrystalline modules mounted on trackers, the layout plans do not change, except for the orientation of the PV arrays: north-south instead of east-west.

The required **footprint** - corresponding on the fenced area - will be the same: **up to 200 hectares** within a developed area (lease portion) of 220 hectares, and the maximum height of the structures (PV modules and support frames) will be approximately 3.1 m above the ground level. Therefore the impacts and mitigation measures will remain exactly the same.

As already mentioned in the paragraph 4.1 - *Project layout*, the main drives of the proposed layouts are:

- to maximize the energy production and the reliability of the PV plant, by choosing proven solar technologies: horizontal 1-axis trackers with polycrystalline solar modules, or thin-film solar modules mounted on fixed mounting systems;
- to develop the PV power plant on flat and low/moderate ecological sensitivity areas;
- to avoid the heritage sites (*low density surface scatter of lithic artefacts*) affecting the property;
- furthermore, a tree buffer zone has been foreseen around the footprint, in order to minimise the visual impact of the proposed development.

The related layout plans are depicted in Figures 3 and 4 and the attached drawings of the Annexure A:

- PDSP_01_DE_Rev.01/EIA Layout of the PV power plant - Alternative location 1 (preferred)
- PDSP_02_DE_Rev.00/EIA Layout of the PV power plant - Alternative location 2

5.4. NO-GO ALTERNATIVE

The no-go alternative is the option of not establishing a Photovoltaic Power Plant on the site, or any of its alternatives. The environment will remain in its current state (*status quo*). This will not create any new employment opportunities, and therefore the anticipated economic benefits of the project will accrue to the study area (see the paragraph 6.4 *Socio-Economic Environment*).

Should this alternative be selected the socio-economic and environmental benefits related to the use of renewable energy resources will not be realised with prejudice to the development of the area. The benefits related to the establishment of a renewable energy power plant are for example analysed in detail in the REFIT Regulatory Guideline published by NERSA (March 2009:

- ***Enhanced and increased energy security***: renewable energy plays an important role in terms of power supply, improving grid strength and supply quality and contemporarily reducing transmission and distribution costs and losses.
- ***Resource economy and saving***: the energy production by coal fired plants consumes a significant amount of water, this amount of water could instead be saved if a renewable energy facility like the proposed one is put in operation.(the Energy White Paper envisages that the implementation of its targets will determine water savings of approximately 16.5 million kilolitres). This will be beneficial on the large scale for the water conservation measures that the country is currently undertaking.
- ***Support of new technologies and new industrial sectors***: the development and establishment of renewable energy power plants contribute to the growth of new technologies and new industrial sectors with benefits for its economy.
- ***Exploitation and capitalization of South Africa's renewable resources***: with the aim of increasing energy security.
- ***Employment creation and career opportunities***: the construction and operation of a renewable energy power plant contributes to job creation and new career opportunities.
- ***Pollution reduction***: the use of renewable energy resources decreases the demand and the dependence from coal and oil for electricity generation.
- ***Contrast to Global warming and climate mitigation***: the development of renewable energy contributes to reduce global warming through the reduction of greenhouse gas (GHG) emissions.
- ***Protection of natural foundations of life for future generations***: the development and establishment of renewable energy power plants offers the opportunity of consistently reducing the risks related to climate change caused by CO2 and CO emissions, therefore preserving life for future generations.
- ***Acceptability to society and community***: the use of renewable energy is largely accepted by society and community as a mean to reduce pollution concerns, improve human health and wellness, protect the environment, the ecosystem and climate;
- ***Commitment to and respect of international agreements***: in particular in light of the possible commitment to the Kyoto Protocol.

6. STATUS QUO OF THE RECEIVING ENVIRONMENT

The receiving environment has been described using a combination of specialist inputs, on-site observations, a review of existing literature and utilizing Geographic Information Systems (GIS) planning tools.

6.1. PROPERTY DESCRIPTION AND CURRENT LAND USE

The proposed development will stretch over a part of the Remainder Portion of the Farm Klipdrift 20**.**

Remainder Portion of the Farm Klipdrift 20 (Jacobsdal Registration Division)

Surveyor-general 21 digit site	F01800000000002000000
Local Municipality	Letsemeng
District Municipality	Xhariep
Province	Free State
Extent	2256.1868 hectares
Land Owner	WEGVAN KLIPDRIFT BOERDERY CC
Diagram deed number	G00/1879
Title deed number	T1126/1968
Registration date	19680314
Current land use	Farming activities
Geo-graphical Co-ordinates:	
Alternative Location 1 (preferred)	29° 02' 40" S; 24° 55' 30" E
Alternative Location 2	29° 05' 13" S; 24° 54' 23" E

The site is located 40 km South-East from the town of Kimberley.

The current land-use of the proposed development site is grazing by livestock. Neighbouring farms are being used for livestock grazing, with some isolated crop cultivation occurring in the deeper soils.

6.2. ENVIRONMENTAL FEATURES

6.2.1. Climate

Kimberley normally receives about 380 mm of rain per year, with most rainfall occurring mainly during summer. It receives the lowest rainfall (0 mm) in July and the highest (59 mm) in March. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures for Kimberley range from 18°C in June to 32°C in January. The region is the coldest during July when the mercury drops to 0.3°C on average during the night.
The Weinert climatic N-number for the area is 11. This indicates that the climate is semi-arid and that physical mineral grain disintegration is predominant.

6.2.2. Topography

Alternative Location 1: the elevation at the middle of this area is 1147 m amsl, with the total elevation difference between the lowest and highest point only 5 m.

Alternative Location 2: this area site is gently sloping northwards, with a slope difference of 12 m from the southernmost point to the northern edge over a distance of 1.5 km.

The two potential development areas are both underlain by a valley floor land facet.

Drainage occurs as sheet-wash towards the **Modder River** that forms the northern boundary of the farm.

6.2.3. Soils and geology

A Geo-technical and Geo-hydrological Report is attached as Annexure J. The site visit was conducted on 8 November 2012, when ten trial pits were excavated across the property.

The site is underlain by quaternary calcrete overlying Karoo shale of the Prins Albert Formation and in the south a dolerite sill represents the local topographical high.
The Prince Albert Formation consists of mainly black mica rich shale and subordinate sandstone and mudstone.
In invading the Karoo strata, the dolerite sills have almost without exception selected the weaker, predominantly argillaceous horizons along which to intrude and generally represent positive erosion features.
The surface calcrete (Qc) occur as discontinuous layers and concretions and are associated with mudstone, shale tillite, dolerite and dolomite. The calcrete are generally associated with low relief and depressions in the landscape.

Three types of calcrete are represented in the area:

- Hardpan calcrete
- Nodular Calcrete and
- Cliff Calcrete

According to the classification presented by Weinert (1980) where the N value is above 10, disintegration is the major contributor to weathering. Disintegration is the process whereby the rock breaks down to progressively smaller sizes until eventually the individual minerals becomes separated. The end-product is usually a gravely sand composed of the unaltered primary minerals.

The calcareous pedogenic soil that develop under fluctuating water levels in the soil present on the Ecca shales is variable and can range from a calcareous soil to hardpan calcrete.
The Ecca shales have an important characteristic that affects it engineering properties. The shales tend to disintegrate and or slake when exposed to the atmosphere.

The two option areas indicated were investigated and four distinct different soil profiles were identified.
The Alternative Location 1 is underlain by a single consistent soil profile (calcrete).
On the Alternative Location 2 three different soil profiles were identified: dolerite, cutanic soil profile and siltstone bedrock.

The calcrete soil present on the Alternative Location 1 is suitable for use as road construction material. The soil is also non expansive and settlement potential is low.

Using the COLTO Standard **excavatability** is classified as hard (boulders larger than 0.1 m3, blasting or pneumatic and Mechanical rock breaking tools required) or soft (all other conditions).

For the Alternative Location 1, underlain by the calcrete soil profile, the expected excavatability up to 0.5 m is soft across the site. Below that level, calcrete will be variable to a depth of 2 m and the siltstone and dolerite is expected to be intermediate to hard below that level.

For all three profiles encountered in the Alternative Location 2, excavatability is soft up to 0.5 m. Below that level, it is regarded as hard. In the areas where scattered outcrop of strong dolerite occur at surface, excavatability will be hard from surface to depth.

The potential for collapse of side walls of deep excavations is low.

The four soil profiles encountered can be reduced to **three land use areas** based on the intended land use and the geotechnical characteristics of the foundation material.

Alterative Location 2:

- The dolerite and siltstone profiles are combined and identified **Land Use Area A**. The soil profile consist of transported soil underlain by either calcretized siltstone or dolerite grading into competent bedrock material. In both areas excavatability will be difficult in places but the overburden and rock is stable. Therefore the Land Use is classified as **developable with precautions with respect to excavatability**.
  The recommended foundation solution for the solar panel frames is bored cast in situ mini-piles.
- The cutanic profile has a moderately active transported soil horizon and therefore **Land Use Area B** is classed as **developable with a low risk of foundation heave** due to active transported soil. Percussion drilled cast in situ piled foundations is recommended.

Alterative Location 1:

- This area is underlain by calcrete that is up to 2 m thick in places underlain be competent bedrock. The calcrete varies in strength over short distances but in general a hardened cap overlies powdery to nodular calcrete. This **Land Use Area C** is classified as **developable with no geotechnical risk**.
  The calcrete is stable and both piled and strip foot foundation options will be suitable as founding for the solar panel support.
  Normal strip foundations would be suitable for the other structures on site.

No shallow groundwater conditions were encountered in any of the trial pits on site.

No mining activities past or present are present on the property or will impact the property.

The Report indicated that the Modder River, running along the northern boundary of the farm, cannot affect any of the Alternative Options 1 and 2, due to the distance (more than 3 km) and elevation (more than 10 m) of the two areas in respect of the river. Therefore, a flood line delineation study is not required.

The Geo-technical and Geo-hydrological Report concluded that - from a geotechnical perspective - both the Alternative Locations 1 and 2 are suitable for the proposed development, with the Alternative Location 1 having the advantage of not having outcrop of very strong rock.

6.2.4. Geo-hydrology

As indicated in the Geo-technical and Geo-hydrological Report (Annexure J):

The site is located within the **C52L Quaternary**, and is situated in the **Lower Vaal Water Management Area.** No abstraction under General Authorization is allowed for in this quaternary.

The Recorded Mean annual precipitation is 377 mm per annum, with an annual run-off of 3 mm. The groundwater recharge is 9.45 mm per year and the groundwater level of the area is 30 m below surface. The Eco status is category is F. The total groundwater use in the quaternary is 4.36 Mm3 per year.

The estimated annual groundwater recharge (9.45 mm/m2 per annum) from an average annual precipitation of 377 mm falling on 220 ha (lease portion) will result in **20,790 m^3 of water available**. The maximum annual water requirement for the project is 2,795 m^3 per year. **The scale of abstraction relative to recharge is 13.4% (Category A).**

6.2.4.1. Boreholes, groundwater availability and quality on the project site

Due to the featureless topography and poor rock exposure, it is difficult to identify aquifer boundaries.
From the geological map and aerial photos, a possible linear feature correlated to the amphibolite soil profile can be identified on the northern and western boundaries.
The Modder River is the northern boundary of the farm and also to act as a constant head boundary for the aquifer. The only other identifiable aquiver boundary is the Klip River, 12 km west of the property.

The argillaceous deposits are poor aquifers and water strikes are associated with the interbedded sandstones and dolerite intrusions. Boreholes are generally deep (150 - 200 m) and yields seldom exceed 2 l/s with the majority of the boreholes delivering between 0.5 l/s and 1.5 l/s.

On the Alternative Location 1 there are no boreholes present. The closest groundwater source is a borehole with wind pump north of the area, indicated as "**Windpump 2**" in the Geo-technical and Geo-hydrological Report and located at 29° 01' 46.64" S ; 24° 55' 07.17" E. It has a yield of 8,000 – 10,000 l/hour and is 50 m deep.

Water for irrigation of two centre pivots across to the river is extracted from the Modder River at the **pump station** located at 29° 01' 31.03" S ; 24° 54' 08.13" E. This pump station has a capacity to extract 40 000 l/hour from the river. The abstraction is licenced.

A **borehole equipped with an electric mono pump** (indicated as "**Windpump 1**" in the Geo-technical and Geo-hydrological Report) is situated close to the homestead (at 29° 03'8. 53" S ; 24° 54' 05.22" E), but it is situated on a different farm portion (Portion 1 of Klipdrift 20), owned by the same landowner. It has a yield of 4000 l/hour and is 42 m deep.

The boreholes equipped with wind pumps are used primarily to provide water for livestock.

A further borehole, located on the north eastern corner of the Alternative Option 2 (at 29° 04' 40.41" S ; 24° 54' 41.36" E), is 42 m deep and has a yield of 2000 l/hour when the wind blows.

The Geo-technical and Geo-hydrological Report concluded that:

- **The indicated borehole yield of the borehole close to Alternative Location 1 is adequate to support the project through the construction and operational phases. The Modder River is an alternative surface water source to supplement the borehole during high demand periods if required.**
- The borehole at the Alternative Location 2 is not strong enough to support the project: alternative water sources should be considered to supplement it during construction and cleaning periods.

Total dissolved solids (TDS) of the water in the area range between 450 and 800 mg/l. The water is noticeably salty, but is well tolerated. No effects on plumbing or appliances and no adverse health effects occur on long term consumption.

The water quality analysis of the samples collected at the property indicates that there are a number of parameters outside drinking water quality standards:

- coliform contamination in the case of groundwater;
- coliform contamination and elevated magnesium concentrations in the case of water from the Modder River.

Therefore, it is recommended that the drinking water supply for the staff on site be treated through an osmotic water filtration system.

The water used for the cleaning of the PV modules should be treated to reduce the build-up of the inorganic salts on the PV panels, reducing its effectiveness in converting sunlight into electrical energy.

6.2.5. Ecology (fauna and flora)

An Ecological Impact Assessment (Annexure E) was conducted by AGES in order to describe the ecology (fauna and flora) present in the site, to assess its ecological sensitivity and to indicate the most suitable areas for the proposed development.

For this purpose, detailed ecological (fauna habitat & flora) surveys were conducted during November 2012 to verify the ecological sensitivity and ecological components of the site at ground level.

The Ecological Specialist evaluated the Alternative Location 2 as undevelopable from the ecological point of view, due to the following considerations:

- The Alternative Location 2 is located further away from the secondary road and the additional impacts that would be created during construction (e.g. dust, clearing of vegetation to gain access to site) would have a detrimental effect on the environment compared to Alternative Location 1 that is located directly adjacent to the secondary road.
- The choice of the Alternative Location 2 would entail the clearing of additional vegetation to construct medium-voltage power lines from Alternative Location 2 to the high-voltage loop-in loop-out substation, to be established on the North-East, close to the existing Eskom's 132 kV power line. The medium-voltage power lines would also traverse a sensitive wetland area with pans and calcareous soils with a high erosion potential. The impacts associated with the development of medium-voltage power lines from Alternative Location 2 to the high-voltage loop-in loop-out substation is therefore considered significant and - if compared to the minimal impacts that will be associated with the development of Alternative Location 1 (directly adjacent to the connecting power line) - this option is not considered viable from an ecological point of view.

Therefore only the Alternative Location 1 is assessed in the Ecological Impact Assessment.

6.2.5.1. Vegetation types

The development site lies within the Nama Karoo biome which occurs on the central plateau and western half of South Africa, at altitudes between 500 and 2000 m, with most of the biome. The dominant vegetation is a grassy, dwarf shrubland. Grasses tend to be more common in depressions and on sandy soils, and less abundant on clayey soils.
The geology underlying the biome is varied, as the distribution of the biome is determined primarily by rainfall. This also determines the predominant soil type with over 80% of the area covered by lime-rich weakly developed soil over rock (Low & Rebelo, 1996). The most recent classification of the area by Mucina & Rutherford (2006) shows that the site is classified as Northern Upper Karoo.

The vegetation features of this vegetation type are shrubland dominated by dwarf Karoo shrubs, grasses and *Acacia mellifera* subsp. *detinens* and some other low trees. Landscape features include flat to gently sloping, with isolated hills of Vaalbos Rocky Shrubland and many interspersed pans. The conservation status of the Northern Upper Karoo is Least Threatened with none conserved in statutory reserves and 4% transformed for cultivation (Mucina & Rutherford, 2006).

The pans on the proposed development site represent the Highveld Salt Pans vegetation type on site. These pans represent depressions containing temporary water bodies. On the pan

edges open to sparse dwarf shrubland may develop, especially when under heavy grazing pressure (please refer to the Wetland Delineation Study - Annexure H).

The proposed development is planned on a landscape that varies from flat to slightly undulating plains. The farm is currently managed as a livestock farm.

The vegetation survey was conducted on site during November 2012. The vegetation was in a moderate to good condition and most species could be identified. No further surveys were necessary considering that the area received sufficient precipitation during the wet season to allow for the identification of most plants in the study area.

The analysis of the data resulted in the identification of 3 major vegetation units. One of these major vegetation units are divided into 2 variations according to species compositions, soil types and dominant plant species.
The vegetation communities identified on the proposed development site are classified as physiographic physiognomic units, where physiognomic refers to the outer appearance of the vegetation, and physiographic refers to the position of the plant communities in the landscape. The physiographic-physiognomic units will be referred to as vegetation units in the following sections. These vegetation units are divided in terms of the land-use, plant species composition, topographical and soil differences that had the most definitive influence on the vegetation units. Each unit is described in terms of its characteristics and detailed descriptions of vegetation units are included in the following section. A species list for the site is included in Appendix A of the Ecological Report (Annexure E).

The following vegetation units were identified during the survey:

- Mixed Karoo shrublands associated with calcareous soils
- Salt pan
- Mixed Grassy karoo associated with dolerite
    - Rocky grassland
    - Karoo grassland associated with red apedal soils

6.2.5.2. Fauna

A survey was conducted during November 2012 to identify specific fauna habitats, and to compare these habitats with habitat preferences of the different fauna groups (birds, mammals, reptiles, amphibians) occurring in the QDS.
The area represents Karoo, woodland and wetland vegetation components with a diverse vegetation structure and height class.
During the site visit, mammals, birds, reptiles, and amphibians were identified by visual sightings through random transect walks. In addition, mammals were also recognized as present by means of spoor, droppings, burrows or roosting sites. The 500 meters of adjoining properties were scanned for important fauna habitats.
Detailed fauna species list for the area is included in Appendix B (birds), C (mammals) and D (herpetofauna) of the Ecological Report.
The recommendations and mitigating measures highlighted in the Ecological Impact Assessment (Annexure E) should be implemented to ensure the survival of these species other fauna habitats and feeding grounds.

6.2.5.3. Summary and results of the Ecological Impact Assessment

Detailed ecological (fauna habitat & flora) surveys were conducted during November 2012 to verify the ecological sensitivity and ecological components of the site at ground level.

Considering the results from the field surveys, mitigation needs to be implemented to prevent any negative impacts on the ecosystem, since most of the site is in a natural state. A sensitivity analyses was conducted to identify the most suitable site for the development of the

Photovoltaic Power Plant. From these investigation and ecological surveys the following main observations was made:

- The Alternative Location 2 is undevelopable from the ecological point of view, for the reasons highlighted above.
- The most suitable area for the development of the project would be throughout most parts of the identified Alternative Location 1, even though the most parts of this area represent natural Nama Karoo types. The Karoo and Grassy Karoo variations of the site have a moderate sensitivity. Limited mitigation is needed for the preservation of some sections of this natural vegetation entity, while the eradication of invasive species such as Prosopis should be considered a high priority. The herbaceous layer should preferably be preserved below the solar panels and managed through slashing during the entire lifetime of the project.
- The salt pans represent sensitive wetland habitat type that will be seasonally wet and have a high sensitivity. No development can occur in these areas and a buffer zone of 30 meters should be implemented around these areas. The related Wetland Delineation Study is attached as Annexure H.
- No red data plant species were found on the site due to the state of the vegetation and physical environment of the larger area mostly not being suitable for any of the red data plant species that may be found in the area.

Some potential rare fauna may also occur in the area, and specific mitigation measures need to be implemented to ensure that the impact of the development on the species' habitat will be low. Specific mitigation relating to red data fauna includes the following:

- Disturbances in close vicinity of the development (periphery) should be limited to the smallest possible area in order to protect species habitat;
- Corridors between the development zones are also important to allow fauna to move freely between the areas of disturbance.

A number of ecological potential impacts were identified and assessed. A few of these were assessed as having potentially medium or high significance, including the following:

- Destruction or disturbance to ecosystems leading to reduction in the overall extent of a particular habitat.
- Impairment of the movement and/or migration of animal species resulting in genetic and/or ecological impacts (habitat fragmentation).
- Increased soil erosion.
- Destruction/permanent loss of individuals of rare, endangered, endemic and/or protected species.
- Establishment and spread of declared weeds and alien invader plants;
- Soil and water pollution due to spillages;
- Air pollution as a result of dust;
- Negative effect of human activities and road mortality.

Mitigation measures are provided that would reduce these impacts from a higher to a lower significance. Provided that al mitigation measures and recommendations in the Ecological Impact Assessment (Annexure E) are strictly adhered to, the proposed development won't significantly influence the potential rare habitats for flora and fauna on the site. A monitoring plan is recommended for the construction phase of the development should the proposed application be approved.

6.2.6. Avifauna

An Avifauna Impact Assessment (Annexure F) was conducted by AGES in order to determine whether the proposed development would have negative impact on avifauna.

A number of potential impacts were individuated and assessed:

- Direct habitat destruction
- Habitat fragmentation
- Electrocutions
- Collision
- Disturbance of human activities and noise.

A series of specific mitigation measures were individuated in respect of all the aforementioned potential impacts in the Avifauna Impact Assessment.
The Avifauna Impact Assessment concluded that the proposed development of the Photovoltaic Power Plant would not impact significantly over any avian habitats of high conservation value.
Considering the layout and design of the proposed development as well as the impact assessment, the extent of the habitat that will be affected will be minimal.
The Avifauna Report concluded that, provided that the suggested mitigation measures and recommendations are adhered to, it is unlikely that the proposed development will have a long-term, significant negative impact on the local avifauna.

6.2.7. Visual

A Visual Impact Assessment (Annexure K) was conducted to determine the visual impact of the proposed solar park.

The Visual Report assessed that viewer sensitivity towards the visibility of the proposed Pulida Solar Park project was *not high* as could be anticipated from residents of nearby farmsteads and *sensitivity* was rated as *low*.

The findings of the report were therefore based on the visual effect during the construction phase, which would be of temporary nature and the worst case scenario, should it happen that there is opposition to the implementation of the proposed project.

During the comparative analysis, it was determined that both Alternatives would have their associated pro's and con's but with a resultant 'equal' negative effect when assigning points per assessed category ('Visibility', 'Visual Intrusion', and Visual Exposure'). However when taking the precautionary vegetation screen into consideration, it was clear that this precautionary measurement would in the case of yhe Alternative Location 1 wholly contain the visibility of the proposed project components and was there for selected as the **preferred alternative** to be further assessed.

The proposed Pulida Solar Park project would result in visual impacts when placed in the attributes of the receiving environment, however Alternative 1 would be located adjacent to an existing power line which would reduce the intrusiveness of the project. Within the natural vegetation, which is predominantly grass species, there are however clusters of small trees / tall shrubs as well as clusters of exotic vegetation which would let a vegetation screen appear less out of context. The nature of the structures, low panels and thin higher pole structures, also reduce the notice-ability of the structures.
It was determined that the *significance* of the proposed Pulida Solar Park would be *moderate*.

6.3. SOCIO-ECONOMIC ENVIRONMENT

A report on the socio-economic considerations related to the proposed project was compiled by Glen Steyn & Associates - development economists (Annexure L).

The following issues were highlighted in the report:

- The national and local economies will benefit from civil contractor work, labour and building materials that will be required on site. On the whole, a share of approximately **40% of total CAPEX (investment costs)** will be sourced locally. This share is likely to increase once there will be a specific and competitive industry in the Republic of South Africa able to supply PV modules and other technological components.
- After approval, the project will take approximately **15 months** to be built and will have a lifetime of 25-30 years. Approximately **100 people** are expected to be employed during the construction period, although this number can increase to 150 for short spaces of time during peak periods. This number can be higher in the case Pulida Energy (Pty) Ltd - once being selected as Preferred Bidder by the Department of Energy and having finalized the Connection Agreement with Eskom, where in particular it is agreed the envisaged connection timeline - evaluates to build the Pulida Solar Park in a timeframe shorter than 15 months. For example, in the case the construction works are planned to last only **6 months**, the average number of workers required on site during construction is **250/300**.
- During operational phase, the power plant will require a permanent staff of approximately **35/40 people**. That impact will be positive, also in consideration of the slowing down of the recruitment rate due to mining stabilization activities.
- Approximately **50% of the operational costs** will have a local economic return (mostly for maintenance works by local sub-contractors), then the impact will also be positive during the operational phase (25÷30 years).
- Furthermore, the project will comply to the Economic Development Requirements, as requested by the IPP Procurement Programme, issued on 3rd August by the DoE. This economic development programme identifies needs of the surrounding communities in order to have a positive socio-economic impact. In particular, Pulida Energy (Pty) Ltd is required to identify a **Local Community** for the purpose of entering into a partnership for the Project.

6.4. AGRICULTURAL POTENTIAL

An Agricultural Potential Impact Assessment on soils potential is attached as Annexure G; the site surveys were conducted during November 2012.

The current land-use of the proposed development site is grazing by livestock. Neighbouring farms are being used for livestock grazing, with some isolated crop cultivation occurring in the deeper soils.

The proposed development site (Alternative Location 1) is largely composed of shallow, calcareous and gravelly soils. Clay content varies between 5 and 10% with depth less than 400 mm. The soils are predominantly shallow with the calcrete or dolerite bedrock often exposed along the surface. The shallow nature of the soils renders the area investigated unfavourable for effective crop production. The farm is also expected to receive an annual total rainfall of below 400 mm which is low and highly variable. Economically viable crop production is therefore not considered as a viable option on this site.

The current vegetation at the proposed site of development consists mainly of shrubland with a well-developed grass layer. According to databases (ARC) the grazing capacity of the area for livestock is low which indicates the veld to be unsuitable for sustainable grazing over a small area such as the project site.

The nature of the vegetation at the farm is therefore marginal for extensive livestock production. Using planted pasture to supplement livestock production is however possible but this could be constrained by high demand for irrigation water due to the shallow and often sandy nature of the soil and relatively higher day temperatures in summer.

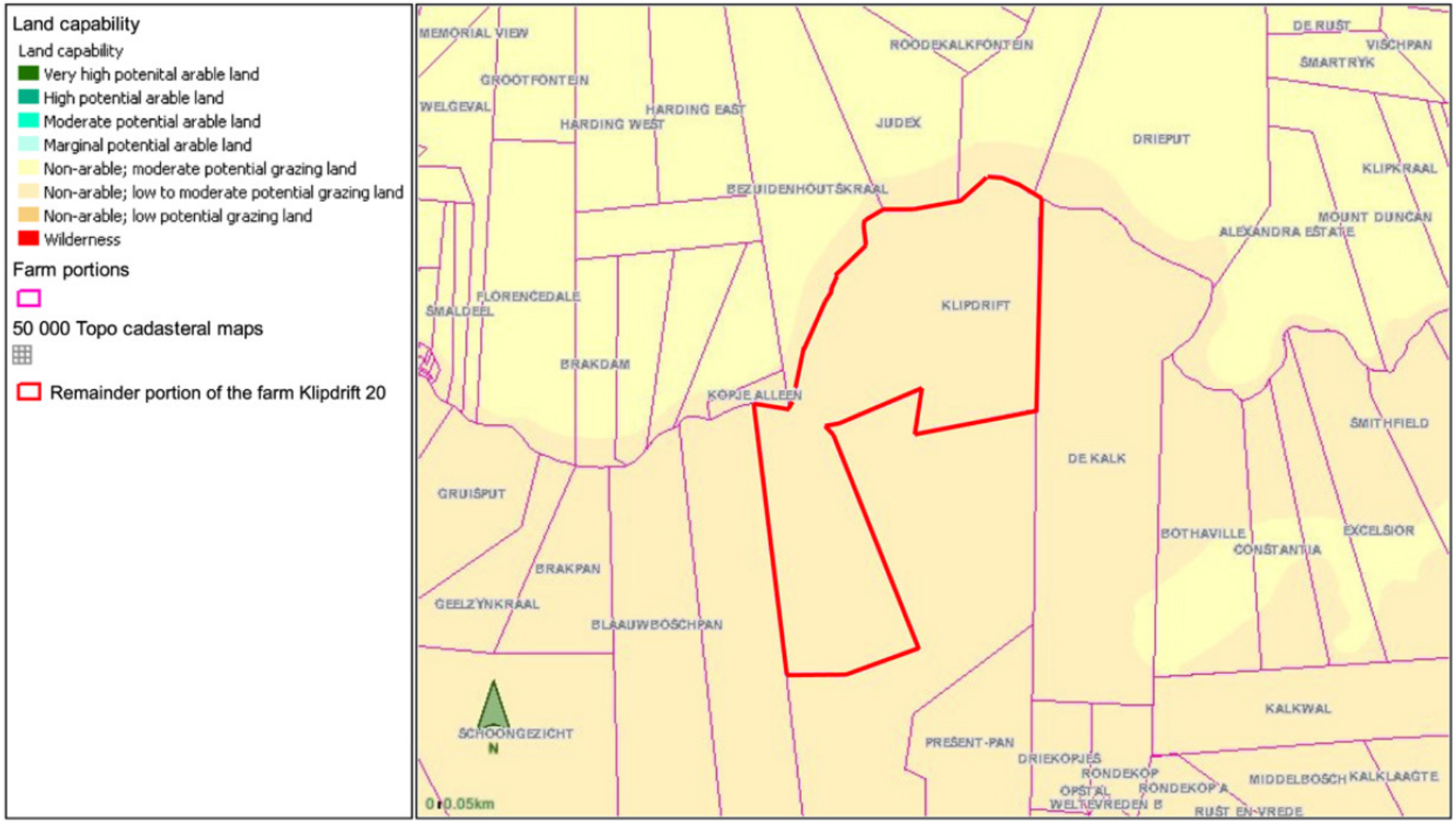
The low agricultural potential of the soils is further confirmed by the Agricultural Maps, attached as Annexure B:

- **Agricultural Potential Map** - indicating that the project site (Remainder Portion of Klipdrift 20) is classified as *Low Agricultural Potential*
- **Land Capability Map** (further depicted in Figure 10 below) - indicating that the site is classified as *Non-arable - low to moderate potential grazing land*
- **Potential Grazing Capacity Map** - indicating that the project site has a potential grazing capacity of 21 - 25 hectares / large stock units. As indicated in the previous map, this grazing potential is *low to moderate*, if compared to the maximum value indicated in the legend: less 3 ha / large stock units.

It can be deduced that the project site would allow for 90 to 107 large stock units on 2256.1868 hectares, while the proposed development (220 ha in extent) would entail a reduction of its grazing potential for 9 to 10 large stock units. These maps were generated from the Website: **http://www.agis.agric.za/agisweb/agis.html** [***AGIS (Agricultural Geo-Referenced Information System) Comprehensive Atlas***, commissioned by the Department of Agricultural to CETI Development CC (http://www.ceit.cc/)]

Considering the fact that re-growth of grass will take place under the PV arrays as the mounting systems are at least 1 m above ground level, the grazing and agricultural potential of the land will not be lost since smaller livestock such as game, goats and sheep will still be able to utilize the grass layer underneath the PV modules. At the end of the lifetime of the solar plant, structures will be removed and natural vegetation will re-establish naturally.

Figure 10 Land Capability Map of the project site



6.5. CULTURAL AND HERITAGE RESOURCES

An archaeological-cum-heritage assessment (Annexure I) was conducted to ascertain whether there are any remains of significance in the area that will be affected by the proposed development.

Two heritage sites were found on the Alternative Location 1, and one on the Alternative Location 2, as detailed below:

Site KD 001 (on the Alternative Location 2)
GPS co-ordinates: 29.09238° S ; 24.89500° E

The identified site consisted of a low density surface scatter of lithic artefacts (± 2-5 artefacts in 10m x10m) and was situated in the south-western corner of the proposed property. The artefacts were exposed by the opening of a road along the southern boundary fence of the property. Subsequent sheet erosion also exposed some of the artefacts in this area. The site was not very big and artefacts were found scattered in an area of approximately 30 m in diameter.
The artefacts included a variety of Late Stone Age flakes, blades and cores. No samples were taken. The site probably extended across the boundary fence into the neighbouring property. The neighbouring property was not investigated.

Field Rating:	Generally Protected; Grade 4B
Heritage Significance:	Medium significance
Impact:	Moderate
Certainty:	Probable
Duration:	Demolished
Mitigation:	B – Recording before destruction

Site KD 002 (on the Alternative Location 1)
GPS co-ordinates: 29.04521° S ; 24.93123° E

Another low density scatter of stone tools was identified here (± 2-5 artefacts in 10m x10m). A low ridge was present on the eastern central part of the proposed site. This low ridge extended from the east to the west across the eastern half of the proposed study area. The identified site was situated on this low ridge which overlooked a lowlying area to the north which resembled a pan, but was not a true pan in the real sense of the word.

The artefacts were identified in several clearings which were exposed to some measure of sheet erosion along the summit of the rise. The stone tools consisted mostly of Late Stone Age blades, scrapers and a few cores and were scattered in small concentrations over an area of approximately 400m x 200m. These small pockets or concentrations of artefacts differed in density and artefacts were not found everywhere across the indicated area (see maps annexed to the Annexure I - Heritage Impact Assessment). Most of the artefacts seemed to be heavily weathered quartzite products. No sample was taken.

Field Rating:	Generally Protected; Grade 4B
Heritage Significance:	Medium significance
Impact:	Moderate
Certainty:	Probable
Duration:	Demolished
Mitigation:	B – Recording before destruction

Site KD 003 (on the Alternative Location 1)
GPS co-ordinates: 29.05009° S ; 24.91871° E

Another low density scatter of stone tools was identified here (± 2-5 artefacts in 10m x10m). The site was in many ways similar to Site KD 002. A small rise was situated in the south-western corner of the proposed study area. This rise overlooked a small pan to its east and north-east. The identified site was situated on the small rise which flanked and overlooked a small pan to the north-east.

The artefacts were identified in several clearings which were exposed to some measure of sheet erosion along the summit of the rise as well as along the southern and western edges of the pan. The stone tools consisted mostly of Late Stone Age blades, scrapers and a few cores and were scattered in small concentrations over an area of approximately 150m x 200m. These small pockets or concentrations of artefacts differed in density and artefacts were not found everywhere across the indicated area (see maps annexed to the Annexure I - Heritage Impact Assessment).
The artefact density also decreased as distance away from the pan increased. Most of the artefacts seemed to be heavily weathered quartzite products. No sample was taken.

Field Rating:	Generally Protected; Grade 4B
Heritage Significance:	Medium significance
Impact:	Moderate
Certainty:	Probable
Duration:	Demolished
Mitigation:	B – Recording before destruction

The heritage specialist recommended avoiding the identified heritage sites, providing the following mitigation measures:

- Demarcate the sites as no go areas.
- The identified sites should be avoided during the development of the project.
- The proposed earth-moving/bush clearing activities should be altered and should be planned around these sites in order to protect them from any damage or other negative impacts.
- A watching brief performed by a suitable qualified person is recommended during the bush clearing and construction phases of the project. This person should see to it that the sites are safe and protected during these phases.

If the above recommendations cannot be adhered to, further steps and measures should be taken to mitigate and document the sites to accepted archaeological standards.
The following is then required:

- Mitigation measures which will include mapping of the identified sites, controlled sampling of identified artefacts and the identification, analysis and storage of the recovered sample by a qualified Stone Age specialist.
- A permit/s for the destruction of the sites from the South African Heritage Resources Agency will be necessary for the mitigation measures as well as further development on these identified heritage sites.

The Heritage Impact Assessment concluded that the proposed development of the Pulida Solar Park in the indicated areas can continue from a heritage point of view if the above mentioned recommendations are adhered to.

7. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROCESS AND PUBLIC PARTICIPATION PROCESS

The environmental impact studies can be summarized in a two-phased approach:

- Phase 1: Environmental Scoping Study (ESS)
- Phase 2: Environmental Impact Assessment (EIA) and Environmental Management Program (EMP)

The scope of the EIA procedure is to provide an assessment of all impacts related to the proposed project in compliance with the EIA Regulations 2010.

7.1. SCOPING PHASE

The Scoping Phase aims to produce the following:

- a description of the proposed activity, the property and the receiving environment;
- the identification of potential significant positive and negative impacts;
- the identification of opportunities and constraints, alternatives and mitigation measures which need to be evaluated and investigated during the successive EIA phase, especially in order to prevent environmental fatal flaws and sensitive or “no-go” areas.

The Scoping Phase includes the Public Participation Process. The PPP has the aim to identify concerns and issues by the interested and affected parties (I&AP’s).

In particular, in the case of the proposed development, issues and concerns raised by the I&AP’s and key stakeholders during the Public Participation Process were collected, processed and addressed in the Comments and Response document which formed a part of the submitted Final Scoping Report.

All issues and concerns identified during the Scoping Phase were documented in this Final Scoping Report which was submitted to the DEA together with a Plan of Study for EIA.

7.2. EIA PHASE

The next (current) step of the EIA process is the development of guidelines for execution of the impact assessment and the compilation of an Environmental Impact Assessment Report.

The database of the stakeholders and I&AP’s developed during the scoping process is used as a reference to ensure that stakeholders are involved and participate in this second phase of the EIA process.

All relevant issues considered during the Scoping Phase are further investigated and assessed during this EIA Phase of this project. The EIA involves various specialist studies and should provide an overall assessment of the biophysical, social and economic environment affected by the proposed project.

A detailed assessment is carried out in terms of environmental criteria and rating of significant impacts of all options identified in the scoping phase. Appropriate mitigation measures are identified and recommended for all significant impacts. These measures are also included in an Environmental Management Program (EMP), submitted together with the Environmental Impact Assessment Report (EIAR) to the DEA.

During the EIA phase stakeholders and I&AP's are notified in writing of the continuation of the project to the EIA Phase and are informed as to the way forward and where and when the Draft Environmental Impact Assessment Report is made available for review. Comments from the stakeholders and I&AP's on the Draft EIR and the Draft EMP will be incorporated into the final EIAR.

The stakeholders and I&AP's will furthermore be informed of the final decision regarding the Environmental Authorization and the appeal process.

7.3. PUBLIC PARTICIPATION PROCESS

All relevant I&AP's have been identified and involved in the public participation process from the beginning of the project as per sections 54, 55, 56 and 57 of the EIA regulations 2010.

The public participation process offers the opportunity to become actively involved through constant sharing of information. The main purposes of the public participation process are to ensure that:

- all relevant information in respect of the application is made available to I&AP's for their evaluation and review;
- reasonable opportunity is given to I&AP's to comment and to submit queries related to the proposed project;
- comments and queries by the I&AP's to the Scoping Reports and to the EIA Reports are submitted and evaluated in a reasonable timeframe and in predetermined terms.

The initial informative stage of the public participation was done from 5 September 2012 until 5 October 2012.

The public was informed of the proposed development and a database of Interested and Affected parties was compiled.

In the enclosed Annexure D there is the list of all components of the public participation process.

The public was informed of the project by means of:

- site notices;
- delivery of Background Information Documents (BID) to all adjacent land owners;
- notices in local and national newspapers; and
- sending of BID to other possible interested and affected parties/stakeholders.

A data base of registered I&AP's has been established to date and will be maintained and added to as required.

Site notices were put up on site in two different locations on the fence surrounding the proposed development area. This was done on 5 September 2012.

Background Information Documents were distributed to all adjacent landowners as well as the relevant governmental departments including inter alia Department of Water Affairs, Agriculture etc.
Other identified interested and/or affected parties/stakeholders include Eskom, the Local municipality, the District municipality etc.
Proof of all correspondence is included in Annexure D.

A newspaper advertisement was published in the 6 September 2012 edition of the Daily Sun, which is a national daily newspaper.
Another advertisement was placed in the local newspaper (the Diamond Fields Advertiser) on 6 September 2012.

A number of responses were received during the public participation process and these responses were recorded and included in a spread-sheet designed as a data base to be used during the public participation process.

Responses received concerns mostly that I&APs would like to be kept informed and up to date during the process. This will be done according to the requests of the I&APs.

A copy of the submitted Draft Scoping Report was made available for comment - for a 40 day period – (from 10 October 2012 to 23 November 2012) to all persons who registered as I&APs and who sent any correspondence as well as all identified relevant governmental departments and stakeholders.

The Final Scoping Report was also made available after submission to DEA. Notification letters were sent out on 3 December 2012. No comments were received on the final scoping report.

Further steps in public participation process

To ensure a transparent and complete public participation process the following steps are still to be taken during the rest of the EIA process:

- The Draft EIA Report will be made available for a commenting period of 40 days.
- After submission of Final EIA Report to DEA notifications will be sent out to inform all I&APs and governmental organizations that the final EIA report was submitted and is again available for comments.

8. METODOLOGY USED FOR THE IDENTIFICATION AND ASSESSMENT OF THE IMPACTS

The potential environmental impacts identified in the study have been quantified and the significance of the impacts has been assessed according to the criteria set out below. Each impact has been assessed and rated. The assessment of the data, where possible, has been based on broadly accepted scientific principles and techniques. In defect, judgements and assessments are necessarily based on the consultant's professional expertise and experience.

8.1. PROJECT PHASING

For the purpose of assessing these impacts, the project has been divided into phases from which impacting activities can be identified:

- **Planning**
- **Site clearing & construction phase**
- **Operational phase**

The phases have been carefully examined in relation to the PV plant and in relation to the connection infrastructure. Indeed, as already described, in this document all impacts and mitigations are defined also for the connection infrastructure, although this part of the project may be executed, owned and operated by Eskom.

As far as the **decommissioning** phase is concerned, it is important to specify that this phase will be subject to a decommissioning plan once the project is nearing its operational life (25-30 years). Decommissioning will also be subject to an environmental authorization (Activity 27 of R544 of 18 June 2010).

This phase is important because it states the **reversibility of the development** and has to be carefully planned and executed, in order to enable the natural re-growth of indigenous vegetation and fauna re-population as well as the reuse of the area for agricultural and grazing purposes. For this reason, in the Draft Environmental Management Plan the decommissioning phase has been included and carefully analyzed, in order to anticipate activities and actions to be taken in order to minimize the relevant impacts.

The decommissioning phase, as described in Chapter 10, is similar to the commissioning phase but all possible care must be considered for the recycling of the materials and for the re-establishment of the site as it was the *status quo – ex ante* the development.

8.2. ASSESSMENT CRITERIA

The terms of reference for the study include criteria for the description and assessment of environmental impacts. These criteria are drawn from the Integrated Environmental Management Guidelines Series, Guideline 5: Assessment of Alternatives and Impacts, published by the Department of Environmental Affairs and Tourism in terms of the Environmental Impact Assessment. These criteria include:

Table 5 Impact Assessment Criteria

Nature of impact This is an appraisal of the type of effect the proposed activity would have on the affected environmental component. The description should include what is being affected, and how.		
Extent The physical and spatial size of the impact.	**Site**	The impact could affect the whole, or a measurable portion of the above-mentioned properties.
	Local	The impacted area extends only as far as the activity, e.g. a footprint.
	Regional	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns.
Duration The lifetime of the impact; this is measured in the context of the lifetime of the proposed base.	**Short term**	The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than any of the phases.
	Medium term	The impact will last up to the end of the phases, where after it will be entirely negated.
	Long term	The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter.
	Permanent	The only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.
Intensity	**Low**	The impact alters the affected environment in such a way that the natural processes or functions are not affected.
	Medium	The affected environment is altered, but function and process continue, albeit in a modified way.
	High	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
Probability This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time.	**Improbable**	The possibility of the impact occurring is very low, due either to the circumstances, design or experience.
	Probable	There is a possibility that the impact will occur to the extent that provisions must be made therefore.
	Highly probable	It is most likely that the impacts will occur at some or other stage of the development. Plans must be drawn up before the undertaking of the activity.
	Definite	The impact will take place regardless of any prevention plans, and there can only be relied on mitigation actions or contingency plans to contain the effect.

Determination of significance. Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required.	**No significance**	The impact is not substantial and does not require any mitigation action.
	Low	The impact is of little importance, but may require limited mitigation.
	Medium	The impact is of importance and therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels.
	High	The impact is of great importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential.

The general approach to this study has been guided by the principles of Integrated Environmental Management (IEM). In accordance with the IEM Guidelines issued by the DEA, an open, approach, which encourages accountable decision-making, has been adopted. The underpinning transparent principles of IEM require:

- informed decision-making;
- accountability for information on which decisions are made;
- a broad interpretation of the term “environment”;
- an open participatory approach in the planning of proposals;
- consultation with I&APs;
- due consideration of alternatives;
- an attempt to mitigate negative impacts and enhance positive impacts of proposals;
- an attempt to ensure that the social costs of development proposals are outweighed by the social benefits;
- democratic regard for individual rights and obligations;
- compliance with these principles during all stages of the planning, implementation and decommissioning of proposals; and
- the opportunity for public and specialist input in the decision-making process.

The study is also guided by the requirements of the EIA Regulations in terms of the NEMA. The NEMA EIA Regulations, which are more specific in their focus than the IEM principles, define the detailed approach to the EIA process.

9. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

9.1. POTENTIAL IMPACTS

Potential impacts associated with the construction and operational phases of the Pulida Solar Park together with its connection infrastructure are outlined and evaluated hereinafter.

As previously described, **construction activities** for the establishment of PV power plants include:

- land clearing activities necessary for preparation of the site and access routes;
- excavation and filling activities;
- transportation of various materials;
- construction of the storage structures;
- installation of the PV modules and construction of associated structures and infrastructure;
- construction of the on-site loop-in loop-out substation, construction of the two new sections of power line - approx. 100 m long - which will deliver the energy to planned Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line.

Environmental impacts associated with the **operational phase** of a solar energy facility may include visual and other impacts.

The **decommissioning activities** of the PV plant mainly include the removal of the project infrastructure and the restoring of the site *status quo ante*.

The identification of impacts will be based on:

- legal and administrative requirements;
- the nature of the proposed activity;
- the nature of the receiving environment;
- specialist studies;
- issues raised during the public participation process.

Potential impacts may include:

- Impacts on soils & agricultural potential;
- Impacts on ground water;
- Impacts on the road system and traffic;
- Impacts on air quality and potential emissions;
- Geological, soil and erosion impacts;
- Impacts on avifauna;
- Impacts on vegetation;
- Impacts on heritage resources;
- Noise impacts;
- Impacts on tourism;
- Social impacts;
- Visual impacts.

9.2. SPECIALIST STUDIES

Due to the nature of the project, a number of specialist studies are required in the EIA process in order to investigate the potential environmental impacts associated with the proposed development.

Detailed studies on potentially significant impacts have been carried out to address these impacts throughout the EIA process. The public participation process provides valuable information in the identification of issues requiring further and specific investigation throughout the EIA process.

The specialist studies which have been conducted and attached to this Draft EIA Report are the following:

- Services Report
- Ecological Impact Assessment
- Avifauna Impact Assessment
- Agricultural Potential Assessment
- Wetland Delineation Study
- Geo-technical and Geo-hydrological Report
- Visual Impact Assessment
- Socio-economic Impact Assessment
- Heritage Impact Assessment
- Paleontological Impact Statement

9.3. IMPACTS & MITIGATION MEASURES

Considering that the Alternative Location 1 is the only suitable location for the proposed development, for the reasons explained in the Section 5.3. LAYOUT DESIGN AND LOCATION ALTERNATIVES and in the Section 4.1. PROJECT LAYOUT, in this section only the Alternative Location 1 has been considered.

9.3.1. Construction & operational phases impacts and mitigation measures

All the possible impacts that can be predicted in both the construction and operational phases of the PV plant are addressed. Specific mitigation measures are proposed and the significance of these impacts is described with and without the mitigation measures.

Furthermore, considering that all or part of the construction infrastructure may be owned and/or operated by Eskom, the mitigation measures described in the following paragraphs and in particular in the attached Environmental Management Plan can be, accordingly, of the responsibility of Eskom or of the developer.

9.3.1.1. Atmospheric pollution and noise

Construction Phase
During this phase there will be a concentration of earthmoving equipment and construction vehicles that will level the area, clear vegetation for construction purposes and in the process will create dust and exhaust smoke that will impact on air quality. There will also be more noise created by the vehicles during this phase. Burning of waste and fires at construction sites may also create smoke.

Operational phase
The increased traffic volumes and people will lead to increased levels of air pollution and noise. Smoke from burning of waste can cause air pollution.

ALTERNATIVE LOCATION 1									
Project Phase	Impact :Atmospheric Pollution and noise								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Earthworks and Vegetation clearance	Air pollution : Dust	Low-medium	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Vehicle movement	Air pollution : Smoke	Low	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Vehicle movement	Air pollution : Dust	Low	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Vehicle movement	Noise pollution	Low-medium	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Burning of cleared vegetation, solid waste & veld fires	Air pollution by excessive smoke	Low-medium	Medium-high	Low-medium	Medium	Medium	Low-medium	Medium
	Cooking fires of workers	Air pollution : Smoke	Low	Medium-high	Low-medium	Medium	Medium	Low	Medium
Operation	Vehicle movement	Noise pollution	Low-medium	Medium-high	Low-medium	High	Medium-high	Low-medium	Medium
	Fireplaces and veldt fires	Air pollution caused by smoke	Low-medium	Medium-high	Low-medium	High	Medium-high	Low-medium	Medium
	Burning of vegetation refuse and solid waste	Air pollution by excessive smoke	Low-medium	Medium-high	Low-medium	High	Medium-high	Low-medium	Medium

Mitigation measures - Construction Phase

- Vehicles must be well serviced so that it does not produce excessive smoke and noise.
- Speed of construction vehicles should be kept as low as possible to reduce the generation of dust and noise.
- Construction areas must be damped to prevent excessive dust formation.
- The clearing of the site should be done in phases as the construction progresses.
- Construction should only take place during the hours between sunrise and sunset on weekdays and Saturdays.
- Contractors must comply with Provincial noise regulations. The construction machinery must be fitted with noise mufflers and be maintained properly.
- Vegetation cleared from the site and solid waste generated by the construction teams may not be burned on site or the surrounding areas, but be regularly removed to the municipal waste disposal site.
- Fire belts must be made around the development according to the regulations of the Veld and Forest Fire Act.
- The cleared vegetation should stock-piled and removed to a licensed waste disposal site on a regular basis.

Mitigation Measures - Operational Phase

- Speed of vehicles on roads should be controlled e.g. speed bumps and speed restrictions.
- All roads should preferably be sealed to eliminate dust formation caused by strong winds and vehicle movement.
- Solid waste should not be burned on the project area.
- Fire belts around the development must be made according to the regulations of the Veld and Forest Fire Act.
- Vegetation refuse should be composted if possible and re-used.

9.3.1.2. Groundwater and surface water pollution

Construction Phase

- Lack of sanitation could result in ground water pollution and associated health risks.
- Construction vehicles will be refuelled at the construction camp.
- Spillage of fuel and lubricants from construction vehicles could occur. Storm water contamination by solid waste could lead to groundwater and surface water pollution.
- In this phase the soil cover as well as the vegetation is removed and storm water over the area could cause erosion as well as siltation of watercourses. Road construction will also increase the possibility of erosion and the siltation/sedimentation of surface water streams, because of increased storm water run-off.

Operational Phase

- Pollution by sanitation leakages, solid waste and erosion may lead to water pollution. Storm water run-off over open areas can cause erosion as well as the washing of soil into the surface water streams.
- Storm water flowing over sealed and/or paved areas could lead to ground and surface water pollution. Chemicals from the vehicle wash area could negatively impact on the quality of surface and groundwater resources.
- Fertilizers, pesticides and herbicides used at the project during operation can create pollution if not handled and applied correctly.

ALTERNATIVE LOCATION 1									
Project Phase	Impact: Groundwater and Surface water Pollution								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Spillage of fuel and lubricants from construction vehicles	Water Pollution	Medium	Medium-high	Low-medium	Medium-high	Medium-high	Low	Medium
	Clearing of vegetation	Erosion & siltation of streams	Low-medium	Medium-high	Low-medium	Medium	Medium-high	Low-medium	Medium
	Solid waste disposal freshwater resources	Pollution of freshwater resources	Low	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium

ALTERNATIVE LOCATION 1									
Project Phase	Impact: Groundwater and Surface water Pollution								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
	Sanitation seepage from chemical toiletsand/or from the temporary sanitation system	Water Pollution	Medium	Medium-high	Low-medium	Medium	Medium	Low	Medium
Operation	Spillage of fuel and lubricants from vehicles	Water Pollution	Medium	High	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Solid waste disposal- freshwater resources	Water Pollution	Low	High	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Leakage from the permanent Sanitation system	Water Pollution	Medium-high	High	Medium	Medium	Medium-high	Low-medium	Medium-high
	Use of fertilizers, insecticides and herbicides	Pollution of streams & rivers	Low-Medium	High	Low-medium	Medium	Medium	Low-medium	Medium
	Storm water runoff	Erosion & siltation of streams	Low-medium	Medium-high	Low-medium	Medium	Medium-high	Low	Medium

Mitigation measures - construction phase

The following precautionary measures are recommended to prevent any surface or groundwater pollution:

- Cleared areas should be rehabilitated by reintroducing a grass layer as soon as possible to limit the occurrence of erosion.
- Berms to limit the flow of water over cleared areas will limit erosion and the siltation of surface streams. Preference should be given to plant species indigenous to the area.
- Drip pans should be used during re-fuelling and servicing of construction vehicles. Used parts like filters should be contained and disposed of at a site licensed for dumping of these waste products.
- Oil traps must be installed in the vehicle wash bay to prevent pollution. Oil traps must be serviced on a regular basis by an approved service agent.
- Diesel storage must not exceed 80 000 litres at construction camps. Diesel tanks and other harmful chemicals and oils must be within a bunded area.
- The vehicle maintenance yard and construction storage area should be placed 100 m away from watercourses. This area should have bund walls and lined with impermeable material to prevent ground and surface water pollution.
- An efficient storm water drainage system should be installed around all structures and infrastructures to effectively catch and drain surface water.
- Chemical sanitation facilities and the temporary sanitation system in the construction

site should be regularly serviced by appropriate companies to ensure that no spills or leaks to surface and groundwater take place. Chemical toilets and the temporary sanitation system should not be placed within 100 m from any watercourse.
- Solid waste must be kept in adequate waste bins. Building rubble and various waste should be removed on a regular basis to a licensed landfill site.

Mitigation measures - operational phase
- Solid waste must be kept in adequate waste bins and removed on a weekly basis to a waste disposal site.
- The use of eco-friendly products e.g. Organic Compost, herbicides and insecticides should be promoted.
- The permanent sanitation system should be regularly inspected to ensure that no spills or leaks from sanitation system to groundwater take place.

9.3.1.3. Water use / water quantity

Construction phase

During this phase, water consumption will be the highest because it will be utilized for gravel roads and building constructions. The water needed for the construction activities will be provided from an existing on-site borehole close to the Alternative Location 1. The Modder River is an alternative surface water source to supplement the borehole during high demand periods if required.

Operational phase

Water use will be limited except for short periods (once per year) when the PV modules are cleaned. The water needed for the operational phase will be provided from an existing on-site borehole close to the Alternative Location 1. The Modder River is an alternative surface water source to supplement the borehole during the cleaning activities of the solar modules.

ALTERNATIVE LOCATION 1									
Project Phase	Impact: Water use								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Construction process	Depletion of water resources: Water consumption	Low-medium	Medium-high	Medium-high	High	High	Medium	Medium-high
Operational	Water use & cleaning of panels	Depletion of water resources: Water consumption	Low	High	Medium	High	High	Low-Medium	Medium

Mitigation measures – Construction Phase
- Water should be used sparingly and it should be ensured that no water is wasted.
- Roads should be treated with chemicals to lower the use of water.
- Washing of construction vehicles should be limited to once or twice a month and must be done with high-pressure sprayers to reduce water consumption.
- Drinking water supply for the staff on site should be treated through an osmotic water filtration system.

Mitigation measures - Operational Phase

- Cleaning of panels should be done only when necessary, twice per year.
- Roads should be treated with chemicals to lower the use of water.
- Washing of vehicles should be limited to once a week and must be done with high-pressure sprayers to reduce water consumption.
- Care must be taken not to waste any water. In the offices, half-flush systems in the toilets as well as water aerators in all taps must be installed to reduce water consumption.
- The workers should be educated on the value of water and how to use it sparingly.
- Only indigenous trees and plants should be planted in the tree buffer zone.
- Drinking water supply for the staff on site should be treated through an osmotic water filtration system.

9.3.1.4. Land and soils

Planning phase

The high sensitivity area (*salt pan*) located on the south western corner of the project site should remain undeveloped - providing a buffer zone 30 m wide - in compliance with the requirements highlighted in the Ecological Impact Assessment (Annexure E) and in the Wetland Delineation Study (Annexure H).

Construction phase

During construction, the vehicles used have the potential to spill diesel and lubricants that can pollute the soil. The storage of solid waste before it can be disposed of has the potential to pollute the soil and becomes a nuisance.

Operational phase

Solid waste can be a nuisance and has the potential to pollute the soil if not managed correctly. The use of conventional fertilizers, herbicides and insecticides should be limited as far as possible. Wastewater from activities can pollute the soil.

ALTERNATIVE LOCATION 1									
Project Phase	Impact: Land and soils								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Spilling of oil/diesel by construction machines	Contamination of soil	Medium	Medium-high	Low-medium	Medium-high	Medium-high	Low	Medium
	Solid waste disposal	Soil pollution + nuisance	Low	Medium-high	Low-medium	Medium-high	Medium-high	Low-medium	Medium
	Storm water over roads and cleared areas	Erosion	Low-medium	Medium-high	Low-medium	Medium	Medium-high	Low-medium	Medium

ALTERNATIVE LOCATION 1									
Project Phase	Impact: Land and soils								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
	Trenches for electric cables and water and sewerage pipes	Erosion	Low-Medium	Medium-high	Low	Medium	Medium-High	Low-medium	Medium
Operation	Solid waste	Soil pollution + nuisance	Low	High	Low-Medium	Medium-High	High	Low	Medium
	Storm water from paved areas and roofs	Erosion	Low-medium	High	Low-medium	Medium	Medium-high	Low	Medium
	Use of fertilizers, insecticides and herbicides	Pollution	Low-Medium	High	Low-medium	Medium	Medium	Low-medium	Medium

Mitigation measures - Construction Phase

- Construction vehicles must be well maintained and serviced to minimise leaks and spills.
- Spill trays must be used during refuelling of vehicles on site.
- Diesel storage must not exceed 80 000 litres at construction camp. Diesel tanks and other harmful chemicals and oils must be within a bunded area.
- Solid waste must be kept in containers and disposed of regularly at licensed dumping site.
- Any building rubble must be removed to a licensed disposal site on a regular basis during construction.
- Trenches that are dug for the supply of services and electrical cables must be filled up and compacted well and slightly higher than the areas around it.
- The clearing of the site should be done in phases as the construction progresses.
- Slopes produced by removing soil must be kept to a minimum to reduce the chances of erosion damage to the area.
- Gravel roads used during construction must be constructed with storm water diversion channels to slow down the movement of water over the road surface to reduce erosion and the siltation of surface streams.

Mitigation measures - Operational Phase

- Solid waste must be kept in adequate waste bins and removed on a weekly basis to the waste disposal site.
- The surface drainage system should be monitored after storms and storm water damage should be repaired. The maintenance of the roads must be kept up to standard to prevent and reduce the incident of erosion next to the roads.
- The use of eco-friendly products e.g. organic compost, herbicides and insecticides should be promoted.

9.3.1.5. Archaeological, Cultural and Social Features

Construction phase

The clearing of the site may have a negative impact on the archaeological features of the site. Care must be taken in the excavations and moving of soil to observe any archaeological feature of importance, which must be left and reported to the archaeological consultant for comments and actions.

Operational phase

The operational phase will not have any negative impact on the archaeological features of the site, if the recommendations of the Heritage Impact Assessment (Annexure I) to be undertaken will be adhered to.

ALTERNATIVE LOCATION 1									
Project Phase	Impact: Loss of Archaeological, Cultural and social features								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Earth moving and soil clearance	Destroy archaeological evidence and heritage and graves	Low-medium	Medium-high	Medium	Medium	Medium-High	Low	Medium-High
Operation	Operational activities of development	Destroy archaeological evidence and heritage and graves	Low-medium	High	Medium	Medium	Medium-High	Low	Medium-high

Mitigation measures – Construction and operational phases

Care must be taken during the construction process that anything of archaeological value that is unearthed must be recorded. See Phase 1 - Heritage Impact Assessment, Annexure I. The archaeologist or SAHRA must be notified whenever anything of importance is discovered.
The heritage sites identified in the Heritage Impact Assessment (Annexure I) should be avoided, providing the following mitigation measures:

- Demarcate the sites as no go areas.
- The identified sites should be avoided during the development of the project.
- The proposed earth-moving/bush clearing activities should be altered and should be planned around these sites in order to protect them from any damage or other negative impacts.
- A watching brief performed by a suitable qualified person is recommended during the bush clearing and construction phases of the project. This person should see to it that the sites are safe and protected during these phases.

9.3.1.6. Impact of the development on the ecology (fauna & flora) of the area

Planning and construction phase

The removal of natural vegetation and destruction of habitat will have a negative effect on the biodiversity. The specific mitigation measures included in the Ecological and Avifauna Impact Assessment (Annexures E & F) should be adhered to.

The high sensitivity area (*salt pan*) located on the south western corner of the project site should remain undeveloped - providing a buffer zone 30 m wide - in compliance with the

requirements highlighted in the Ecological Impact Assessment (Annexure E) and in the Wetland Delineation Study (Annexure H).

Operational phase

The operation of the development can have a negative impact on the bio-diversity if it is not managed correctly. Exotic invasive plant species can have a negative impact on the indigenous vegetation.

ALTERNATIVE LOCATION 1									
Project Phase	Environmental Aspect: Ecology (Fauna and Flora)								
	Activity that causes impact	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Earthworks and vegetation clearance at construction site	Loss of indigenous plant species & disturbance to sensitive habitat	Medium	Medium	Low-Medium	Medium	Medium-High	Low-medium	Medium
	Vegetation clearance and the use of herbicides to control re-growth at the different development areas	The eradication and control of exotic invasive plant species Loss of indigenous plant species	Medium	Medium	Medium	Low-Medium	Medium-High	Low-Medium	Medium
	The occurrence of veldt fires on site	Destruction of flora/habitats Loss of indigenous fauna	Medium-High	Medium	Medium	Medium-High	High	Medium	Medium-high
	Littering (e.g. cans and plastics) along access road and at construction site	Public nuisance and loss/death of indigenous fauna	Low-Medium	Medium	Medium	Medium-High	Medium	Low	Medium
	The control of animals on site Killing, poisoning or hunting of animals	Loss of indigenous fauna to the area	Medium-High	Medium	Medium	Medium	Low-Medium	Low-Medium	Medium
Operation	Planting of indigenous vegetation in the tree buffer zone	Improve bio-diversity	Medium +	High +	Medium +	High +	High +	Medium-high+	Medium +
	Rehabilitation of cleared areas	The spreading of exotic invasive plant species Loss of habitat and indigenous flora	Medium	High	Medium	Low-Medium	Medium	Low-Medium	Medium
	The occurrence of veldt fires	The loss of indigenous fauna and flora	Medium-High	Medium	Medium	Low-Medium	High	Medium	Medium-high

ALTERNATIVE LOCATION 1									
Project Phase	Environmental Aspect: Ecology (Fauna and Flora)								
	Activity that causes impact	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
	The functioning of the permanent sewage treatment systems – treated sewage outflow	Deterioration in the habitat for avifauna and aquatic life	Medium-High	High	Medium	Medium-High	Medium	Low-Medium	Medium-High
	Disposal and storage of solid waste and littering	The death/loss of indigenous fauna e.g. raptors, mammals and reptiles	Medium-High	High	Medium-High	Medium-High	Medium	Low-Medium	Medium
	The control of pests and vermin	Killing and poisoning of fauna feeding on the poisoned vermin or pest	Low-Medium	High	Low-Medium	Medium-High	Medium	Low	Medium
	The feeding of fauna e.g. birds &small mammals	Disturbance to bio-diversity and the natural movement of the animals through the site The death/loss of indigenous fauna	Low-Medium	High	Low-Medium	Medium-High	Low-Medium	Low	Medium
	Catching of wild animals e.g. reptiles, bids and small mammals as pets	Disturbance to bio-diversity and decline in indigenous faunal numbers	Medium-High	High	Low-Medium	Low-Medium	Low	Low	Medium
	Birds colliding with power line and panels	Electrocution of birds	Medium-High	High	Low-Medium	Low-Medium	Low	Low	Medium
	The erection of fences and the construction of roads with a kerb	The fragmentation of available habitat and the restriction of movement of small mammals, reptiles and amphibians	Low-Medium	High	Low-Medium	High	Medium	Low	Medium

Mitigation measures – Construction phase

- The tree buffer zone should be only composed by indigenous vegetation, a list of well-adapted indigenous plant species should be made available.
- Care must be taken that unnecessary clearance of vegetation does not take place. Where possible, natural vegetation must be retained.
- The high sensitivity area (*salt pan*) located on the south western corner of the site should remain undeveloped, providing a buffer zone 30 m wide.
- Protected trees can only be removed once the necessary permits have been obtained.
- The herbicides used to control the invasive plant species should be chosen in consultation with an ecologist, as some of the agents might be detrimental to the surrounding indigenous fauna and flora e.g. Roundup is for example extremely toxic

to frogs.

- Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the raptors occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist.
- Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
- Fires should only be allowed in designated places within the construction camp and extra care should be taken to prevent veldt fires of occurring.
- Firebreaks should comply with the National Veldt and Forest Fire Act, 1998 (Chapter 4: Duty to Prepare and maintain firebreaks).
- Cleared areas should be rehabilitated by reintroducing a grass layer as soon as possible to limit the occurrence of erosion.
- The cleared vegetation should not be burned on site. The cleared vegetation should be stockpiled and taken to the closest available landfill site.
- Solid waste must be kept in adequate animal proof waste bins at the construction camp and construction sites. Building rubble and various wastes should be removed on a regular basis to the closest available landfill site.
- Regular clean-up programs should be put into effect along the access road and throughout the premises to limit the impact of littering caused by construction activities.
- The stockpiled topsoil and construction material should be managed in such a way that the material is not transported by wind or rain. This can be done by restricting the height of the stockpiles, sandbagging and avoiding steep slopes.
- No animals may be killed, captured or hunted on site by construction workers. Do not feed any wild animals on site.
- Where trenches pose a risk to animal safety, they should be adequately cordoned off to prevent animals falling in and being trapped and/or injured. This could be prevented by the constant excavating and backfilling of trenches during construction process.
- Existing game on the developed area will be relocated when the proposed solar park is developed. The relocation of the game will be executed according to the relevant legislation.

Mitigation measures – Operational phase

- The tree buffer zone should be only composed by indigenous vegetation, a list of well-adapted indigenous plant species should be made available.
- An ecologist should be consulted on the use of herbicides/eco-friendly products to control exotic tree and shrub species.
- Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the raptors occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist.
- Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
- The high-risk sections of the power line should be marked with a suitable anti-collision marking device on the earth wire as per the Eskom guidelines.
- Solid waste must be kept in animal proof waste bins.
- A monitoring program should be compiled and implemented to ensure that the

sewage treatment system is functioning properly and that the treated wastewater conforms to the standards set by the Department of Water Affairs.

- Staff members should be discouraged from attempting to catch or kill any wildlife for use as food, pets or to feed any wild animals.
- Firebreaks should comply with the National Veldt and Forest Fire Act, 1998 (Chapter 4: Duty to Prepare and maintain firebreaks).
- The impact on the flying invertebrates will be minimized through the use of sodium vapour (yellow) lights as outside lighting.
- The use of eco-friendly products e.g. Organic Compost and/or Effective Microorganisms (EM), which reduces the frequency of application of conventional fertilizers, herbicides and insecticides, should be promoted.

9.3.1.7. Visual impacts

Construction phase

The natural aesthetic character of the site will be changed. The Eskom's "Kimberley DS - Skietpan Switching Station" 132 kV power line crossing the developed area has already changed the visual characteristics of the site.

Operational phase

Buildings and the solar modules have a *visual impact* and lights at night can be a *nuisance.*

ALTERNATIVE LOCATION 1									
Project Phase	Impact: Visual disturbance								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Buildings & panels	Visual	Low	High	Low-Medium	High	High	Low-Medium	Medium
	Lights	Visual	Low	Medium	Low-medium	Medium-high	High	Low-Medium	Medium
Operation	Buildings and panels	Visual	Low	High	Low-Medium	High	High	Low-Medium	Medium
	Lights	Nuisance	Low	High	Low-medium	Medium-High	High	Low-Medium	Medium
	Electrical lines	Visual	Low	High	Low	High	High	Low-Medium	Low-Medium

Mitigation measures

- Earth works should be executed in such a way that only the footprint and a small 'construction buffer zone' around the proposed components are exposed. In all other areas, the natural occurring vegetation, more importantly the indigenous vegetation should be retained.
- Where possible retain a visual screen (tree buffer zone) of existing vegetation around the proposed project components to reduce the negative visual impact.
- Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the project site.

- Minimise the amount of light fixtures to the bare minimum and connecting these lights to motion sensors can also considered in reducing light pollution.
- A video-surveillance system using infrared or microwave video cameras, which do not need a switched on lighting system, is recommended.

9.3.1.8. Safety, security and fire hazards

Construction phase

Construction activities such as excavating of foundations and trenches, movement of construction vehicles, the use of equipment and the congregation of workers and staff on site further increases the risk of injury. The activities of construction personnel on site may contribute to an increase in the level of crime in the area and may also contribute to an increase in the risk for fires.

Operational phase

Fires and criminal activities pose a significant risk during the operation of the development.

ALTERNATIVE LOCATION 1									
Project phase	Impact: Safety, security and fire hazards								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Construction	Construction activities – excavation of foundations, trenches etc.	Loss or injury to human life	Low-medium	Medium-high	Low	High	Medium	Low	Medium
	Security	Crime	Medium	Medium-high	Low-medium	Medium	Medium-high	Low - medium	Medium
	Fire hazards	Loss of human life and construction equipment etc.	High	Medium-high	Medium	Low	Low-Medium	Low-Medium	Medium
Operation	Security	Crime	Medium	High	Medium	Medium	Medium-high	Medium	Medium-high
	Fire hazards	Loss of human life, bio-diversity, buildings, infrastructure etc.	High	Medium	Medium -High	Low	Low	Low	Medium

Mitigation measures

- The Contractor shall conform to the stipulations of the Occupational Health and Safety act (Act 85 of 1993) and regulations applicable. The Act requires the designation of a Health and Safety representative when more than 20 employees are employed.
- Open trenches or excavations must be marked with danger tape.
- The number of construction workers to stay on site should be limited to the minimum.

- Proper access control (I.D. cards) should be enforced to ensure that no authorised persons enter the site.
- No solid waste or vegetation may be burnt on the premises or surrounding areas.
- Firebreaks should comply with the National Veldt and Forest Fire Act, 1998 (Chapter 4: Duty to prepare and maintain firebreaks).
- Fire extinguishers and fire fighting equipment must be available.
- A fence should be constructed along the boundary of the development.

9.3.1.9. Socio-economic impact

Construction phase

The construction and operation phases of the development will have a positive impact on the socio-economic environment of beneficiary communities through employment opportunities and training and skills development.

Operational phase

A number of permanent jobs will be created for local people during this phase.
Pulida Energy (Pty) Ltd should identify a local Community for the purpose of entering into a partnership for the Project, as required by the rules of the IPP Procurement programme.

ALTERNATIVE LOCATION 1									
Project phase	Impact: Job creation								
	Activity/Aspect	Specific impact	Severity	Duration	Extent	Frequency	Probability	Significance	
								With Mitigation	Without Mitigation
Operation	Job creation	Job Creation	High +	High +	Medium-high +	High +	High +	N/A	High +
Operation	Local Community development	Local Community development	High +	High +	high +	High +	High +	N/A	High +

Mitigation measures

- During the construction and operational phases, jobs must be created for unemployed local people and skills must be transferred to them.
- Where viable, the work must be executed in a labour intensive manner to create as many jobs possible.

9.4. POTENTIALLY SIGNIFICANT IMPACTS

Impacts with a rating of Medium-high or High are impacts which are regarded as potentially significant, rated without any mitigation measures. In this impact assessment, the following impacts were regarded as potentially significant impacts:

i. Water pollution by the inadequate functioning of the sanitation system.
ii. Water consumption and depletion during construction phase.
iii. The occurrence of veldt fires.
iv. Damage / destruction of heritage sites

These impacts (i-iv) will now briefly be discussed.

9.4.1. Cumulative impacts

i. The effect of water pollution (surface and groundwater) by a malfunctioning of the sanitation system will have a cumulative effect only if it is not detected by a regular monitoring and if it takes place on a regular basis.
ii. This effect is cumulative only if care is not taken to conserve water and if water usage and the water levels of boreholes are not monitored regularly.
iii. This can have a cumulative effect if preventative measures are not followed.
iv. This can have a cumulative effect if preventative measures are not followed.

9.4.2. Nature of impact

i. This is pollution of a renewable resource.
ii. This is a negative impact that affects water quantity available for use in the area.
iii. Damage to property, ecology and safety of people.
iv. Damage/destruction to heritage sites.

9.4.3. Extent and duration of impact

i. The extent could potentially be within the farm of the proposed development and the surrounding farms.
ii. The extent could potentially be within the area of the proposed development and the surrounding farms. The duration is only during construction.
iii. The extent is potentially on the development area as well as surrounding properties and even regional. The duration is for the life of the development.
iv. The extent is only within the developed area.

9.4.4. Probability of occurrence

i. The probability is unlikely.
ii. The probability is possible.
iii. The probability is infrequent or seldom.
iv. The probability is possible.

9.4.5. Degree to which impact can be reversed

i. Impact is reversible if mitigated in time.
ii. This impact is reversible because the higher abstraction will only be during the construction period.
iii. If the development is not continuing there will be no guarantee that veldt fires will not occur on the property. This impact must therefore be managed accordingly.
iv. If negative impact has occurred and archaeological site destroyed the impact would be irreversable.

9.4.6. Degree to which impact can cause irreplaceable loss of resource

i. If this impact takes place over a very long time and there is gross negligence, the water resource can be damaged to a point where it will take very long to recover and where it could almost be seen as being irreplaceable.
ii. The recovery of the water resource is linked to rainfall and will recover accordingly. The negative impact is during the construction period.
iii. Veldt fires can create such damage that it will take a long time for the veldt to recover but the fact is that the vegetation has been subjected to veldt fires ever since. Loss of property (buildings) can be replaced.
iv. If this impact takes place over a very long time and there is gross negligence, the heritage sites can be damaged severely and is irreplaceable.

9.4.7. Degree to which impact can be mitigated

i. Successful mitigation is possible
ii. Successful mitigation is possible
iii. Successful mitigation is possible
iv. Successful mitigation is possible

10. DECOMMISSIONING PHASE

Decommissioning activities of the PV plant mainly include removal of project infrastructure and restoring of the site's *status quo ante*.

The decommissioning phase will start at the end of the PV power plant lifetime (25 - 30 years) and will last approximately 7 months, involving a team of 50 workers.

Decommission will be subject to a decommissioning plan once the project is nearing its operational life (25-30 years). Decommissioning will also be subject to an environmental authorization (Activity 27 of R544 of 18 June 2010).

10.1. SITE PREPARATION

In order to ensure a correct decommissioning of the site, the first step of the process will include adequate site preparation. Integrity of access points and of laydown areas will be confirmed and eventually re-established in order to accommodate equipment and to load vehicles.

10.2. DISASSEMBLE AND REPLACEMENT OF EXISTING COMPONENTS

All components will be disassembled. Silicon of the PV modules will be recycled, as well as mounting structures (aluminium or zinced steel frames and piles) and cables (copper and/or aluminium conductor).

Non-recyclable components of inverter, transformers and electrical devices will be disposed in appropriate way, in compliance with applicable laws and international standards.

10.3. RESTORATION OF THE SITE

Adequate measures will be undertaken in order to restore the site by re-planting of indigenous plant species.

10.4. ALTERNATIVE OPTION: UPGRADING THE SOLAR PARK

At the end of the PV power plant lifetime (25 ÷ 30 years), as alternative option to the decommissioning, it will be evaluated the feasibility of upgrading the solar park with the most appropriate technology/infrastructure available at that time.

11. CONCLUSIONS AND RECOMMENDATIONS

The Draft EIA Report describes the activities undertaken for the development of the Pulida Solar Park.

The purpose of this report is to provide the relevant authorities and interested and affected parties with sufficient information regarding the potential impacts of the development to render meaningful comments. Potential impacts were identified in consultation with I&AP's and technical specialists (where applicable) and were assessed using a matrix and by applying professional knowledge.

The potentially significant negative impacts that have been identified should be mitigated through the implementation of the mitigation measures highlighted in this report. It is submitted that the proposed mitigation measures, will effectively diminish the impacts to acceptable levels. Given the socio-economic imperatives of the development, the residual impacts are not of sufficient importance to thwart the development.

It is the professional opinion of AGES that the proposed development does not present any fatal flaws in terms of negative impacts to the environment and therefore will not have any significant detrimental impacts to render the project unfeasible.

It is proposed that the following conditions must be included in the Record of Decision if the project is authorised:

- The mitigation measures contained in this report must be implemented.
- The management and or mitigation measures contained in the Environmental Management Plan must be implemented.
- The responsibilities to obtain any further authorisations and/or licenses will rest on the proponent of the project, PRIOR to any activities on site.