Final EIA Report **14/12/16/3/3/2/627**

PROPOSED RENEWABLE ENERGY GENERATION PROJECT ON PORTION 2 OF THE FARM VLAKPAN No. 59, HOPETOWN RD, SIYANCUMA LOCAL MUNICIPALITY, PIXLEY KA SEME DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE

Short name: Vlakpan Solar Park

November 2014

Commissioned by: Danfir (Pty) Ltd
Document version 2.0 – Final

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Purpose with Passion

Proposed Renewable Energy Generation Project on Portion 2 of the Farm Vlakpan 59, Hopetown RD, Siyancuma Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province
Short name: Vlakpan Solar Park

November 2014

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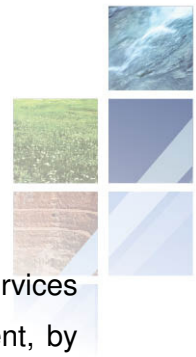

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DOCUMENT HISTORY

Report No	Date	Version	Status
14/12/16/3/3/2/627	November 2014	2.0	Final
14/12/16/3/3/2/627	September 2014	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	**VLAKPAN59, HOPETOWN RD**
Portion	**Portion 2**
Surveyor-general 21 digit site	C03300000000005900002
Local Municipality	Siyancuma
District Municipality	Pixley Ka Seme
Province	Northern Cape

Property details	
Extent	982.7512hectares
Land Owner	JACOBUS HORN
Diagram deed number	T13729/1937
Title deed number	T20076/1982
Registration date	19820607
Current land use	Farming

Site data (development area)	
Latitude	29° 25' 40" S
Longitude	23° 14' 50" E
Altitude	1055 m a.m.s.l.
Ground slope	flat

Adjacent farm portions	
Farm **Portion** Surveyor-general 21 digit site Land Owner Diagram deed number Title deed number Registration date Extent Current land use Motivation of affection	**VLAKPAN 59, HOPETOWN RD** **Remaining Extent** C03300000000005900000 JASPER JOHANNES JACOB VAN WYK HO QTS 6-19/8/1880 T19740/1965 19650802 978.84 ha Farming N/A (adjacent farm portion)
Farm **Portion** Surveyor-general 21 digit site Land Owner Diagram deed number Title deed number Registration date Extent Current land use Motivation of affection	**VLAKPAN 59, HOPETOWN RD** **4** C03300000000005900004 JASPER JOHANNES JACOB VAN WYK T13730/1937 T19740/1965 19650802 412.75 ha Farming N/A (adjacent farm portion)

Farm	**VLAKPAN 59, HOPETOWN RD**
Portion	**5**
Surveyor-general 21 digit site	C03300000000005900005
Land Owner	JACOBUS HORN
Diagram deed number	T9866/1940
Title deed number	T20076/1982
Registration date	19820607
Extent	984.78 ha
Current land use	Farming
Motivation of affection	N/A (adjacent farm portion)
Farm	**GREEFS PAN 58, HOPETOWN RD**
Portion	**Remaining Extent**
Surveyor-general 21 digit site	C03300000000005800000
Land Owner	J A WIID FAMILIE TRUST
Diagram deed number	HTQ9-13/1885
Title deed number	T89416/2003
Registration date	20030926
Current land use	Farming
Motivation of affection	N/A (adjacent farm portion)
Farm	**KALK KRANS 41 (Slypsteen), HOPETOWN RD**
Portion	**3**
Surveyor-general 21 digit site	C03300000000004100003
Land Owner	HENRIK VAN DER MERWE LE ROUX
Diagram deed number	T4562/1899
Title deed number	T22875/1988
Registration date	19880502
Extent	1304.78 ha
Current land use	Farming
Motivation of affection	N/A (adjacent farm portion)
Farm	**KALK KRANS 41 (Slypsteen), HOPETOWN RD**
Portion	**4**
Surveyor-general 21 digit site	C03300000000004100004
Land Owner	HENRIK VAN DER MERWE LE ROUX
Diagram deed number	T6824/1900
Title deed number	T22875/1988
Registration date	19880502
Extent	743.06 ha
Current land use	Farming
Motivation of affection	N/A (adjacent farm portion)

PV power plant design specifications and connection to the Eskom grid

Project data	
Project name	**VLAKPAN 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)(*)	up to 160GWh/year with fixed mounting system up to 190GWh/year with trackers
Load factor (*)	0.223 with fixed mounting system 0.251 with trackers
Full net equivalent hours (EOH) (*)	1950h/year (Wh/Wp/y) with fixed mounting systems 2200 h/year (Wh/Wp/y) with trackers
(*) calculated by PVSYST, simulation professional tool	

Technical specifications	
Maximum generation capacity	**up to 75 MW**
Installed power capacity - AC side	**up to 77 MW**
Installed power capacity - DC side	**up to 86.25 MWp**
Number of PV modules	up to 638,400 thin film modules of 135 Wp up to 288,000 mono/polycrystalline modules of 300 Wp
Number of structures (PV arrays)	up to 24,570 fixed structures up to 15,1301-axis horizontal trackers (SAT)
Minimum structure height above ground level	0.7 m
Maximum structure height above ground level	3.1 m

Other information	
Footprint, including internal roads (fenced area)	up to 210 ha
PV power plant lifetime	25 - 30 years
Construction camp (temporary)	10 ha
Construction timeframe	approximately15 months

Connection to the Eskom grid (**)	
Preferred connection solution: description	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 substation with high-voltage power transformers, stepping up the voltage to the voltage of the Eskom's grid, a control building and one busbar with metering and protection devices (also called "switching station"); (ii) two new small sections of high-voltage power line allowing either the **Eskom "Greefspan - Mooidraai" 132 kV power line**- crossing the project site - to loop in and out of the 132 kV busbar of the new on-site loop-in loop-out substation. The connection solution may also entail intervention on the Eskom's grid.

Point of connection (preferred)	Eskom "Greefspan - Mooidraai"132 kV power line
Point of connection (farm, portion)	Portion 2 of the Farm Vlakpan 59 (on-site)
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 paragraph 4.2.5 - water requirements

Site maps and GIS information

Status quo information	***ESRI shapefiles***
Site	Portion 2 of Vlakpan 59
Building and other structures	Boreholes, quarries
Agricultural field	Not applicable
Natural and endangered vegetation areas	Vegetation and Sensitivity map
Cultural historical sites and elements	Site AGES-VP59-SA01, Site AGES-VP59-SA02, Site AGES-VP59-SA03, Site AGES-VP59-SA04, Vlakpan October 2014 Heritage_Areas, Vlakpan October 2014 Heritage_points
High potential agricultural areas	Not applicable
Existing Eskom infrastructure	Eskom Greefspan-Mooidraai 132kV power line
Cadastrals	Cadastrals
Existing roads	existing roads
Railway lines and stations	Not applicable
Industrial areas	Not applicable
Harbours and airports	Not applicable
Critical Biodiversity Areas and Ecological Support Areas	Not applicable
Other solar projects (cumulative impact)	11 MW Greefspan PV

Development proposal maps	***ESRI shapefiles***
Development Area	Fenced area (footprint)
Position of solar facilities	PV arrays
Permanent laydown area footprint	Fenced area (footprint)
Construction period laydown footprint	Construction site
Access road and internal roads	Access road, Internal roads
River, stream, water crossing	Not applicable
Substation and transformers	On-site HV substation
Connection routes	On-site LILO 132kV lines
Buildings	MV stations, On-site HV substation, control building, warehouses

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- VKSP_03_r0 Mounting System – Alternative option 1: fixed mounting systems
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- VKSP_05_r0 Medium-voltage stations
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- VKSP_08_r0 Warehouse

Annexure B Photos of the project site

Annexure C Public Participation Process

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ABBREVIATIONS AND ACRONYMS

AGES	Africa Geo-Environmental and Engineering Consultants Limpopo (Pty) Ltd
BID	Background Information Document
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CSP	Concentrating Solar Power
Danfir	Danfir (Pty) Ltd (applicant)
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DENC	Northern Cape Department of Environment and Nature Conservation
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
NCNCA	Northern Cape Nature Conservation Act - Act No. 9 of 2009
NFA	National Forest Act - Act No.84 of 1998
NWA	National Water Act - Act no. 36 of 1998
PoS	Plan of Study
Property	Portion 2 of the Farm Vlakpan59, Hopetown RD
Project company	Danfir(Pty) Ltd (applicant)
Project site	Portion 2 of the Farm Vlakpan59, HopetownRD
PV	Photovoltaic
RE	Renewable Energy
REFIT	Renewable Energy Feed-in Tariffs
RFP	Request for Qualification and Proposals for New Generation Capacity under the REIPP 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

Danfir (Pty) Ltd (Reg. No. 2012/016337/07) 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 **Portion 2 of Farm Vlakpan 59, Hopetown RD (Siyancuma Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province),** located 56 km North-East of Prieska and 64 km South-West of Douglas. The property is crossed by the regional road R357 between Prieska and Douglas.

Site location: Portion 2 of the Farm Vlakpan 59, Hopetown RD
Surveyor-general 21 digit site code:

C	**0**	**3**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**9**	**0**	**0**	**0**	**0**	**2**

The name of the project is **VLAKPAN SOLAR PARK** and it envisages a **photovoltaic (PV) power plant having a maximum generating capacity of 75 MW**.

Access to the **Vlakpan Solar Park** will be from the **regional road R357**, which crosses the south-eastern boundary of the property. A new access road, 410 m long and 8 m wide, will link the R357 with the development area.

The **footprint** (fenced area) of the proposed development is **up to 210 ha,** to be located on the south-western side of Portion 2 of Farm Vlakpan 59 (*preferred location Final EIA*).

The preferred development area proposed in this Final EIA was moved in order to avoid the high-density heritage site which occurs in the middle of the property. This area was found by the Heritage Specialist during a new site visit conducted in October 2014 and was partially affected by the preferred development area proposed in the Draft EIA. In this Final EIA, the preferred development area was reconsidered in order to exclude the heritage area.

As *alternative location* (not preferred), the proposed solar park may be developed on the south-eastern side of Portion 2 of Farm Vlakpan 59 (982.7 ha in extent), between the Eskom "Greefspan - Mooidraai" power line and the regional road R357. This location was proposed during the Scoping Phase, but following the outcomes of the Heritage Impact Assessment it's not envisaged anymore due to the presence of several heritage sites which would be affected by development on this area.

The new preferred location was finalised following the concerns of the landowner of the farm Greefs Pan 58, in order to reduce / minimize any potential visual impact arising from the solar park in respect of the Farm Greefs Pan 58, adjacent to the northern boundary of the property. The minimum distance of the new development area to such farm is now 1.52 km, so that the existing vegetation will be able to screen to some extent the solar park from the Farm Greefs Pan 58. This has been confirmed by the Architect in the Addendum A of the Visual Impact Assessment (Annexure J).

Vlakpan Solar Park will deliver electrical energy to the **Eskom "Greefspan - Mooidraai" 132 kV power line**, running through the project site. The Eskom 132 kV power line will loop in and out of the 132 kV busbar of the new on-site substation, via two new sections of 132 kV line approximately 100 m long.

The Vlakpan Solar Park will participate to the Renewable Energy IPP Procurement Programme (REIPPPP) issued on 3 August 2011 by the Department of Energy.

In order to develop the facility, Danfir must undertake an Environmental Impact Assessment (EIA) process and acquire environmental authorization from the National Department of Environmental Affairs (DEA), in consultation with the *Northern Cape Department of*

Environment and Nature Conservation, 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 14/12/16/3/3/2/627.**

The EIA procedure of the Vlakpan Solar Park includes the connection to the Eskom grid. Eskom is the entity which assesses 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 Limpopo (Pty) Ltd.**

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 Danfir; 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 Vlakpan Solar Park is defined and evaluated in this EIA Report and its annexures.

2. MOTIVATION AND RATIONALE OF THE VLAKPAN SOLAR PARK IN LIGHT OF THE REIPP PROCURMENT PROGRAMME REQUIREMENTS

2.1. THE CHOICE OF THE NORTHERN CAPE PROVINCE AND OF THE SITE LOCATION

The Vlakpan Solar Park will be located in the Northern Cape Province. The Northern Cape Province has been identified by Danfir (Pty) Ltd 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 2,132kWh/m^2/year;
- there are several green projects currently under development in the Northern Cape, 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;
- The Northern Cape Province, Local Municipalities and Communities are eager to continue establishing an eco-green image in consideration of the burden of CO_2 emissions they have to bear.

The proposed Vlakpan Solar Park is situated within the **Siyancuma Local Municipality**. The project site is situated between Prieska and Douglas along the main corridor known as Road R357 in the Pixley Ka Seme District Municipality in the Northern Cape Province. Douglas is the main urban node in the Siyancuma Local Municipality and the town is situated near the confluence of the Orange and Vaal Rivers. The Siyancuma Local Municipality does not have a formal Spatial Development Framework. However in the Local Economic Development Objectives, the Vision Statement of the Siyancuma Local Municipality is drafted as "*a sustainable and growing local economy that aims to create employment opportunities for local communities, while working towards providing a high quality of life for all*." This can be achieved through education and skills development and diversification of the local economy. The Integrated Development Plan of the Municipality also emphasises the increase of employment opportunities. Employment creation is considered to be the most important criterion for development project prioritisation. There is no specific reference to renewable energy or to solar electricity generation in the LED strategy, despite the clear expression of this priority in the Provincial Growth and Development Strategy.

The introduction of a renewable energy project will directly contribute towards these goals: it will be a new industry to the area and will require special skills during the construction and operation phases. The facility will create a multiplier effect as far as job creation, skills upgrading and local empowerment and upliftment is concerned. The Solar Park will therefore stimulate the local (and regional) economy. Various other secondary trades will benefit from the proposed facility. These will include security service providers, local suppliers of building material, steel, cement, etc.

The addition of the Vlakpan Solar Park to this area will thus contribute towards the provision of employment opportunities to the area and thus boost the local economic growth of the wider area, thereby meeting the LED Vision Statement of the Siyancuma Municipality.
In view of the above it is clear that the proposed Vlakpan Solar Park will comply with the general spatial development and local economic development goals of the Siyancuma Local Municipality.

In addition to these very favourable characters in terms of desirability of renewable solar energy projects in the Northern Cape Province within the Siyancuma Local Municipality, the site of the Vlakpan Solar Park has been chosen by Danfir on the grounds of several considerations, in particular:

- The availability of an easy connection solution, due to the presence of the **Eskom "Greefspan - Mooidraai" 132 kV power line**, which crosses the project site;
- the flatness of the proposed project site;
- the low ecological sensitivity and agricultural value of the proposed development area.

In the light of the IPP procurement Programme requirements, the **Vlakpan 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 maximum 15 months and the PV plant will be able to begin commercial operation before the end of 2020.

With specific reference to Vlakpan Solar Park, Eskom has indicated that the projects does not interfere with Eskom's present and future developments and do not affect negatively 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 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 REIPP 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 2020.

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 Vlakpan 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 Northern Cape Province.

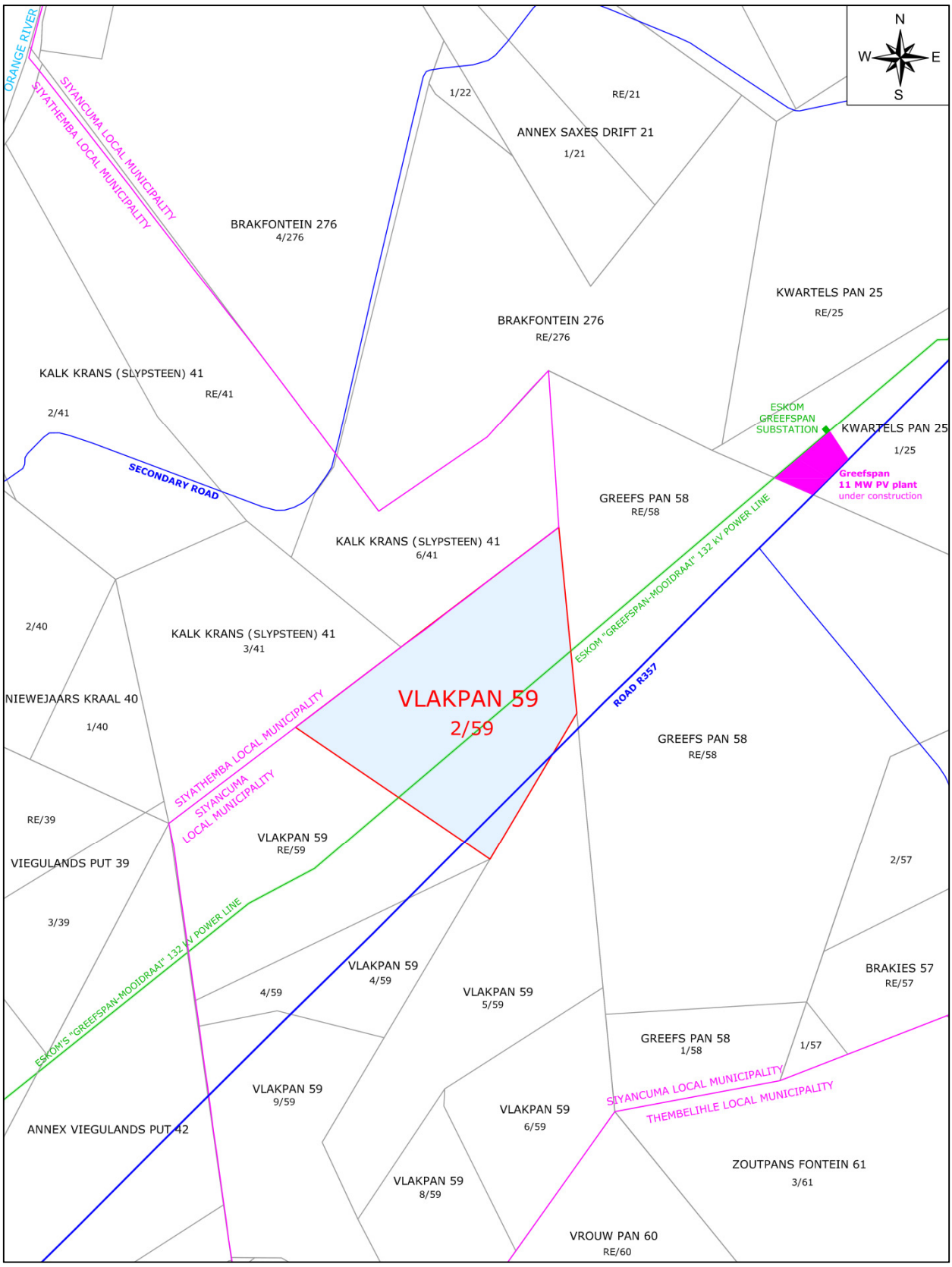
The use of solar radiation for power generation is considered as a non-consumptive use and a renewable natural resource which does not produce greenhouse gas emissions.

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 can be synthesized 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: Locality map of the project site



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 *Northern Cape Department of Environment and Nature Conservation;* 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. The project should comply with the *Northern Cape Nature Conservation Act* (Act No. 9 of 2009).

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 Northern Cape 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 *Siyancuma,* which is part of the *Pixley Ka Seme 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.

The proposed Vlakpan Solar Park is situated within the Siyancuma Local Municipality. The project site is situated between Prieska and Douglas along the main corridor known as Road R357 in the Pixley Ka Seme District Municipality in the Northern Cape Province.

Douglas is the main urban node in the Siyancuma Local Municipality and the town is situated near the confluence of the Orange and Vaal Rivers. The Siyancuma Local Municipality does not have a formal Spatial Development Framework. However in the Local Economic Development Objectives, the Vision Statement of the Siyancuma Local Municipality is drafted as "*a sustainable and growing local economy that aims to create employment opportunities for local communities, while working towards providing a high quality of life for all*." This can be achieved through education and skills development and diversification of the local economy. The Integrated Development Plan of the Municipality also emphasises the increase of employment opportunities.

The most significant land use in the municipal area is agriculture. The bulk of the agricultural production value in Siyancuma Local Municipality is derived from irrigation along the Orange and Vaal Rivers. The rest of the area is mostly low to moderate potential grazing land.

Some mining activities in Siyancuma include alluvial diamond mining along the Orange and Vaal Rivers. Various semi-precious stones, such as tiger-eye, are also produced in the region. The four pillars stimulating growth and development within the Siyancuma economy are:

- Agriculture and agro-processing,
- Small, medium and micro enterprise support,
- Tourism development and
- Mineral beneficiation.

Employment creation is considered to be the most important criterion for project development prioritisation. There is no specific reference to renewable energy or to solar electricity generation in the LED strategy, despite the clear expression of this priority in the Provincial Growth and Development Strategy. There are also no specific spatial or land development proposals for this area in the policy documents of the Siyancuma Local Municipality.

It can be accepted that renewable energy as a land use is fairly new to spatial development and land use schemes. Nevertheless with reference to the goals of skills development and diversification of the local economy, the introduction of a renewable energy project will directly contribute towards these goals. It will be a new industry to the area and will require special skills during the construction and operation phases. The facility will create a multiplier effect as far as job creation, skills upgrading and local empowerment and upliftment is concerned. The Solar Park will therefore stimulate the local (and regional) economy. Various other secondary trades will benefit from the proposed facility. These will include security service providers, local suppliers of building material, steel, cement, etc.

The addition of the Vlakpan Solar Park to this area will thus contribute towards the provision of employment opportunities to the area and thus boost the local economic growth of the wider area, thereby meeting the LED Vision Statement of the Siyancuma Municipality.

The location of the proposed Vlakpan Solar Park will furthermore harmonise very well with the location of other intra-municipal links that is important to the Siyancuma and Siyathemba Municipalities. The Road R357 links Douglas with Prieska forming a main corridor between these two towns. The location of the Vlakpan Solar Park along this corridor will strengthen this link along with the existing Eskom “Greefspan-Mooidraai” 132kV power line that runs through the Vlakpan Solar Park site parallel to the R357. The development of the proposed Vlakpan Solar Park will therefore add a further infrastructure component to the area, i.e. that of energy generation by means of a photovoltaic power plant and reinforce the infrastructure links between the two Municipalities.

In view of the above it is clear that the proposed Vlakpan Solar Park will comply with the general spatial development and local economic development goals of the Siyancuma Local Municipality.

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 conservation and care of cemeteries and graves by SAHRA, where 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 list of: critical endangered species, endangered species, vulnerable species and protected species (S56(1) - 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
Northern Cape Nature Conservation Act (Act No. 9 of 2009)	• Indigenous flora protected under this act • No hunting to take place without a permit
Occupational Health and Safety Act (Act No. 85 of 1993)	• Health and safety of all involved before and after construction must be protected.

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)	• White Paper outlines the Government's vision, policy, principles, strategic goals and objectives for e 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 REIPP Procurement Programme, 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 2020**.
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 potentially involved in the proposed development

Relevant notice	Activity No.	Description
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 proposed Vlakpan Solar Park will be established **on Portion 2 of the Farm Vlakpan 59, Hopetown RD**, measuring 982.7 ha in extent, located in the Siyancuma, Pixley Ka Seme District Municipality, Northern Cape Province. The project will consist of construction, operation and maintenance of a Photovoltaic (PV) Power Plant with a generation capacity of up to 75 MW.
R.545, 18 June 2010	**15**	***Physical alteration of undeveloped, vacant or derelict land for industrial use where the total area to be transformed is 20 hectares or more*** The Photovoltaic Power Plant with associated infrastructure and structures will be constructed and operated on a footprint up to 210 ha on a portion measuring 983 ha. The project will be established on undeveloped land and the proposed activity is regarded as "industrial".
R.544, 18 June 2010	**10**	***The construction of facilities or infrastructure for the transmission and distribution of electricity:*** ***(i) Outside urban areas or industrial complexes with a capacity of more than 33 kilovolts but less than 275 kilovolts.*** The project will be established outside urban areas. The connection to the Eskom grid will be done according to the Eskom connection solution, which requires: (i) one small on-site high voltage loop-in loop-out substation with one or more high-voltage power transformer(s) stepping up the voltage to the voltage of the Eskom grid (132 kV), a 132 kV busbar with protection an metering devices ("switching station") and a control building; (ii) two new small sections of 132 kV power line allowing the **Eskom "Greefspan - Mooidraai" 132 kV power line** - crossing the project site - to loop in and out of the 132 kV busbar of the new on-site loop-in loop-out substation. The connection may also entail interventions on the Eskom grid according to Eskom's connection requirements/solution.
R.544, 18 June 2010	**22**	***The construction of a road, outside urban areas,*** ***(i) with a reserve wider than 13,5 metres***

		The new access road from R357 will be 8.0 m wide. During the construction phase, the road reserve may be wider than 13.5 meters in order to allow the transportation of abnormal loads. Internal roads will be maximum 8 m wide with a road reserve maximum 12.0 m wide. At the turning points / intersection points the road reserve may be wider than 13.5 m due to the shape of the intersection / turning points.
R.546, 18 June 2010	**14**	***The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation,*** ***a) In Northern Cape*** ***(i) all areas outside urban areas.*** The Photovoltaic Power Plant with associated infrastructure and structures will be constructed and operated on a footprint up to 210 hectares which will be cleared from indigenous vegetation. The project will be established outside urban areas.

The footprint of the proposed development will be located on the south-western side of the property, OUTSIDE any drainage / pan / wetland or undevelopable areas indicated in the Ecological Impact Assessment (Annexure D) and Geo-technical and geo-hydrological Study (Annexure I).

A salt pan (endorheic depression) occurs close to the western boundary of the proposed footprint, at a minimum distance of 900 m from the proposed footprint.

No material will be taken from the salt pan and also, no material will be imported into the salt pan, therefore the structure and characteristics of the salt pan will not be changed and or altered. No infilling or depositing of any material or the dredging, excavation, removal or moving of soil will take place in the salt pan considering that the construction activities will be restricted to the proposed PV plant fenced area / footprint. Therefore, **activities 11 and 18 of GN R544 are NOT APPLICABLE**.

The current EIA procedure of the Vlakpan 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 drafted by Danfir (enclosed as Annexure A) have been finalised and all information acquired were analysed in order to determine the proposed final development layout and site plan. Such approach ensures 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 Local and District Municipal 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 of up to 75 MW.**

The construction timeframe is estimated at approximately 15 months, whereas the commissioning date will depend on the REIPP Procurement Programme timeframe.

The preferred technical solutions envisage:

- **thin-film PV modules or mono/polycrystalline PV modules,**
- **fixed mounting systems** or **horizontal 1-axis trackers.**

The estimated annual energy production is calculated in approximately:

- **1950 kWh/kWp/year** (load factor = 0.223), in the case of PV modules mounted on fixed mounting systems; or
- **2,200 kWh/kWp/year** (load factor = 0.251) in the case of PV modules mounted on trackers.

Therefore, the Vlakpan Solar Park will generate:

- **160.1GWh per year** in the case of PV modules mounted on fixed mounting systems; or
- **190.1GWh per year** in the case of PV 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 2.132 kWh/m^2/year (NASA-SSE satellite data, 1983-1993, release 6).

The energy generated by the Vlakpan 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 Vlakpan Solar Park.

The quantity of the avoided CO_2 is calculated as follows: the energy produced by the Vlakpan Solar Park (up to 160.1 GWh/y or 190.1GWh/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 Vlakpan Solar Park, the **avoided CO_2 emissions** are approximately **192,931 tons of CO_2 per year** in the case of PV modules mounted on trackers, or **162,564 tons of CO_2 per year** in the case of PV modules mounted on fixed mounting systems. 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 Vlakpan Solar Park will be approximately 51,373 tons of coal / year** in the case of PV modules mounted on trackers, or **43,287 tons of coal / year** in the case of PV modules mounted on fixed mounting systems.

A detailed description of the characteristic and functioning of the PV 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 specialists studies conducted during the scoping phase. The PV plant is designed and conceived in order to minimize 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 proposed layout are:

- to maximize the energy production and the reliability of the PV plant, by choosing proven solar technologies: thin-film or mono/polycrystalline solar modules mounted on 1-axis horizontal trackers or on fixed mounting systems;
- to develop the PV power plant on the southern side of the property, because this area is flat and has a *medium* ecological sensitivity,
- to avoid the northern side of the property, because of the presence of a salt pan;
- to avoid the high-density heritage site area which occurs in the middle of the property;
- furthermore, a minimum distance of 100 m will be kept between the southern and western boundary of the property and the planned development area (PV plant footprint / fenced area), so that the existing vegetation will be able to screen the solar park to some extent from the adjacent properties.

The **footprint** (fenced area) of the proposed development is **up to 210 ha,** to be located on the south-western side of Portion 2 of Farm Vlakpan 59 (*preferred location Final EIA*).

The preferred development area proposed in this Final EIA was drawn in order to avoid the high-density heritage site area which occurs in the middle of the property. This area was found by the Heritage Specialist during another site visit conducted in October 0214 and was partially affected by the preferred development area proposed in the Draft EIA. In this Final EIA, the preferred development area has been revised in order to exclude such heritage area.

As **alternative location (not preferred)**, the proposed solar park may be developed on the south-eastern side of the property, between the Eskom "Greefspan - Mooidraai" power line and the regional road R357.This alternative location, proposed as "preferred" during the scoping phase, has been assessed as "not preferred" in this EIA phase, due to the presence of several heritage sites affecting this development area, and due to the concerns received by the landowner of the Farm Greefs Pan 58 about potential visual impacts.
The new preferred development area is further (minimum distance: 1.52 km) from the Farm Greefs Pan 58 than the previous proposed development area, therefore the potential visual impact of the proposed solar park to the Farm Greefs Pan 58 can be mitigated to some extent by the existing vegetation, as indicated in the Visual Impact Assessment (Annexure J). This has been confirmed by the Landscape Architect in the Addendum A of the Visual Impact Assessment (Annexure J).

The preferred development area of this Final EIA is depicted in the drawing of the Annexure A:

- VLSP_00_r4 *Locality Map and Development Area (Preferred Location Final EIA)*

The preferred and alternative locations proposed in the Draft EIA are shown in the drawing of the Annexure A:

- VKSP_00_r3 *Locality Map and Development Area (preferred and alternative locations Draft EIA)*

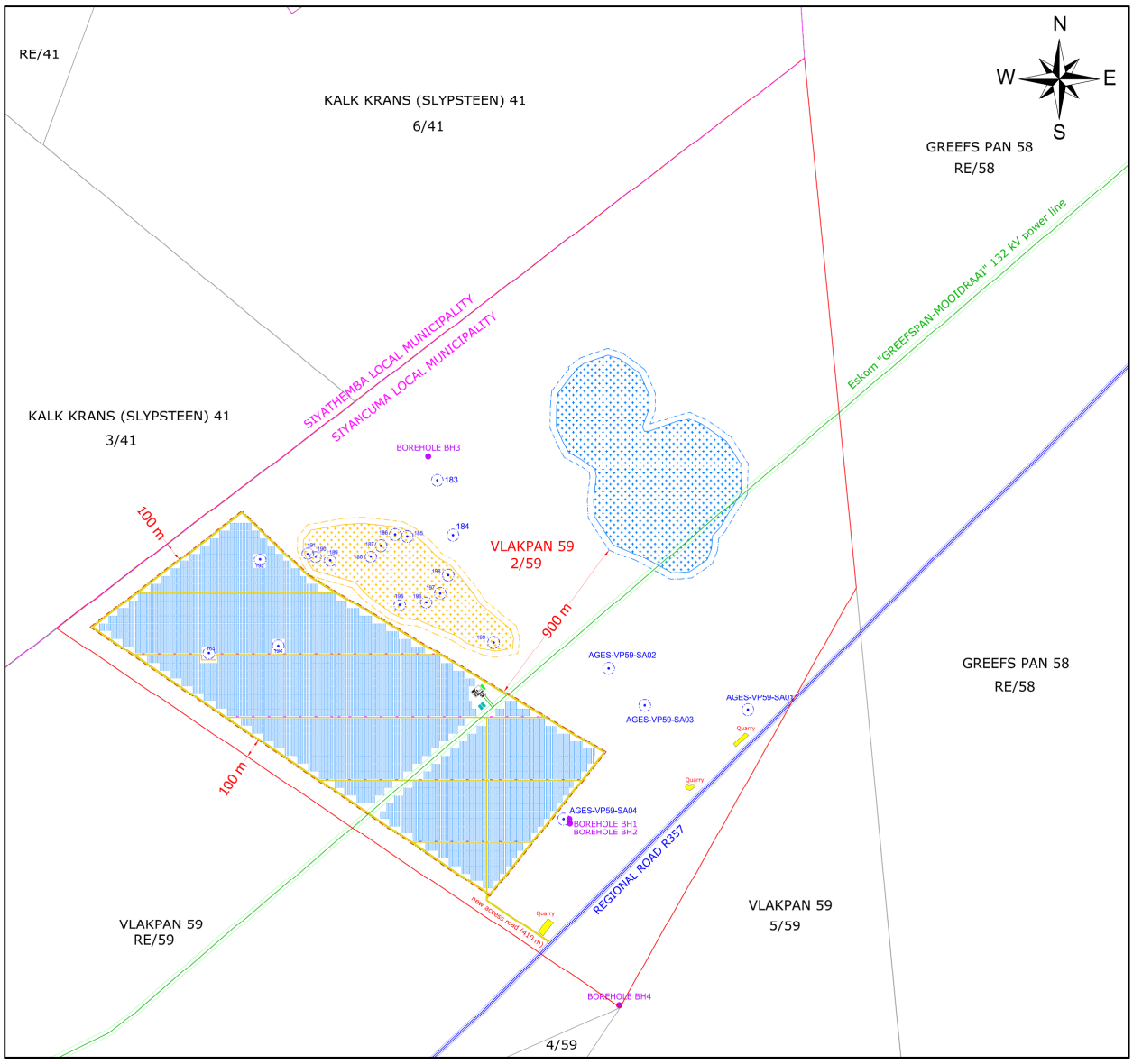
The proposed layout plan (attached as Annexure A and also shown in Figure 2 below) was drawn using PV modules mounted on trackers; in the case of PV modules mounted on fixed mounting systems, the layout plans do not change, except for the orientation of the PV arrays: east-west instead of north-south.

The required **footprint** - corresponding on the fenced area - **will not exceed 210 ha**, and the maximum height of the structures (PV modules and support frames) will be approximately 3.1 m above the ground level.

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

- VKSP_01_r3 Layout plan - PV power plant up to 75 MW
- VKSP_03_r0 Mounting System – Alternative option 1: fixed mounting systems
- VKSP_04_r0 Mounting System – Alternative option 2: horizontal single-axis trackers
- VKSP_05_r0 Medium-voltage stations
- VKSP_06_r0 Control building and medium-voltage receiving station
- VKSP_07_r0 High-voltage loop-in loop-out substation
- VKSP_08_r0 Warehouse

Figure 2: Proposed Layout plan of the Vlakpan Solar Park (Final EIA)



Footprint (fenced area): up to 210 ha

PV arrays

High-voltage substation
2 x 40 MVA power transformers

Medium voltage receiving station
and control building

Medium voltage stations

Warehouses

Internal roads

Eskom "GREEFSPAN-MOOIDRAAI" 132 kV power line and registered servitude

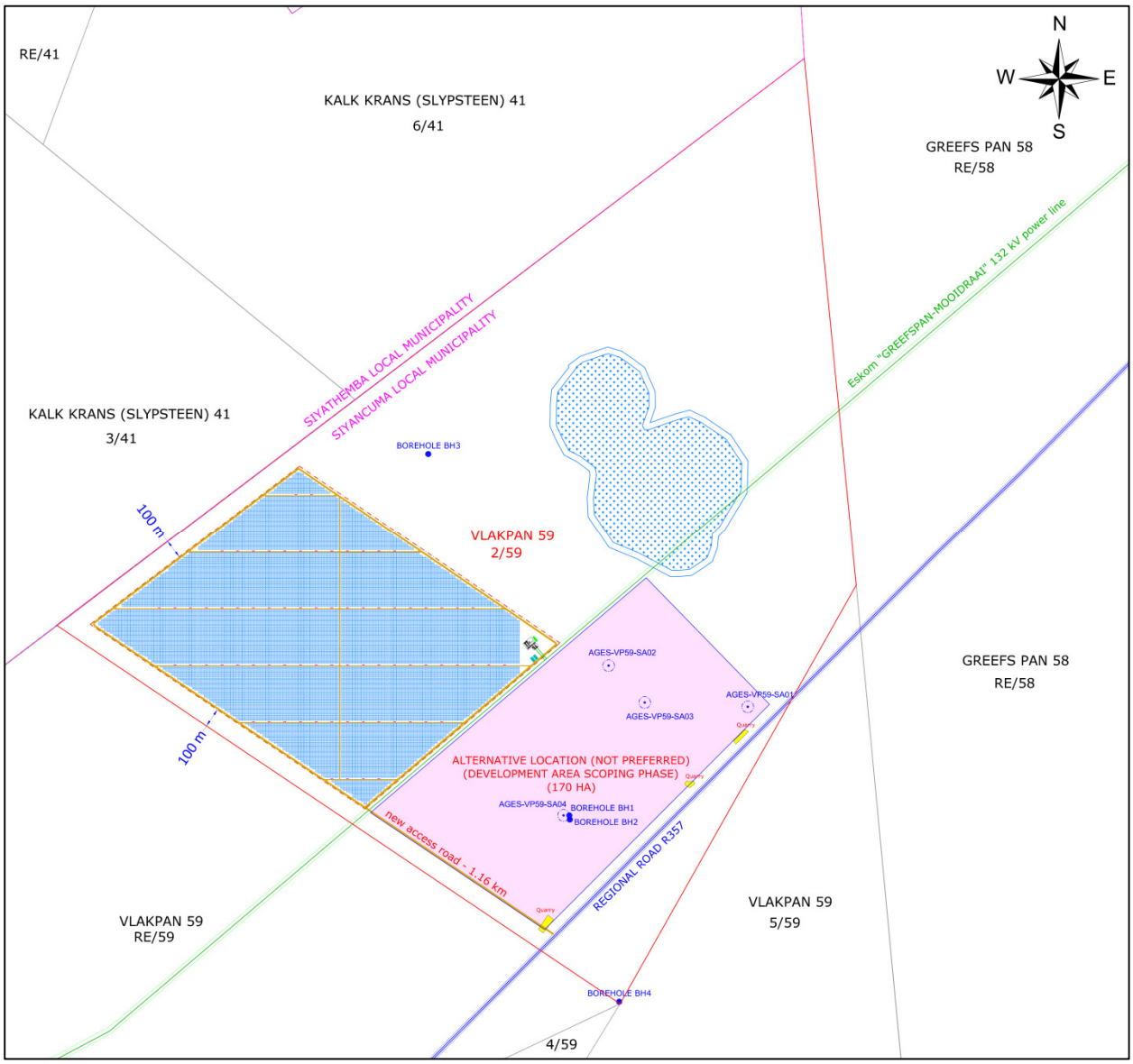
Salt pan (endorheic depression) and 32 m buffer

Boreholes

Heritage sites and 30 m buffer

High density heritage site area and 30 m buffer

Figure 3: Proposed Layout plan of the Vlakpan Solar Park in the Draft EIA (preferred and alternative locations)



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 (mono-crystalline, polycrystalline or thin-film solar modules)
- Mounting systems (fixed or single-axis horizontal trackers) for the PV arrays and related foundations
- Internal cabling and string boxes
- Medium voltage stations, hosting DC/AC inverters and LV/MV power transformers
- Medium voltage receiving station(s)
- Workshop & warehouses
- 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 132 kV line** allowing the **Eskom "Greefspan - Mooidraai" 132 kV power line** - crossing the project site - to loop in and out of the 132 kV busbar of the new on-site switching station
- Electrical system and UPS (Uninterruptible Power Supply) devices
- 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
- Sewerage system (*Ballam Waterslot* or *Lilliput* system).

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:

- water access point and water extraction on-site borehole(s) point, water supply pipelines, water treatment facilities;
- pre-fabricated buildings;

to be removed at the end of construction.

Table 3: Project components

Component	Description/ Dimensions
Property / Project site	**Portion No. 2 of the Farm Vlakpan No. 59, Hopetown RD** Siyancuma Local Municipality Pixley Ka Seme District Municipality Northern Cape Province LPI code: C03300000000005900002 Latitude 29° 25' 40" S Longitude 23° 14' 50" E
PV plant footprint	**PV plant footprint (fenced area): up to 210 ha on the western side of the property** Geo-graphical coordinates of the footprint / security fence: P01 29° 25' 10.4" S, 23° 14' 31.3" E P02 29° 25' 21.2" S, 23° 14' 44.0" E P03 29° 25' 51.2" S, 23° 15' 39.9" E P04 29° 26' 14.8" S, 23° 15' 17.4" E P05 29° 25' 29.2" S, 23° 14' 02.2" E
Site access	Access point from R357: 29° 26' 22.6" S, 23° 15' 28.4" E Gate at the PV plant fence: 29° 26' 14.6" S, 23° 15' 17.1" E 410 m long / 8.0 m wide
Generation capacity	up to 75 MW

Proposed technology	The preferred technical solutions are: **PV solar modules**: thin-film modules or monocrystalline or polycrystalline modules **Mounting systems:** fixed mounting systems or single-axis horizontal trackers (SAT)
Panel Dimensions	It depends on the technical solutions and electrical configuration. In any case the minimum and maximum height above the ground level will not exceed the values indicated at the item below.
Height of PV module supporting structures from ground level	maximum height (highest point of the PV arrays): 3.1 m above the ground level minimum height (lowest point of the PV arrays): 0.7 m above the ground level
Width and length of internal roads	The main internal road around the security fence is max. 8.0 m wide and approximately 6.6 km long. **Main Internal Road around the security fence** FIR01: 29°25'10.8" S, 23°14'31.4" E FIR02: 29°25'21.3" S, 23°14'43.9" E FIR03: 29°25'51.3" S, 23°15'39.4" E FIR04: 29°26'14.6" S, 23°15'17.3" E FIR05: 29°25'29.2" S, 23°14'02.8" E Secondary internal roads are 4.0 m wide (max. 5.0 m wide) and max. 8.0 km long **Internal Roads** East to West IR1: 29°25'24.1" S, 23°14' 48.4" E / IR1: 29°25'23.6" S, 23°14' 11.6" E IR2: 29°25'34.7" S, 23°15' 08.3" E / IR2: 29°25'34.0" S, 23°14' 10.7" E IR3: 29°25'45.3" S, 23°15' 28.1" E / IR3: 29°25'44.6" S, 23°14' 28.3" E IR4: 29°25'55.8" S, 23°15' 35.0" E / IR4: 29°25'55.1" S, 23°14' 45.7" E IR5: 29°26'06.0" S, 23°15' 25.3" E / IR5: 29°26'05.7" S, 23°15' 03.1" E North to South IR1: 29°25'24.3" S, 23°14' 48.9" E / IR1: 29°25'56.8" S, 23°14'48.3" E IR2: 29°25'45.3" S, 23°15' 17.3" E / IR2: 29°26'14.0" S, 23°15'16.8" E
Height of Fencing	security fence around the footprint: maximum height: 3.0 meters above the ground level
New on-site high-voltage substation	**On-site high-voltage loop-in loop-out substation - within the fenced area** Substation Fence: 70 m x 70 m Substation Footprint: 0.4 ha Latitude 29° 25' 41.0" S Longitude 23° 15' 15.9" E
Loop-in loop-out lines	**Two new sections of 132 kV power line for the connection to the Eskom "Greefspan - Mooidraai" 132 kV power line** Length: max. 100 m each Loop-in line starting point: 29° 25' 41.5" S, 23° 15' 17.0" E Loop-in line ending point: 29° 25' 43.4" S, 23° 15' 18.7" E Loop-out line starting point: 29° 25' 41.7" S, 23° 15' 16.7" E Loop-out line ending point: 29° 25' 43.6" S, 23° 15' 18.4" E

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 transformer(s) stepping up the voltage to the voltage of the Eskom grid (132 kV), a 132 kV busbar with protection an metering devices ("switching station") and a control building;

(ii) two new small sections of 132 kV power line allowing the Eskom "Greefspan - Mooidraai" 132 kV power - crossing the project site - to loop in and out of the 132 kV busbar of the new on-site loop-in loop-out substation

The connection solution may also entail intervention on the Eskom's grid.

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 or mono / polycrystalline modules, mounted on:
- fixed mounting systems or 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.

The required footprint - corresponding with the fenced area - will not exceed 210 ha, and the maximum height of the structures (PV modules and support frames) will be approximately 3.1 m above the ground level. For further reference please refer to section 5.2.

The following description is referred to the examples of "thin-film PV modules on fixed mounting systems" and of "polycrystalline modules on trackers", but the combinations "thin-film PV modules on trackers" and "polycrystalline PV modules on fixed mounting systems" are also possible and feasible.

The required **footprint** (including internal roads) will not exceed **210 ha.**

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 PV modules mounted on fixed mounting systems:

Each mounting frame will host several PV modules along two or more parallel rows consisting of PV modules placed side by side, with the position of the PV arrays northwards and at an optimized tilt. The rows are mounted one on top of the other, with an overall mounting structure height **up to 3.1 meters above ground level**.

Figure 4: Lateral views of PV arrays mounted on fixed mounting systems

Figure 5: Frontal view of PV arrays mounted on fixed mounting systems

For further details, Please refer to the Figures 4 and 5 above and to the drawing of the Annexure A:

- VKSP_03_r0 *Mounting System – Alternative option 1: fixed mounting systems*

B) In the case of PV modules mounted on trackers:

Each PV array is composed of several PV modules disposed along one or more parallel rows consisting of PV modules placed side by side.
Each tracker is composed by several PV arrays North-South oriented and linked by a 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.

The maximum mounting structure height will be **up to 3.1 meters above ground level**.

Figure 6: Simulation views of the PV arrays mounted on 1-axis horizontal tracker

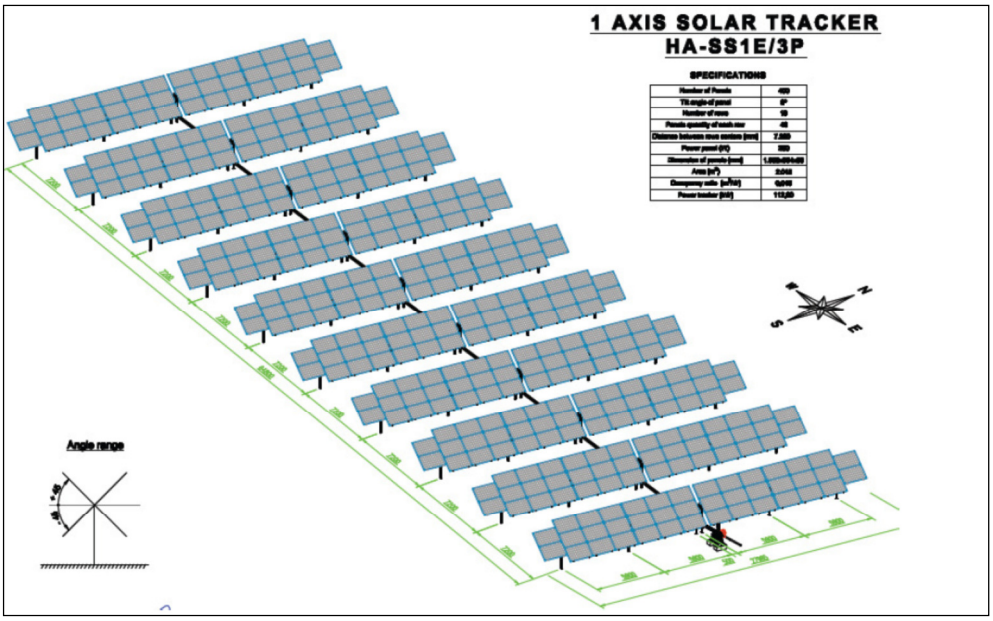


Figure 7: Frontal views of the PV arrays mounted on 1-axis horizontal tracker

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

- VKSP_04_r0 *Mounting System – Alternative option 2: single-axis horizontal trackers*

C) In both cases:

PV modules are series-connected outlining PV strings made of several modules, so that the PV string voltage fits into the voltage range of the inverters. PV strings are set up in order to be connected to DC-connection boxes. Each String Box allows the parallel connection of several PV strings (also called “PV sub-field”).

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 (16 parallel sub-fields), 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:

- VKSP_05_r0 *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 Eskom requirements.

The Vlakpan Solar Park will deliver the electrical energy to either the Eskom "Greefspan - Mooidraai" 132 kV power line, crossing the project site. The Eskom's 132 kV power line will loop in and out of the 132 kV busbar of the new on-site substation via two new sections of the 132 kV 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**.**

Two **metering devices and related kiosks** are included in the layout: one for Eskom, close to the busbar, and one for Danfir, close to the power transformers. The kiosks (2.4 x 4.8 x 3.2 m) 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 covering 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 Danfir's side are detailed in the drawings included in Annexure A:

- VKSP_06_r0 *Control building and medium-voltage receiving station*
- VKSP_07_r0 On-site *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

Access to the Vlakpan Solar Park will be from the regional road R357, which crosses the south-eastern boundary of the property. A new access road, 410 m long and 8 m wide, will link the R357 with the development area.

Access point from R357:	29° 26' 22.6" S, 23° 15' 28.4" E
Gate at the PV plant fence:	29° 26' 14.6" S, 23° 15' 17.1" E
Length and width of the new on-site access road:	410 m long / 8.0 m wide

Internal roads will consist of gravel roads designed in accordance with engineering standards. The roads will have a width of 8.0 meters allowing for slow moving heavy vehicles.
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: maximum10 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. Stormwater collection system

Given the low rainfall, flat topography and low flow speed of run-off, **no formal storm water structures are required** as the proposed gravel roads will be developed at ground level so as not to disturb the natural flow of storm water. This means that run-off will not be concentrated and the existing drainage patterns will be left undisturbed.

4.2.5. Water requirements

4.2.5.1. Water requirements during the construction phase

The construction phase will last a 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 100,000 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 periods during peak periods. This number can be higher if Danfir (Pty) Ltd will be selected as Preferred Bidder by the Department of Energy. When the Connection Agreement with Eskom has been finalised, and in particular there is an agreed connection timeline, it may be required to build the Vlakpan Solar Park in a timeframe shorter than 15 months (i.e. 330 working days).

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 will be**250**.

- Each worker needs 30 litres / 8 working hours for sanitary use.
- Water consumption will be:
  - 100 people x 30 l/person x 330 working days = 990 m^3 over 15 months, or:
  - 250 people x 30 l/person x 132 working days = 990 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 approximately 10,000 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 not during working days, also in order to not increase the water requirement during the construction activities.
In order not to reduce water use, high pressure cleaners will be used.
Overall, the water requirement for cleaning activity is very low.

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

Table 4: Water consumption during the construction phase of the project

WATER REQUIREMENT DURING THE CONSTRUCTION PHASE OF THE PROJECT		
DESCRIPTION	**UNIT**	**TOTAL**
Timeframe of the construction activities	*months*	15
Timeframe of the construction activities	*days*	450
Timeframe of the construction activities	*working days*	330
Overall water consumption for internal roads	m^3	5,000
Overall water consumption for sanitary use	m^3	990
Overall water consumption for concrete production	m^3	2,000
OVERALL WATER CONSUMPTION	***m^3***	**7,990**
OVERALL WATER CONSUMPTION	***m^3/day***	**17.7**
EQUIVALENT WATER FLOW OVER 15 MONTHS (450 DAYS)	***l/s***	**0.20**

Storage tanks will be sized in order to provide a reserve of water 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 Vlakpan 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**60 litres** / **day** / **person** per **20 people** (14 people daytime and 6 people at night). The daily water consumption will be approximately **1,200 litres/day.**

B) Water consumption to clean the PV modules

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

It is assumed that up to 1.0 litres per m^2 of PV panel surface will be needed.
Therefore, the amount of water for cleaning is up to **850 m^3 per cleaning cycle and 1,700 m^3per year**.

PV modules cleaning activity can last less than 1 month. If the cleaning activity lasts approximately 2 weeks (12 working days), the daily water consumption will be approximately **71,000 litres/day**, **over 12 days**.

Conclusion

The daily water requirement will be approximately **1,200 litres/day** over 12 months for sanitary use (i.e. **36,000 l/month** and **438 m^3/year**).

The water consumption will increase up to **72,200 litres/day** during the cleaning of the solar modules (71,000 litres/day for cleaning activity and 1,200 for sanitary use), which will last less than a month and will occur twice 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 5: Water consumption during the operational phase of the project

WATER REQUIREMENT DURING THE OPERATIONAL PHASE OF THE PROJECT		
DESCRIPTION	**UNIT**	**TOTAL**
Average daily water consumption for sanitary use	*l/day*	1,200
Average daily water consumption during cleaning activity (*)	*l/day*	72,200
Average monthly water consumption for sanitary use (over 30 days)	*l/month*	36,000
Annual water consumption for sanitary use	***m^3/year***	**438**
Annual water consumption for PV modules cleaning activities (twice/year)	***m^3/year***	**1,700**
ANNUAL WATER CONSUMPTION DURING OPERATION	***m^3/year***	**2,138**
DAILY WATER CONSUMPTION DURING OPERATION (average over 365 day)	***m^3/day***	**5.86**
EQUIVALENT WATER FLOW OVER 365 DAYS	***l/s***	**0.067**

(*) over 12 working days, twice per year

4.2.5.3. Water provision during construction and operation

The site is located within the **Quaternary Catchment Area (QCA) D71C**, which falls within the **Lower Orange Management Area (WMA).**
The General Authorization allow for **45 m^3/ha/annum** to be abstracted from the groundwater resource.

The estimated annual groundwater recharge (6.94 mm/m2 per annum) from an average annual precipitation of 250mm falling on 983ha will result in 20,317 m^3/annum of water available.

The maximum annual water requirement for the project is 2,798 m^3/annum and for livestock is 1,440m^3/annum. The scale of abstraction relative to recharge is **5.24% (Category A).**

Information obtained from the National Borehole Database indicate that shallow boreholes in the area have yields below 0.2 l/s. Boreholes between 50 m and 80m deep recorded blow yields of between 1.2 and 1.5 l/s.

As indicated in the Geo-technical and Geo-hydrological Report (Annexure I), there are**four wind pumps** erected on boreholes currently active on the property. The wind pumps are located in straight line trending north-northwest to south-southwest across the site, indicating that they are all possibly on the same structure.
Boreholes BH 1 and BH 2 are close together (less than 30m apart) and at the time of the site visit only BH 1 was in use. The land owner indicated that the boreholes are approximately 18 to 24 m deep and capable of yielding **400 l/h** on average. The water levels in the boreholes are unknown but expected to be in the order of 10m below surface as is the case with most shallow boreholes in the area.
All three dams were full at the time of the site visit. Approximately 30 head of cattle and 50-70 head of small game and 20 head of large game were present on site.

Wind pump 1, Wind pump 2 and Wind pump 4 are all low yielding and are only suitable for livestock. The current average water consumption by the cattle and other livestock on the farm is approximately 4,000l/day. The boreholes targeting the shallow aquifer are equipped with wind pumps and not capable to sustain the water demand of the proposed solar park development during construction and operational phases.

It is possible to locate a successful borehole with a sustainable yield of 0.5 l/s on the property. This borehole will be for the exclusive use of the solar project and the existing wind pump equipped boreholes for livestock use.
A borehole with a sustainable abstraction of 0.067 l/s will be sufficient to supply the solar project with sufficient water during the operational phase. This indicates the low demand the project has on the long term groundwater demand. A sustainable yield of 0.196l/s will be sufficient to supply water during construction phase of 15months.
A new borehole with a 0.5 l/s yield will satisfy the demand of the project even in dry periods, when only 6h and 40 minutes of pumping can satisfy the demand during the construction phase and only 2 hours and 30 minutes of pumping will be required daily during the operational phase.

The water demand of the project is low and groundwater abstraction in the area indicates that sufficient water supply is available to sustain the project. The location and yield of the new borehole should be identified and confirmed through a Hydrogeological Investigation study.

The analysis of the water sample collected from the wind pump indicate that the conductivity and turbidity is above the SANS 241 drinking water standard specifications and the remainder of the parameters are within the standard specifications for drinking water. The water is therefore suitable for long term human consumption.

Danfir will submit a Water Use Licence application to the Department of Water Affairs in respect of groundwater abstraction from a new borehole.

4.2.6. Sewerage

Because there is no Municipal sewer system available, sewer reticulation will be handled by the patented and commercially available *Ballam Waterslot* (or similar) sewer treatment system.

The sewer system will therefore consist of an installation to serve the offices of the control building. It is foreseen that the system will be installed in line with the requirements of the manufacturer.

Typical systems consist 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 system could require chlorine tablets available commercially. The effluent from the *Ballam Waterslot* (or similar) system will be suitable for irrigation of lawns, or re-use in the dwellings as water for the flushing of toilets, or for fire-fighting purposes. This could reduce the overall water requirement of the development substantially.

A Water Use License application will be submitted to the Department of Water Affairs by Danfir (Pty) Ltd with regard to release of water from the water treatment system on site.

4.2.7. Refuse removal

During the construction phase, solid waste will mainly consist of vegetation material as a result of the clearing activity. Other type of solid waste will be wood from packaging, cardboard boxes, expanded polystyrene and household waste. Vegetation material from clearing activity can be recycled to be re-used as organic fertilizer. Other solid wastes will be recycled as much as possible. Non-recyclable waste will be delivered to the closest municipal landfill site.

During the operational phase (25 - 30 years), solid waste will mainly consist of household waste from the operational team. Other type of solid waste will come from the maintenance activity in case of failure of some components.

At the end of the project lifetime, the PV plant will be decommissioned. Silicon of the PV modules and cables (copper and/or aluminium conductor) will be recycled, as well as the aluminium (or zinced steel) frames and piles of the mounting systems.

Danfir will enter into an agreement with the Siyancuma 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 CAMP SITE

The construction camp site (approximately 10ha) will be located on the south-eastern corner of the planned footprint, covering the area where the last 4MWp are planned. Consequently, the construction camp 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 camp is an important element of the planning phase also in order to minimize impacts on the surrounding environment.

The location of the camp 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 camp 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, plants that can be re-planted, 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.

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 constructed with dry materials and compacted with water.

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

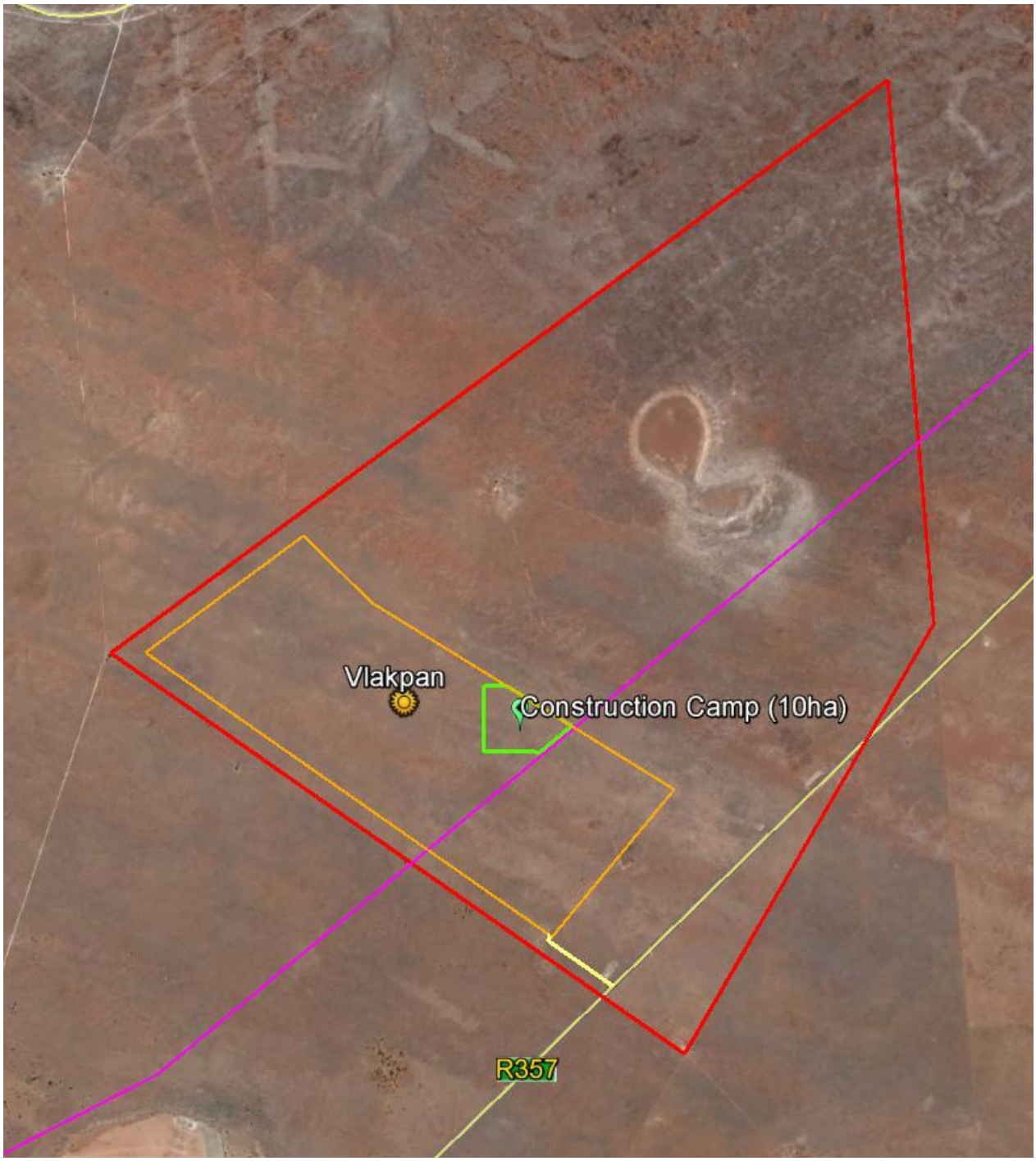
Temporary storage areas of materials and workshops will be constructed and used for:

- 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;
- chemical toilets; 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.

Figure 8: Location of construction camp



4.3.5. Earthworks

Clearing activity is required in order to remove shrubs and trees from the planned footprint / fenced area (up to 210 ha).

Due to the flatness of the development area, no earthworks are envisaged for the installation of the PV module mounting systems. The mounting systems will consist of metallic frames to be assembled on-site, supported by the driven piles or pre-bored cast-in-situ concrete piles. Concrete ballasted footing foundations are also possible.
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 approximately 137,000 m^2, the amount of cut or fill is estimated to be approximately 41,100 m^3.Given the low rainfall, flat topography and low flow speed of run-off - no formal storm water structures are required as the proposed gravel roads will be developed at ground level, so as not to disturb the natural flow of storm water. This means that run-off will not be concentrated and the existing drainage patterns will be left undisturbed.

Small earthworks will be required for the installation 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 spoils heaps which must be spread over the site upon completion of the project.

Underground cables will be laid down along the internal roads.

Concrete is 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 Prieska or Douglas).
Gravel is necessary for the construction of internal roads may be provided from the commercial sources in the vicinity of the development (in Prieska or Douglas).

4.4. TRAFFIC IMPACT OF THE PROPOSED DEVELOPMENT

4.4.1. Traffic impact – construction phase

Approximately 100 people are expected to be employed during the construction period (15 months), although this number can increase to 200 for short periods during peak periods.
This number can be higher if Danfir (Pty) Ltd will be selected as Preferred Bidder by the Department of Energy. When the Connection Agreement with Eskom has been finalised, and in particular there is an agreed connection timeline, it may be required to build the Vlakpan Solar Park in a timeframe shorter than 15 months (i.e. 330 working days).For example, in the case where 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 250/300.

A small accommodation area with few prefabricated buildings inside the site may be required if accommodation facilities in Prieska or Douglas are not sufficient to accommodate all workers.

Overall traffic to and from the work site will amount to approximately **1000 medium** / **heavy vehicle trips** over the whole construction period. As indicated in the table below, the average number of medium and heavy trucks to and from the site will be of **3 trucks per working day.**

Table 6: Construction timeframe: average daily trips of medium and heavy vehicles

Transportation of:	Months	1	2	3	4	5	6	7	8
fencing and tools	trips/month	8	8	0	0	0	0	0	0
clearance of the site (vegetation transportation)	trips/month	56	32	0	0	0	0	0	0
piles / frames for mounting systems	trips/month	0	0	20	20	20	20	20	0
Sands & gravel for on-site concrete production	trips/month	0	30	48	48	48	52	52	54
PV modules	trips/month	0	0	0	0	0	0	0	0
MV stations	trips/month	0	0	0	0	0	12	12	12
HV substation components	trips/month	0	0	8	8	8	0	0	0
cables	trips/month	0	0	0	0	0	0	0	16
Average trips per month	trips/month	**64**	**70**	**76**	**76**	**76**	**84**	**84**	**82**
Average trips per working day (*)	trips/day	**2.9**	**3.2**	**3.5**	**3.5**	**3.5**	**3.8**	**3.8**	**3.7**

Transportation of:	Months	9	10	11	12	13	14	15	TOTAL
fencing and tools	trips/month	0	0	0	0	0	0	0	**16**
clearance of the site (vegetation transportation)	trips/month	0	0	0	0	0	0	0	**88**
piles / frames for mounting systems	trips/month	0	0	0	0	0	0	0	**100**
Sands & gravel for on-site concrete production	trips/month	52	48	32	0	0	0	0	**464**
PV modules	trips/month	0	16	32	68	66	34	0	**216**
MV stations	trips/month	12	12	0	0	0	0	0	**60**
HV substation components	trips/month	0	0	0	0	0	0	0	**24**
cables	trips/month	16	0	0	0	0	0	0	**32**
Average trips per month	trips/month	**80**	**76**	**64**	**68**	**66**	**34**	**0**	**1000**
Average trips per working day (*)	trips/day	**3.6**	**3.5**	**2.9**	**3.1**	**3.0**	**1.5**	**0.0**	**3.03**

(*)22 working days per month

Medium and heavy trucks will access / leave the site only during the working days (Monday to Friday), on the daytime (8h - 17h).

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 35/40 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 Vlakpan 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
- 9/12 people for electric and generic maintenance
- 20/22 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
- Available land surface area (at least 210ha)
- Current land use
- Low environmental impact (low biodiversity)
- Low agricultural potential
- High solar irradiation
- Socio-economic issues (land cost and local community unemployment)

The macro area between Prieska and Douglas was investigated, due to the high value of solar irradiation and to the presence of the Eskom “Greefspan - Mooidraai” 132 kV power line. Several sites crossed by such Eskom132 kV power lines were investigated during the feasibility assessment, due to the flatness of the areas, such as:
a) Portion 1 of the Farm Annex Viegulands Put 42, Hopetown RD
b) Remainder Portion of Farm Vlakpan59, Hopetown RD
c) Portion 2 of the Farm Vlakpan59, Hopetown RD
d) Remainder Portion of Greefs Pan 58, Hopetown RD
e) Portion 1 of the Farm Kwartels Pan 25, Hopetown RD
f) Other farm portions crossed bythe Eskom “Greefspan - Mooidraai” 132 kV power line.

a) **Portion 1 of the Farm Annex Viegulands Put 42, Hopetown RD** is ±1677 ha in extent; this property resulted to be not suitable for the proposed development, since affected by several wetlands/pans over the whole farm portion.

b) **Remainder Portion of the Farm Vlakpan 59, Hopetown RD** is ±975 ha in extent; even if almost suitable for a solar park, this farm portion resulted to be not ideal for the proposed development, since affected by a big quarry and some wetlands/pans, which limit the size of the available areas.

c) **Portion 2 of the Farm Vlakpan 59, Hopetown RD** is 982.7512ha in extent; this property were found to be highly suitable due to the easy access and the presence of the Eskom “Greefspan - Mooidraai” 132 kV power line, crossing the site. The southern part of the property is also suitable from an environmental point of view, with little to no environmental issues, while the northern side is affected by wetlands/pans. Furthermore, the landowner resulted to be available to rent out a portion (±200ha) of his farm.

d) **Remainder Portion of the Farm Greefs Pan 58, Hopetown RD** is approximately 4076 ha in extent; it resulted to be not ideal for a solar park, since the areas close to the Eskom power (the north-western corner of the farm) are affected by wetlands/pans. The central portion would be suitable from an ecological point of view, but not feasible from a technical viewpoint, due to the distance from the Eskom power line.

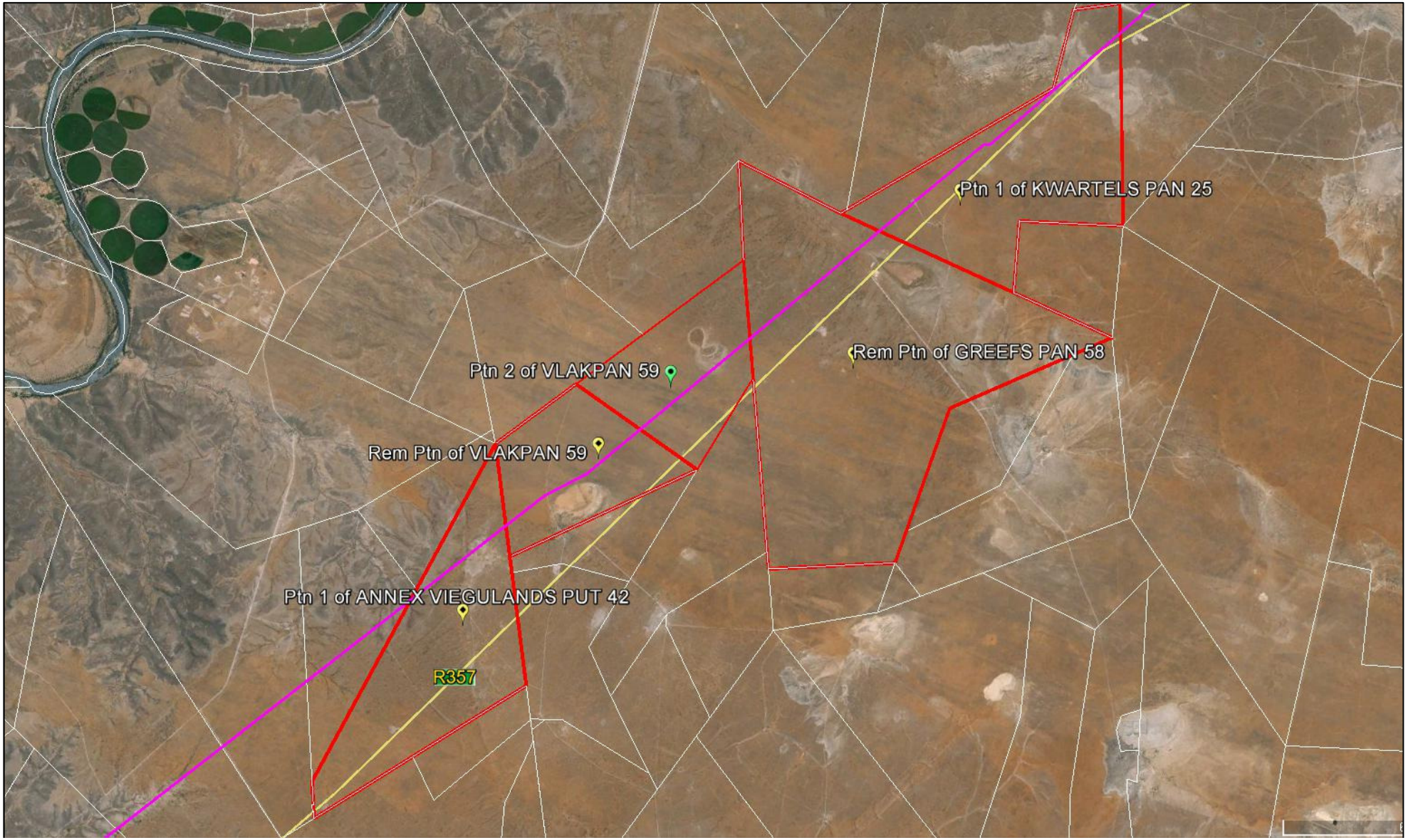
e) **Portion 1 of the Farm Kwartels Pan 25, Hopetown RD** is approximately 1855 ha in extent; even if suitable for a solar park, this farm portion resulted to be not available, since already involved in a solar project currently under construction: the "**11 MW Greefspan Solar Park"**.

f) Other farm portions crossed by the Eskom "Greefspan - Mooidraai" 132 kV power line resulted to be either not suitable for an ecological point of view, due to the presence of wetlands / drainage areas, which reduce the suitable areas to less than the required minimum footprint (210 hectares); or not available for a long-term lease.

Therefore, **Portion 2 of the Farm Vlakpan59, Hopetown RD** is the *preferred site*, being the most suitable and available alternative. This Final EIA Report is related to only this farm portion, which is therefore the only alternative considered following the outcomes of the feasibility assessment.

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 photovoltaic power plants with a generating capacity up to75 MW, on a footprint up to 210 ha.

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 higher solar conversion efficiency (14% to 16%), if compared to the thin-film /PV modules (9% to 13%).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 %/℃ instead of 0.45 %/℃ 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 (210ha).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** (*alternative option 1*) or on **horizontal single-axis trackers** (*alternative option 2*).

The tracking solution is the best performing in terms of efficiency, because its energy production is approximately 15% more if compared with fixed systems. This type of technology is characterized by higher technical complexity and deeper installing and maintenance costs, if compared with the fixed mounting solution.

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 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. The development will not exceed the currently planned footprint (210ha) 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 ANDLOCATION ALTERNATIVES

The site chosen for the establishing of the proposed Vlakpan Solar Park is **Portion 2 of the Farm Vlakpan 59, Hopetown RD**. The PV power plant will have a generating capacity **up to 75 MW**, on a footprint **up to 210 ha**.

5.3.1. Layout design and Location alternatives

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 / under drafting during this 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.

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

- to maximize the energy production and the reliability of the PV plant, by choosing proven solar technologies: thin-film or mono/polycrystalline solar modules mounted on 1-axis horizontal trackers or on fixed mounting systems;
- to develop the PV power plant on the southern side of the property, because this area is flat and has a *medium* ecological sensitivity,
- to avoid the northern side of the property, because of the presence of a salt pan;
- to avoid the high-density heritage site area which occurs in the middle of the property;
- furthermore, a minimum distance of 100 m will be kept between the southern and western boundary of the property and the planned development area (PV plant footprint / fenced area), so that the existing vegetation will be able to screen the solar park to some extent from the adjacent properties.

The **footprint** (fenced area) of the proposed development is **up to 210 ha,** to be located on the south-western side of Portion 2 of Farm Vlakpan 59 (*preferred location Final EIA*).

As already explained in the paragraph 4.1 - *Project layout*, the preferred development area proposed in this Final EIA has been conceived in order to avoid the high-density heritage site area which occurs in the middle of the property. This area - found by the Heritage Specialist during a new site visit conducted in October 2014 - was partially affected by the preferred development area proposed in the Draft EIA. In this Final EIA, the preferred development area has been revised in order to exclude such heritage area.

As **alternative location (not preferred)**, the proposed solar park may be developed on the south-eastern side of the property, between the Eskom "Greefspan - Mooidraai" power line and the regional road R357.This alternative location, proposed as "preferred" during the scoping phase, has been assessed as "not preferred" in this EIA phase, due to the presence of several heritage sites affecting this development area, and due to the concerns received by the landowner of the Farm Greefs Pan 58 about potential visual impacts.
The new preferred development area is further (minimum distance: 1.52 km) from the Farm Greefs Pan 58 than the previous proposed development area, therefore the potential visual impact of the proposed solar park to the Farm Greefs Pan 58 can be mitigated to some extent by the existing vegetation, as indicated in the Visual Impact Assessment (Annexure J). This has been confirmed by the Landscape Architect in the Addendum A of the Visual Impact Assessment (Annexure J).

The preferred development area of this Final EIA is depicted in Figure 10 below and in the drawing of the Annexure A:

- VLSP_00_r4 *Locality Map and Development Area (Preferred Location Final EIA)*

The preferred and alternative locations proposed in the Draft EIA are shown in Figure 11 below and in the drawing of the Annexure A:

- VKSP_00_r3 *Locality Map and Development Area (preferred and alternative locations Draft EIA)*

The proposed layout plan was drawn using PV modules mounted on trackers; in the case of PV modules mounted on fixed mounting systems, the layout plans do not change, except for the orientation of the PV arrays: east-west instead of north-south. The required **footprint** - corresponding on the fenced area - **will not exceed 210 ha**, and the maximum height of the structures (PV modules and support frames) will be approximately 3.1 m above the ground level.

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

- VKSP_01_r3 Layout plan - PV power plant up to 75 MW
- VKSP_03_r0 Mounting System – Alternative option 1: fixed mounting systems
- VKSP_04_r0 Mounting System – Alternative option 2: horizontal single-axis trackers
- VKSP_05_r0 Medium-voltage stations
- VKSP_06_r0 Control building and medium-voltage receiving station
- VKSP_07_r0 High-voltage loop-in loop-out substation
- VKSP_08_r0 Warehouse

5.3.2. Connection alternatives

The Vlakpan Solar Park is planned to deliver the electrical energy to **the Eskom "Greefspan - Mooidraai" 132 kV power line**, running through the project site. The Eskom 132 kV power line will loop in and out of the 132 kV busbar of the new on-site substation, **via two new sections of a 132 kV line (loop in line and loop out line) approximately 100 m long.**

The two new section of power line will be overhead, as per the Eskom standards. Underground cables are not considered a viable alternative: considering the short length (maximum 100 m each), the environmental benefits would be negligible.

Alternative connection solutions are not envisaged, being the Eskom "Greefspan - Mooidraai" 132 kV power line the only Eskom power line crossing the project site. Other Eskom substations / power lines are too far from the project site or too small to receive the planned export capacity (75 MW) to taken into account.

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 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.

Figure 10: Preferred development area - Final EIA

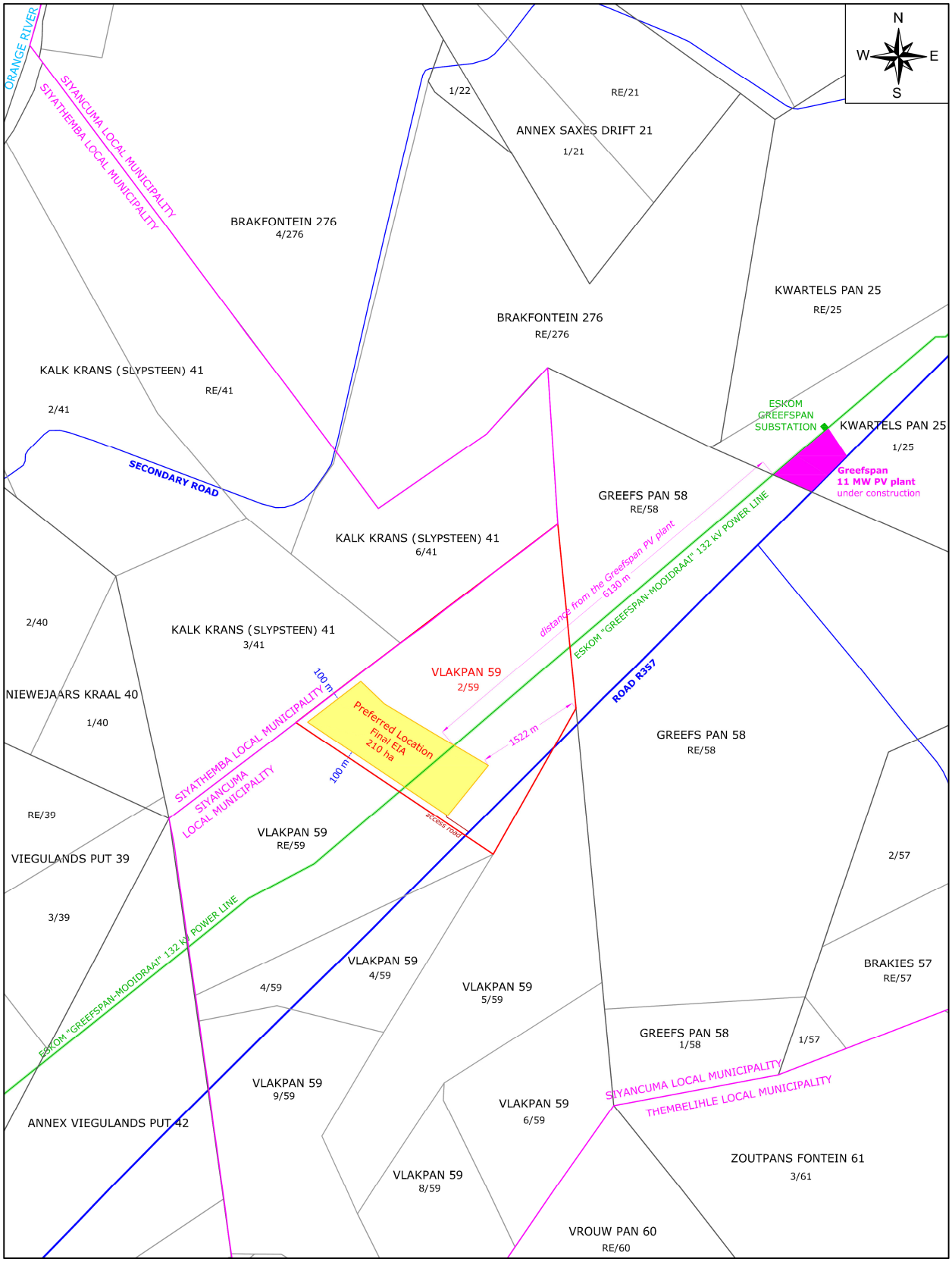
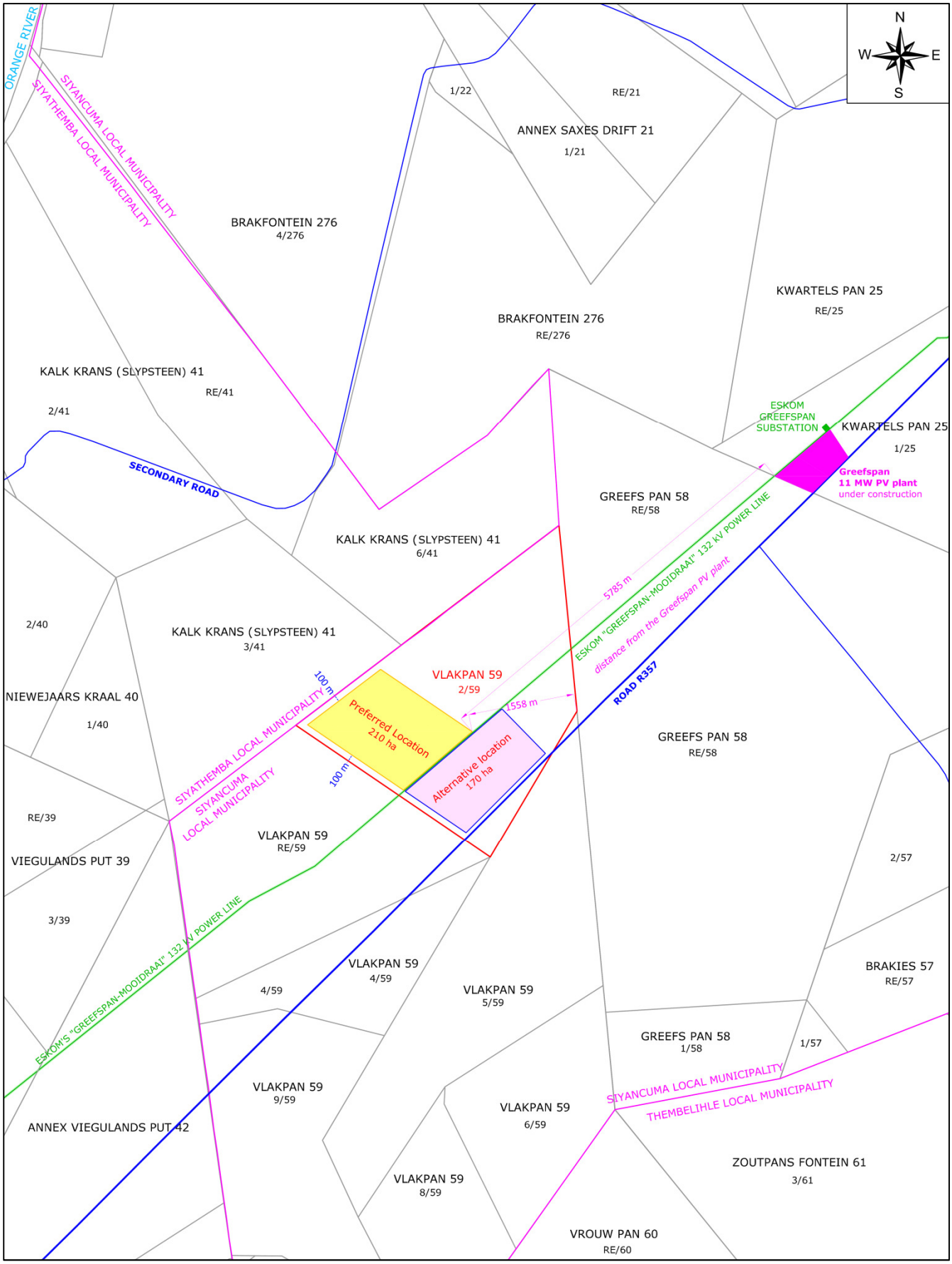


Figure 11: Preferred and alternative development areas - Draft EIA



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 the south-eastern side of Portion 2 of Farm Vlakpan 59, Hopetown RD (982.7 ha in extent), between the Eskom "Greefspan - Mooidraai" power line and the regional road R357.

Portion 2of the Farm Vlakpan59, Hopetown RD

Surveyor-general 21 digit site	C03300000000005900002
Local Municipality	Siyancuma
District Municipality	Pixley Ka Seme
Province	Northern Cape
Extent	982.7 ha
Land Owner	HORN JACOBUS
Diagram deed number	T13729/1937
Title deed number	T20076/1982
Registration date	19820607
Current land use	farming
Geo-graphical Co-ordinates	29° 25' 40" S; 23° 14' 50" E (proposed footprint)

The site is located 56 km North-East of Prieska and 64 km South-West of Douglas. The regional road R357 between Prieska and Douglas crosses the south-eastern corner of the site.

As aforementioned, the property is already affected by energetic infrastructure such as the **Eskom "Greefspan - Mooidraai" 132 kV power line**.

Farm portions close to the project site are mainly used for grazing (game and livestock) purposes.

6.2. OTHER RENEWABLE ENERGY PROJECTS IN THE VICINITY OF THE PROPOSED DEVELOPMENT

The renewable energy project closest to the proposed Vlakpan Solar Park is the **Greefspan PV project**, an 11 MW Photovoltaic plant located on **Portion 1 of the Farm Kwartels Pan 25**. This project has been selected by the Department of Energy under the Window 1 of the REIPP Procurement Programme and it's currently under construction.
The Greefspan PV development area is located **6.1 km** North-East from the envisaged Vlakpan Solar Park development area.

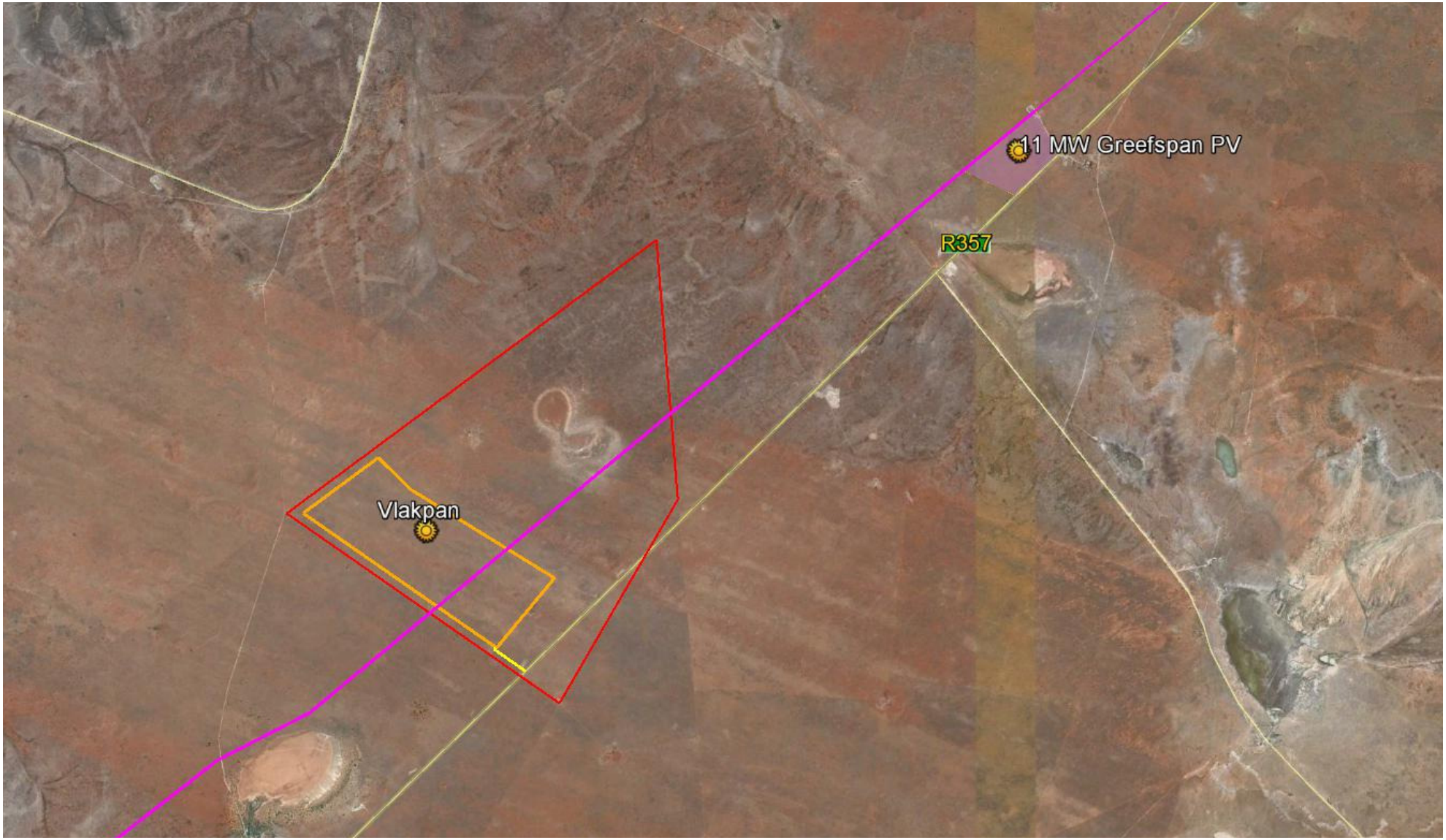
Please refer to the Figure 12 below and to the drawing of the Annexure A:

- VKSP_00_r4 *Locality Map and Development Area (Preferred Location Final EIA)*

AGES is not aware about other renewable energy projects close to the Vlakpan Solar Park for which an authorisation process may be undertaken / on-going by other developers / EAP's.

Due to the distance (6.1 km) of the Greefspan PV project from the proposed Vlakpan Solar Park as well as mitigation measures implemented for the proposed Vlakpan Solar Park, cumulative impacts are very low / negligible.

Figure 12: Vlakpan Solar Park and other PV projects under construction



6.3. ENVIRONMENTAL FEATURES

6.3.1. Climate

Douglas, the closest town with a weather station, 64 km away, normally receives about 250mm of rain per year, with most rainfall occurring mainly during autumn. It receives the lowest rainfall (0mm) in June and the highest (57mm) in March. The average midday temperatures for Douglas range from 18.4°C in June to 32.9°C in January. The region is the coldest during July when the mercury drops to 1°C on average during the night.
The Weinert climatic N-number for the area is 14. This indicates that the climate is *semi-arid* and that physical mineral grain disintegration is predominant.

6.3.2. Topography and drainage

The topography across the site is slightly undulating with the average elevation of 1050mamsl the lowest point (1047mamsl)is at the salt pan located on the northern side of the property, and the highest point is 1056mamsl at the southern corner of the property. The average slope across the site is 0.6%, with a maximum slope of 3% at the salt pan.

Drainage occurs as sheet-wash towards in a northerly direction, with the pan collecting rainwater locally.
The proposed development area is situated on a **valley floor land facet**, with the Orange River flowing east to west, approximately 9km north of the property. The second landform present on the site is the **salt pan**, acting as a local drainage point.

6.3.3. Soils, geology and geo-technical conditions

A Geo-technical and Geo-hydrological Report is attached as Annexure I. The site visit was conducted on 23 June 2014, when 10 trial pits were excavated across the property.

Surface calcrete (T-Qc) occur as discontinuous layers and concretions and are associated with mudstone, shale tillite, dolerite. 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
- Powdery calcrete.

The proposed development area is underlain by transported soil and pedogenic calcrete and Dwyka Tillite. Four different soil profiles were encountered on site:

- Profile 1: Kalahari Sand and Calcrete,
- Profile 2: Weathered Calcrete and Tillite,
- Profile 3: Weathered Calcrete (Pan), and
- Profile 4: Powdery Calcrete.

<u>Soil Profile 1: Kalahari Sand and Calcrete</u>
The western portion of the property is underlain by Kalahari sand and hardpan calcrete. The profile consist of a 300mm to 500mm thick dry, uniform reddish brown very loose to loose fine grained sand with silt, overlying white to light pinkish grey weak to strong hardpan calcrete with pebbles and cobbles at the upper contact. The TLB refused in the hardpan calcrete at depths ranging from 0.4 to 0.7 m below surface.

Soil Profile 2: Weathered Calcrete and Tillite

The majority of the eastern portion of the property is underlain by surface rubble consisting of weathered calcrete cobbles and weathered tillite in a matrix of calcareous sand overlying hardpan calcrete. The agglomerate layer is thin, generally not more than 200mm thick, overlying hardpan calcrete. The TLB refused on the hardpan calcrete within 300mm from surface. In places cobbles of tillite is embedded in the calcrete, indicating the hardpan calcrete is not very thick in this area.

Soil Profile 3: Weathered Calcrete

The pan area is underlain by surface rubble consisting of weathered calcrete cobbles and pebbles in a matrix of calcareous sand overlying hardpan calcrete. The agglomerate layer is thin, generally not more than 100mm thick, overlying hardpan calcrete. The TLB refused on the hardpan calcrete within 300mm from surface. In places cobbles of tillite is embedded in the calcrete, indicating the hardpan calcrete is not very thick in this area.

Soil Profile 4: Powdery Calcrete

The area south of the pan is underlain by calcareous soil consisting of aeolian sand and weathered calcrete, grading into powdery calcrete op to 1.50m deep, below that the powdery calcrete grade into platy calcrete and hardpan calcrete, causing refusal of the TLB on the Hardpan calcrete at 2.20m.

Using the COLTO Standard, the **excavatability** of the upper 0.3 - 0.5m of Profile 1 will be *soft* as will the upper 2.0 m of profile 4; the rest of the site *intermediate to hard* excavatability can be expected within 200m from surface.

The potential for collapse of side walls of deep excavations is moderate in profile area 4. It is recommended that the sidewalls excavated be battered back to a 1:1.5 grade slope or shored in excavations deeper than 1.5m to comply with minimum safety regulations.

Four LAND USE AREAS across the property have been assessed:

LAND USE AREA A

Land Use Area A covers the Soil Profile 1 area and is classified as **DEVELOPABLE WITH MINOR PRECAUTIONS** and is regarded low risk with respect to the intended development of the solar park. The soil profile consists of transported aeolian soil underlain by hardpan calcrete. The excavatability of the up to 500mm thick sand is soft and the hardpan calcrete is intermediate to hard.

The recommended foundation solution for tracker based solar panels is pre-bored cast in situ concrete piles of approximately 2.0m long. For fixed frames, strip foot foundations founded on the calcrete is recommended. Rammed or mini piles can be considered if trials demonstrate that the piles can penetrate the hardpan calcrete. Concrete ballasted footing foundations are also possible. For conventional structures, strip foot foundations founded on the hardpan calcrete is recommended. Where soft spots in the calcrete occur, localized steel reinforcement should be installed.

LAND USE AREA B

Land Use Area B covers the Soil Profile 2 area and is classified as **DEVELOPABLE WITH PRECAUTIONS** and is regarded low to medium risk with respect to the intended development of the solar park. The soil profile consists of an agglomerate of weathered tillite and calcrete cobbles and pebbles in a calcareous sand matrix up to 100mm thick overlying Hardpan Calcrete. The excavatability of the up to 100mm thick agglomerate is soft and the hardpan calcrete is intermediate to hard.

The recommended foundation solution for tracker based solar panels is pre-bored cast in situ concrete piles of approximately 2.0m long. For fixed frames, strip foot foundations founded on the hardpan calcrete is recommended. Rammed or mini piles can be considered if trials demonstrate that the piles can penetrate the hardpan calcrete. Concrete ballasted footing foundations are also possible.
For conventional structures, slab on the ground foundations founded on the hardpan calcrete is recommended. Where soft spots in the calcrete occur localized steel reinforcement should be installed.

LAND USE AREA C
The pan area (LANDUSE AREA C) is **UNDEVELOPABLE**, due to the possibility of water ponding in that area during the rainy season.

LAND USE AREA D
Land Use Area D covers the Soil Profile 4 area and is classified as **DEVELOPABLE WITH PRECAUTIONS** and is regarded as a medium risk with respect to the intended development of the solar park. The soil profile consists of calcareous sand of mixed origin and powdery calcrete up to 1.5m deep, overlying platy calcrete and hardpan calcrete. The TLB experienced refusal at 2.20m indicate the Hardpan level. For the installation of piled foundations, only rammed or driven piles can be considered because the sidewalls will collapse when pre-bored piles are installed. The risk with rammed or driven piles is that adequate penetration into the calcrete cannot be achieved to generate sufficient shear resistance. Concrete ballasted footing foundations are also possible.
For conventional structures, re-enforced strip foot foundations or soil mattress foundations is recommended.

From a geotechnical perspective, Land Use Area A is best suited for the proposed development because:

- No shallow groundwater conditions were encountered in any of the trial pits on site.
- No mining activities (past or present) occurred in the property.

The Geo-technical Study concluded that - from a geo-technical perspective - the project site - limited to the Land Use Areas A, B and D - is suitable for the proposed development.

6.3.4. Geo-hydrology

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

The site is located within the **Quaternary Catchment Area (QCA) D71C**, which falls within the **Lower Orange Management Area (WMA).**

The quaternary statistics of this catchment were used for further evaluation.

The recorded mean annual precipitation is 250 mm per annum and the groundwater recharge is 6.94 mm per year. The groundwater level of the area is 4.5m below surface (from the National groundwater database). The Eco status is category D. The total groundwater use in the quaternary is 0.13Mm^3 per year and the groundwater exploitation potential estimated at 4.5Mm^3/year.

General Authorization allows for **45 m^3/ha/annum** to be abstracted from the groundwater resource.

Information obtained from the National borehole database indicate that shallow boreholes in the area have yields below 0.2 l/s. Boreholes between 50 m and 80m deep recorded blow yields of between 1.2 and 1.5 l/s.

The estimated annual groundwater recharge (6.94 mm/m^2 per annum) from an average annual precipitation of 250mm falling on 983ha will result in 20,317 m^3/annum of water available.
The maximum annual water requirement for the project is 2,798 m^3/annum and for livestock is 1,440m^3/annum. The scale of abstraction relative to recharge is **5.24% (Category A).**

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

The contact between the Dwyka and the Vryburg Formation Sandstone present itself as a scarp bisecting the property. No other features that can be defined as aquifer boundaries was identifiable from aerial photos or regional geological maps.

There are **four wind pumps** erected on boreholes currently active on the property. The wind pumps are located in straight line trending north-northwest to south-southwest across the site, indicating that they are all possibly on the same structure.
Boreholes BH 1 and BH 2 are close together (less than 30m apart) and at the time of the site visit only BH 1 was in use. The land owner indicated that the boreholes are approximately 18 to 24 m deep and capable of yielding **400 l/h** on average. The water levels in the boreholes are unknown but expected to be in the order of 10m below surface as is the case with most shallow boreholes in the area.
All three dams were full at the time of the site visit. Approximately 30 head of cattle and 50-70 head of small game and 20 head of large game were present on site.

Wind pump 1, Wind pump 2 and Wind pump 4 are all low yielding and are only suitable for livestock. The current average water consumption by the cattle and other livestock on the farm is approximately 4,000l/day. The boreholes targeting the shallow aquifer are equipped with wind pumps and not capable to sustain the water demand of the proposed solar park development during construction and operational phases.

It is possible to locate a successful borehole with a sustainable yield of 0.5 l/s on the property. This borehole will be for the exclusive use of the solar project, and the existing wind pump equipped boreholes for livestock use.
A borehole with a sustainable abstraction of 0.067 l/s will be sufficient to supply the solar project with sufficient water during the operational phase. This indicates the low demand the project has on the long term groundwater demand. A sustainable yield of 0.196l/s will be sufficient to supply water during construction phase of 15months.
A new borehole with a 0.5 l/s yield will satisfy the demand of the project even in dry periods, when only 6h and 40 minutes of pumping can satisfy the demand during the construction phase and only 2 hours and 30 minutes of pumping will be required daily during the operational phase.

The water demand of the project is low and groundwater abstraction in the area indicates that sufficient water supply is available to sustain the project. The location and yield of the new borehole should be identified and confirmed through a Hydrogeological Investigation study.

The analysis of the water sample collected from the wind pump indicate that the conductivity and turbidity is above the SANS 241 drinking water standard specifications and the remainder of the parameters are within the standard specifications for drinking water. The water is therefore suitable for long term human consumption.

6.3.5. Ecology (fauna and flora)

An Ecological Impact Assessment (Annexure D) 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 March 2014 to verify the ecological sensitivity and ecological components of the site at ground level.

6.3.5.1. 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.

The Highveld Salt Pans is characterized as depressions in a plateau landscape containing temporary water bodies. The central parts of the pans are often seasonally inundated and sometimes with floating macrophyte vegetation. On the pan edges open to sparse dwarf shrubland may develop, especially when the pan is under heavy grazing pressure.

The proposed development is planned on a landscape characterised by slightly undulating plains. The importance to survey the area as a whole to have a better understanding of the ecosystem and the potential impact of the development on the natural environment was identified as a key factor, and subsequently the property was completely surveyed. The farm is currently managed as a livestock farm.

The vegetation units on the site vary according to soil characteristics, topography and land-use. The site is characterized by grassland and karoid shrubland that varies in density and species composition. The drainage features on site are pan in the central section of the site. Vegetation units were identified and can be divided into 3 distinct vegetation units according to soil types and topography.

- *Stipagrostis uniplumis – Eragrostis lehmanniana* grassveld;
- *Acacia mellifera – Pentzia calcarea* karoid shrubland;
- Endorheic depression.

6.3.5.2. Fauna

A survey was conducted during March 2014 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. Detailed fauna species list for the area is included in Appendix B (birds), C (mammals) and D (herpetofauna) of the Ecological Impact Assessment (Annexure D).

During the site visits 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.

6.3.6. Summary and results of the Ecological Impact Assessment

Following the investigation and potential ecological impact of the proposed Vlakpan Solar Park and associated infrastructure on the fauna and flora of the area, some conclusions can be made.

- All aspects of the environment, especially living organisms, are vulnerable to disturbance of their habitat. The proposed development will potentially impact and modify the vegetation and faunal habitats on the footprint areas to a certain extent varying according to the state of the environment (vegetation and fauna habitats).

- **Most sensitive sections**: In this case the area on which the proposed development footprint of the solar plant will be constructed will be cleared, therefore directly impacting on the environment. Most of the vegetation will be completely modified during the construction. Detailed ecological (fauna habitat & flora) surveys were conducted during March 2014 to verify the ecological sensitivity and ecological components of the site at ground level.

- **Most sensitive habitats:** The development will have a medium impact on the vegetation and general ecology of the area and therefore the least sensitive areas should be considered for the proposed footprint of the Vlakpan Solar Park. 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. From these investigation and ecological surveys the following main observations was made:
    - **The most suitable area** for the development of the project would be on the **grassveld area or the dwarf karoid shrubland (*Medium 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 pan** represents a sensitive wetland habitat type that will be seasonally wet and have a ***high sensitivity***. No development can occur around the pan and a buffer zone of 32 meters should be implemented.

- After a detailed survey was conducted during March 2014, no protected plant species under the Northern Cape Nature Conservation Act (NCNCA), No. 9 of 2009 and no protected trees under the National Forest Act (NFA) No. 84 of 1998 were found on the property.
- No individuals of the endemic or biogeographically important plants were observed during the survey, although it was previously found in the larger area. No other red data species potentially occur in the QDS of the study area according to the SIBIS database. No other red data species was also found in the area, although the potential habitats were surveyed to the extent representative of the area.
- Some potential rare fauna may 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.
- All aspects of the environment, especially living organisms, are vulnerable to disturbance of their habitat. If we can bring about a more integrated approach to living within our ecosystems, we are much more likely to save the fundamental structure of biodiversity. Positive contributions can be made even on a small scale such as within the proposed Vlakpan Solar Park development. All stakeholders need to be involved to avoid a loss of biodiversity in the area.
- The proposed development site will partially modify the natural vegetation and faunal habitats, although the herbaceous layer will be preserved below the panels. The importance of rehabilitation and implementation of mitigation processes to prevent negative impacts on the environment during and after the development phase should be considered a high priority.

- The Ecological Impact Assessment (Annexure D) concluded that, provided that all mitigation measures are implemented during the development phases of the solar plant, the planned development can be supported.

6.3.7. Avifauna

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

About 210 hectares of natural bird habitats will be modified through the development if one considers the vegetation types (Northern Upper Karoo) associated with the larger area.

The following bird habitats were identified in the study area during the field surveys that formed part of the avifauna scoping study:

- Karoo shrubland;
- Grassveld;
- Pan (wetland habitat).

The project area still supports low densities of priority species such as secretary bird, kori bustard, vulture species and lanner falcons. The presence of these birds couldcause collisions and increase mortality rate of these species and subsequently no additional power lines should be constructed other than the already established corridors.

The impacts associated with the proposed solar farm development include the following:

- Habitat destruction, fragmentation and human disturbances (Indirect impacts);
- Electrocutions and collisions (direct impacts).

The implementation of the mitigation measures should be considered a requirement for the proposed development if approved by authorities.

Baseline monitoring should be implemented on the avifauna during the pre-construction, construction and operational phases of the Vlakpan Solar Park. This is one of the main recommended conditions of approval for solar energy facilities to monitor and reduce potential impacts on avifauna by Birdlife South Africa and Endangered Wildlife Trust.

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 (Annexure E) 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, although a monitoring plan should be implemented during the construction and operational phases of the PV plant.

6.3.8. Visual

A Visual Impact Assessment (Annexure J) has been conducted to determine the visual impact of the proposed solar park.

This study area has a unique combination of flat plains, rolling ridge lines, wetlands, pans and farmsteads. This creates a natural environment which evokes a ‘rural’ and ‘pastoral’ sense of place. The study area also includes mining infrastructure, and the “Greefspan – Mooidraai” power line. However, these ‘industrial’ elements do not dominate the environment. Lines within the study area are mostly in the horizontal plane created by the flat topography. Fine textures are mostly derived from the vegetation. The vegetation also dominates the colour scene with a dominant light olive green grass-shrub cover dotted with darker green patches of shrubs. The visual absorption capacity within this horizontal field would be low due to the absence of tall vegetation in the vegetation pallet. At night, specks of lights from the farmsteads and workers housing would be visible in the dark rural landscape. Lights from the nearby mining activities are also considered to be a form of light pollution.

It is clear from the purple areas in Figure 9 of the Visual Impact Assessment (*Relevance of Visual Impacts map*), that important visual impacts might occur for a handful of *Visually Sensitive Receivers* (VSRs), namely;

1. the farmstead on the farm Welgegund, north of the project site (VSR R1),
2. the farmstead on the farm Vlakpan, southwest of the project site (VSR R2),
3. the farmstead on the farm Weltevrede, south of the project site (VSR R3),
4. along sections of the main road R357 (VSR T1), and
5. along sections of the roads to these farmsteads (VSR T2).

These are the areas where additional mitigation measures should be considered if existing vegetation does not fulfil that role.

The photo-simulations seen in Figures 10 and 11 of the Visual Impact Assessment illustrate the proposal set within the receiving landscape. The photo-simulations illustrates that for the most part, existing vegetation will adequately conceal most of the proposed project components (the vast stretch of solar panels), but not likely the larger warehouses (6m high) and 132kV connecting power lines (20m high). Mitigating visual impacts arising from the implementation of projects with accentuated linear components, like power lines, are a challenge. Ideally mitigation measures should already be taken into consideration at planning phase. Existing vegetation is considered a bonus existing mitigation measure for which the developer is responsible for maintaining. Proposed mitigation measures include: timing of the construction phase, dust clouds, clearing of vegetation, erosion control, and the effect of lighting at night.

The final significance of the impact would be *moderate* for the construction and operational phases and l*ow* for the decommissioning phase. When the effect of the existing vegetation as well as other correct and effectively applied mitigation measures are incorporated into the rating, the significance for the construction phase would reduce to ***low*** and ***negligible*** for the operational and decommissioning phases. It is thus important that integrity of the existing vegetation should be kept intact, as well as implementing the other proposed mitigation measures be correctly and effectively.

6.4. SOCIO-ECONOMIC ENVIRONMENT

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

The following aspects 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 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 Danfir(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 Vlakpan 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 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 operation 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).
- The project will comply with 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, Danfir (Pty) Ltd is required to identify a **Local Community** for the purpose of entering into a partnership for the Project.

6.5. AGRICULTURAL POTENTIAL

An Environmental Report on the Soils, Land Use, Agricultural Potential and Land Capability is attached as Annexure F; the site survey was conducted during March 2014.

The current land-use of the proposed development site is grazing by livestock. Neighbouring farms are being used for livestock grazing.

The soils were classified into broad classes according to the dominant soil form and family as follows:

- Shallow, calcareous soils of the Glenrosa or Mispah soil form associated with limestone;
- Vertic clay soils of the Katspruit soil form associated with the pan;
- Red-yellow apedal Aeolian sandy soils of the Hutton or Clovelly soil form.

The area is expected to receive an annual total rainfall between 200 and 400mm, mostly between October to April. This amount is low. The site is considered to be located in an area too dry for rained arable crop production. The high variability in rainfall distribution within the area could further render dryland farming a risky venture, even under irrigated conditions.

The proposed development footprint is largely composed of very sandy Aeolian sands [clay content varies between 2 and 8% with depth varying from shallow (100-200mm) to medium depth (300-600mm).

The sandy nature of the soils, soil depth and climatic conditions of the area renders the area investigated unfavourable for effective crop production. **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 Karoo shrub-land and grassland. According to databases (ARC), the potential grazing capacity of the area for livestock largely to be estimated to be **22 to 25 ha/LSU**. When applying the national norms applicable to Act 70 of 70, which indicates the land unit to be able to carry 60 LSU's per farm unit, an economically viable farm for this area would be between 1320 and 1500ha.

It can be deduced that the project site, being **982.7512 hectares in extent**, would allow for only **39 to 44 *potential* large stock units (LSU's)**, while the proposed development (up to 210 ha in extent) would entail a reduction of its grazing potential for only 8-10 *potential* large stock units.

Therefore, the property is a NOT viable grazing farm (39 to 44 LSU < 60 LSU's) either with and without the proposed development in place.

It should be noted that the Mr Jacobus Horn is the landowner not only of the project site (Portion 2 of Vlakpan 59, Hopetown RD, 982.7512ha in extent), **but also of Portion 5 (984.7 ha), the Remaining Extent of Portion 6 (513.9 ha) and Portion 8 (470.8 ha) of the same farm.** The size of these farm portions combined is **2,952 ha** and therefore constitutes an economically viable grazing area that can support between **118** and **134 LSU's**.

As said, the proposed development (footprint: 210 ha) would entail a reduction of its grazing potential for **only 8 – 10 potential LSU's,** therefore it will not have a negative impact on the land, being an economically viable unit if one considers that **the combined farm portions can still support between 110 and 124 LSU's with the development in place.**

Therefore, the combined farm portions are a viable grazing property either with and without the proposed development in place.

The Agricultural Potential Assessment (Annexure F) concluded that the agricultural potential of soils on the proposed development area is mostly low (shallow, calcareous soils or very sandy soils with limited suitability for grazing). The results obtained from the study were done after field observations aimed to verify the soil potential classified by the Department of Agriculture on a small scale. The site should subsequently be considered as ***moderate to low* potential grazing land with low to zero potential for arable agriculture** considering the climatic conditions, soil physical characteristics and size of land potentially available.

The **low agricultural potential** of the soil is confirmed by the Agricultural Maps below (Figures 16 to 19):

- **Agricultural Potential Map** - indicating that the project site (Portion 2of the Farm Vlakpan59) is classified as *Low Agricultural Potential.*
- **Land Capability Map**- indicating that the site is classified as *Non-arable – Low potential grazing land.*
- **Potential Grazing Capacity Map (1993)** - indicating that the project site has a potential grazing capacity of **22 - 25 ha** / **large stock units**. As indicated in the previous map, this grazing potential is *low*, if compared to the maximum value indicated in the legend: less 3 ha / large stock units.
- **Potential Grazing Capacity Map (2007)**- indicating that the project site has a potential grazing capacity of **21 - 25ha** / **large stock units**, which is *low*. This map (2007) is not official yet and should be further confirmed by the Department of Agricultural, therefore in the calculation above we referred to the Map (1993).

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/)]

6.6. CULTURAL AND HERITAGE RESOURCES

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

A low density Middle Stone Age Scatter at **Site AGES-VP59-SA01, S29.42905 E23.26861** occurs along a quarry site on the north-eastern periphery the study area. This area has been adversely altered by quarry and digging activities and the occurrence is of limited scientific value due to the mixing of artefacts and the low density of the lithics. This artefact scatter is in a temporally mixed and secondary or derived context and therefore, it is considered to be ***of low to no archaeological significance***. The site is situated within the demarcated development area but it has been adequately documented during this study and no further recording is required before destruction. In addition, two medium density lithic scatters at **Site AGES-VP59-SA02, S29.42706 E23.26129 & Site AGES-VP59-SA04, S29.43394 E23.25879** occurs in the study area, the first along a discreet ridge in the north-east sector of the study area, and the second near the windmill and cattle pen to the south. Formal tools have been identified among lithics scatters at the sites but since the sites are in both cases temporally mixed and contextually derived, these archaeological occurrences are considered to be of ***medium-low significance***.

Two Earlier Stone Age hand axes and rough stone flakes and cores were recorded along a small ridge in the north-eastern sector of the study area at **Site AGES-VP59-SA03, S29.42879 E23.26317**. Even though the material has been temporally mixed and derived pf primary contextually, they are considered to be representative of the archaeological record of the immediate surroundings and the presence of formal tools is significant. To compensate for potential future cumulative impacts, it is recommended that this locale should be avoided by the proposed development. This can be accomplished by implementing a 20m conservation buffer around the location of the lithic scatter. However, if this site is to be directly impacted by development activities, it is recommended that the site be recorded and that the cultural and archaeological context of the heritage resource be established by means of a limited Phase 2 Specialist Study. This study should minimally include a surface sampling and consequent analysis of the stone artefacts by a qualified Stone Age specialist, in order to elucidate the understanding of the development and spread of the MSA in the area. The Specialist should obtain the necessary permits from SAHRA for the in-situ analysis, possible collection and photography of the artefacts during the study.

During the first site visit (May 2014), the survey was mainly focused on the south-eastern side of the property, being the preferred development area at that stage (scoping phase).

In October 2014, a second site visit was conducted on the property, focused on the south-western and central side of the property, where the new preferred development area was planned (Draft EIA).

A number of **Stone Age scatters**, that have been exposed along fined-grained rock surface protrusions, occur in the north-eastern sector of the preferred development area (Draft EIA). This Stone Age rich rock corridor, which is overlain by deep sands in lower lying areas, can actually be identified on the aerial photograph aligned in a north-west south-east orientation along the north-eastern border of the new development area (Draft EIA).
The Stone Age occurrences, belong mostly to the Middle Stone Age (MSA) with a significant **Earlier Stone Age Scatter (ESA),** containing numerous formal tools identified at **points 183 and 18**4. A few **Later Stone Age (LSA) occurrences** were also identified amongst the scatters. The highest concentration of MSA occurrences, holding formal stone tools, were noted in an area around **points 185 to 190** and **points 195 to 197**. The latter mentioned scatters occur in the development area proposed in the Draft EIA. They are significant since large numbers of diagnostic formal MSA tools (Points, side scrapers, blades and cores) occur in these assemblages and they would require a Phase 2 Stone Age Specialist Study if impacted on by the development. Single occurrences have been noted at **points 192, 193 and 194** but these areas are not as significant due to the low density of artefacts observed.

As suggested by the Heritage Specialist, the development area (Final EIA) has been amended in order to to exclude the most sensitive Stone Age scatters (points 185 to 191 and points 195 to 199).

Please refer to the revised layout plan, depicted as Figure 13 below and also attached as Annexure A:

- VKSP_01_r3 *Layout plan - PV power plant up to 75 MW*

The new development area (Final EIA) is depicted in the drawing of the Annexure A:

- VKSP_00_r4 *Locality Map and Development Area (Preferred Location Final EIA)*

Heritage resources have been documented on the project site and impact on these resources is anticipated. However, in the opinion of the author of this Archaeological Impact Assessment Report, the proposed Vlakpan Solar Park Project on Portion 2 of the farm Vlakpan 59 may proceed from a culture resources management perspective, provided that mitigation measures provided in this assessment, endorsed by the relevant Heritage Resources authority, are implemented where applicable.

It should be noted that - following the outcomes of the Heritage Impact Assessment - **the layout plan has been revised in order to avoid all the heritage sites found on the property; provision has been made for a minimum 30m buffer zone around them.**

Figure 13: Revised layout plan (FEIA) and heritage sites

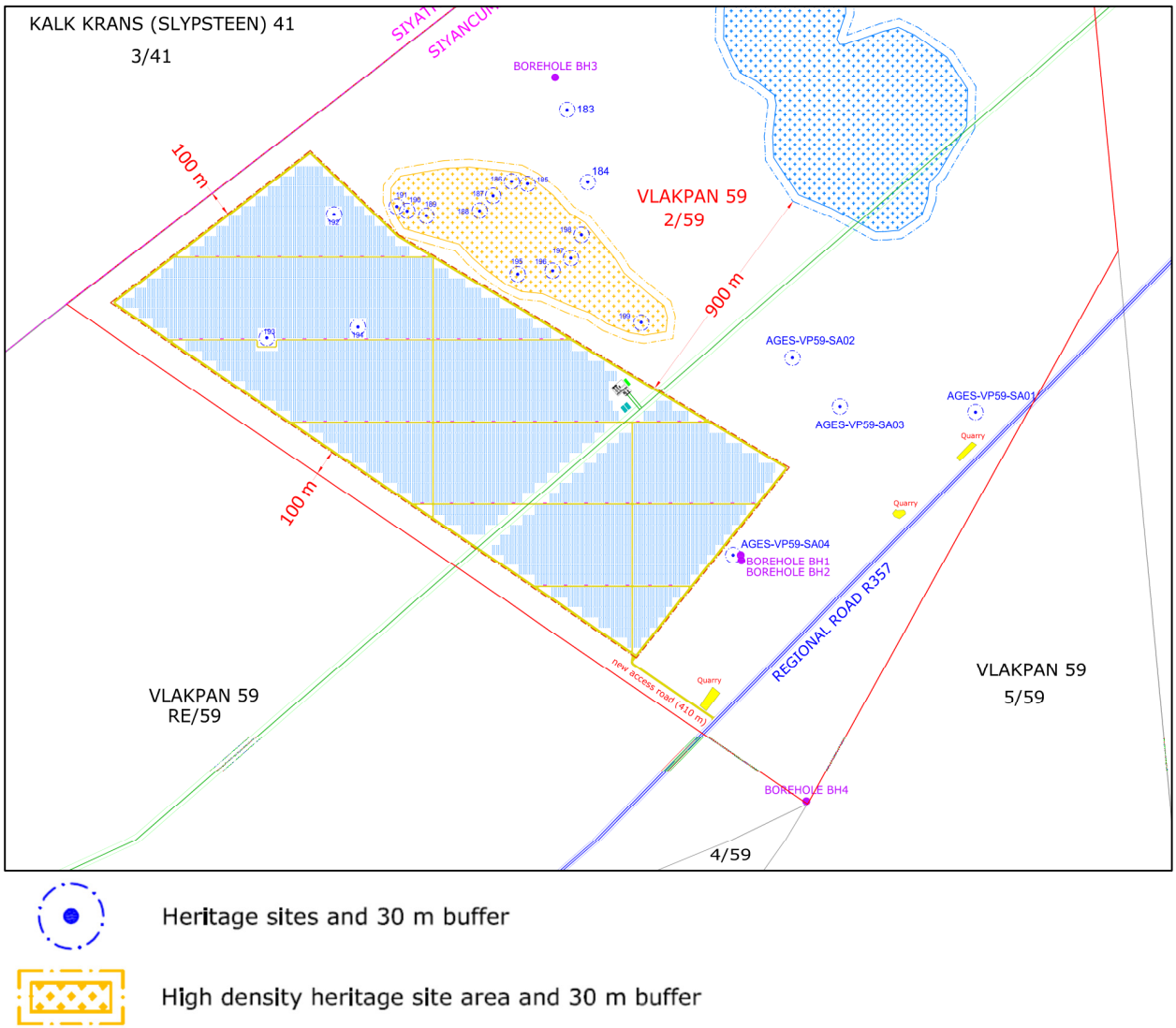


Figure 14: Vegetation Map of the project site

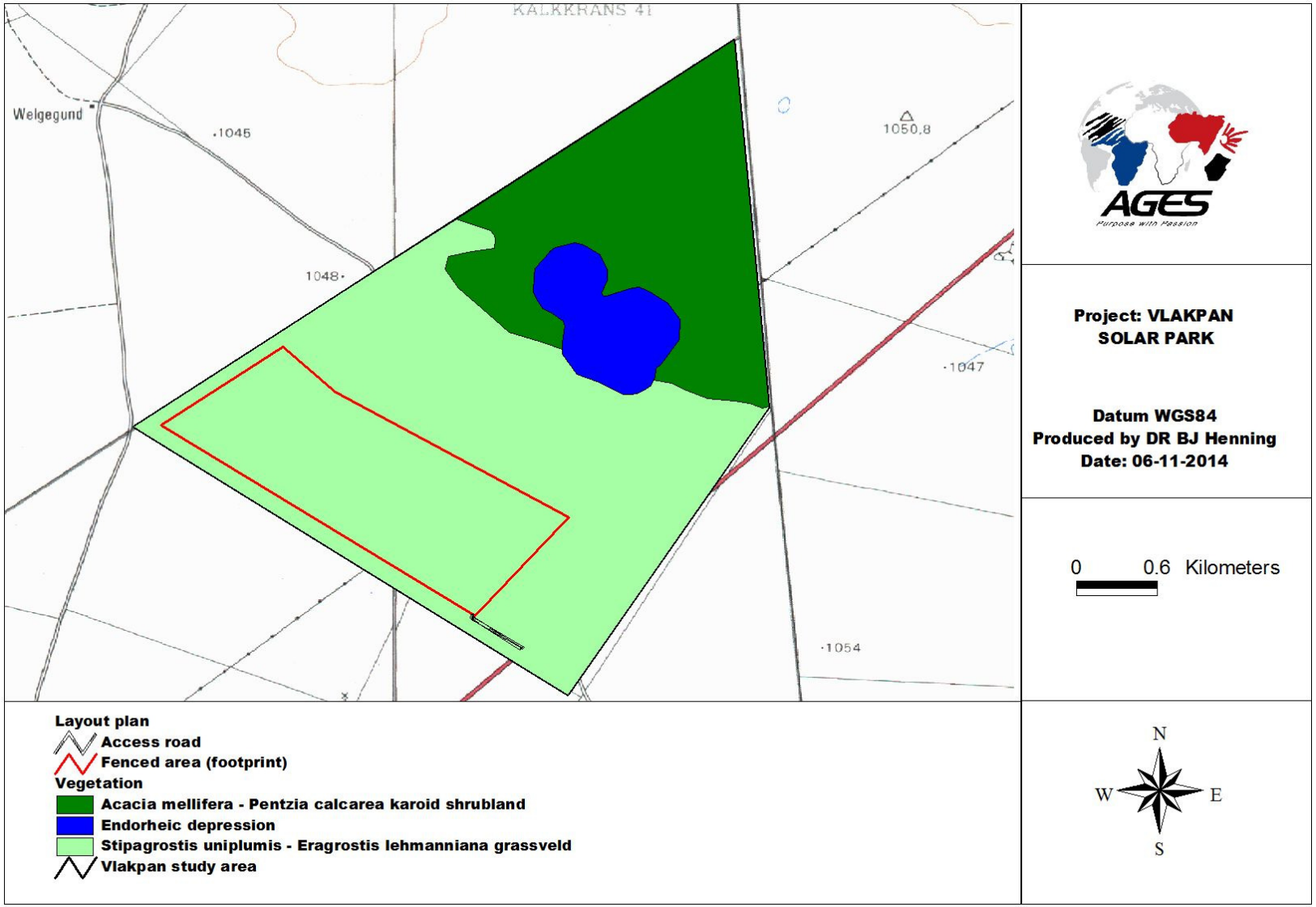


Figure 15: Sensitivity Map of the project site

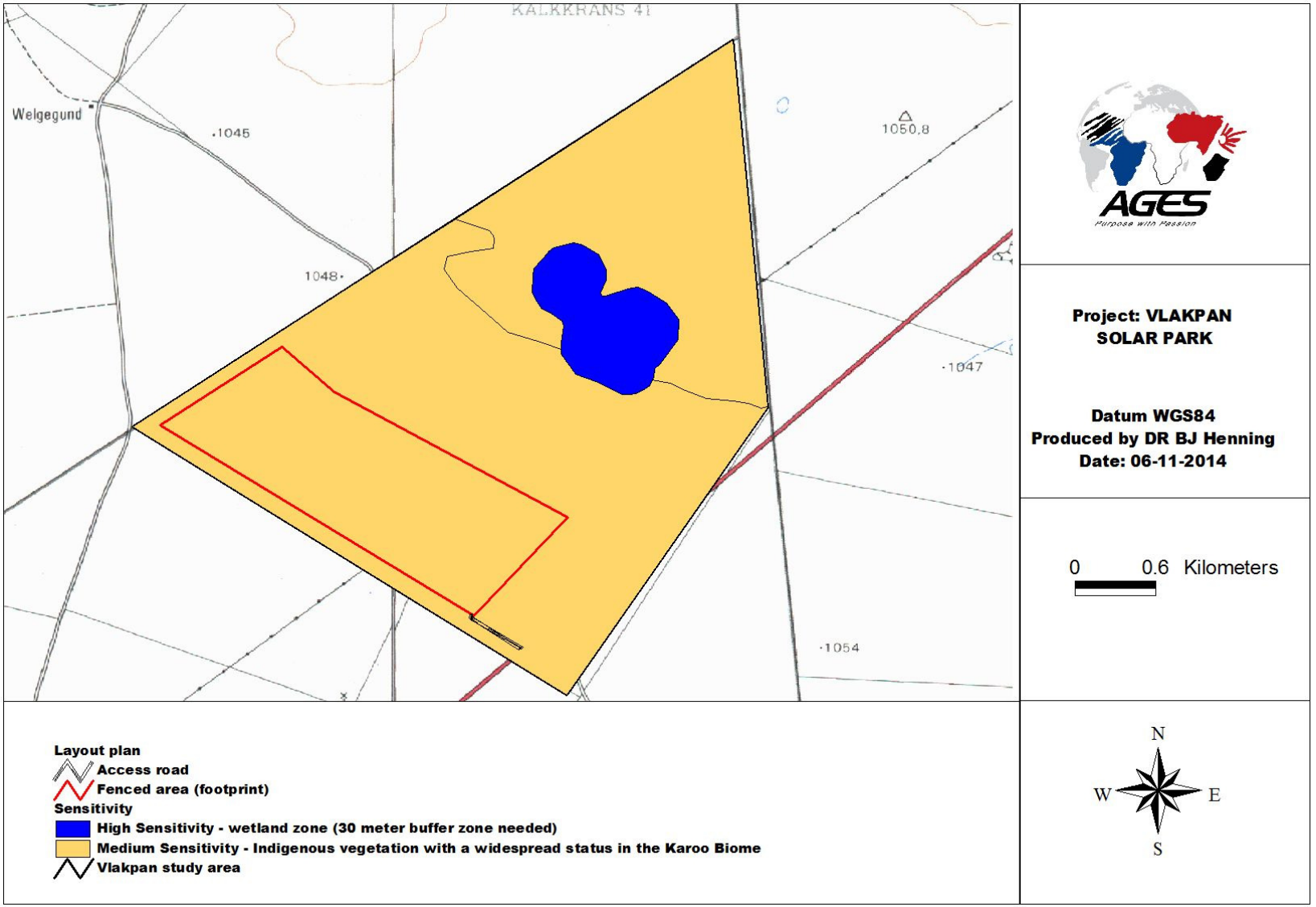


Figure 16: Agricultural Potential Map of the project site

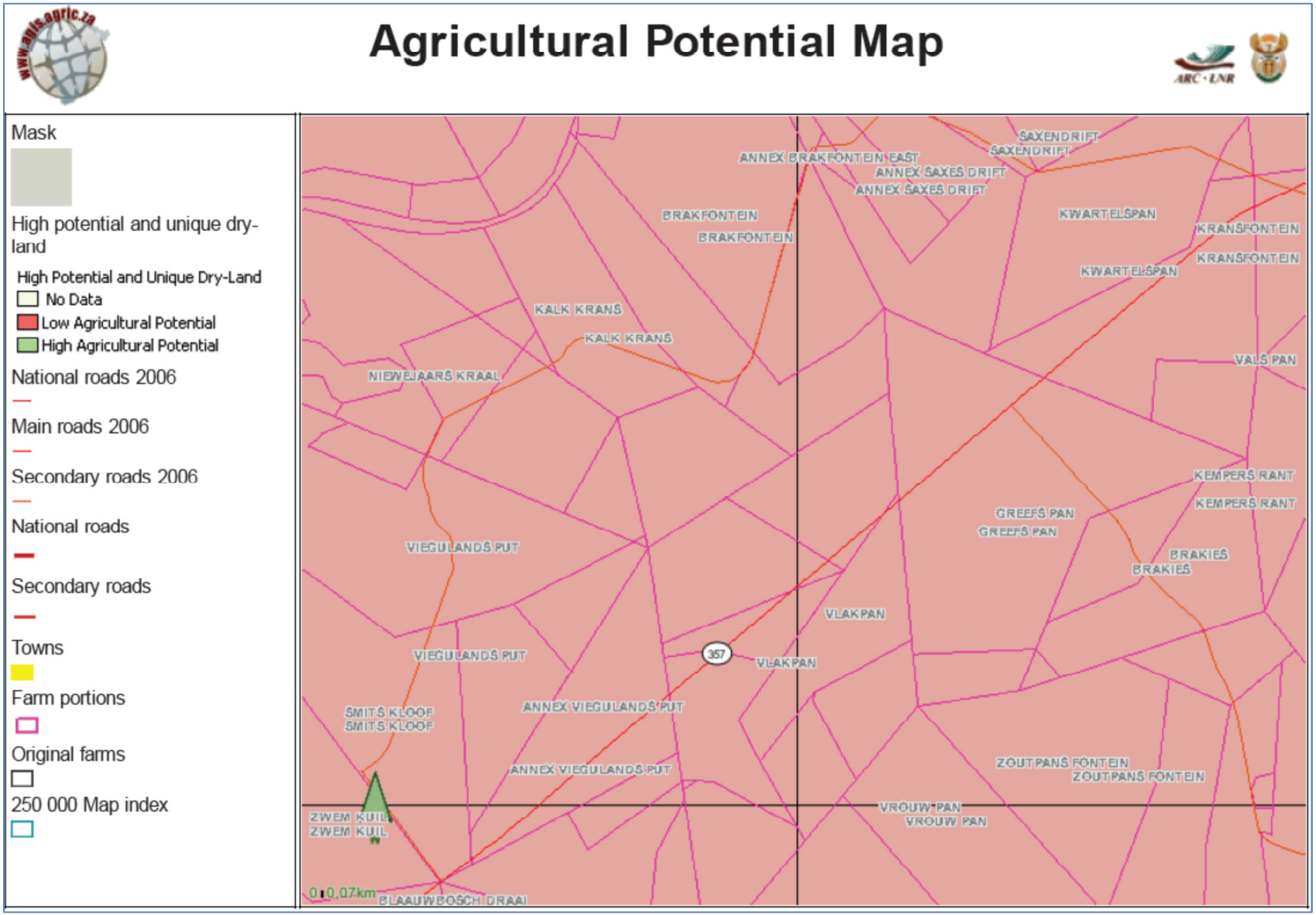


Figure 17: Land Capability Map of the project site

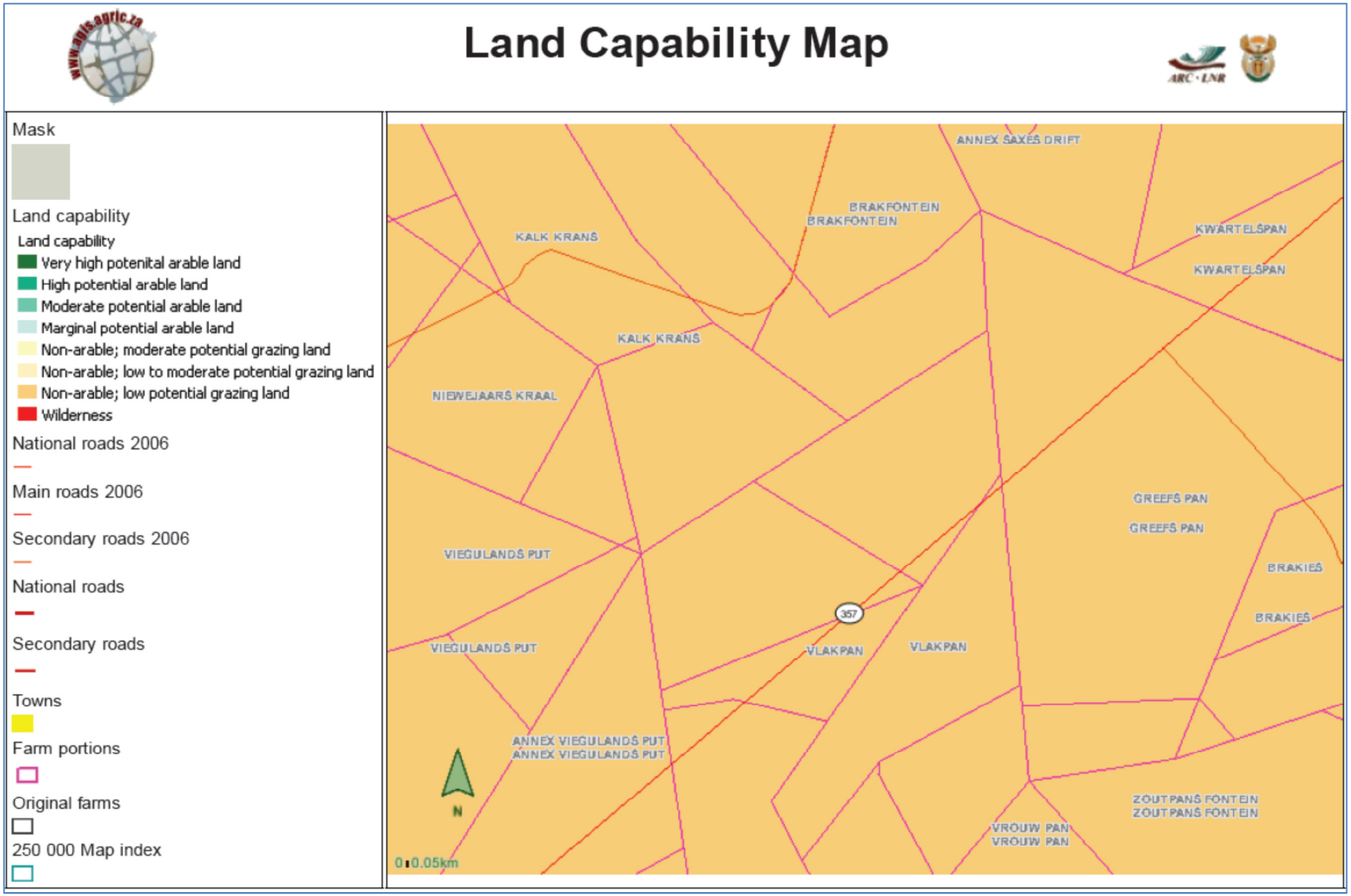


Figure 18: Potential Grazing Capacity Map (1993)

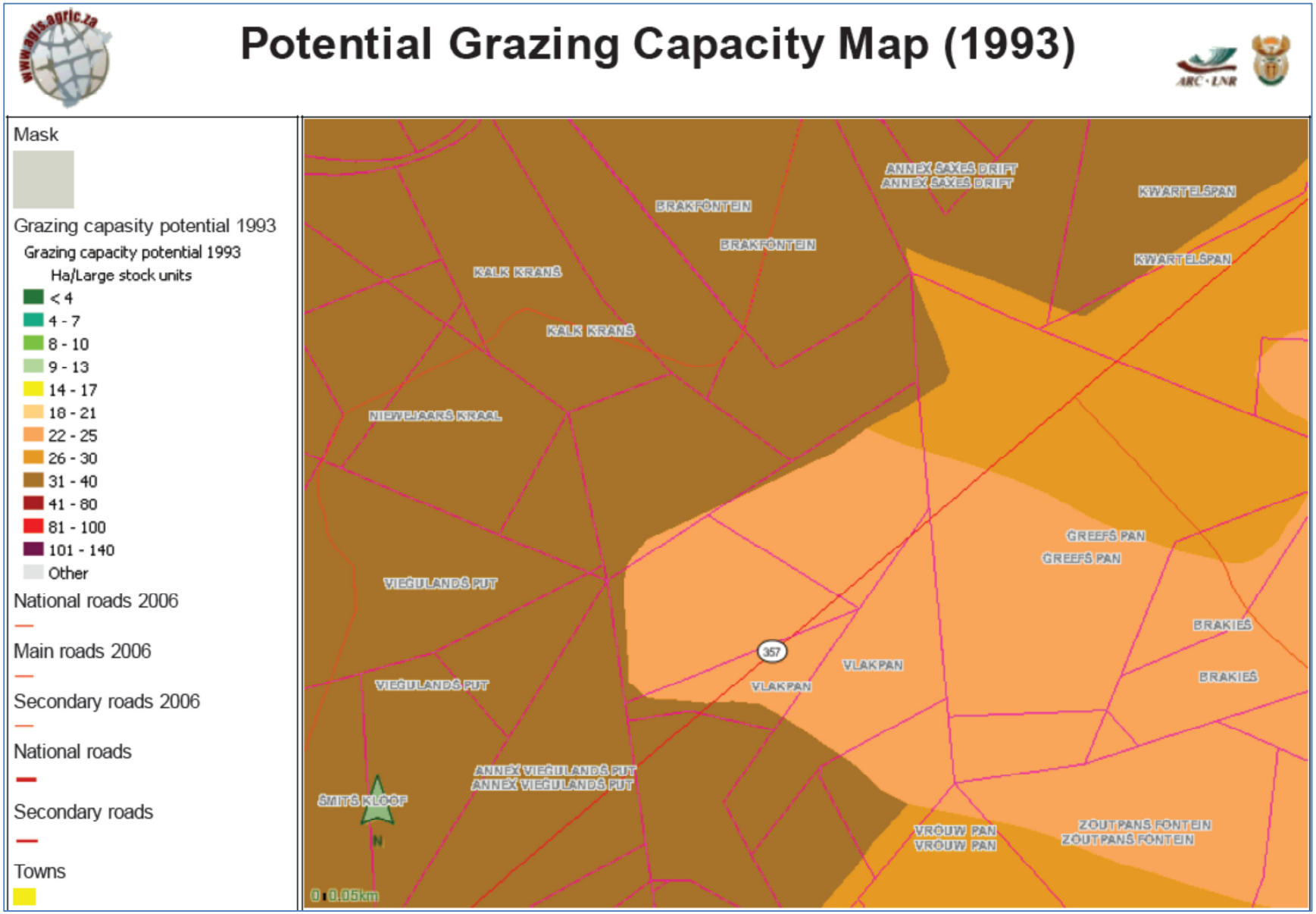
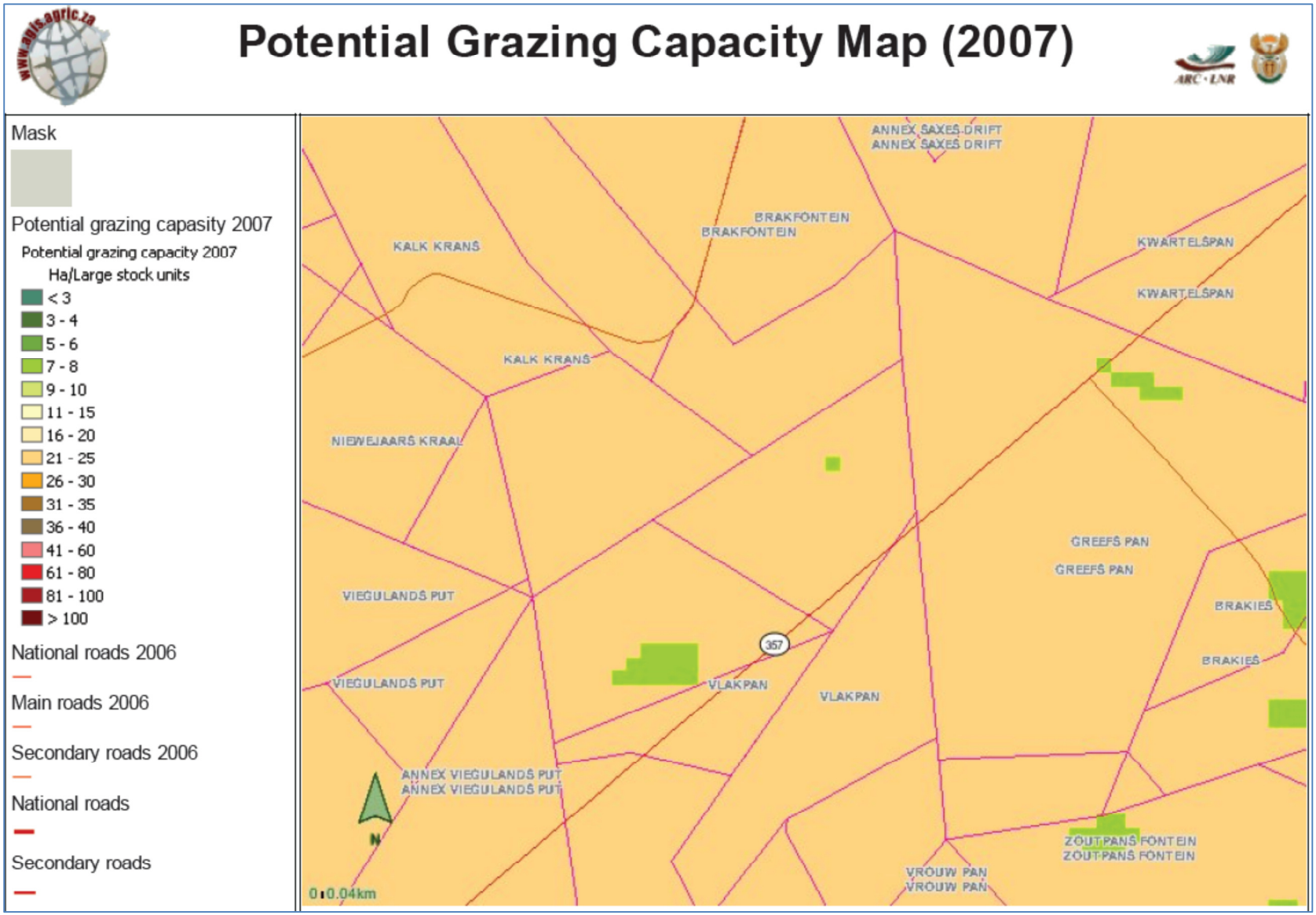


Figure 19: Potential Grazing Capacity Map (2007)



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; and
- 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).
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 Final Scoping Report.

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

7.2. EIA PHASE

The 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 the second phase of the EIA process.

All relevant issues considered during the Scoping Phase are further investigated and assessed during the EIA Phase of this project. The EIA involves various specialist studies and provides 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 have been included in the Environmental Management Programme (EMPr), 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 Final Environmental Impact Assessment Report is made available for review. Comments from the stakeholders and I&AP’s on the Draft EIAR and the Draft EMPr have been incorporated into this 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 Final Scoping and to the EIA Reports are submitted and evaluated in a reasonable timeframe and in predetermined terms.

Initial public participation process

The initial informative stage of the public participation was done from 10 December 2013 until 24 January 2014.

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

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

The public was informed of the project by means of:

- Site notices;
- Background Information Documents (BID) sent to all adjacent land owners;
- Notices in a local newspaper; 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 on the fence surrounding the proposed development area on 6 December 2013.

After a Deed Search was done on the surrounding properties Background Information Documents were sent to adjacent landowners. Proof of this is attached in Annexure C.A number of these documents was also distributed to the relevant governmental departments including *inter alia* Department of Water Affairs, Agriculture Land Reform & Rural Development*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 C.

A newspaper advertisement was published in the 10 January 2014 edition of the Gemsbok, which is a local daily newspaper.

Two responses were received during the initial public participation process:

- One was from an adjacent landowner enquiring generally on the proposed development.
- The second response was received from the adjacent landowner of Farm Greefs Span 58, objecting in respect of potential visual impacts arising from the solar park to his farm.

A new preferred location was selected as a result of his comments and in order to reduce / minimize any potential visual impact arising from the solar park in relation to the farm Greefs Pan 58, which is adjacent to the northern boundary of the property. The minimum distance of the new development site to Greefs Pan is now 1.52 km. The result is that existing vegetation will be able to screen the solar park effectively.

The Draft EIA Report was submitted to the DEA on 23 September 2014 and all registered I&AP's were informed of the availability of the report for public comments.

7.3.1. Further steps in Public Participation Process

Hard copies of the Final EIA Report and CD's containing the EIA report will be sent to the Local Municipality office as well as all applicable governmental organizations for a commenting period of 21 days. CD's containing the report will also be sent to I&AP's who requested copies after notifications to indicate that the Final EIA report is available for public comment.

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

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- All I&APs and governmental organizations will be notified about the final decision of the DEA (Environmental Authorisation granted or not).
- A notice with regard to the department's decision will be published in a local newspaper

7.3.2. Results of the Public Participation Process

Not a lot of registrations as I&APs were received throughout the public participation process. No comments were received on the Draft Scoping Report.

The Northern Cape Department of Environment and Nature Conservation (DENC) acknowledged receipt of the Draft Scoping Report but did not send any comments.

Mr. Wiid (registered owner of the farm Greefs Span 58) indicated that he has got some concerns with regard to the proposed Vlakpan Solar Park. Before the Draft and Final EIA reports were submitted and distributed, an e-mail was sent to Mr. Wiid and the new site lay out plan was sent to him to indicate the new position of the solar park. It was requested that he indicates whether this would suit him better as it is a lot further from him than what was previously planned. The Draft EIA report was sent to him and follow-up correspondence followed but we never received any indication whether he is satisfied with the changes.

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 GN 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 analysed, 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 7: 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&AP’s;
- 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 Vlakpan Solar Park together with its connection infrastructure are outlined and evaluated hereinafter.

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

- establishment of the temporary construction camp;
- land clearing activities necessary for preparation of the site and access routes;
- excavation and filling activities;
- transportation of various materials;
- installation of the PV modules and construction of associated structures and infrastructure;
- construction of the on-site high-voltage substation;
- construction of two new sections of 132 kV power line (100 m long) which will deliver the energy to the **Eskom "Greefspan-Mooidraai" 132 kV power line**, crossing the project site.

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. CUMULATIVE IMPACTS

Cumulative impacts were assessed and it was found that due to the distance of other renewable energy developments from the proposed Vlakpan Solar Park, the cumulative impacts will be very low. Also, a number of mitigation measures are proposed which will lead to the impacts that may result from the establishment of the Vlakpan Solar Park to be low. The cumulative impacts of each of the possible impacts are also assessed hereunder.

9.3. 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 EIA Report are the following:

- Ecological Impact Assessment (Annexure D)
- Avifauna Impact Assessment (Annexure E)
- Agricultural Potential Assessment (Annexure F)
- Wetland Delineation Study (Annexure G)
- Heritage Impact Assessment (Annexure H)
- Geo-technical and Geo-hydrological Report (Annexure I)
- Visual Impact Assessment (Annexure J)
- Socio-economic Impact Assessment (Annexure K)
- Services Report (Annexure L)

9.4. IMPACTS & MITIGATION MEASURES

9.4.1. 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.

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.

9.4.1.1. 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.

PREFERRED LOCATION FEIA AND PREFERRED AND ALTERNATIVE LOCATIONS DEIA									
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
Cumulative impacts	Pollution & Noise	Increase in release of smoke and increase in noise levels	Low	Medium-high	Low-medium	Medium	Medium	Low	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.

9.4.1.2. 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 as a result of 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.

PREFERRED LOCATION FEIA AND PREFERRED AND ALTERNATIVE LOCATIONS DEIA									
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
	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
Cumulative impacts	Water pollution and increased water run-off	Increased potential for water pollution and increased water run-off	Low-Medium	High	Low-medium	Medium	Medium	Low-medium	Medium

Mitigation measures - construction phase

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

- The solar park development should be restricted to Land Use Area A, indicated in the Geo-technical and Geo-hydrological Study (Annexure I).
- Clearance of vegetation should be restricted to 210 ha footprint and access road.
- Construction activities should be restricted to the proposed 210 footprint.

- The salt pan (endorheic depression) located on the northern side of the property should be excluded by the PV plant footprint, as recommended in the Geo-technical and Geo-hydrological Study (Annexure I), in the Ecological Impact Assessment (Annexure D) and in the Wetland Delineation Study (Annexure G). A buffer zone minimum 32 m wide should be maintained around the salt pan.
- 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 100m away from watercourses. This area should have bund walls and lined with impermeable material to prevent ground and surface water pollution.
- 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 100m 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.

9.4.1.3. 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 a new borehole to be drilled on the property.

Operational phase

Water use will be limited except for short periods(twice per year) when the PV modules are cleaned. The water needed for the operational phase will be provided from a new borehole to be drilled on the property.

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
Cumulative impacts	Water use	Increased pressure on local water resources	Medium	Medium - High	Very Low	Low	Low-Medium	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.
- Drinking water supply for the staff on site should be treated through an osmotic water filtration system.

9.4.1.4. Land and soils

Planning phase

The salt pan (endorheic depression) located on the northern side of the property should be excluded by the PV plant footprint, as recommended in the Geo-technical and Geo-hydrological Study (Annexure I), in the Ecological Impact Assessment (Annexure D) and in the Wetland Delineation Study (Annexure G). A buffer zone minimum 32 m wide should be maintained around the salt pan.

The solar park development should be restricted to **Land Use Area A** indicated in the Geo-technical and Geo-hydrological Study (Annexure I).

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.

PREFERRED LOCATION FEIA AND PREFERRED AND ALTERNATIVE LOCATIONS DEIA									
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
	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
Cumulative impacts	Increased potential for negative impacts on soil resource	Increased potential for erosion and soil pollution	Low-medium	High	Low-medium	Medium	Medium-high	Low	Medium

Mitigation measures - Construction Phase

- The high and medium-high sensitivity areas (*duneveld areas and woodland associated*

with shallow rocky soils, endorheic pan) should remain undeveloped - in compliance with the requirements highlighted in the Ecological Impact Assessment (Annexure D) and in the Geo-technical and Geo-hydrological Study (Annexure I).

- The solar park development should be restricted to Land Use Areas A and B indicated in the Geo-technical and Geo-hydrological Study (Annexure I).
- Clearance of vegetation should be restricted to 270 ha footprint and access road.
- Construction activities should be restricted to the proposed 270 footprint.
- The disturbed quarry / drainage located close to the south-eastern boundary of the property should be excluded by the PV plant footprint, due to erosion problems, as recommended in the Geo-technical and Geo-hydrological Study (Annexure I).
- 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.

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.

9.4.1.5. Archaeological, Cultural and Social Features

Planning phase

The layout plan should be conceived in order to avoid all the heritage sites found on the property. The *preferred alternative location* is therefore supported.

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 (Annexures H) to be undertaken will be adhered to.

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	Low	Low	Low-medium	Low	Low-medium
Operation	Operational activities of development	Destroy archaeological evidence and heritage and graves	Low-medium	High	Low	Low	Low-medium	Low	Low-medium
Cumulative impacts	Activities on site during construction and operational	Increase in potential to unearth archaeological evidence and graves	Low-medium	High	Low	Low	Low-medium	Low	Low-medium

PREFERRED AND ALTERNATIVE LOCATIONS DRAFT EIA									
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	Medium-High	Medium	Medium	Medium-High	High	Medium	Medium-high
Operation	Operational activities of development	Destroy archaeological evidence and heritage and graves	Medium	Medium	Medium	Low-Medium	Medium-High	Low-Medium	Medium
Cumulative impacts	Activities on site during construction and operational	Increase in potential to unearth archaeological evidence and graves	Medium-High	Medium	Medium	Medium-High	High	Medium	Medium-high

Mitigation measures – Construction and operational phases

All the heritage sites found on the property should be excluded from the PV plant footprint and a minimum 30 m buffer zone is recommended. The high-density heritage sites area which occurs in the middle of the property should be avoided by the proposed development.

Care must be taken during the construction process that anything of archaeological value that is unearthed must be recorded. Please refer to the Heritage Impact Assessment (Annexure H). The archaeologist or SAHRA must be notified whenever anything of importance is discovered.

9.4.1.6. 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 D & E) should be adhered to.

The salt pan (endorheic depression) located on the northern side of the property should be excluded by the PV plant footprint, as recommended in the Geo-technical and Geo-hydrological Study (Annexure I), in the Ecological Impact Assessment (Annexure D) and in the Wetland Delineation Study (Annexure G). A buffer zone minimum 32 m wide should be maintained around the salt pan.

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.

PREFERRED LOCATION FEIA AND PREFERRED AND ALTERNATIVE LOCATIONS DEIA									
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	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

PREFERRED LOCATION FEIA AND PREFERRED AND ALTERNATIVE LOCATIONS DEIA									
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
Cumulative Impacts	Increased potential of negative impacts on ecology of the area	Increase in natural vegetation to be removed.	Medium-High	High	Medium-High	Medium-High	Medium	Low-Medium	Medium

Mitigation measures – Construction phase

- Clearance of vegetation should be restricted to 210 ha footprint and access road.
- Construction activities should be restricted to the proposed 210 footprint.
- Care must be taken that unnecessary clearance of vegetation does not take place. Where possible, natural vegetation must be retained.
- The herbaceous layer should be revived after clearance of the vegetation and actively managed through slashing during the entire lifetime of the project.
- The salt pan (endorheic depression) located on the northern side of the property should be excluded by the PV plant footprint, as recommended in the Geo-technical and Geo-hydrological Study (Annexure I), in the Ecological Impact Assessment

(Annexure D) and in the Wetland Delineation Study (Annexure G). A buffer zone minimum 32 m wide should be maintained around the salt pan.

- A monitoring plan is recommended for the construction phase.
- Protected trees (if any) and protected plant species (if any) can only be removed once the necessary permits have been obtained (DAFF and DENC).
- The project should comply with the *Northern Cape Nature Conservation Act* (Act No. 9 of 2009).
- 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.
- Cumulative impacts on the ecology of the area can be significant. However, with the mitigation measures in place, the potential is very low for significant negative impacts on the ecology of the area.
- The EMPr will have to be adhered to both during the construction as well as operational phases and regular monitoring should be done to ensure that there is sound environmental practice at the Vlakpan Solar Park.

Mitigation measures – Operational phase

- The herbaceous layer should be revived after clearance of the vegetation and actively managed through slashing during the entire lifetime of the project.

- 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.
- The EMPr will have to be adhered to both during the construction as well as operational phases and regular monitoring should be done to ensure that there is sound environmental practice at the Vlakpan Solar Park.

9.4.1.7. Visual impact

Construction phase

The natural aesthetic character of the site will be changed. The Eskom “Greefspan-Mooidraai” 132 kV power line crossing the project site, have 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.*

PREFERRED LOCATION FEIA AND PREFERRED AND ALTERNATIVE LOCATIONS DEIA									
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	Medium	High	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
Cumulative Impacts	Increased in visibility of yet another solar park in the area	Increased visual intrusion and nuisance	Medium-High	Medium	Medium	Low-Medium	High	Low-Medium	Medium

Mitigation measures– Construction phase

- Ensure to retain as much of the existing vegetation where possible.
- Incorporate cleared vegetation (the most value plants) into a rehabilitation plan. This should be done in conjunction with the Vegetation, Visual Impact and any other relevant specialists.
- Cleared vegetation (the most value plants) could be planted in area that has line of sight from VSRs.
- 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.
- Ensure that dust suppressing techniques are in place at all times. These could include the regular wetting of the soil or the application of dust suppressing agents. The regular wetting of soil should however be used as a last resort due to the low availability of water within the study area.
- Refrain from causing 'light spillage' beyond the construction camp by installing light fixtures with directional illumination.
- Keep lighting to the minimum by installing bollard type lights instead of post top lights along walkways between buildings.
- 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.
- Cumulative impacts will be low as it was possible to mitigate the visual impact at Vlakpan Solar Park successfully as a result of the natural characteristics of the area.

Mitigation measures – Operational phase

- Road and other exposed soil surfaces should either be paved or covered with gravel or similar materials to reduce the risk of dust particles becoming air born. Alternatively dust suppressing techniques should be used.
- It is assumed that operational and maintenance activities would be restricted to daylight hours and thus reduce the requirement for lighting at night. However where lighting at night is needed, please refer and adhere to the mitigation measures as proposed for the construction phase.

9.4.1.8. 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.

PREFERRED LOCATION FEIA AND PREFERRED AND ALTERNATIVE LOCATIONS DEIA									
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
Cumulative Impacts	Higher number of people in the area increases safety risks	Potential for an increase in criminal activity	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.
- The cumulative impacts of this impact can be successfully mitigated if managed properly.

9.4.1.9. 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.
Danfir 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.

PREFERRED LOCATION FEIA AND PREFERRED AND ALTERNATIVE LOCATIONS DEIA									
	Impact: Job creation								
Project phase	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 +
Cumulative impacts	Increased potential for job creation.	Increased potential for 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.
- The cumulative impact of this impact can just be positive. As one of the poorest provinces in South Africa, the Northern Cape is definitely in need of more job opportunities.

9.5. 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. Visual impact of panels and buildings

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

9.5.1. 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 more solar farms are developed in the immediate area.

9.5.2. 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. Negative impact on visual attributes of the area.

9.5.3. 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 on the development area as well as surrounding properties. The duration is for the life of the development.

9.5.4. Probability of occurrence

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

9.5.5. 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. Impact can only be reversed at the end of the project when panels are removed and natural vegetation is allowed to return.

9.5.6. 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. It will not cause the irreplaceable loss of vegetation or visual attributes of the area because it can be reversed at the end of the project when panels are removed and natural vegetation is allowed to return.

9.5.7. Degree to which impact can be mitigated

i. Successful mitigation is possible
ii. Successful mitigation is possible
iii. Successful mitigation is possible
iv. Limited 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 6 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 lay down 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 EIA Report describes the activities undertaken for the development of the Vlakpan 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.

The proposed Vlakpan Solar Park is situated within the **Siyancuma Local Municipality**. The project site is situated between Prieska and Douglas along the main corridor known as Road R357 in the Pixley Ka Seme District Municipality in the Northern Cape Province.
Douglas is the main urban node in the Siyancuma Local Municipality and the town is situated near the confluence of the Orange and Vaal Rivers. The Siyancuma Local Municipality does not have a formal Spatial Development Framework. However in Local Economic Development Objectives the Vision Statement of the Siyancuma Local Municipality is drafted as "*a sustainable and growing local economy that aims to create employment opportunities for local communities, while working towards providing a high quality of life for all*." This can be achieved through education and skills development and diversification of the local economy. The Integrated Development Plan of the Municipality also emphasises the increase of employment opportunities .Employment creation is considered to be the most important criterion for development project prioritisation. There is no specific reference to renewable energy or to solar electricity generation in the LED strategy, despite the clear expression of this priority in the Provincial Growth and Development Strategy.
The introduction of a renewable energy project will directly contribute towards these goals: it will be a new industry to the area and will require special skills during the construction and operation phases. The facility will create a multiplier effect as far as job creation, skills upgrading and local empowerment and upliftment is concerned. The Solar Park will therefore stimulate the local (and regional) economy. Various other secondary trades will benefit from the proposed facility. These will include security service providers, local suppliers of building material, steel, cement, etc.
The addition of the Vlakpan Solar Park to this area will thus contribute towards the provision of employment opportunities to the area and thus boost the local economic growth of the wider area, thereby meeting the LED Vision Statement of the Siyancuma Municipality.
In view of the above it is clear that the proposed Vlakpan Solar Park will comply with the general spatial development and local economic development goals of the Siyancuma Local Municipality

The development of clean, green and renewable energy has been qualified as a priority by the Government of South Africa. The **Renewable Energy IPP Procurement Programme (REIPPPP)**, issued on 3rd August 2011 by the Department of Energy, envisages the commissioning of 3725 MW of renewable projects (1450 MW with solar photovoltaic technology) capable of beginning commercial operation before the end of 2020.

The development of photovoltaic power plants will represent a key feature in the fulfilment of the proposed goals and the reduction of CO_2 emissions.

The purpose of the Vlakpan Solar Park is to add new capacity for the generation of renewable electric energy to the national electricity supply in compliance with the REIPP Procurement Programme and in order to meet the "sustainable growth" of the Northern Cape Province.

It is the professional opinion of AGES that the proposed development is **highly desirable** and **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.